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PROGRAM ENVIRONMENTAL IMPACT REORT
(Volume 2 – Technical Appendices)

FOR THE

INLAND EMPIRE UTILITIES AGENCY
CHINO BASIN PROGRAM (CBP)

Prepared for:

Inland Empire Utilities Agency
6075 Kimball Avenue
Chino, California 91708
(909) 993-1600

Prepared by:

Tom Dodson & Associates
2150 North Arrowhead Avenue
San Bernardino, California 92405
(909) 882-3612

In association with Rincon Consultants, Inc. and West Yost

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CBP Assumptions
Technical Memorandum #1

Brown AND Caldwell

IN ASSOCIATION WITH WSC WATER SYSTEMS CONSULTING, INC.

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Chino Basin Program Assumptions

Technical Memorandum No. 1

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Prepared for

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

CBP CHINO BASIN PROGRAM

18500 Von Karman Avenue, Suite 1100
Irvine, CA 92612
T: 714.730.7600

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To: Sylvie Lee, P.E., Manager of Planning & Environmental Resources
Liza Munoz, P.E., Project Manager

From: Andrew Lazenby, P.E., Director/Sr. Project Manager, Brown and Caldwell

Prepared by: ________________________________
Jennifer K. Thompson, P.E., Sr. Project Manager, Brown and Caldwell
License No. C64820, Expiration 6/30/21

Reviewed by: ________________________________
Andrew Lazenby, P.E., Director/Sr. Project Manager, Brown and Caldwell

**List of Additional Contributors and Reviewers are on the following page.*

List of Additional Contributors and Reviewers

Contributors:

Lauren Bray, Brown and Caldwell

Hannah Ford, P.E., Brown and Caldwell

Kirstin Byrne Kale, P.E., Brown and Caldwell

Windsor Lee, Brown and Caldwell

Marcus Maltby, P.E., Brown and Caldwell

Alan Mangosong, P.E., Brown and Caldwell

Taylor McCauley, Brown and Caldwell

Elizabeth Orozco, Brown and Caldwell

Troy Arashiro, WSC

Laine Carlson, P.E., WSC

Michael Cruikshank, PG, CHG, WSC

Heather Freed, P.E., WSC

Aaron Morland, WSC

Jeroen Olthof, P.E., WSC

Debra L. Burris, P.E., DDB Engineering, Inc.

Marvin Glotfelty, R.G., Clear Creek Associates

Nate Scheevel, P.E., Scheevel Engineering

Reviewed By:

Katie Porter, P.E., Brown and Caldwell

Adam Zacheis, P.E., Brown and Caldwell

Kirsten Plonka, P.E., WSC

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List of Abbreviations

1,2,3-TCP	1,2,3-Trichloropropane
A/S	air stripping
AFD	acre-feet per day
AFY	acre-feet per year
AWRCE	Australian Water Recycling Centre of Excellence
AWPF	advanced water purification facility
Caltrans	California Department of Transportation
CBP	Chino Basin Program
CBWM	Chino Basin Watermaster
CBWCD	Chino Basin Water Conservation District
CCR	California Code of Regulations
CCWRF	Carbon Canyon Water Recycling Facility
CDA	Chino Desalter Authority
CECs	constituents of emerging concern
CIP	Capital Improvement Program
CIP	clean-in-place
CIWQS	California Integrated Water Quality System
COD	chemical oxygen demand
CTC	carbon tetrachloride
CVWD	Cucamonga Valley Water District
DDW	Division of Drinking Water
DLR	detection limit for reporting purposes
EC	electrical conductivity
eSMR	Electronic Self-Monitoring and Reporting Program
EW	extraction well
EWL	Etiwanda Wastewater Line

FERC	Federal Energy Regulatory Commission
ft	feet
FWC	Fontana Water Company
GAC	granular activated carbon
gpd	gallons per day
gpm	gallons per minute
GRRP	Groundwater Replenishment Reuse Project
hP	horsepower
IEBL	Inland Empire Brine Line
IEUA	Inland Empire Utilities Agency
in	inches
IW	injection well
JCSD	Jurupa Community Services District
LACSD	Los Angeles County Sanitation Districts
LRV	log reduction value
MBR	membrane bioreactor
MCL	maximum contaminant level
mgd	million gallons per day
MPI	Material Physical Injury
MTBE	methyl tert-butyl ether
MVWD	Monte Vista Water District
MWD	Metropolitan Water District of Southern California
MZ	management zone
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
NDMA	N-Nitrosodimethylamine
NL	notification level
NRWS	Non-Reclaimable Wastewater System
NRWSCU	Non-Reclaimable Wastewater System Capacity Units
OBMP	Optimum Basin Management Plan
PDR	preliminary design report
PCE	perchloroethylene
PEIR	Program Environmental Impact Report
PS	pump station
RAS	return activated sludge
ROW	Right-of-Way
RP-1	Regional Water Recycling Plant No. 1

RP-2	Regional Water Recycling Plant No. 2
RP-4	Regional Water Recycling Plant No. 4
RP-5	Regional Water Recycling Plant No. 5
RW	recycled water
RWC	recycled municipal wastewater contribution
RWQCB	Regional Water Quality Control Board
SAR	Santa Ana River
SBCFCD	San Bernardino County Flood Control District
SFI	Storage Framework Investigation
sMCL	secondary maximum contaminant level
SNMP	Salt and Nitrogen Management Plan
SWRCB	State Water Resources Control Board
TAFY	thousand acre-feet per year
TCE	trichloroethylene
TDH	total dynamic head
TDS	total dissolved solids
TM	technical memorandum
TM1	Technical Memorandum 1
TSS	total suspended solids
TVMWD	Three Valleys Municipal Water District
VOC	volatile organic carbon
WAS	waste activated sludge
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.
Western	Western Municipal Water District
WFA	Water Facilities Authority
WMWD	Western Municipal Water District
WRCRWA	Western Riverside County Regional Wastewater Authority
WRP	water reclamation plant
WSIP	Water Storage Investment Program
WWTP	wastewater treatment plant

Section 1: Introduction

The Chino Basin Program (CBP or Program) is an innovative local water supply project that combines local infrastructure needs and salinity management with groundwater storage and water supply needs and ecosystem benefits in Northern California. This project is being led by the Inland Empire Utilities Agency (IEUA) to develop necessary infrastructure within the IEUA service area and the area of the Chino Groundwater Basin (Chino Basin).

The CBP builds upon water supply needs that have been identified as part of the region's water supply planning. Recycled water, which is an increasingly essential asset to the region particularly with uncertainties with imported water supplies due to climate change, will require advanced treatment in the future to meet regulatory requirements for total dissolved solids (TDS) and other constituents of emerging concern (CECs). Additionally, new regional water supply infrastructure has been identified through IEUA's Integrated Water Resources Plan (IRP) development to enhance water supply reliability in the Chino Basin area. The advanced water purification facility (AWPF) and regional water supply infrastructure included in the CBP will help meet these regional needs. The remainder of this Technical Memorandum (TM) and TM2 CBP – PUT, TAKE, and Program Alternatives Evaluation focus on the development of the CBP components and alternatives and identification of the preferred program alternative.

This project, the CBP Technical Feasibility Study (Study), is being completed to advance the projects that comprise the CBP. This project includes two main elements:

1. Identification and evaluation of PUT, TAKE, and program alternatives to identify the preferred CBP approach.
2. The conceptual design for elements of the recommended program.

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. The PUT and TAKE components are summarized in Table 1-1. Summary of PUT and TAKE Components.

Table 1-1. Summary of PUT and TAKE Components

PUT Components	TAKE Components
• Tertiary recycled water supply and conveyance • AWPF • Purified water pumping and conveyance • Groundwater recharge (injection wells and/or recharge basins)	• Groundwater extraction and treatment • Potable water pumping and conveyance • Potable water usage (MWD pump back or in lieu)
The CBP will comprise both PUT and TAKE components.	

Note: MWD = Metropolitan Water District of Southern California

The Technical Feasibility Study will be the primary deliverable for the overall project and will present the overall findings of the project, including the conceptual design for elements of the recommended program. The alternatives evaluation of the PUT, TAKE, and program alternatives, which will define the recommended CBP for documentation in the Technical Feasibility Study, is documented in the following TMs:

- **TM1 – Chino Basin Program Assumptions (this TM):** Documents the assumptions used to develop the PUT and TAKE alternatives and presents the alternatives evaluation approach used to evaluate the PUT, TAKE, and program alternatives.
- **TM2 – Chino Basin Program – PUT, TAKE, and Program Alternatives Evaluation**: Presents the development and formation of the PUT and TAKE alternatives and evaluation, the development of the program alternatives (based on the results of the PUT and TAKE alternatives evaluation), and the selected program alternative for the overall CBP.
- **TM3 – Brine Disposal System:** Presents a summary of the brine disposal systems in IEUA's service area and how the CBP facilities would connect to the systems.

These TMs support the development of the Study and will be appended to the Study as shown graphically in Figure 1-1.

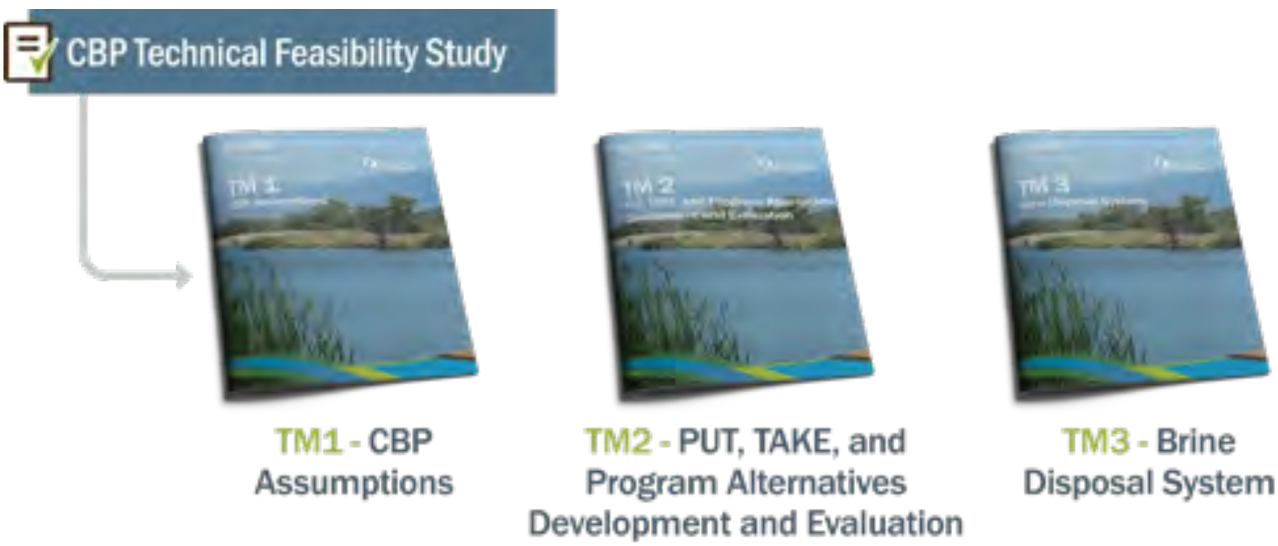

Figure 1-1. CBP Documents

1.1 Program Overview

The CBP was submitted for Proposition 1 – Water Storage Investment Program (WSIP) funding and was awarded $206.9M in conditional funding in July 2018. Under the WSIP, the CBP is proposed to be a 25-year conjunctive use project that proposes to use advanced water purification to treat and store up to 15 thousand acre-feet per year (TAFY) of recycled water in the Chino Basin and extract the water during call years, which will likely be in dry seasons. The program is intended to provide a reliable source of water during call years, while providing ecological benefits in the Sacramento-San Joaquin Delta watershed. Through agreements with the California Department of Water Resources (DWR), the California Department of Fish and Wildlife, the Metropolitan Water District of Southern California (MWD), and other project partners, the basin would be operated in a way which dedicates blocks of water of up to 50 TAFY towards ecosystem benefits north of the Delta. Advanced water purification is assumed to meet long-term salinity requirements in the Chino Basin and to meet the regulatory requirements for subsurface application of recycled water. The infrastructure included in the CBP is consistent with infrastructure identified to reduce recycled water salinity for regulatory compliance as well as water infrastructure that has been identified through IEUA's IRP effort.

The program would rely on water transfer agreements through MWD. For every acre-foot of water requested for north of the Delta ecosystem benefits, IEUA would pump locally stored groundwater and deliver it to MWD or use the water locally instead of taking raw imported water from MWD (referred to as in lieu). MWD would then leave behind an equivalent amount of water in Lake Oroville to be dedicated and released for the requested ecosystem benefit. It is also envisioned that the CBP would include both storage capacity and borrowing capacity in the Chino Basin as approved by the Chino Basin Watermaster (CBWM or Watermaster). The borrowing capacity would be used to help deliver multiple consecutive, dedicated blocks of water for ecosystem benefits. This water would be borrowed from previously stored groundwater, outside of this program, and replaced over time. Through this approach, the CBP can be operated in a way to provide up to 50 TAFY of water for up to 7.5 years of the 25-year program (375 TAF total) as long as the groundwater extraction does not exceed the approved borrow amount. This would result in balancing the PUTs and TAKEs to the Chino Basin at the end of the 25-year program, i.e., 375 TAF would be recharged over 25 years and the same amount would be extracted over 25 years.

The annual PUT and periodic TAKE cycles are shown graphically in Figure 1-2.

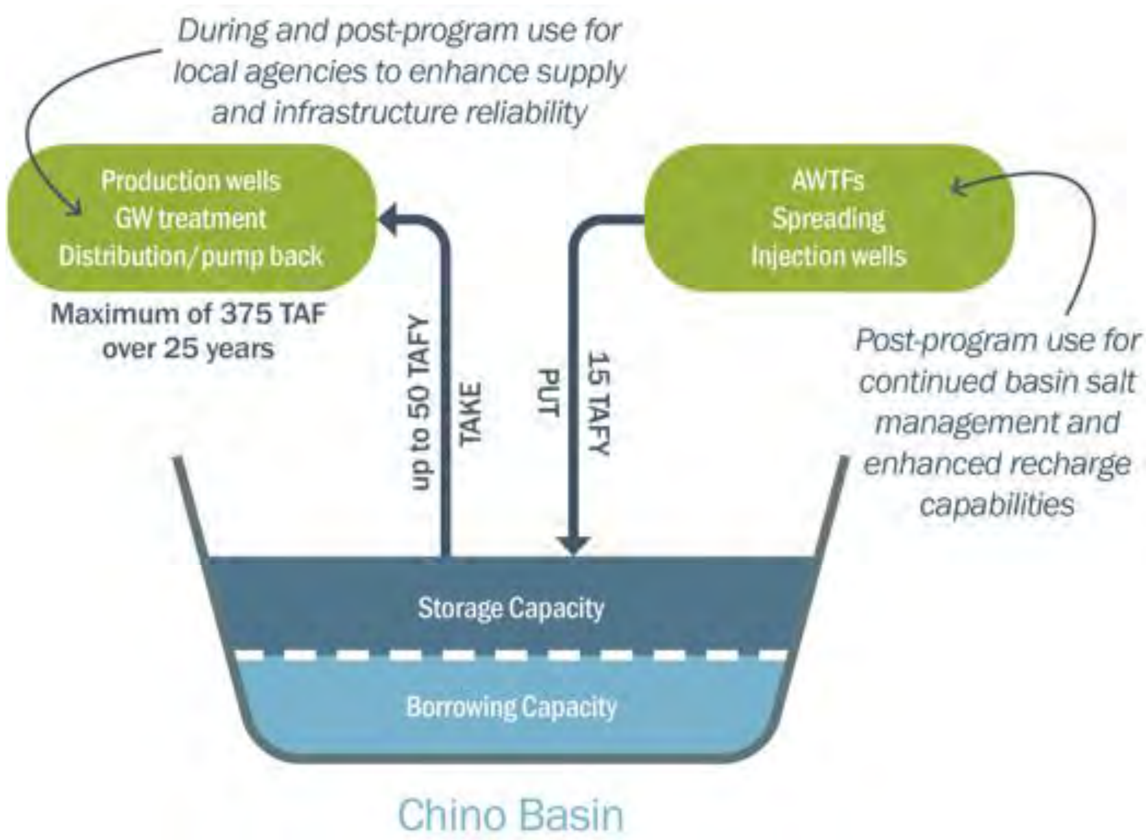

Figure 1-2. CBP Overview

1.2 Critical Success Factors

At the start of this project, IEUA and the consulting team established critical success factors to lay the foundation for the CBP alternatives and the big picture goals for developing the alternatives and establishing the recommended CBP projects. The critical success factors are as follows:

- Continue to protect and enhance the Chino Basin
- Align CBP operations and facilities with the 2020 Optimum Basin Management Plan (OBMP) Update, OBMP Update Implementation Plan, and Storage Management Plan
- Meet conditional funding requirements by Fall 2021
  - Technical Feasibility Study
  - Environmental Impact Report
- Collaborate with Stakeholders and identify planned projects
- Identify and secure source supplies
- Collaborate with MWD to define pump back requirements

1.3 PUT, TAKE, and Program Alternatives Approach

The CBP includes treatment plants, conveyance, and groundwater recharge and extraction facilities. An alternatives evaluation was completed to identify the recommended program alternative. The alternatives analysis was completed in two main steps, which are described below and shown graphically in Figure 1-3.

- **Step 1 – PUT and TAKE alternatives evaluation (component alternatives evaluation):** In the first step, the components of the CBP – PUT and TAKE – were separately identified, developed, and evaluated to identify the preferred PUT and TAKE components to build the overall program alternatives.
- **Step 2 – Program alternatives evaluation:** Once the component alternatives evaluations were completed, then the preferred PUT and TAKE alternatives were combined to develop the overall program alternatives. The alternatives will be evaluated using the same framework as for PUT and TAKE alternatives and the recommended alternative were identified with the support of the alternatives evaluation results. Each program alternative was evaluated using groundwater modeling to confirm the operating constraints of the Chino Basin were met.

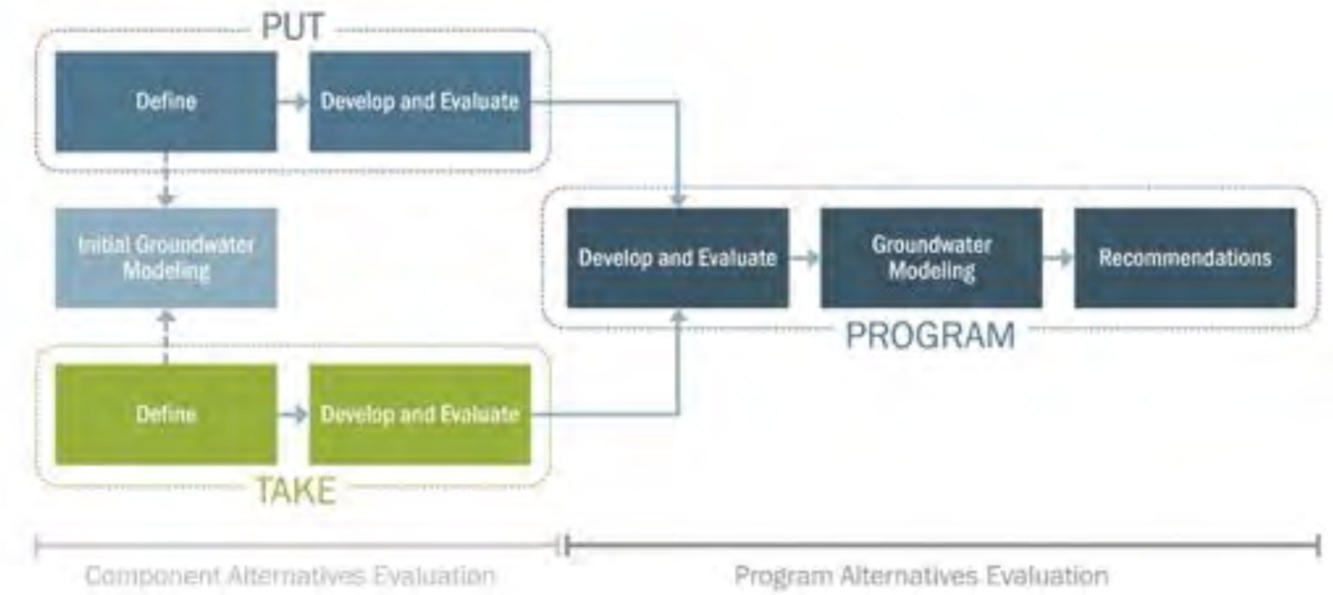

Figure 1-3. CBP Alternatives Analysis Approach

The alternatives evaluation approach and description of objectives and evaluation criteria are in Section 8 of this TM.

The background assumptions and information necessary to formulate the PUT and TAKE alternatives is presented in this TM. TM2 includes the development and evaluation alternatives: first, development and evaluation of the PUT and TAKE alternatives, and then, second, the development and evaluation of the CBP alternatives based on the recommended PUT and TAKE alternatives. TM2 also includes the identification of the recommended CBP alternative(s).

1.4 TM1 Overview

TM1 documents the assumptions used to create the PUT and TAKE alternatives that, when combined, comprise the CBP. The information presented in TM1 provides the foundation for the development of the PUT and TAKE alternatives, which are presented in TM2.

The following information is presented in TM1 (this TM):

- **Section 1: Introduction**
- **Section 2: Related Studies and Activities –** includes information about the CBP Workgroup, IEUA studies and activities, and information about the CBWM and the Chino Basin groundwater basin.
- **Section 3: Regulatory Requirements –** summarizes regulatory requirements that pertain to IEUA and the Chino Basin, including IEUA's National Pollution Discharge Elimination System (NPDES) permit limitations, the RWQCB Water Quality Control Plan (Basin Plan) and Maximum Benefit Objective, groundwater replenishment regulations, anticipated requirements for future direct potable reuse (DPR), and drinking water regulations.
- **Section 4: PUT Alternatives Components –** presents the assumptions for the PUT alternatives including tertiary recycled water supply, AWPF assumptions, and recharge assumptions. Since conveyance applies to both PUT and TAKE alternatives, conveyance assumptions are presented in Section 6.
- **Section 5: TAKE Alternatives Components –** presents the assumptions for the TAKE alternatives including extraction well assumptions, pump back assumptions to MWD, and in lieu capacity assumptions. Since conveyance applies to both PUT and TAKE alternatives, conveyance assumptions are presented in Section 6.
- **Section 6: Conveyance Approach –** presents the conveyance assumptions for the PUT and TAKE alternatives, which includes sizing criteria for tertiary recycled water, purified water, brine conveyance, and potable water.
- **Section 7: Cost Estimating Approach –** presents the cost estimating approach for the PUT and TAKE alternatives, which included development of unit costs, markups, and a lifecycle evaluation approach that was developed in conjunction with GEI.
- **Section 8: Evaluation Approach –** documents the alternatives evaluation approach that is used to evaluate the PUT, TAKE, and program alternatives.

Section 2: Related Studies and Activities

There are several related activities and studies that provide the foundation for the components for the overall CBP. These related studies and activities are organized in four main categories:

- IEUA
- CBP
- Chino Basin Watermaster (Watermaster) and Chino Groundwater Basin (Chino Basin)
- Stakeholders

The related studies and activities for each of these four categories are described briefly below.

2.1 IEUA Studies and Activities

IEUA has completed a number of studies that were used to formulate the CBP components and overall program, which are summarized in this section.

2.1.1 Regulatory Challenges TM (April 2020)

IEUA prepared a Regulatory Challenges TM in April 2020 that discusses the challenges associated with recycled water salinity and water quality in the Chino Basin. Regulatory challenges facing IEUA in 2020 are as follows:

- Ambient water quality.
- IEUA's wastewater discharge NPDES permit limit for TDS.
- IEUA's recycled water GWR permit limit for TDS.
- Compliance with blended groundwater recharge permit limit and Basin Plan objective for TDS.
- Compliance with recycled water quality for groundwater recharge as provided by the 2014 Groundwater Replenishment Reuse Project (GRRP) Title 17 and Title 22 Regulations.

Recycled water is an increasingly essential asset to the region particularly with the uncertain future of imported water supplies due to climate change and environmental factors. Recycled water is the region's most climate resilient water supply because the amount of water available is not affected by dry years. Recycled water makes up approximately 15 percent of IEUA's water supply portfolio and hundreds of millions of dollars have been invested into the regional recycled water program. It is critical for IEUA to maintain this resource within the region.

The continued use of recycled water is compliance driven, with regulatory limitations for TDS in IEUA's recycled water and groundwater recharge. Levels of TDS in recycled water have been increasing, exacerbated by climate change, conservation and episodic periods of drought over the last twenty years. In 2015, IEUA's recycled water neared the permit limit for TDS. Today, IEUA estimates that, without taking additional action, TDS limits for recycled water direct use and groundwater recharge may be exceeded within the next ten years. Long-term solutions take years and can be as long as a decade to develop, finance and implement. Left unchecked, the possibility of noncompliance with regulatory requirements grows and risks the possibility of reduced recycled water use, challenges responding to changing water quality regulations, and greater reliance on imported supplies. This underscores IEUA's need for a long-term solution to secure recycled water as a resource within the region.

Based on findings supported by this memorandum and other planning efforts, IEUA is pursuing a suite of solutions, which are targeted at mitigating these TDS risks and that are fully aligned with IEUA's mission and vision. These solutions integrate structural elements, alternative and new water supplies, operational enhancements, potential permit modifications, and other management strategies, which when bundled together could improve water reliability, achieve multiple benefits, protect Chino Basin water quality, and maintain compliance for the long-term. Advanced treatment is an integral component of this suite of solutions.

In addition to the challenges associated with TDS, IEUA is also facing regulatory challenges with 1,2,3-Trichloropropane (1,2,3-TCP), perfluorooctanoic acid (PFOA), microplastics and other contaminants of emerging concern. In 2019, recycled water used for groundwater recharge exceeded the 1,2,3-TCP maximum contaminant level (MCL) and PFOA Notification Level (NL). It becomes evident, then, that advanced treatment may also be needed to address other regulatory challenges within the region. (IEUA and GEI, April 2020)

2.1.2 2015 Recycled Water Program Strategy and Recycled Water Model

In October 2015, Stantec completed the 2015 Recycled Water Program Strategy (RWPS) for IEUA. The major goals of the RWPS were to update the recycled water supply and demand forecasts through 2035 and identify needed improvements to maximize the use of recycled water within the service area (Stantec, October 2015). The projected recycled water demands were split between Santa Ana River (SAR) discharges, direct use demands on a 12-month basis, and groundwater recharge (GWR) demands on a 9-month basis. The 2015 RWPS provides a comprehensive list of recycled water system upgrades and a project implementation strategy with demand triggers. The projects that will be completed by the year 2026 will be included when performing the system analysis using the hydraulic model.

In 2016, Carollo updated and calibrated the recycled water system hydraulic model to represent existing 2016 conditions. Updates to the model included refining diurnal demand patterns for pressure zones and large recycled water customers, reviewing and updating controls, and scaling both direct use and recharge demands. The model calibration was completed for a 24-hour run over August 31, 2016, a peak demand day. The calibrated model was used as the basis for performing the alternative system analyses for CBP, which is described in further detail in Section 4.

2.1.3 Chino Basin Recycled Water Groundwater Recharge Program 2018 Annual Report

IEUA and CBWM obtained a GWR permit in 2005 to start the GWR program to protect the Chino Groundwater Basin. IEUA, CBWM, the Chino Basin Water Conservation District (CBWCD), and San Bernardino County Flood Control District through a Four Party Agreement collaboratively operate the groundwater recharge program. The program focuses on bolstering water supply reliability and water quality in the basin via increased recharge from stormwater, imported water, and recycled water sources. Each year, IEUA and the CBWM submit an annual report for the Chino Basin Recycled Water Groundwater Recharge Program to summarize the progress of the program per the California Regional Water Quality Control Board (RWQCB), Santa Ana Region, Order Nos. R8-2007-0039 and R8-2009-0057.

The 2018 Annual Report for the Chino Basin Recycled Water Groundwater Recharge Program was issued in May 2019, shortly after this Project was initiated in April 2019. The information in the report was used by the project team to better understand how the existing groundwater recharge program is operated. In 2018, the total amount of water recharged into the Chino Groundwater Basin was 23,944 acre-feet (AF), which included stormwater (6,751 AF), recycled water (12,942 AF), and imported water (4,251 AF) from the State Water Project.

2.1.4 2015 and 2020 IRPs

IEUA's 2015 IRP was led by IEUA's Planning and Environmental Resources Department to assess water supply and climate change impacts through 2040 in the IEUA service area. Two key goals of the IRP were to integrate and update water resource planning documents in a focused, holistic manner and to develop an implementation strategy that will improve near-term and long-term water resources management for the region. In addition, the IRP evaluated new growth, development, and water demand patterns within the service area and conducts an assessment of water needs and supply source vulnerabilities under climate change.

To achieve the aforementioned goals, the IRP has been split up into two phases: Phase 1 - Analysis and Recommendations (referred to as the 2015 IRP), and Phase 2 – Implementation and Capital Improvement Program (2020 IRP). The 2015 IRP is complete and documented in the 2015 *Integrated Water Resources Plan: Water Supply & Climate Change Impacts 2015-2040* (IEUA, 2015) (also referred to as IRP Phase 1), and development of the 2020 IRP began in Summer 2016 and is still in progress.

The 2015 IRP includes recommended regional water strategies, costs for different water supplies, and possible local and regional supply projects to provide water supply resilience to the area into the future. The 2015 IRP focused on an extensive analysis of future projected water needs and water supply strategies under conditions of climate change and growth. Results from the 2015 IRP include summaries of the recommended regional water resource strategies; corresponding ranges of costs for the various supply categories; and a regionally developed, all-inclusive list of potential supply projects (local and regional). The 2015 IRP was developed in three parts: Part 1 – Needs Assessment, Part 2 – Regional Strategy Development, and Part 3 – Strategy Testing. Five water supply strategies were developed to understand how the combinations of projects could meet future water needs and address the challenges and constraints facing the region. Eight project portfolios were developed to test the five water supply strategies and modeling was used to determine the effect of each portfolio on water supplies.

The two core findings of the 2015 IRP are as follows:

- The region's past investments in local water supplies and the diversification of the available water resources have positioned the region well to deal with the future impacts of climate change. If no further actions were taken beyond the currently planned investments in regional supplies and water use efficiency, the region would be able to meet 80-90% of its projected water needs by 2040.
- Portfolios that combined water supply and water efficiency actions yielded the most adaptive strategies for the region. Many portfolios were able to reduce the region's risk of not having sufficient water supplies to meet future needs. Several portfolios were able to dramatically increase the amount of water stored in the Chino Basin.

Based on these findings, IEUA determined the following recommendations to ensure water security for the region:

- Continue investment in recycled water projects to maximize the beneficial reuse.
- Acquire low total dissolved solids (TDS) supplemental water to enhance groundwater quality to sustain production and reduce salinity.
- Implement water use efficiency measures to reduce current urban demand by at least 10% to enhance water supply resiliency.
- Strategically maximize the purchase of supplemental water for recharge or in-lieu when available.
- Include external supplies, consisting of exchanges, storage, and water transfers, strategically in combination with conservation to augment groundwater recharge, recycled water, and build storage reserves. External supplies include surface, imported, and non-potable water.
- Continue to maximize stormwater recharge projects, including rainwater capture and infiltration.

To fund the possible projects and strategies summarized in the IRP, the recommendations were included in the IEUA Facilities Master Plan Program Environmental Impact Report (PEIR) (ESA, December 2016) (ESA, February 2017).

The 2020 IRP is currently being developed by IEUA and will address additional detailed project level analysis including project scopes, costs, prioritization, and implementation scheduling. As part of this phase, a regional infrastructure model has been created to simulate the potable water system water balance and distribution capacity between agencies and from pressure zone to pressure zone within agencies. The model is being used to identify existing operational constraints and redundant capabilities and identify and assess the potential local and regional benefits of various infrastructure projects (INTERA, August 2018). The CBP builds upon regional water supply infrastructure that have been identified as part of the 2015 IRP and the development of the 2020 IRP to enhance water supply reliability in the Chino Basin area.

2.1.5 Feasibility Study of Recycled Water Interconnections between City of Pomona, Monte Vista Water District and Inland Empire Utilities Agency (2016)

The Feasibility Study of Recycled Water Interconnections Between the City of Pomona, Monte Vista Water District (MVWD), and IEUA (Carollo, January 2016) assessed potential future projects and strategies to increase water supply to each of the aforementioned agencies. The evaluation focused on seven project alternatives that each provide a different approach to increase water supply via recycled water from the Sanitation Districts of Los Angeles County's Pomona Water Reclamation Plant (PWRP) and from IEUA's recycled water system. Additional non-potable water sources were also considered, such as groundwater from the Spadra Basin and brine from the City of Pomona's Anion Exchange Plant (AEP). MVWD's Plant 28 site was identified as a location for advanced treatment facilities.

The recommended alternative for Phase 1 of the project is Alternative 2a, which includes an AWPF that would source 3.7 million gallons per day (mgd) of recycled water from both the City of Pomona and from existing IEUA recycled water infrastructure for treatment at an AWPF to be built at MVWD's Plant 28 site. New infrastructure required by this alternative would require approximately six miles of 16-inch diameter pipeline, a 400-horsepower (hP) pump station, and a 3.1-mgd AWPF. This alternative was recommended because of its operational flexibility, high water quality production (for recharge), low travel time to pumping wells, and future potential for expansion. Alternatives 2b or 4, which both require the same infrastructure as Alternative 2a, could be considered for a future phase of the project.

For the CBP, a satellite AWPF in the western portion of the Chino Basin was considered in the PUT alternatives and, based on this study, it was assumed that the AWPF would be located at MVWD's Plant 28 site and the AWPF concept developed as part of this feasibility study was used as the basis for the CBP alternatives. The AWPF assumptions are discussed further in Section 4.2 of this TM and the AWPF components included in the PUT alternatives are discussed further in TM2 Section 3.2.2.

2.1.6 Wastewater Facilities Master Plan Update Report (2015)

The *Wastewater Facilities Master Plan Update Report (Volumes 1 and 2)* (CH2MHILL, June 2015) was an update to the 2002 Wastewater Facilities Master Plan to create a 20-year Capital Improvement Plan (CIP) for IEUA's Regional Water Recycling Plants (RWRPs), collection system, and organics management. The report was completed as a series of TMs which are as follows:

- TM 1 – Existing Facilities
- TM 2 – Hydraulic Modeling and GIS Implementation
- TM 3 – Regional Trunk Sewer Alternatives Analysis
- TM 4 – Wastewater Flow and Loading Forecast
- TM 5 – RP-1 Future Plans
- TM 6 – RP-4 Future Plans
- TM 7 – RP-5 and RP-2 Complex Future Plans
- TM 8 – Carbon Canyon WRF Future Plans
- TM 9 – Organics Management Plan
- TM 10 – Asset Management Program

These TMs were written to assess long-term water supply and growth projections, the usage of the four existing RWRPs, the use of RP-5 for all future RP-2 solids handling, and the effect of diverting RP-1 flow for increased groundwater recharge in certain areas of the IEUA service area. One of the products of this report is a table of the projects that must be implemented over the next 20 years to meet projected capacity goals. The projects of interest for this TM included those that affect RP-1 and RP-4 which are included in the PUT alternatives as discussed in this TM. The RP-1 projects included projects to expand liquid and solids treatment, and to eliminate primary effluent equalization. RP-4 has a liquid treatment expansion project in IEUA's 20-year CIP. The recommendations of the Wastewater Facilities Master Plan Update Report were included in the IEUA Facilities Master Plan PEIR (ESA, December 2016) (ESA, February 2017).

The RP-1 and RP-4 information was used to develop the AWPF concepts for the PUT alternatives, which are discussed further in Section 4.

2.1.7 RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report (2019)

The *RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report* (Carollo, April 2019) included the preliminary design for projects projected to be online by 2030 and site planning for the site through 2060, when RP-1 is expected to reach its built-out flow rate of 40 mgd, and beyond. RP-1 has lost some treatment capacity through increased mass loading, which will be restored to 40-mgd average day flow and 80-mgd peak day flow (without equalization) through the RP-1 Capacity Recovery Project. The improvements will include converting secondary treatment to a membrane bioreactor (MBR) system, new solids thickening, increased digestion capacity, and improved support facilities.

Beyond 2030 through 2060, new facilities to replace aging infrastructure are planned at RP-1 as well as an AWPF to reduce TDS of the MBR effluent to meet permit requirements for tertiary recycled water groundwater recharge and effluent discharge. Space was also planned for an ultraviolet (UV) advanced oxidation process (AOP) for future groundwater injection. The AWT facilities were planned to be located in the southwest corner of RP-1 in the location of the existing solar facilities. The existing solar facilities are contracted through June 2029 and are anticipated to be demolished after that date.

For the CBP, the RP-1 preliminary design for the new MBR and the AWT planning concepts were utilized for the PUT alternatives that assume the AWPF is located at RP-1. There is a time conflict with the proposed AWPF location since the CBP will be online by 2026 and the RP-1 solar will not be demolished until June 2029. If RP-1 is identified as the preferred AWPF location through the PUT and program alternatives analyses, then this site location conflict will need to be evaluated in more detail.

2.2 CBP Studies and Activities

In addition to this technical feasibility study, there are several ongoing efforts related to the CBP project, including the CBP workgroup and additional analyses on water supply sources, economics, and financial. The additional analyses are being developed by IEUA and others in conjunction with this study. The CBP alternatives evaluation relies on the net present value (NPV) analysis completed using the economic analysis tool described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020), which is described more in Section 7.3 of this TM.

IEUA formed a CBP Workgroup with IEUA local member agencies/local stakeholders after the conditional funding award from Proposition 1 WSIP for the CBP. Starting in December 2018, IEUA held a series of CBP workgroup meetings to develop a Memorandum of Understanding (MOU), which provided the collaborative forum to initiate the CBP feasibility studies and has continued to conduct workgroup meetings to discuss the ongoing CBP studies and evaluation. To date, information related to this Technical Feasibility Study project (also referred to as the Preliminary Design Report (PDR) project) was presented at the following CBP Workgroup meetings:

- May 14, 2019: PDR overview and update
- June 18, 2019: PDR approach, overview of PUT and TAKE alternatives, and overview of evaluation approach
- March 10, 2020: Overview and update of PUT and TAKE alternatives
- July 15, 2020: PUT and TAKE alternatives evaluations and overview of CBP program alternatives

In addition to these meetings, IEUA and the project team have met with many stakeholders in smaller group meetings to discuss detailed information about their service areas. IEUA continues to meet with the workgroup to present information, receive input, and discuss stakeholders' questions. The CBP workgroup stakeholders are presented in Table 2-1.

Table 2-1. CBP Workgroup Stakeholders

Stakeholder	Retail Member Agencies[1]	IEUA Member Agency	Wastewater Contract Agency[1]	Chino Basin Appropriative Pool[2]	Other
Chino Basin Water Conservation District					✓
Chino Basin Watermaster					✓
Chino Desalter Authority (CDA)					✓
City of Chino	✓		✓	✓	
City of Chino Hills	✓		✓	✓	
City of Fontana			✓	✓	
City of Montclair			✓		
City of Ontario	✓		✓	✓	
City of Pomona				✓	
City of Upland	✓		✓	✓	
Cucamonga Valley Water District (CVWD)	✓		✓	✓	
Fontana Water Company (FWC)	✓			✓	
Jurupa Community Services District (JCSD)				✓	
Metropolitan Water District (MWD)					✓
Monte Vista Water District (MVWD)	✓			✓	
San Antonio Water Company (SAWCO)	✓			✓	
Three Valleys Municipal Water District (TVMWD)					✓
Water Facilities Authority (WFA)		✓			
West Valley Water District (WVWD)				✓	
Western Municipal Water District (WMWD)					✓

Notes:

[1]Source: IEUA-WFA Final 2015 Urban Water Management Plan (Arcadis, June 2016).

[2]Source: Appropriative Pool Committee, Calendar Year 2019.

2.3 Chino Basin Watermaster and Chino Basin Studies and Activities

The Chino Basin is one of the largest groundwater basins in Southern California. The basin contains approximately 5,000,000 AF of water and has an unused storage capacity of approximately 1,000,000 AF. The Chino Basin consists of approximately 235 square miles of the upper Santa Ana River watershed and lies within portions of San Bernardino County, Riverside County, and Los Angeles County.

The groundwater pumping and storage rights in the Chino Basin were adjudicated pursuant to the Original Judgment in Chino Basin Municipal Water District vs. City of Chino et al (Judgment) in 1978. The Judgment also established the Watermaster to administer and enforce the provisions of the 1978 Judgment. The Watermaster also developed and implements the Optimum Basin Management Program (OBMP) and Peace Agreement per subsequent orders of the Court on February 19, 1998, which was completed in 1999 and 2000, respectively (Wildermuth Environmental, Inc. (WEI), 1999). The OBMP Implementation Plan, included as Exhibit B of the Peace Agreement, incorporated the operable features of the OBMP. The OBMP includes four goals for the basin:

1. Enhance Basin Water Supplies
2. Protect and Enhance Water Quality
3. Enhance Management of the Basin
4. Equitably Finance the OBMP

The OBMP also includes nine program elements or initiatives to reach these goals, provided in Table 2-2 below.

Table 2-2. OBMP Program Elements

Program Element	Description
1	Develop and Implement Comprehensive Monitoring Program
2	Develop and Implement Comprehensive Recharge Program
3	Develop and Implement Water Supply Plan for the Impaired Areas of the Basin
4	Develop and Implement Comprehensive Groundwater Management Plan for Management Zone 1
5	Develop and Implement Regional Supplemental Water Program
6	Develop and Implement Cooperative Programs with the Regional Water Quality Control Board, Santa Ana Region (Regional Board), and Other Agencies to Improve Basin Management
7	Develop and Implement Salt Management Plan
8	Develop and Implement Groundwater Storage Management Program
9	Develop and Implement Conjunctive-Use Program

2.3.1 Completed Studies and Programs

Since the 1978 Judgement, the water users have taken a significant effort to study the Chino Basin, implement the Program Elements, and reach the goals set forth in the OBMP. Chino Basin management and operations are supported by groundwater modeling; the first three-dimensional groundwater model of the Chino Basin was developed in 1994, which has continued to be updated and refined. The groundwater model is being used to support the development and evaluation of the CBP alternatives as part of this project.

Table 2-3 includes a list of studies and actions that have happened in the Chino Basin since the Judgement. Following the table is additional information about the Recharge Master Plan, the Storage Framework Investigation, the Dry Year Yield (DYY) Program, and the 2020 OBMP Update. The Storage Framework Investigation was used as a data source for the CBP and provided the framework for the development of the PUT and TAKE alternatives.

Table 2-3. List of Studies and Actions in the Chino Basin since the 1978 Judgement

Year	Study/ Action Description
1978	1978 Judgement adjudicates the Chino Basin pumping and storage rights.
1994	Development of Three-Dimensional Groundwater Model.
1995	Conceptual Study Design to Review Existing Water Quality Objectives, Wasteload Allocations & Monitoring Programs for Total Inorganic Nitrogen (TIN) & Dissolved Solids in the Santa Ana River Watershed and to Develop Appropriate Alternatives Where Necessary completed.
1998	Chino Basin Recharge Master Plan, Phase 1 Final Report completed. Prepared for Chino Basin Water Conservation District and Chino Basin Watermaster.
1999	The OBMP is developed in response to a 1998 court ruling in continuance of the 1978 Judgment. The OBMP provides a strategy that provides for enhanced yield of the Chino Basin and seeks to provide reliable, high quality water supplies for the Basin. The OBMP Implementation Plan is the court approved governing document for achieving the goals defined in the OBMP (WEI, June 2019). The OBMP includes 9 program elements or initiatives to meet the goals of the OBMP.
2000	The Peace Agreement is finalized and programmatic EIR accepted.
2000	TIN/Total Dissolved Solids (TDS) Study of the Santa Ana Watershed Technical Memorandum developed. Prepared for the TIN/TDS Task Force.
2001	Recharge Master Plan completed. The plan included recommendations to modify 17 flood retention facilities to increase diversion and storage and to construct two new recharge facilities. The projects were estimated to increase recharge by 17.5 TAFY.
2002	Initial State of the Basin Report completed. The State of the Basin Report is updated every 2 years by the Watermaster.
2002	Dry Year Yield (DYY) Program was initiated in 2002 among Metropolitan Water District, IEUA, TVMWD, and Watermaster, with sub-agreements for participating Chino basin appropriators.
2007	Final Groundwater Modeling Report and Evaluation of the Peace II Project Description.
2007	Groundwater management zone 1 (MZ-1) Plan completed to study subsidence and establish a monitoring protocol for subsidence in MZ-1.
2008	DYY Program Expansion Report completed. The DYY Program Expansion is a comprehensive water resources program to maximize conjunctive-use opportunities in the Chino Basin but was not implemented. See additional information in Section 2.3.1.3.
2010	The Peace II Agreement accepted. This includes provisions for the expansion of desalters in the Chino Basin, the dedication for 400,000 AF of groundwater in storage for desalter replenishment, and changes in the Judgment to implement Peace Agreement II.
2013	2010 Recharge Master Plan Update and 2013 Amendment (Referred to as 2013 Recharge Master Plan Update) completed. The updated plan recommends constructing 10 new recharge facilities and an includes an implementation plan.

Table 2-3. List of Studies and Actions in the Chino Basin since the 1978 Judgement	
Year	**Study/ Action Description**
2013	The 2013 Chino Basin Groundwater Model Update and Recalculation of Safe Yield Pursuant to the Peace Agreement Report provided a reassessment of the hydrology of the basin and update of projections through 2050. The safe yield was reevaluated and reduced to reflect long-term hydrology and near-term cultural conditions.
2015	2015 Update to the Chino Basin Subsidence Management Plan.
2018	2018 Recharge Master Plan Update completed. Includes no new major updates from the 2013 Recharge Master Plan Update and recommends the implementation plan from that report be continued.
2018	2018 Storage Framework Investigation developed to provide the tools and technical information necessary to enable the development of storage management plan. The results will be used by the Watermaster to update the OBMP in 2020.
2019	2020 Storage Management Plan (SMP) was completed in December 2019 and is incorporated into the 2020 OBMP Update and implementation plan.
2020	The January 2020 OBMP Update provides an update to the original 2000 OBMP to reflect the most current understanding of basin hydrogeology and hydrology and new water management challenges to ensure long-term groundwater pumping sustainability.
Source: Chino Basin Water Bank Strategic Plan WaterSMART Grant (IEUA, July 2018)	

2.3.1.1 Recharge Master Plan and Updates

Program Element 2 of the OBMP Implementation Plan is to Develop and Implement Comprehensive Recharge Program. Recharge in the Chino Basin is key to meeting the goals of OBMP, including enhanced Basin supplies and protect and enhance water quality. Pursuant to the OBMP and Peace Agreement, the Watermaster, IEUA, the Chino Basin Water Conservation District (CBWCD), and the San Bernardino County Flood Control District (SBCFCD) completed the 2001 Recharge Master Plan with the purpose of evaluating existing and planning for future groundwater replenishment for water supply reliability in the Chino Basin. Major projects from the Recharge Master Plan included modifications to flood retention facilities to increase groundwater recharge. Since the 2001 plan, the Recharge Master Plan has been updated in 2010, amended in 2013, and updated again in 2018. Additional projects for new recharge facilities have been included in the updates (WEI, September 2018).

2.3.1.2 Storage Framework Investigation

In 2018, the Watermaster completed a Storage Framework Investigation (SFI) to describe how the Chino Basin would respond to the use of storage space, the expected Material Physical Injury (MPI) and other management challenges (if any) with storage projects, and conceptual descriptions of various approaches to mitigate MPI and other management challenges (WEI, October 2018). The SFI provided the technical support for the 2020 Storage Management Plan (WEI, December 2019).

The SFI found that through 2050 there would be no MPI related to land subsidence and net recharge and that Hydraulic Control could be maintained in the Basin under the baseline scenarios with no new storage projects. The SFI then evaluated the impacts to the Basin under multiple storage scenarios, including different ranges of managed storage and various cumulative PUT and TAKE capacities. The findings from the SFI were used to define the location and capacities of PUT and TAKE facilities for the CBP to limit MPI and negative impacts to the Chino Basin.

On April 4, 2019, IEUA hosted a charette with IEUA, the Watermaster, WEI, and the project team to brief the team on the SFI assumptions and findings and how the SFI could be used to develop PUT and TAKE alternatives. Based on the results of the SFI, the following constraints were identified for the CBP alternatives:

- **Spatially symmetrical PUT/TAKE:** for the most part, the PUT and TAKE operations should be symmetrical within management zones. The PUT facilities (injection wells) should be located upgradient of the TAKE facilities (extraction wells) to minimize the potential for prolonged water level declines. For example, if 15 TAFY is recharged in groundwater management zone (MZ) 2 (MZ-2), then the same amount should be extracted from MZ-2. (Note, see Figure 3-1 for a map showing the Chino Basin groundwater MZs.)
- **Maintain Hydraulic Control:** all CBP alternatives must maintain Hydraulic Control within the basin, which is confirmed through modeling. Hydraulic Control is the reduction of groundwater discharge from the Chino Basin to the Santa Ana River to less than 1.0 TAFY. Achieving Hydraulic Control is imperative as it is a requirement of the Regional Board to permit IEUA the ability to reuse recycled water per the Basin Plan. Any storage and recovery projects that impact Hydraulic Control would require mitigation, such as modified groundwater production operations. Hydraulic Control is evaluated with groundwater modeling and, based on the results of groundwater modeling, mitigations can be identified.
- **Net recharge implications and identify mitigation requirements:** net recharge needs to be considered and mitigation requirements need to be identified. Net recharge is net inflow to the basin excluding the direct recharge of Supplemental Water. Pumping in excess of net recharge will cause a decline in storage. Furthermore, net recharge is a key factor in the calculation of Safe Yield, and, therefore, a reduction in net recharge will cause a reduction in Safe Yield (WEI, October 2018). Net recharge is evaluated with groundwater modeling and, based on results of groundwater modeling, net recharge mitigations can be identified.
- **MZ-2:** the northern portion of MZ-2 was identified and evaluated as the primary recharge location for purified water. The northern portion of MZ-2 is generally outside of known areas of contamination and does not have subsidence constraints or significant pumping depressions.
- **MZ-1 potential future constraints:** the Watermaster will be continuing to monitor subsidence in MZ-1 and storage and recovery programs in MZ-1 will need to be coordinated with that future plan.
- **MZ-3 constraints:** pumping sustainability challenges related to low groundwater levels have the potential to limit storage and recovery programs in MZ-3.
- **Operating bands of the SFI:** for the purpose of evaluating storage and recovery, the SFI assumed four operational bands for storage and recovery programs. Managed storage without a new program is operational band 1 and assumed to be 700 TAF. Operational bands 2, 3, and 4 consist of 100 TAF each and represent ranges of 700 to 800 TAF, 800 to 900 TAF, and 900 to 1,000 TAF, respectively. CBP would fall within operational bands 2 and 3 corresponding to a cumulative PUT and TAKE capacity of 25.0 to 50.0 TAFY and 33.0 to 67.0 TAFY, respectively.

WEI completed groundwater modeling scenarios for initial CBP PUT and TAKE alternatives that informed the alternatives development and evaluation and the results are summarized in TM2 Section 2. WEI is currently in the process of modeling the CBP alternatives to confirm that the program meets the Chino Basin operating requirements and the results will be summarized in TM2 Section 5.

2.3.1.3 Dry Year Yield Program

This section is currently in development.

2.3.1.4 2020 OBMP Update Report

Since the OBMP was adopted in 2000, the understanding of the basin hydrogeology and hydrology has improved and new water management challenges have been identified that need to be addressed to ensure long-term groundwater pumping sustainability (Chino Basin Watermaster, July 2019). Some major drivers to update the OBMP included climate change, legislation and regulation, salt and nutrient management, outside interest in Chino Basin operations, grant and low-interest loan project funding, improvements in science and technology, and the need for the OBMP CEQA Document to be updated. The *2020 OBMP Update*, which was completed in January 2020 (WEI, January 2020), was developed through a collaborative stakeholder process, the same approach used to develop the original OBMP. The Watermaster held a series of public “Listening Sessions” in 2019 to obtain information, ideas, and feedback from all stakeholders. Through this process, the stakeholders have identified the collective goals, impediments to achieving the goals, and the actions required to remove the impediments (Watermaster, March 2020). The *2020 OBMP Update* and associated *Implementation Plan and California Environmental Quality Act* (CEQA) process will set the framework for the next 20 years of basin-management activities.

The CBP components need to align with the *2020 OBMP Update*. Compliance with the OBMP requirements was included as a minimum requirement in the in the alternatives evaluation process for all PUT, TAKE, and program alternatives. The recommended program alternative will be developed in more detail to confirm alignment with the *2020 OBMP Update* requirements.

2.3.2 In Progress and Future Studies

There are two in progress and future studies for the Chino Basin that need to be considered when planning for the CBP. These include the IEUA NPDES permit modification via Basin Plan Amendment (in progress) and the Subsidence Management Plan (future). These studies are described below.

2.3.2.1 IEUA NPDES Permit Modification via Basin Plan Amendment

An updated *Water Quality Control Plan for the Santa Ana River Basin* (Basin Plan) was adopted by the Regional Board in 1994. The updated Basin Plan incorporated a revised Total Inorganic Nitrogen (TIN) waste load allocation and revised Nitrogen and TDS management plan. The Basin Plan was amended in 2004 and included updated water quality objectives that would reduce former constraints on water recycling. The Basin Plan Amendment and water quality objectives still assure the reasonable protection of the beneficial uses of surface and groundwaters within the Region, including the Chino Basin, and are consistent with the state’s antidegradation policy.

IEUA, in conjunction with the Watermaster, is exploring the use of a longer-term averaging period for defining compliance with the TDS limitations in the Basin Plan and NPDES Permit. This approach could provide relief compared to the current permit conditions with the RWQCB. The current NPDES Permit and Basin Plan require TDS concentrations in recycled water and effluent to be monitored and computed on a 12-month running average basis for permit compliance. Computing averages over a longer period (such as a 5-year running average) could provide an average that is less susceptible to exceedances during droughts. The RWQCB has required that IEUA and CBWM performed detailed groundwater modeling analysis estimate the TDS concentration impacts to groundwater and recycled water supplies in the Chino Basin from allowing a longer-term averaging period (e.g., 3, 5, 10 years). If it can be demonstrated that beneficial uses of the basin and downstream users are protected under a longer-term averaging period, in combination with ongoing compliance with the maximum benefit commitments, the RWQCB would likely approve a longer-term averaging period for the compliance metric. Based on the modeling results, and RWQCB’s own analysis, there could be several resulting recommendations, ranging from no change to permit limits to an averaging period less than the requested 5-year running average (IEUA and GEI, April 2020).

Statistical analysis of the long-term data set from 1995 to 2019 with a 5-year running average instead of the 12-month running average was performed to develop a long-term trend analysis, but did not consider other factors such as the groundwater recharge TDS limitations, triggering management actions when the ambient water quality exceeds the maximum benefit objectives, source water salinity change, or climate change. At the request of the RWQCB, climate change considerations and impacts to source water quality in the groundwater modeling are being completed to show long term impacts to the Chino Basin. Since this analysis is still in progress, simulations of historical drought period or future climate change impacts are not included at this time and is part of the larger modeling effort being prepared under the guidance of the RWQCB. The study was initiated in 2017, and conclusion on the feasibility of the longer-term averaging could be reached by end of 2021, with permit modifications to follow (IEUA and GEI, April 2020).

If a Basin Plan Amendment is issued in the future, then the CBP would need to be reviewed for compliance with the new requirements. It is anticipated that the CBP would comply with this potential future Basin Plan Amendment since the CBP includes an AWPF and would decrease the TDS concentration of IEUA's recycled water.

2.3.2.2 Long-Term Subsidence Management Plan

In 2007 the Watermaster developed the Chino Basin MZ-1 Plan that focused on monitoring ground level and managing subsidence in a managed area within MZ-1. The plan was updated in 2014 to better describe the Watermaster's effort and obligations with regard to land subsidence, which has expanded to areas outside of MZ-1 (WEI, July 2015). The *2015 Update to the Chino Basin Subsidence Management Plan* includes a subsidence management program and provides a process for annual analysis of monitoring data and reporting. The plan is adaptive and is intended to be continually updated and revised to best protect the basin from subsidence. The process of the annual analysis of monitoring data includes the evaluation of the effectiveness of the Subsidence Management Plan to minimize or stop land subsidence and ground fissuring and, if warranted by the data, a recommendation to update the Subsidence Management Pan (WEI, January 2020).

Development of a storage and recovery program, such as the CBP, needs to consider the ongoing subsidence management program and ongoing monitoring. If a storage and recovery program is implemented in MZ-1, then it may need to be modified in the future to be consistent with an updated subsidence management approach.

2.4 Stakeholders' Studies and Information

The project team met with most of the Stakeholders individually at the start of the project to discuss the CBP and how Stakeholders could potentially participate in the Program. As part of these meetings, the project team requested input and information to support the development of the PUT and TAKE components that make up the CBP. Examples of input and information requested by the project team includes information about existing facilities, recent studies, recent project costs, and planned projects. The information received from Stakeholders were used to develop example concepts/projects for the various components that could potentially be included in the CBP and does not imply a commitment to the CBP. This section includes summaries of studies and information from the following stakeholders:

- MWD
- City of Chino
- City of Chino Hills
- City of Pomona
- City of Rialto (Rialto)
- CVWD
- FWC

- JCSD/Western Riverside County Regional Wastewater Authority (WRCRWA)
- WFA

2.4.1 MWD

MWD is a public agency that provides supplemental imported water from the northern California State Water Project and the Colorado River Aqueduct to 26 member agencies located in Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties. As a water wholesaler, MWD does not have retail customers and distributes treated and untreated imported water to its member agencies. IEUA is a wholesale supplier from MWD and provides wholesale water (untreated imported water) to retail agencies in the Chino Basin area. (Arcadis, June 2016) MWD would be the State Water Contractor partner for the CBP

MWD has participated in meetings and workshops provided input to explore potential PUT and TAKE components that are being considered for the CBP. Information provided by MWD to support this planning process include the following:

- Participation in meetings and discussions to explore potential alternatives and ideas, including potential ideas for a future storage and recovery program(s) in the Chino Basin.
- Confirmed minimum requirements for pumping potable water into the Rialto Pipeline including water quality and hydraulic assumptions.
- Discussed pre-delivery options with the project team and how to incorporate the costs in the economic analysis as a potential wheeling charge.
- Provided example drawings for a turnout on the Rialto Pipeline to support planning for a new connection to the Rialto Pipeline for pump back to MWD.

The coordination with MWD for the CBP has been beneficial to MWD's future work for the Rialto Pipeline prestressed concrete cylinder pipe rehabilitation.

2.4.2 City of Chino

The City of Chino Water Quality Feasibility Study (Hazen and Sawyer, 2018) was conducted to investigate alternatives to utilize groundwater wells contaminated with 1,2,3-TCP, nitrate, perchlorate, and hexavalent chromium. Criteria for evaluation were process robustness, operational complexity, acquisition and disposal of chemicals and waste, ease of implementation, lifecycle cost, and uncertainty in cost and regulation. Non-treatment, interconnections, and blending were considered as non-treatment options, while granular activated carbon (GAC), ion exchange (IX), reverse osmosis, air stripping, and biological filtration were considered as treatment options. Of the treatment options, GAC and IX were determined to be the most feasible, and several alternatives were evaluated further. The top ranked programmatic alternative included four new facilities to treat Wells 4 and 6, Wells 10 and 12, Well 11, and Well 14, and the expansion of the Eastside Water Treatment Facility to treat Well 16. All facilities used a process consisting of cartridge filters, GAC, IX and chlorination. This alternative would cost an estimated $57.3M for 18.7 TAFY of expanded capacity (Hazen and Sawyer, 2018).

The study was used for this Project to develop an example wellhead treatment project that could potentially be included in the CBP as an In-Lieu Local option. The example project includes a centralized wellhead treatment facility connecting Wells 10, 12, and 14. Information obtained from the study included groundwater quality data, well capacities, and characteristics of the proposed site, located at the southwest corner of Philips Boulevard and Central Avenue.

2.4.3 City of Chino Hills

The *Preliminary Design Technical Memorandum for the Chino Hills 1,2,3-TCP Removal Project* (Michael Baker International 2018) was completed to investigate treatment alternatives for groundwater extraction wells contaminated with 1,2,3-TCP. The extraction wells of concern were Wells 1A, 7A, 7B, and 17. The report evaluated water quality data, treatment equipment requirements, and site layouts as a basis for recommending an alternative. Criteria for recommendation were lifecycle cost, ease of maintenance, permitting issues, land requirement, water quality improvement, and overall feasibility. The two alternatives presented were a centralized treatment facility or individual treatment facilities at each well site. Blending and GAC were determined as the most feasible in reducing the concentration of 1,2,3-TCP. The recommendation was a centralized treatment facility located adjacent to the City of Chino Hills Booster 9, with provisions for future expansion. The facility consists of four GAC treatment trains, with each vessel containing 20,000 pounds of carbon. This alternative would cost an estimated $4.1M for 4.4 TAFY of capacity (Michael Baker International 2018).

The study was used for this project to develop an example wellhead treatment project that could potentially be included in the CBP. The example project includes a centralized wellhead treatment facility connecting Wells 1A, 7A, 7B, and 17. Information obtained from the study included water quality data, well capacities and pump curves, and characteristics of the proposed site located on Eucalyptus Avenue in Chino.

2.4.4 City of Pomona

Based on the *Feasibility Study of Recycled Water Interconnections* (Carollo, January 2016) (see Section 2.1.5), recycled water from the City of Pomona was investigated as an additional supply source for the AWPF. While PWRP recycled water is available on an annual basis, the amount of water varies on a seasonal basis with more water available in the winter months and less water available in summer months when recycled water direct use demands are higher. The AWPF requires a constant water supply to most cost effectively produce purified water. Because IEUA's recycled water has the same seasonal variation (more in winter and less in summer), the PWRP recycled water supply was not pursued further as a supply for the CBP. The recycled water supply available from Pomona is summarized in Table 2-4. Recycled water supplies are discussed further in Section 4.1.

Table 2-4. City of Pomona Available Recycled Water

Month	2019 Available Recycled Water (AF)[1]	2026 Available Recycled Water (AF)[2]
January	315	521
February	262	434
March	226	374
April	173	286
May	105	174
June	39	64
July	1	2
August	3	4
September	53	88
October	132	218
November	220	364
December	285	472
Total	**1,811**	**3,000**

Notes:
[1]Provided by City of Pomona, May 21, 2019.
[2]2019 available recycled water scaled up to the anticipated 2026 supply of 3,000 AFY.

2.4.5 CVWD

CVWD provided background documents to support development of unit costs and other analysis. The information included:

- Drawings for the Royer Nesbit Water Treatment Plant (WTP) to provide background information for the planning.
- Project construction costs for a recent extraction well to support the unit cost development.
- General information about the Microvi biological groundwater treatment system which is being installed on a CVWD groundwater well.
- Minimum water treatment plant capacity for the Lloyd W. Michael WTP of 10 mgd (15.5 cubic feet per second [cfs]) to support the minimum water treatment plant flow analysis for the TAKE in-lieu usage analysis.

2.4.6 FWC

FWC provided information about the minimum water treatment plant capacity for the Sandhill WTP of 4 cfs (2.6 mgd) to support the minimum water treatment plant flow analysis for the TAKE in-lieu usage analysis.

2.4.7 JCSD/WRCRWA

IEUA and JCSD are in discussions to provide recycled water to the CBP from their portion of wastewater from WRCRWA. Information about the WRCRWA recycled water is included in Section 4.1 of this TM and TM2 Section 3.2.1.1.

IEUA and JCSD have studied alternatives for the recycled water connection between WRCRWA and IEUA's recycled water system, which are presented in the Joint IEUA-JCSD Recycled Water Intertie Project Title XVI/WIIN Feasibility Study (IEUA, December 2017) and the WaterSMART: Title XVI Water Reclamation and Reuse Project Funding Opportunity BOR-DO-18-F011 (IEUA, July 2018).

2.4.8 Rialto

IEUA and Rialto are in discussions to provide recycled water to the CBP from the Rialto WWTP. Information about the Rialto WWTP recycled water is included in Section 4.1 of this TM and TM2 Section 3.2.1.2.

2.4.9 TVMWD

TVMWD provided information about the minimum water treatment capacity for the Miramar WTP of 10 cfs (6.5 mgd) to support the minimum water treatment plant flow analysis for the TAKE in-lieu usage analysis.

2.4.10 WFA

WFA, which is a Joint Powers Authority for the member agencies of the cities of Chino, Chino Hills, Ontario, Upland and MVWD, provided information about the minimum water treatment plant capacity for the Agua de Legos Treatment Facility of 9 mgd (13.9 cfs) to support the minimum water treatment plant flow analysis for the TAKE in-lieu usage analysis.

Section 3: Regulatory Requirements

Alternatives developed for the CBP were screened for viability in the context of regulatory compliance. Key regulatory requirements are set forth by the California State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW) and the Regional Water Quality Control Board (RWQCB), Santa Ana Region, which have the following responsibilities:

- SWRCB DDW
  - Administers California's Drinking Water and Recycled Water Programs;
  - Establishes criteria to protect public health regarding recycled water production and use;
  - Develops Water Recycling Criteria in the California Code of Regulations (CCR), Title 22, which includes regulations for non-potable and potable use projects; and,
  - Participates in public hearings and makes recommendations for recycled water permits issued by the RWQCBs.
- RWQCB, Santa Ana Region
  - Establishes and oversees surface water and groundwater quality objectives to protect designated beneficial uses of waters in the region;
  - Issues and enforces water recycling and waste discharge permits and requirements; and,
  - Incorporates Title 22 requirements and recommendations from the SWRCB DDW into permits for water recycling and groundwater recharge projects.

This section describes the regulatory requirements that will govern the various aspects of the CBP. Since the program will include both groundwater replenishment and potable water, the applicable regulations include:

- IEUA's existing water recycling and recharge permits: discussed in Section 3.1
- Groundwater replenishment regulations: discussed in Section 3.2
- Drinking water regulations: discussed in Section 3.3

The PUT, TAKE, and program alternatives were developed to comply with these regulatory requirements, as will the recommended alternative as it is developed in more detail throughout the Study.

Additionally, a description of future DPR regulations are discussed in Section 3.4. While the CBP does not specifically include DPR concepts, the program could be expanded to include DPR in the future.

3.1 IEUA's Existing Water Recycling and Recharge Permits

IEUA has existing permits for the operation of the regional water recycling facilities and the groundwater recharge program. The basis for both permits is the Basin Plan, which is discussed further in Section 3.2.1.

IEUA operates its four regional water recycling facilities in compliance with RWQCB Order No. R8-2015-0036 which sets forth waste discharge and master water reclamation requirements (RWQCB, 2015):

- Regional Water Recycling Plant No. 1 (RP-1);
- Regional Water Recycling Plant No. 4 (RP-4);
- Regional Water Recycling Plant No. 5 (RP-5); and,
- Carbon Canyon Water Recycling Facility (CCWRF).

IEUA also operates Regional Water Recycling Plant No. 2 (RP-2), which treats solids from RP-5 and CCWRF, and is included in the permit as part of the RP-5 facility design flow. RP-2 is within the flood zone upstream of the Prado Dam and will be decommissioned once the new RP-5 solids treatment facilities are constructed.

IEUA operates the existing Chino Basin Recycled Water Groundwater Recharge Program in accordance with water recycling requirements set forth in RWQCB Order No. R8-2007-0039, as amended by Order No. R8-2009-0057 (RWQCB, 2007a, 2007b). Furthermore, IEUA operates and maintains its groundwater recharge basins in accordance with waste discharge requirements set forth in RWQCB Order No. R8-2018-0088, which specifies provisions for sediment excavation, dredging, dewatering, and upkeep activities.

3.2 Groundwater Replenishment Using Recycled Water Regulations

This section describes the groundwater replenishment regulations that CBP alternatives will need to comply with, which include the Basin Plan and Maximum Benefit Objective and the groundwater replenishment regulations.

3.2.1 Basin Plan and Maximum Benefit Objectives

The *Basin Plan* (RWQCB, 2019) provides the basis for permits issued and enforced by the RWQCB to implement State water quality controls and plans. The *Basin Plan* designates beneficial uses and water quality objectives for surface water and groundwater in the Santa Ana River watershed. Permit requirements for non-potable and potable water recycling projects are based on Title 22 as well as the *Basin Plan*. Permit limits for groundwater replenishment projects using recycled water are established to ensure that groundwater quality is not degraded or affected such that it contains concentrations of chemicals in amounts that adversely impact beneficial uses, except for approved “maximum benefit” allowances to encourage water recycling.

Historically, it is interesting to note that the Basin Plan was amended in 2004 (RWQCB Resolution No. R8-2004-0001), which updated the groundwater basin boundaries and water quality objectives for TDS and nitrogen. The updated *Basin Plan* also incorporated (1) a revised *Salt and Nitrogen Management Plan* (SNMP), which revised TDS and nitrogen waste load allocations for discharges to the Santa Ana River and its tributaries, (2) revised findings regarding the assimilative capacity in groundwater, and (3) a plan for water recycling in the region. Based on its review of on-going water quality monitoring, the RWQCB updates the SNMP for the Santa Ana region periodically as amendments to the *Basin Plan*.

One of the important issues in the watershed is the accumulation of salts and nitrates, which adversely impact designated beneficial uses of surface water, groundwater, and downstream users. Surface water quality objectives are established to protect receiving waters. The *Basin Plan* establishes five groundwater management zones (MZ) – MZ-1, MZ-2, MZ-3, MZ-4, and MZ-5 – with TDS and nitrate-nitrogen objectives to support water reclamation. The groundwater management zones are numbered from west to east with MZ-1 in the west to MZ-5 in the southeast and are shown in Figure 3-1. For selected groundwater MZs, the *Basin Plan* establishes “maximum benefit” water quality objectives that allow for lower groundwater quality standards (i.e., higher TDS and nitrate-nitrogen concentrations) provided that beneficial uses remain protected. Recycled water agencies must agree to achieve certain water resource commitments in order to implement projects using the “maximum benefit” objectives designated for specific groundwater MZs. If the “maximum benefit” commitments are not met, then the Basin Plan specifies that more restrictive “antidegradation” water quality objectives (lower TDS and nitrate-nitrogen concentrations) would be enforced.

Table 3-1 summarizes the beneficial uses of waters specified in the *Basin Plan* in the Program area.

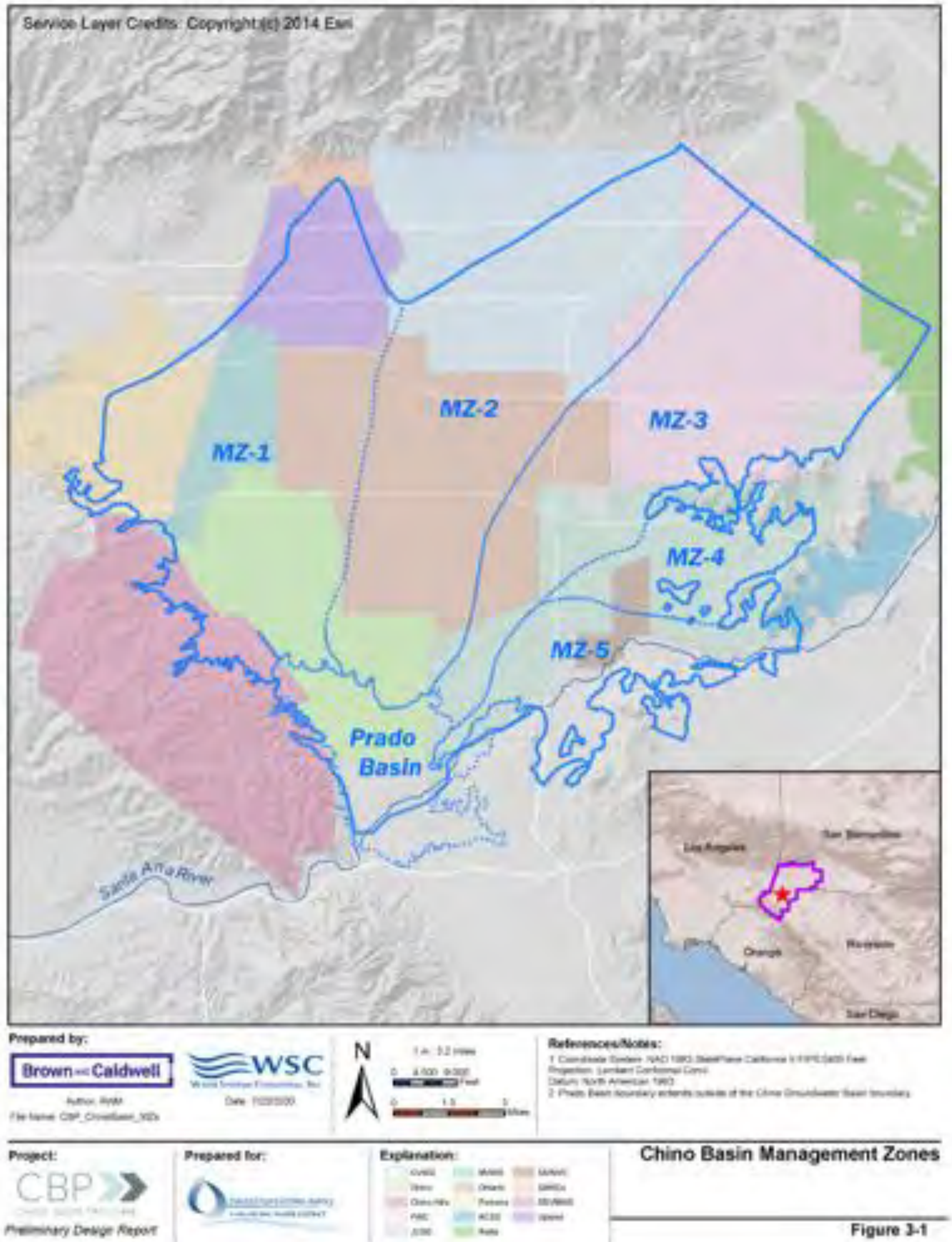

Figure 3-1. CBP Chino Basin MZs

Table 3-1. Beneficial Uses of Water in the Chino Basin Program Area															
		Summary of Existing or Potential Beneficial Uses[1]													
		Surface Waters								Groundwater Management Zones					
Abbreviation and Use Type		Prado Park Lake	Cuca-monga Creek, Reach 1	Chino Creek, Reach 1A	Chino Creek, Reach 1B	Chino Creek, Reach 2	Santa Ana River, Reach 3	Prado Flood Control Basin	Mill / Cuca-monga Creek Wetland	Chino North maximu m benefit	Chino 1 antideg radatio n	Chino 2 antideg radatio n	Chino 3 antideg radatio n	Cuca-monga
MUN	Municipal and Domestic Supply									ü	✓	✓	✓	✓
AGR	Agricultural Supply						ü			ü	✓	✓	✓	✓
IND	Industrial Service Supply									ü	✓	✓	✓	✓
PROC	Industrial Process Supply									ü	✓	✓	✓	✓
GWR	Groundwater Recharge		ü			ü	ü							
REC1	Water Contact Recreation	ü		ü	ü	ü	ü	ü	ü					
REC2	Non-Contact Water Recreation	ü	ü	ü	ü	ü	ü	ü	ü					
COMM	Commercial and Sport Fishing	ü												
WARM	Warm Freshwater Habitat	ü		ü	ü		ü	ü	ü					
LWRM	Limited Warm Freshwater Habitat		ü			ü								
WILD	Wildlife Habitat	ü	ü	ü	ü	ü	ü	ü	ü					
RARE	Rare, Threatened or Endangered Species			ü	ü		ü	ü	ü					
SPWN	Spawning, Reproduction and Development						ü							

For inland surface waters, Chapter 4 of the Basin Plan establishes narrative and numeric water quality objectives for the following parameters depending on the associated beneficial use(s):

- Algae
- Ammonia (un-ionized)
- Boron
- Chemical Oxygen Demand
- Chloride
- Chlorine residual
- Color
- Floatables
- Fluoride
- Hardness (as calcium carbonate)
- Metals
- Methylene Blue-Activated Substances
- Nitrate
- Nitrogen, total inorganic
- Oil and grease
- Oxygen, dissolved
- Pathogen indicator bacteria
- pH
- Radioactivity
- Sodium
- Solids, suspended and settleable
- Sulfate
- Sulfides
- Surfactants
- Taste and odor
- Temperature
- TDS
- Toxic Substances
- Turbidity

The *Basin Plan* establishes similar water quality objectives for groundwater to those listed above with the exception of TDS and nitrate for designated management zones. The Basin Plan establishes "maximum benefit" and "antidegradation" groundwater quality objectives for TDS and nitrate-nitrogen for the Chino Basin area of IEUA as shown in Table 3-2.

Table 3-2. Groundwater Quality Objectives in Chino Basin

Groundwater MZ	Maximum TDS Concentration (mg/L)[1]		Maximum Nitrate-Nitrogen Concentration (mg/L)[1]	
	Maximum Benefit	Antidegradation	Maximum Benefit	Antidegradation
Chino North	420	--	5.0	--
MZ-1 (Chino 1)	--	280	--	5.0
MZ-2 (Chino 2)		250		2.9
MZ-3 (Chino 3)		260		3.5

[1] Source: Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin Chapter 4 (RWQCB, 2019).

The Basin Plan divides the Chino North groundwater MZ into three parts for purposes of applying antidegradation objectives. The maximum benefit TDS objective established for the Chino North groundwater MZ is 420 mg/L. Antidegradation TDS objectives are established for MZ-1, MZ-2, and MZ-3 (also referred to as the Chino 1, Chino 2, and Chino 3 groundwater MZs, respectively) at 280, 250, and 260 mg/L, respectively. The same methodology is used for nitrate-nitrogen.

The Basin Plan allows for irrigation uses of recycled water to be credited for nitrogen uptake by plants. When recycled water is used for irrigation, no nitrate-nitrogen limit is set because nitrogen is anticipated to be used by plants and should not affect the underlying groundwater quality. For non-potable recycled water use (i.e., not groundwater recharge), only a TDS limit is established for maximum benefit.

IEUA's master reclamation permit (RWQCB Order No. R8-2015-0036) establishes agency-wide TDS maximum benefit limits for recycled water use, with the exception of groundwater recharge, in areas overlying the Chino North groundwater MZ. Compliance with the maximum benefit limit is based on the 12-month, flow-weighted (by facility) running average of 550 mg/L TDS. It should be noted that the IEUA permit limit is 550 mg/L TDS, which is higher than the aforementioned 420 mg/L groundwater quality objective, because IEUA's maximum benefit commitments call for blending of recycled water with other lower salinity sources of supply (e.g., storm water or imported State Water Project water). The permit specifies that should IEUA not comply with its commitments, then the more restrictive (antidegradation) TDS limits established for MZ-1, MZ-2, and MZ-3 would be imposed. The antidegradation TDS limits are the same as the water quality objectives because MZ-1, MZ-2, and MZ-3 lack assimilative capacity for TDS.

For the Chino Basin Recycled Water Groundwater Recharge Program, both the TDS and nitrate-nitrogen groundwater quality objectives are applicable for maximum benefit. IEUA operates the existing Program in accordance with water recycling requirements set forth in RWQCB Order No. R8-2007-0039, as amended by Order No. R8-2009-0057 (RWQCB, 2007a, 2007b). For groundwater recharge, recycled water from RP-1 and RP-4 must be blended with other water sources so that the five-year running average TDS and nitrate-nitrogen concentrations are equal to or less than the "maximum benefit" water quality objectives for the Chino North MZ of 420 mg/L and 5.0 mg/L, respectively. As part of this commitment, IEUA assures that the combined effluent quality from its reclamation plants will not exceed 550 mg/L TDS and 8 mg/L total inorganic nitrogen (on a 12-month, running average basis).

There are strict consequences associated with non-compliance with the maximum benefit commitments (e.g., failure to develop the required mitigation plans when the action limits are triggered) that could lead to recycled water and groundwater recharge program interruption and/or retroactive activities. If the NPDES permit limit is exceeded, IEUA will be in violation of its NPDES permit and if a plan to address it is not submitted to the RWQCB in a timely manner, this could result in the halting of all use of recycled water. Consequently, all effluent from IEUA's water recycling facilities will need to be discharged to the SAR, which would be above the discharge limitation (550 mg/L). Additionally, according to the Basin Plan, if the maximum benefit commitments (including the 550 mg/L limit) are not met, "the Regional Board will require that CBWM and IEUA mitigate the effects of discharges of recycled and imported water that took place under the maximum benefit objectives." This will require advanced water purification to mitigate the effects of the recycled water and groundwater recharge programs that have operated above the more stringent antidegradation objectives since the 2004 Basin Plan amendment was adopted. The Basin Plan also states that "The Regional Board will also require mitigation of any adverse effects on water quality downstream of the Chino Basin that result from failure to implement the 'maximum benefit' commitments." Non-compliance could result in permit modification with more stringent recycled water and groundwater recharge limits, severely impacting both the operability of the programs as well as the costs.

A summary of the Chino Basin "maximum benefit" commitments specified in the Basin Plan for IEUA and the Chino Basin Watermaster are:

1. Surface water monitoring
2. Groundwater monitoring
3. Chino Desalters
4. Future desalters
5. Recharge facilities
6. IEUA wastewater quality improvement plan
7. Recycled water blending with other sources to comply with "maximum benefit" TDS and nitrate-nitrogen objectives

8. Hydraulic control failure (eliminating groundwater discharge from Chino Basin to the SAR) (Note that IEUA's commitment is for hydraulic control to reduce groundwater discharge from the Chino Basin to the SAR to less than 1.0 TAFY)
9. Ambient groundwater quality determination

3.2.2 Groundwater Replenishment Using Recycled Water Regulations

Water recycling is regulated by Title 22, Division 4, Chapter 3 of the California Code of Regulations (CCR, 2018). Title 22 Water Recycling Criteria are developed and administered by the SWRCB DDW. Non-potable water production for reuse has been practiced for decades and was initially regulated under Title 22 as reclaimed water in 1978. Common non-potable uses of recycled water include irrigation, impoundments, and cooling water. Over the years, expanded beneficial uses were recognized and incorporated in the regulations. Requirements for groundwater replenishment with recycled water were added to Title 22 Water Recycling Criteria in 2014; requirements for surface water augmentation with recycled water were added in 2018. Both groundwater replenishment and surface water augmentation using recycled water are indirect forms of potable reuse.

Title 22 Water Recycling Criteria classify planned GRRPs by their method of recharge:

- Surface application (spreading); and
- Subsurface application (injection wells).

Surface application projects (Title 22, Article 5.1) are allowed to use recycled water that meets the Title 22 tertiary filtration and disinfection requirements with limitations on the amount of tertiary recycled water that can be applied and associated requirements for diluent water (i.e., dilution). Dilution, measured as the recycled municipal wastewater contribution (RWC) in the total recharge volume, may initially be limited to 0.2 (20% recycled water based on the running monthly average over the preceding 120 months). Demonstrated soil aquifer treatment can be used to remove total organic carbon (TOC) and support a GRRP's operation at a higher RWC (i.e., more recycled water and less diluent). Surface application projects can also use recycled water that has undergone advanced treatment as defined in the regulations and thus use higher quantities of recycled water relative to diluent water and potentially no diluent water (with DDW approval).

IEUA was one of the first agencies to be approved to use demonstrated soil aquifer treatment to remove TOC and TN, which allowed IEUA to increase the quantity of recycled water recharged to the Chino Basin. In addition, the 2007 permit was amended in 2009 to modify how IEUA tracks diluent water and recycled water blending, which effectively increased IEUA's ability to recharge using recycled water.

For subsurface application projects (Title 22, Article 5.2), the full volume of recycled water applied (e.g., injected) must receive advanced treatment that consists of reverse osmosis (RO) and an advanced oxidation process (AOP). The regulations establish RO and AOP performance criteria. Subsurface application projects utilize advanced treatment processes to remove TOC and may operate at higher RWC levels, potentially 1.0 (100% recycled water and no diluent) with DDW's approval.

All GRRPs must comply with other requirements for water quality, pathogenic microorganism control, underground retention, response retention time, and monitoring wells. In addition, all GRRPs are required to comply with the SWRCB Recycled Water Policy (SWRCB, 2019). Appendix A summarizes the Title 22 Water Recycling Criteria for groundwater replenishment using recycled water and compares the requirements for surface and subsurface applications.

3.3 Drinking Water Regulations

The SWRCB DDW regulates public water systems in accordance with federal and California Safe Drinking Water Acts (SDWAs). This section summarizes drinking water regulations/statutes including:

- Safe Drinking Water Plan for California
- Water Code and Health and Safety Code Statues
- California Code of Regulations for Drinking Water
- Federal and California Ground Water Rule
- Extremely Impaired Sources
- Upcoming Drinking Water Regulations

The DDW Field Operations Branches are responsible for the enforcement of the federal and California SDWAs by performing field inspections, issuing permits, reviewing plans and specifications for new facilities, taking enforcement actions for non-compliance with laws and regulations, reviewing water quality monitoring results, and supporting and promoting water system security. The staff from the Field Operations Branches also work with county health departments, planning departments, and boards of supervisors.

3.3.1 Safe Drinking Water Plan for California

In 1993, the California Department of Health Services (CDHS) submitted a draft plan called "*Drinking Water into the 21st Century: Safe Drinking Water Plan for California*" that included an overview of drinking water regulations, reviews and plans for drinking water quality/monitoring and threats, treatment technologies, funding aspects and financial assistance, and a focus on the challenges faced by small drinking water systems.

The CDHS, which became the California Department of Public Health (CDPH), transferred the Drinking Water Program (DWP) to the SWRCB in 2014 giving the authority to enforce federal and state Safe Drinking Water Acts. The SWRCB was also given responsibility for completion of the Draft Safe Drinking Water Plan in 2015. The 2015 Plan enhanced DDW's recommendations and implementation plan based on input from the public as well as the collaborations and resources resulting from incorporation of the CDPH DWP into the SWRCB as DDW.

The Safe Drinking Water Plan includes assessment of the quality of the state's drinking water, the identification of specific water quality problems, an analysis of the known and potential health risks that may be associated with drinking water contamination in California, and specific recommendations to improve drinking water quality. The Safe Drinking Water Plan is currently being updated (2020 Plan) to include the topics from previous plans as well as topics recently added and signed into law.

The requirements for the Safe Drinking Water Plan are set forth in Health & Safety Code Section 116355, which identifies the topics to be addressed and requires periodic updates.

3.3.2 Water code and Health and Safety Code Statutes

The California Code, Water Code includes statutes regarding drinking water. The Water Code was originally enacted in 1948 though most of California's water use laws were created by the Water Commission Act passed on 1914.

3.3.3 California Code of Regulation for Drinking Water

California Code of Regulations (CCR) Titles 17 and 22 pertaining to drinking water are listed below. Refer to Appendix B for more information on the CCR.

- Title 17, Division 1
  - Chapter 5, Subchapter 1, Group 4 – Drinking Water Supplies
- Title 22, Division 4
  - Chapter 13 – Operator Certification
  - Chapter 14 – Operator Water Permits

- Chapter 14.5 – Fees
- Chapter 15 – Domestic Water Quality and Monitoring Regulations
- Chapter 15.5 – Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors
- Division 4, Chapter 16 – California Waterworks Standards
- Division 4, Chapter 17 – Surface Water Treatment
- Division 4, Chapter 17.5 – Lead and Copper

In addition, Title 22 includes Addendums A and B, which include the California Ground Water Rule (see Section 3.3.4 below) and California Long Term 2 Enhanced Surface Water Treatment Rule, respectively.

3.3.3.1 Water Quality and Monitoring Regulations

Water quality and monitoring regulations are defined in Title 22, Division 4, Chapter 15.

3.3.3.2 Maximum Contaminant Levels (MCLs) and Detection Limits for Reporting Purposes (DLRs)

Regulations include monitoring and reporting of chemical constituent primary MCLs and DLRs and secondary MCLs (sMCLs). Table 3-3 lists the tables in Title 22, Chapter 15 of the CCR pertaining to MCLs and DLRs.

Table 3-3. CCR Tables for Primary MCLs and DLRs and Secondary MCLs

List of MCL/DLR	CCR Table Reference No.
MCL Inorganic Chemicals	64431-A
DLR Regulated Inorganic Chemicals	64432-A
Radionuclide (Gross Alpha Particle Activity, Radium-226, Radium-228, and Uranium) MCL and DLR	64442
Radionuclide (Beta Particle and Photon Radioactivity) MCL and DLR	64443
MCL Organic Chemicals	64444-A
DLR Regulated Organic Chemicals	64445.1-A
Secondary MCLs "Consumer Acceptance Contaminant Levels"	64449-A
Secondary MCLs "Consumer Acceptance Contaminant Level Ranges"	64449-B

[1] Refer to Title 22, Chapter 15 of the California Code of Regulations for more information.

Monitoring and compliance for inorganic chemicals listed in Table 64431-A shall be in accordance with Section 64432. Monitoring and compliance for nitrate/nitrite, asbestos and perchlorate shall be in accordance with Sections 64432.1, 64432.2 and 64432.3, respectively. Monitoring requirements for Gross Alpha Particle Activity, Radium-226, Radium-228, and Uranium shall be in accordance with Section 64442. Monitoring requirements for Beta Particle and Photon Radioactivity shall be in accordance with 64443.

Monitoring and compliance for organic chemicals shall be in accordance with Section 64445.1.

Secondary MCLs listed in Table 64449-A includes MCLs for aluminum, color, copper, MBAS, iron, manganese, methyl tert-butyl ether (MTBE), odor, silver, thiobencarb, turbidity, and zinc. If any of these constituents exceeds an MCL additional sampling is required per Section 64449.

Table 64449-B includes MCL ranges (recommended, upper and short term) for TDS, specific conductance, chloride and sulfate with level ranges. No fixed consumer acceptance contaminant level has been established for these constituents, however upper and short-term contaminant levels are only acceptable on a temporary basis for existing community water systems pending construction of treatment facilities or development of acceptable new water sources. New services from community water systems serving water which carries constituent concentrations between the upper and short-term contaminant levels are only acceptable if adequate progress is being demonstrated toward providing water of improved mineral quality or for other reasons acceptable to the State Water Board.

3.3.3.3 Notification Levels

Currently there are 31 chemicals with notification levels (as of February 6, 2020). Notification levels are health-based advisory levels established by the DDW for chemicals in drinking water that do not have an MCL. When chemicals are found at concentrations greater than their notification levels, certain requirements and recommendations apply. The level at which DDW recommends removal of a drinking water source from service is called the "response level."

When a notification level is exceeded in the drinking water, State law (Health & Safety Code Section 116455) requires the drinking water system to notify its governing body. In addition, DDW recommends that the utility inform its customers regarding the exceedance of the notification level and about health concerns associated with exposure to it.

If a chemical is present in drinking water at concentrations considerably greater than the notification level, DDW recommends that the drinking water system take the source out of service. The level prompting a recommendation for source removal is the "response level" of Health & Safety Code and depends upon the toxicological endpoint that is the basis for the notification level.

3.3.4 Federal and California Ground Water Rule

The Ground Water Rule applies to public water systems that use groundwater as a source of drinking water. The rule also applies to any system that delivers surface and groundwater to consumers where the groundwater is added to the distribution system without treatment. The Ground Water Rule was published in the Federal Register on November 8, 2006, and requires four major components:

- Routine sanitary surveys of systems required every three years (minimum);
- Triggered source water monitoring;
- Corrective action is required for any system with a significant deficiency or source water fecal contamination; and
- Compliance monitoring to ensure that treatment technology installed to treat drinking water reliably achieves 99.99 percent (4-log) inactivation or removal of viruses.

Ground Water Rule requirements are included in Section 64430 and Addendum A of the CCR. Section 64430 states that a public water system that uses groundwater shall comply with the following provisions of 40 Code of Federal Regulations as they appear in the Ground Water Rule published in 71 Federal Register 65574 (November 8, 2006) and amended in 71 Federal Register 67427 (November 21, 2006) and 74 Federal Register 30953 (June 29, 2009).

3.3.5 Extremely Impaired Sources

DDW follows Process Memorandum 97-005 for evaluating the use of extremely impaired sources for drinking water. The 97-005 Memorandum was updated in 2015, as a draft memorandum. The update is summarized in Appendix C. (SWRCB, DDW, 2015). An extremely impaired source is a water source that exceeds 10 times an MCL or action level (AL) based on chronic health effects, exceeds three times an MCL or AL based on acute health effects, is a surface water that requires more than 4 log Giardia and 5 log virus reduction, is extremely threatened with contamination due to proximity to know contaminating activities, contains a mixture of contaminants of health concern, and is designed to intercept known contaminants of health concern.

3.3.6 Upcoming Drinking Water Regulations

There are several drinking water regulations that are in process or planned that could potentially impact the drinking water concepts being developed for the CBP. The following upcoming regulations should be monitored as they relate to the drinking water concepts being developed for CBP.

- **Revised Total Coliform Rule:** The Federal Revised Coliform Rule became effective in 2016. California is preparing its version of the regulations. Until the state version is adopted, public water systems must comply with California's existing Total Coliform Rule and the new Federal Revised Coliform Rule.
- **Lead and Copper Rule:** Draft regulation packages are being prepared for the State and Federal Lead and Copper Rules. Since 2016, DDW has provided recommendations to California water systems about U.S. EPA's recommendations to provide additional information to the public related to lead pipes and fixtures. A draft of the Lead and Copper Rule Long-Term Revisions was published in November 2019 and a final rule is expected to be released shortly. Compliance is likely to begin around 2023.
- **Cross Connection Regulations:** Work on updating these regulations Title 17 CCR is conducted periodically as needed. Updates to these regulations are underway with a Policy Handbook. The SWQCB will request comments on the Draft Policy Handbook prior to adoption.
- **AB 2501 (Chu) (Statutes of 2018, Chapter 871):** amended drinking water requirements in 2018 to add additional topics, including a statement that every human being has the right to safe, clean, affordable and accessible water adequate for human consumption, cooking, and sanitary purposes, and a review of the use of administrators for disadvantaged communities' public water systems and an evaluation of the success of consolidation of drinking water systems.
- **Review of the Perchlorate Maximum Contaminant Level (MCL):** The DDW review of the perchlorate MCL was completed to determine whether it should be revised in response to the 2015 public health goal (PHG). In 2017, DDW proposed lowering the detection limit for purposes of reporting for perchlorate.
- **Microplastics: Senate Bill No. 1422 (filed on September 28, 2018):** requires the State Water Board to adopt a definition of microplastics in drinking water on or before July 1, 2020, and on or before July 1, 2021, to adopt a standard testing methodology for microplastics and requirements for four years of testing and reporting, including public disclosure of results.
- **MCL Review:** To meet requirements of the Health & Safety Code Section 116365(g), each year the State Water Board identifies the MCLs it intends to review.
- **DPR:** The report to the Legislature regarding the feasibility of developing DPR criteria was submitted in December 2016 with work on DPR continuing. DDW issued the Second Edition of the DPR Framework for public comment in August 2019. The Framework is not a regulatory document.
- **Per- and Polyfluoroalkyl Substances (PFAS):** PFAS are a large class of emerging contaminants which includes perfluorooctanesulfonic acid (PFOS) and PFOA. These contaminants have been detected in water supplies and the SWRCB has established NLs of 6.5 parts per trillion (ppt) for PFOS and 5.1 ppt for PFOA and Response Level (RL) of 40 ppt for PFOS and 10 ppt for PFOA. Starting in January 2020, water suppliers that detect PFOS and PFOA at levels higher than the RLs must take that water supply out of service, treat the water delivered, and provide public notification.
- **Hexavalent Chromium:** A hexavalent chromium MCL of 10 micrograms per liter (µg/L) was established in California on July 1, 2014 and invalidated by a court judgement on May 31, 2017. It is anticipated to be re-proposed at this same level in the future.

3.4 Future Potential DPR Regulations

The CBP concept is based on indirect potable reuse (IPR) to be able to use the Chino Basin as a storage basin. DPR is not currently included in the CBP, but IEUA's recycled water program could be expanded to include DPR in the future. A DPR concept could expand upon the advanced water purification concepts developed for the CBP with additional treatment/buffers and mix the water with a raw imported water source prior to water treatment, such as the Rialto Pipeline or upstream of CVWD's Lloyd. W. Michael WTP.

The main difference between IPR projects and DPR projects is the presence of an environmental buffer. An IPR project features an aquifer or reservoir that provides measurable and significant public health benefits. Lacking such an environmental buffer, a DPR project can utilize enhanced reliability from mechanical systems and treatment plant performance to replace the environmental buffer benefits and maintain an equivalent level of public health protection. DPR was defined in March 2019 under California Assembly Bill (AB) 292 by removing the term "direct" and defining based on purified water application instead through the following two terms: raw water augmentation (RWA) and treated water augmentation (TWA).

In August 2019, the SWRCB DDW issued "*A Proposed Framework for Regulating Direct Potable Reuse in California, Second Edition*" (SWRCB, 2019) for public review. The Framework, Second Edition, is an update of an earlier Framework completed in April 2018; the Framework, Second Edition represents DDW's current thinking on regulating DPR. DDW presented the Framework, Second Edition along with a summary of public comments to the SWRCB Board in November 2019. The Framework, Second Edition, focuses on development of a single regulatory package that covers the range of DPR, from TWA through RWA. DPR is defined in AB 574 as the planned introduction of recycled water either directly into a public domestic water system (i.e., TWA) or into a raw water supply immediately upstream of a drinking water treatment plant (i.e., RWA).

As noted previously, the environmental buffer in a DPR scenario may be significantly reduced or eliminated compared to IPR. Consequently, there may be enhanced requirements for pathogen control, chemical attenuation, real-time monitoring, engineered storage, and blending. Though regulations for RWA and TWA have not yet been developed, potential future requirements can be inferred from recent publications and presentations from DDW and the California DPR Expert Panel.

Under legislative mandate in AB 574, the SWRCB is required to develop regulations for RWA by the end of 2023 (with a potential extension to mid-2025). The aforementioned *2019 Framework, Second Edition* indicated DDW's intent to develop a single DPR regulatory package encompassing requirements for both RWA and TWA. The timeline for the DPR regulatory package remains consistent with the AB 574 deadline of December 2023.

In marked contrast with earlier potable reuse regulations, the revised DPR regulations will require treatment to consistently meet a daily risk objective versus an annual risk objective. This shift will likely increase the log reduction value (LRV) requirements for DPR applications, though the specific criteria are still under development. The SWRCB is funding five priority DPR research topics to address knowledge gaps identified as critical for regulatory development. Centered around control of pathogens and toxic chemicals (Table 3-4), these research topics provide further insight into potential future DPR considerations and, thus, may influence the design of the CBP AWPF should RWA or TWA be a possible future.

Table 3-4. Approaches to Maintain Public Health Protection in DPR settings	
Approach	**Description**
Source Control	Source control is a management barrier that provides a first layer of protection against toxic chemicals. Controls chemical risks by reducing concentration and variability of chemicals entering an AWPF. More stringent source control requirements will apply to DPR compared to IPR, due to lack of an environmental buffer.
Wastewater Treatment	Upstream wastewater treatment that provides a consistently high-quality feedwater to AWPFs is key to more consistent AWPF performance. The State and Expert Panel recommend minimum criteria for WWTPs serving as source water to a DPR system, including a high degree of organics destruction (e.g., secondary processes providing biological nutrient removal) and tertiary filtration prior to the AWPF (Olivieri et al, 2016; Tchobanoglous et al, 2015; State Water Board, 2019). Other beneficial elements include management of flows into the system and rigorous process monitoring.
Pathogen Control	Pathogens represent the most important public health concern because a single exposure can result in a public health impact. The State will require additional redundancy in pathogen control for DPR, possibly extending beyond IPR requirements and based on complying with a daily risk goal (instead of annual risk goal used for IPR). Barriers include treatment and management (non-treatment) approaches. The DPR Regulatory Framework will likely require project sponsors to justify removal credits at each treatment location (e.g., WWTP, AWPF, and drinking WTP [DWTP]). Non-treatment barriers may include blending with other source waters and dilution/mixing through reservoirs or other large storage structures, offering variable degrees of protection depending on system size and configuration.
Chemical Control	DPR trains will likely need to provide additional control measures, including treatment, in order to attenuate chemical peaks and provide added protection against compounds known to pass through full advanced treatment trains (Olivieri et al, 2016) and unknown compounds with similar characteristics.
Response Time and Failures	In IPR settings, an environmental buffer enables more time for identifying failures and responding appropriately. With DPR retention time being hours (not months), DPR requires moving towards greater failure prevention and configuring the elements of a DPR system including monitoring, diversions, storage, treatment, automated controls, and operator training to achieve a balance that protects public health without much failure response time.

Section 4: PUT Assumptions

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. The assumptions that were used to develop the PUT components are discussed in this section, except for conveyance, which is discussed for both PUT and TAKE components in Section 6.

The PUT components are as follows, with the corresponding section noted:

- **Tertiary recycled water supply** of 17 TAFY to produce 15 TAFY of purified water (discussed in Section 4.1).
- **Tertiary recycled water conveyance** to supply additional tertiary recycled water to IEUA's recycled water distribution system and the AWPF(s) (conveyance for both PUT and TAKE components is discussed in Section 6).
- **Advanced water purification** to treat the tertiary recycled water and produce purified water suitable for groundwater recharge through subsurface application (discussed in Section 4.2).
- **Purified water pumping and conveyance** to convey water from the AWPF(s) to the injection wells for groundwater recharge (conveyance for both PUT and TAKE components is discussed in Section 6).
- **Groundwater recharge using injection wells** and backup connections to recharge basins (discussed in Section 4.3).

To support the development of the PUT, TAKE, and program alternatives, WEI completed initial groundwater modeling for the PUT and TAKE components. The initial groundwater modeling results are discussed in TM2 Section 2.

4.1 Tertiary Recycled Water Supply and Quality

To meet the CBP objectives, various recycled water supply sources were considered that would allow IEUA to expand both direct use and groundwater recharge of tertiary recycled water as well as meet the future needs of CBP. The CBP will require 17.0 TAFY of tertiary recycled water to produce 15.0 TAFY of purified water.

For this Study, the recycled water supply sources considered for the CBP include IEUA, the Rialto WWTP, and the WRCRWA treatment plant. Recycled water supply is discussed further in Section 4.1.1 and recycled water quality in Section 4.1.2.

The seasonal and diurnal availability of recycled water could impact the AWPF sizing and operations. An evaluation of seasonal availability was also conducted to confirm that the AWPF could be supplied with a constant supply of recycled water to most cost-effectively produce purified water. New recycled water supplies that can provide constant flow year-round, such as WRCRWA and the Rialto WWTP, have the biggest benefit to the CBP to supply the AWPF at a constant rate and eliminate the need for seasonal storage. Due to the seasonal availability of recycled water from the PWRP (see Section 2.4.4), this source was not considered as a future supply for the CBP.

Diurnal recycled water supply fluctuations were assumed to be managed with existing and new equalization basins and recycled water storage tanks, which will be analyzed in more detail in future phases of the Program. The external recycled water supplies both have existing or planned equalization that will allow them to deliver a constant recycled water supply to IEUA's system (see Sections 4.1.1.2 and 4.1.1.3 in this TM). Equalization basins to manage diurnal recycled water supply fluctuations within IEUA's system were assumed for the AWPF components (see TM2 Section 3.2.2).

An analysis of IEUA's recycled water system was also completed using IEUA's recycled water model to confirm that recycled water can be conveyed to the appropriate locations in the recycled water system to meet current and future direct use and tertiary GWR demands as wells as future CBP demands

4.1.1 Recycled Water Supplies and Demands

This section is currently in development.

4.1.2 Recycled Water Quality

The following sections summarize the water quality for the three recycled water sources (IEUA, WRCRWA, and the Rialto WWTP) and potential water quality impacts on the AWPF design.

4.1.2.1 IEUA Recycled Water

There are two primary locations that are being considered for the primary AWPF in IEUA's system: RP-1 and

RP-4. The primary recycled water supply for the AWPF will be from the RP where the AWPF is located with additional recycled water supplied from IEUA's recycled water system and new external supplies. This section discusses the RP-1 and RP-4 treatment systems employed to treat wastewater and produce tertiary recycled water and presents recycled water quality and potential issues with future advanced water purification processes.

The treatment systems at RP-1 and RP-4 are as follows:

- RP-1 currently treats municipal wastewater through screening, grit removal, primary clarification, activated sludge aeration, secondary clarification, coagulation, dual-media gravity filtration, and final disinfection with sodium hypochlorite. As documented in the RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report (Carollo, April 2019), RP-1 will be upgraded with an MBR system (expected to be online by 2030) to recover capacity at the plant and implement other upgrades to replace structures and facilities that have reached the end of their useful lives. The treatment capacity of RP-1 is currently 32 mgd and will be restored to 40 mgd with the RP-1 Capacity Recovery Project.
- RP-4 currently treats municipal wastewater through screening, grit removal, primary clarification, Bardenpho activated sludge treatment, secondary clarification, coagulation, filtration, and final disinfection with sodium hypochlorite. The treatment capacity of RP-4 is 14 mgd. IEUA is planning to expand/upgrade RP-4 around 2040 to an MBR treatment facility.

RP-1 and RP-4 dose polymer and ferric chloride for enhanced primary clarification and aluminum sulfate as a filter aid as part of the wastewater treatment process. Aluminum can react with silica to form aluminum silicate salts such as calcium aluminum silicate and sodium aluminum silicate that cause scaling in RO systems. Ferric hydroxide, aluminum hydroxide, and phosphate salts, such as ferric hydroxyphosphate and aluminum hydroxyphosphate, also can precipitate on the membrane surface, attract silica, and cause silica fouling. Total aluminum and iron levels reported in Table 4-1 are at acceptable levels for RO treatment. Should aluminum and iron levels become problematic in the future, IEUA may need to optimize its wastewater treatment chemical addition to avoid RO fouling in the future AWPF.

Table 4-1 summarizes RP-1 and RP-4 final effluent average, minimum, and maximum water quality as reported in IEUA's annual recycled water quality reports. To better characterize water quality for AWPF design and to fill in the gaps on missing parameters that influence membrane performance (i.e., strontium and bromide), a sampling plan has been recommended for IEUA to conduct at RP-1 and RP-4.

Table 4-1. IEUA RP-1 and RP-4 Recycled Water Quality						
Constituent (1)	IEUA RP-1			IEUA RP-4		
	Avg	Min	Max	Avg	Min	Max
Calcium (mg/L Ca^{2+})	45	25	51	39	28	51
Magnesium (mg/L Mg^{2+})	9	7	11	9	7	11
Sodium (mg/L Na^{+})	97	79	116	96	75	116
Potassium (mg/L K^{+})	16(2)	14(2)	18(2)	15(2)	14(2)	16(2)
Barium (mg/L Ba^{2+})	0.014	0.011	0.021	0.011(4)	0.008(4)	0.013(4)
Copper (mg/L Cu^{+2})	0.004	0.002	0.008	0.004(4)	0.001(4)	0.006(4)
Iron (mg/L Fe^{2+})	0.11(3)	0.11(3)	0.11(3)	0.038	0.000	0.073
Manganese (mg/L Mn^{2+})	0.010	0.002	0.037	0.023(2)	0.016(2)	0.032(2)
Ammonium (mg/L NH_4^+ as N)	< 0.1	< 0.1	< 0.3	< 0.1	< 0.1	0.1
Aluminum (mg/L Al^{3+})	0.084(2)	0.024(2)	0.141(2)	0.073(7)	0.056(7)	0.095(7)
Bicarbonate (mg/L HCO_3^-)	177	132	217	159	100	197
Sulfate (mg/L SO_4^{2-})	51	39	80	53	39	74
Chloride (mg/L Cl^-)	111	96	132	112	82	134
Fluoride (mg/L F^-)	0.3	0.1	0.3	0.2	0.1	0.3
Nitrate (mg/L NO_3^- as N)	5.9	3.0	9.6	4.6	2.7	7.3
Phosphate (mg/L PO_4^{3-})	0.6	0.6	2.5	4.0	0.1	11.5
Silica (mg/L SiO_2)	24	19	29	21	4	31
pH	7.1	6.8	7.4	7.0	6.8	7.3
Alkalinity (mg/L as $CaCO_3$)	145	108	178	130	82	161
Hardness (mg/L as $CaCO_3$)	150	91	173	137	99	173
Boron (mg/L)	0.2	0.2	0.3	0.3	0.2	0.3
TOC (mg/L)	5.6	4.8	6.6	4.3	3.4	6.1
TDS (mg/L))	499	408	602	459	384	526
1,4-Dioxane (µg/L) (5), (6)	1.02	ND	1.10	1.02	ND	1.10
N-Nitrosodimethylamine (NDMA) (ng/L) (5)	4.35	2.20	7.00	4.35	2.20	7.00
NMOR (ng/L) (5)	66.17	6.90	350	66.17	6.90	350
Temperature (°C) (8)	25.01	16.29	30.40	-	-	-

Notes:
(1) Unless otherwise noted, based on monthly averages from 2014 to 2018 as reported in IEUA's annual recycled water quality report.
(2) Based on monthly samples from January 2018 to July 2019.
(3) Based on one sample taken in February 2018.
(4) Based on monthly samples from April 2018 to July 2019.
(5) Based on quarterly sample from March 2018 to May 2019 of blended RP-1 and RP-4 recycled water for groundwater recharge.
(6) If non-detect (ND) was reported, reporting limit value of 1.0 µg/L was used to calculate average.
(7) Based on eight samples from May 2018 to August 2019.
(8) Based on daily samples from January 2018 to August 2019.

4.1.2.2 Rialto WWTP Recycled Water

The Rialto WWTP currently consists of five independent treatment plants: Claraetor No. 1 (out of service), Claraetor No. 2, Conventional Plant No. 3, Conventional Plant No. 4 and Conventional Pant No. 5. Each plant provides screening, grit removal, primary clarification, activated sludge treatment, and secondary clarification. Combined flows from the plants then receive tertiary treatment through filtration and disinfection through chlorination for non-potable reuse. Rialto WWTP has an UV disinfection system, which never was put into operation.

The Rialto WWTP is currently undergoing upgrades to their existing infrastructure, focused on Conventional Plant No. 5, that includes replacement of the influent meter, headworks improvements, a new primary clarifier, a new aeration basin, a new secondary clarifier, new blowers, new disk filters, expansion of the chlorine contact tank, upgrades to the yard piping, electrical and instrumentation, and modifications to the sludge holding tank and filtrate equalization tank. The upgrades are expected to be completed in 2020 (Rialto Water Services, 2018). Rialto has a limited recycled water system that currently only provides recycled water to Caltrans at the Interstate Highway 10 irrigation corridor.

Table 4-2 summarizes the Rialto WWTP's final effluent average, minimum, and maximum water quality post dechlorination as reported on California Integrated Water Quality System (CIWQS) Electronic Self-Monitoring and Reporting Program (eSMR) from 2014 through 2018. Iron data was not available. Alum and polymer are added upstream of the tertiary filters to aid in filtration. Should aluminum and iron levels become problematic in the future, Rialto may need to optimize its wastewater treatment chemical addition to minimize or avoid RO fouling in the future AWPF for the CBP.

Table 4-2. Rialto WWTP Recycled Water Quality

Constituent (1)	Avg	Min	Max
Magnesium (mg/L Mg^{2+})	9	8	11
Sodium (mg/L Na^{+})	87	80	98
Barium (mg/L Ba^{2+})	0.022	0.017	0.024
Copper (mg/L Cu^{+2})	0.018	0.005	0.079
Ammonium (mg/L NH_4^{+} as N)	0.16	<0.10	6.7
Aluminum (mg/L Al^{3+})	0.052	0.053	0.065
Bicarbonate (mg/L HCO_{3-})	183	160	200
Sulfate (mg/L SO_4^{2-})	70	64	76
Chloride (mg/L Cl^{-})	83	77	89
Fluoride (mg/L F^{-})	0.4	0.3	0.5
Nitrate (mg/L NO_{3-} as N)	8.9	6.8	12
pH	7.4	6.9	8.5
Alkalinity (mg/L as $CaCO_3$)	150	131	164
Hardness (mg/L as $CaCO_3$)	189	150	230
Boron (mg/L)	0.2	0.2	0.2
TOC (mg/L)	6.8	5.7	13.0

Table 4-2. Rialto WWTP Recycled Water Quality			
Constituent (1)	Avg	Min	Max
TDS (mg/L)	398	199	542
Temperature (°C)	25.7	18.7	31.5

Notes:
(1) Unless otherwise noted, samples are based on CIWQS eSMR from 2014 through 2018. These samples are taken post dechlorination.

4.1.2.3 WRCRWA Recycled Water

To produce tertiary effluent for non-potable reuse, WRCWRA currently treats municipal wastewater through screenings, grit removal, primary clarification, secondary oxidation, secondary clarification, coagulation, Dynasand filtration, and medium-pressure ultraviolet disinfection.

Table 4-3 summarizes WRCRWA's final effluent average, minimum, and maximum water quality from effluent pump station for discharge to Reach 3 of the SAR as reported on CIWQS eSMR from 2014 through 2018. WRCRWA adds polymer and aluminum sulfate as filter aids. Data for iron is missing and should iron levels become problematic in the future, WRCRWA may need to optimize its wastewater treatment chemical addition to avoid RO fouling in the future AWPF for the CBP. The high fluoride concentration in Table 4-3 reflects one sample point of 68 mg/L reported on July 18, 2018. All other measured fluoride concentrations were 0.4 mg/L or less. Because high fluoride concentrations can cause calcium fluoride scaling on the future AWPF RO system, BC recommends more sampling for fluoride to confirm if the July 18, 2018 is a non-repeating outlier in the data set or an indication of increasing fluoride concentrations in the future.

Table 4-3. WRCRWA Recycled Water Quality			
Constituent[1]	Avg	Min	Max
Calcium (mg/L Ca^{2+})	56.9	47.0	68.0
Magnesium (mg/L Mg^{2+})	9.5	7.8	11.0
Sodium (mg/L Na^{+})	104	87.0	140
Barium (mg/L Ba^{2+})	0.030	0.010	0.053
Copper (mg/L Cu^{+2})	0.002	0.0004	0.004
Ammonium (mg/L NH_4^+ as N)	0.42	<0.048	14
Aluminum (mg/L Al^{3+})	0.56	0.28	0.87
Bicarbonate (mg/L HCO_{3-})	179	130	230
Sulfate (mg/L SO_4^{2-})	162	57	264
Chloride (mg/L Cl^-)	150	58	190
Fluoride (mg/L F^-)	0.27	0.18	68[2]
Total Nitrogen (mg/L N^{3+})	3.3	0.1	98[3]
pH	7.1	5.9	8.5
Alkalinity (mg/L as $CaCO_3$)	146	107	189

Table 4-3. WRCRWA Recycled Water Quality			
Constituent[1]	Avg	Min	Max
Hardness (mg/L as $CaCO_3$)	183	150	210
Boron (mg/L)	0.42	0.29	0.63
TOC (mg/L)	7.0	4.9	48[(4)]
TDS (mg/L)	538	330	660
NDMA (ng/L)	<1,400	<1,400	<1,400
Temperature (°C)	26	6.7[(5)]	36

Notes:

(1) Unless otherwise noted, samples are based on CIWQS eSMR from 2014 through 2018. These samples are taken from effluent pump station for discharge to Reach 3 of Santa Ana River.

(2) Outlier data point recorded on 7/18/2018. All other fluoride samples were 0.4 mg/L or less.

(3) Of the monthly nitrogen samples from 2014 to 2018, two samples were greater than 7 mg/L: 19 mg/L recorded on 1/4/2017 and 98 mg/L recorded on 3/8/2017.

(4) Of the weekly samples recorded from 2014 to 2018, two TOC samples were greater than 14 mg/L: 48 mg/L recorded on 8/26/2015 and 20 mg/L recorded on 12/17/2014. Average TOC concentrations were similar to IEUA and Rialto WWTP recycled water.

(5) Of daily samples recorded from 2014 to 2018, only one was as low as 6.7°C. The remainder were 16 or greater.

4.1.2.4 Overall Recycled Water Quality

The overall impact of recycled water quality on the AWPF design is discussed in this section.

For the RP-1 alternatives, it is assumed that the AWPF influent would largely reflect the RP-1 values reported in Table 4-5 under the IEUA RP-1 columns with slightly lower chloride, sodium, pH, and NDMA levels because AWPF effluent would be diverted immediately downstream of the tertiary filters, and upstream of chlorination. Because the AWPF would add chlorine and ammonia immediately upstream of the MF process, the preliminary design will assume values shown in Table 4-4 are the same as the AWPF influent following chlorination.

For the RP-4 alternatives, it is assumed that the AWPF influent would similarly reflect the RP-4 values reported in Table 4-4 with slightly lower chloride, sodium, pH, and NDMA levels for 60 percent of the influent flow on average. The remaining 40 percent of the RP-4 AWPF influent flow would reflect the water quality from IEUA's recycled water distribution system, comprised of a varying blend of recycled water from RP-1, WRCRWA, and/or the Rialto WWTP. Table 4-4 summarizes the projected water quality for the RP-4 AWPF alternatives assuming the following for each condition and this projected water quality was used to develop the RP-4 AWPF alternatives.

- **Average:** 60 percent RP-4 and 40 percent RP-1.
- **Minimum:** Minimum of RP-4, RP-1, WRCRWA, and the Rialto WWTP.
- **Maximum:** Maximum of RP-4, RP-1, WRCRWA, and the Rialto WWTP.

Table 4-4. Projected RP-4 AWPF Influent Water Quality			
Constituent [1]	Avg	Min	Max
Calcium (mg/L Ca^{2+})	41	25	68
Magnesium (mg/L Mg^{2+})	9.4	7.0	11
Sodium (mg/L Na^{+})	96	75	140
Potassium (mg/L K^{+})	15	14	18
Barium (mg/L Ba^{2+})	0.012	0.008	0.053
Copper (mg/L Cu^{+2})	0.004	0.0004	0.079
Iron (mg/L Fe^{2+})	0.068	0.000	0.112
Manganese (mg/L Mn^{2+})	0.018	0.002	0.037
Ammonium (mg/L NH_{4+} as N)	<0.1	<0.1	14.0
Aluminum (mg/L Al^{3+})	0.077	0.024	1.2
Bicarbonate (mg/L HCO_{3-})	166	100	230
Sulfate (mg/L SO_4^{2-})	52	39	264
Chloride (mg/L Cl^{-})	112	58	190
Fluoride (mg/L F^{-})	0.22	0.10	0.54[2]
Nitrate (mg/L NO_{3-} as N)	5.1	2.7	12
Phosphate (mg/L PO_4^{3-})	2.6	0.1	12
Silica (mg/L SiO_2)	22	4.0	31
pH	7.06	5.9	8.5
Alkalinity (mg/L as $CaCO_3$)	136	82	178
Hardness (mg/L as $CaCO_3$)	142	91	230
Boron (mg/L)	0.24	0.18	0.63
TOC (mg/L)	4.9	3.4	48
TDS (mg/L)	475	199	660
1,4-Dioxane (µg/L)	1.0	ND	1.1
NDMA (ng/L)	4.4	<1.4	7.0
NMOR (ng/L)	66	6.9	350
Temperature(°C)	25	16[3]	36

Notes:

(1) Refer to Table 4-5 for RP-1 and RP-4, Table 4-6 for Rialto WWTP recycled water and Table 4-7 for WRCRWA recycled water.

(2) Removed 68 mg/L outlier from WRCRWA data set.

(3) Removed 6.7°C outlier from WRCRWA data set.

4.1.3 Recycled Water Hydraulic Modeling

IEUA's recycled water model was originally constructed in 2003 in H¬2OMAP Water. Since then, the model has gone through multiple updates and has been converted into InfoWater model software. The model was most recently upgraded and calibrated in 2016 including updated controls and diurnal demand curves. The 2016 calibration scenario is considered representative of the system, and capital projects completed since 2016 were added to the model. The system hydraulic profile is shown in Figure 4-1 below. The recycled water model was used to support the development of CBP alternatives to (1) complete a recycled water distribution analysis to confirm that IEUA's existing recycled water system has sufficient capacity to convey water and maintain adequate pressures once the external supplies and the AWPF are incorporated into the system and (2) estimate tertiary recycled water pumping requirements whether the AWPF is located at RP-1 or RP-4.

The elements of the recycled water system included in the hydraulic model and recent system improvements are listed below:

- Pipelines: The recycled water pipelines are included in the hydraulic model, and include the pipeline length, diameter, roughness coefficient, and a check valve if the pipe does not allow reverse flow. The Baseline Pipeline and the Napa Lateral pipelines were constructed after the 2016 model calibration and are included in the model.
- Junction: The junctions in the recycled water model are necessary to connect joining pipelines at intersections. The elevation is defined at the junctions and necessary for the model to calculate system pressures. The system demands and demand patterns are also applied to the junctions.
- Tanks: The recycled water system includes 22.5 MG of available storage within six storage tanks. These tanks provide operational storage during times of peak demands. The modeled tanks include properties such as elevation, minimum and maximum water level, and diameter.
- Pumps: The pumps at each pump station are included in the model and run based on their pump curve and operational controls. The RP-1 1158 Pump Station was recently upgraded to include higher capacity pumps and was also updated in the model.
- Reservoirs: Fixed head reservoirs are used to model the water recycling plants.
- Valves: The model includes both pressure reducing valves (PRV) and flow control valves (FCV). The PRVs are representative of actual PRVs in the recycled water system that allow higher pressure zones to supply lower pressure zones. The PRVs includes the valve diameter, pressure setting, and operational controls as applicable. The FCVs in the model are located on the discharge side of IEUA's water recycling plants to control the recycled water supply. Diurnal production curves developed from the SCADA data during the 2016 calibration are applied to each plant to mimic the actual production at each plant throughout the day.

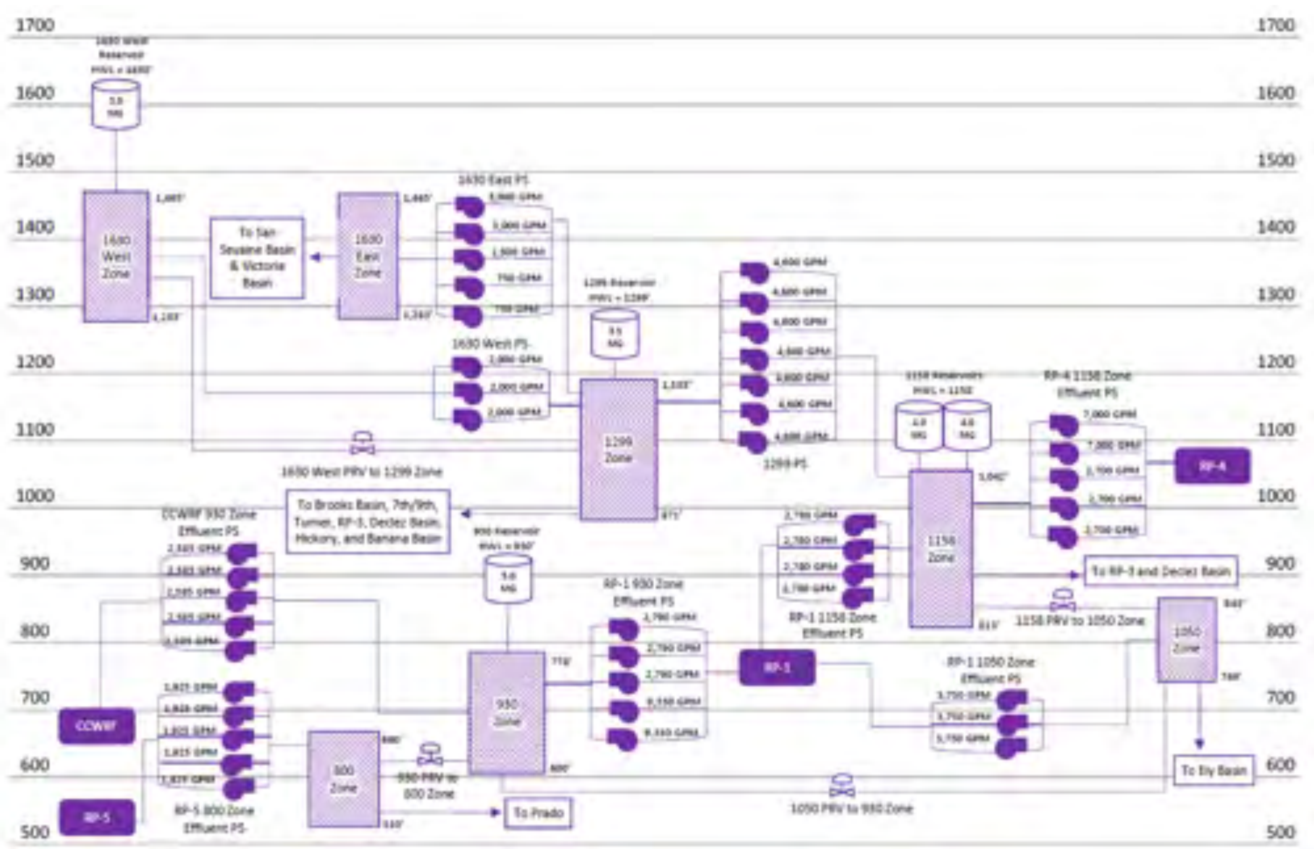

Figure 4-1. Recycled Water System Hydraulic Profile

4.1.3.1 Modeling Assumptions

The following sections describe the assumptions used in developing the modeling scenarios used to validate the CBP.

As part of the 2016 model update and calibration, diurnal production curves were developed for each IEUA recycling plant. The diurnal supply patterns from each plant follow expected patterns, with lower flows in the early morning and peak production later in the day. The future supply from each plant was scaled from the calibration day supply to maintain the same diurnal supply curve. During the 2016 model calibration, peaking factors and diurnal demand patterns were updated for each pressure zone and for large customers, spreading basins, and the Prado discharge. Figure 4-2 depicts the demand and the supply over the calibration day from the hydraulic model. Overall, demands are typically highest during the night and early morning, which is typical of a system with high agricultural demands. During these hours the demand exceeds supply and the system relies on storage to meet demands.

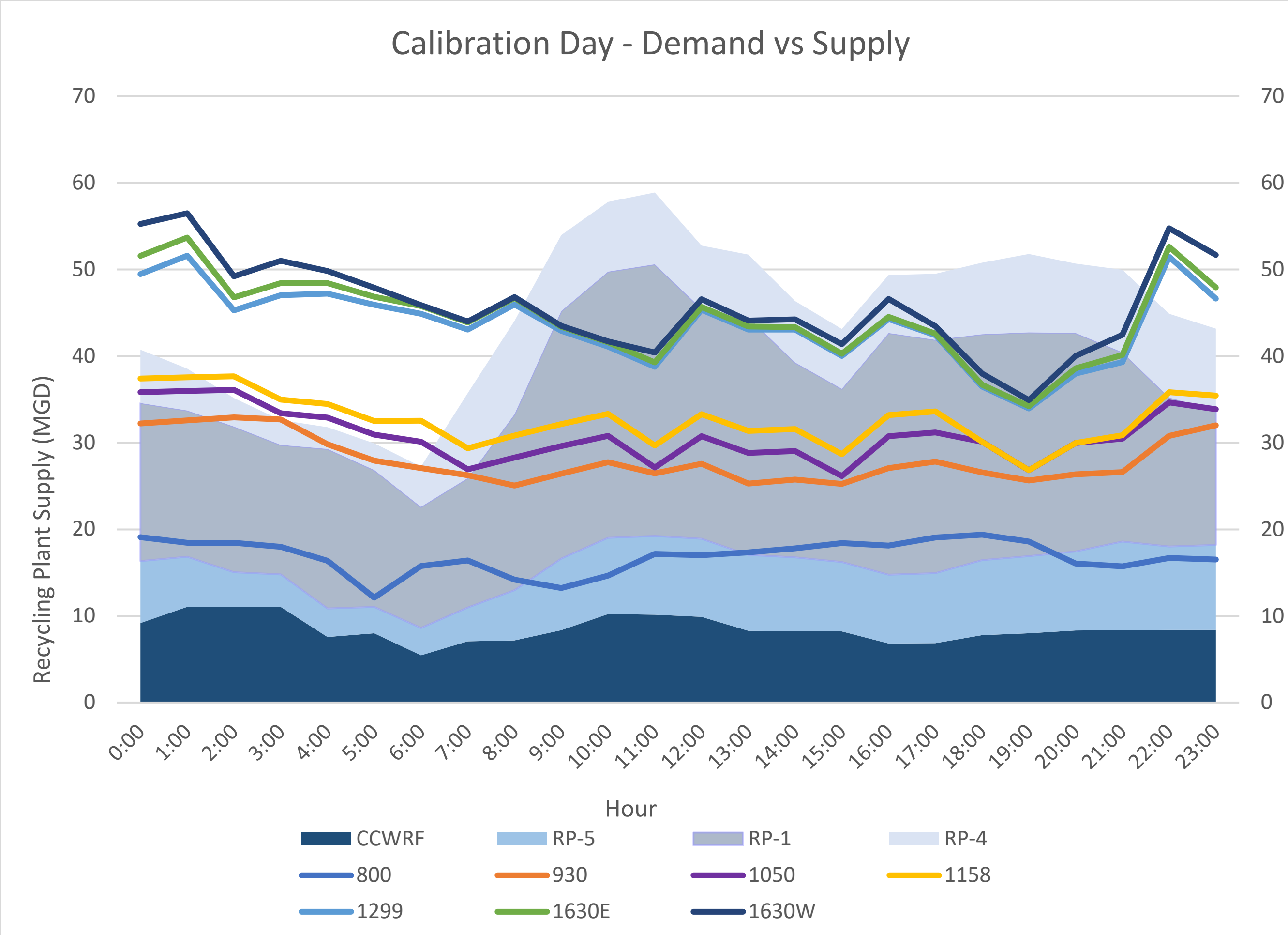

Figure 4-2. Supply and Demand Diurnal Patterns from the Hydraulic Model Calibration Day

For the recycled water distribution analysis using the hydraulic model, the demand allocation and diurnal patterns in the 2016 calibration scenario were maintained for the 2026 demand scenarios. The 2026 supply from each WRP was scaled from the 2016 calibration scenario to future projections, and assumes that utility water that is used onsite at the plant is excluded from these values. Demands were also scaled to future projections.

The supply projections from each IEUA recycling plant were developed based on the proportion of growth at each recycling plant between 2015 and 2026 from the Wastewater Facilities Master Plan Update Report (CH2MHILL, June 2015). The growth percentages for each plant were applied to the existing supply from the calibration day scenario to scale the future supply to the 62.4 TAFY 2026 projection.

The calibration day demand spatial allocation was used to scale projected summer demands. For projected winter demands, the 2012 fall/spring/winter demand sets were used to scale to projected non-summer month demands.

On the modeled calibration day, tertiary GWR demands are only allocated to the Ely, Hickory, and Banana Basin. When the tertiary GWR demands are scaled to 2026 projection, capacity in the Hickory and Banana Basins are maxed out, and the additional tertiary GWR demand is allocated evenly to the Ely and Turner Basins.

The peaking factors developed during the 2016 model update are shown in Table 4-5. Projected demands were scaled using the calibration demand spatial allocation for summer scenarios. The calibration day peaking factors by zone were used to calculate the average day demand spatial allocation. The demand spatial allocation for 2026 demands is assumed the same as the 2016 calibration scenario.

Table 4-5. Peaking Factors by Zone

Zone	Average Day	Max Day	Calibration Day
800	1	2.5	2.2
930	1	2.5	1.9
1050	1	2.1	0.9
1158	1	2.7	1.7
1299	1	2.9	1.3
1630 E	1	4.1	1.6
1630 W	1	1.84	1.6
System	1	2.5	1.58
Source: TM 1 Recycled Water Hydraulic Model Calibration (Carollo, June, 2017)			

All diurnal demand patterns applied to each node in the model were maintained for future demand scenarios. For the CBP, the 17.0 TAFY demand for the AWPF was modeled as a constant point load at a single node. For the AWPF at RP-1, the demand node is located upstream of all pump stations and assumes the plant will be supplied directly from RP-1. A new PRV was also added to the model from the 1158 pressure zone to the AWPF to supply the AWPF when supply from RP-1 drops below the AWPF demand, which typically only occurs a few hours a day.

For the AWPF at RP-4, the demand node is located within the 1158 pressure zone to allow multiple sources of water to feed the facility because RP-4 cannot fully meet the demand of the AWPF. The outside supply sources (WRCRWA and the Rialto WWTP) are supplied at a constant rate throughout the day. The pipeline from the Rialto WWTP connects to the demand node at the RP-4 AWPF. The pipeline from WRCRWA ties into the 930 pressure zone.

4.1.3.2 Scenario Development

The hydraulic model was used to evaluate the existing recycled water system and the future system with the implementation of the CBP in year 2026. The model was used to establish the system baseline as it is currently operating and evaluate the CBP PUT alternatives impacts on the recycled water system. In order to do so, four new scenarios were created in the recycled water model, as described below. It was important to maintain consistency between the alternatives so the results are comparable. All four scenarios included the same supply and demand sets, system controls, the new recycled water supply sources from the Rialto WWTP and WRCRWA and were run for a 24-hour duration. The focus of the modeling scenarios is 2026 summer when the system demands can exceed the supply for short periods of time due to daily diurnal patterns. The major differences in the modeled scenarios is the location of the AWPF.

1. **Scenario 1: AWPF at RP-1.** The first scenario set up included a single AWPF located at RP-1. In this scenario, a 17.0-TAFY demand was added to a node located adjacent RP-1 in the model on the suction side of the RP-1 1158 Pump Station within the 1158 pressure zone. A new PRV was added from the 1158 pressure zone to the AWPF demand node as a supplemental supply when the supply from RP-1 drops below the AWPF demand.
2. **Scenario 2: AWPF at RP-4.** In the second scenario the 17.0-TAFY AWPF demand node located adjacent to RP-4 on the discharge side of the RP-4 1158 pump station, within the 1158 pressure zone. The recycled water pipeline from the Rialto WWTP ties directly into this demand node in all scenarios.
3. **Scenario 3: Combination at RP-1 and in MZ-1.** The third modeled scenario includes two AWPFs, a large plant located at RP-1 and a smaller plant located within MZ-1. The same AWPF demand node used in the first scenario was used in this scenario for the RP-1 AWPF, but the demands were reduced to 12.0 TAFY. A new demand node was created in the model for the MZ-1 AWPF 3.0-TAFY demand, along with a new 16-inch pipeline to serve that demand. The location of the MZ-1 AWPF is assumed to be located in Montclair, just south of Interstate 10 and along Palo Verde Street, and just west of the Montclair recharge basins.
4. **Scenario 4: Combination at RP-4 and in MZ-1.** The last modeling scenario includes two AWPFs, a large plant with a 12.0-TAFY demand located at RP-4 and a small AWPF with a 3.0-TAFY demand located in MZ-1. The locations of the plant demands are the same as described in Scenario 2 for the RP-4 plant and in Scenario 3 for the plant located in MZ-1.

Based on these four modeling scenarios, it was concluded that the IEUA recycled water system has sufficient capacity to (1) convey the additional external supplies from WRCRWA and the Rialto WWTP and (2) maintain adequate pressures while meeting anticipated demands, including direct use and tertiary GWR as well as the new AWPF(s) at either RP-1, RP-4, or at either RP-1 or RP-4 combined with a smaller AWPF in MZ-1. Based on these conclusions, additional upgrades to the IEUA recycled water system are not required for the CBP.

The model was also used to evaluate the difference in recycled water pumping costs when the AWPF is located at RP-1 and when it is located at RP-4 to include in the PUT alternatives evaluation. This evaluation is presented in TM2 Section 3.2.1.3.

4.2 Advanced Water Purification

The PUT alternatives include advanced water purification to meet long-term salinity requirements in the Chino Basin. In addition, as discussed further in Section 4.3, subsurface application through injection wells is assumed for groundwater replenishment, which also requires purified water. This section discusses the AWPF assumptions for the PUT alternatives, which are presented in the following sections:

- Potential AWPF locations (Section 4.2.1)
- Purified water goals (Section 4.2.2)
- Process rationale (Section 4.2.3)
- AWPF capacity (Section 4.2.4)
- Brine disposal (Section 4.2.5)

4.2.1 Potential AWPF Locations

The potential AWPF locations impact treatment process selection and infrastructure requirements for tertiary recycled water, purified water, and brine conveyance. The closer that the AWPFs can be sited to source water supply (tertiary recycled water), the groundwater recharge locations, and brine disposal will result in lower capital and operating costs. To avoid additional costs and schedule delays associated with siting and purchasing land for an AWPF, only IEUA-owned or stakeholder-owned properties are being considered for the CBP.

Of IEUA's existing four regional water recycling facilities (RP-1, RP-4, RP-5, and CCWRF), RP-1 and RP-4 were identified as the two most-feasible locations for the future AWPF for the following reasons:

- RP-1: this plant is being upgraded to MBR treatment (expected to be online by 2030), which could eliminate the membrane filtration (MF) process in the future AWPF and reduce overall treatment costs at RP-1 (discussed further in Section 4.2.3). RP-1 is further away from the proposed recharge locations in MZ-2 (discussed further in Section 4.3) and will require longer purified water pipelines.
- RP-4: this plant is the closest IEUA treatment plant to the proposed groundwater recharge locations in northern MZ-2 (discussed further in Section 4.3), which will result in the shortest purified water pipelines. RP-4 is also planned for an upgrade to MBR treatment, but the upgrade will be in the long term and is not considered in the process selection for the AWPF.

Both locations are located near extensions of the Non-Reclaimable Wastewater System (NRWS) for brine disposal (discussed further in Section 4.2.6).

RP-5 and CCWRF were eliminated from consideration due to their locations in the southern part of IEUA's service area and the distance to the areas in northern MZ-2 identified for groundwater replenishment, which would require extensive purified water piping systems.

Additionally, to support purified water recharge options in MZ-1, a small AWPF is considered at the MVWD Plant 28 site, which was identified as part of the *Feasibility Study of Recycled Water Interconnections* (Carollo, January 2016). Alternatives that include this small AWPF in MZ-1 will be coupled with an AWPF at either RP-1 or RP-4.

With additional supplies being brought into the IEUA's recycled water system and water being routed to the AWPF, the tertiary recycled water distribution would be impacted regardless of where the AWPF is located. The distribution of tertiary recycled water was assessed as part of the PUT alternatives development to confirm that the existing IEUA recycled water system has sufficient capacity for the additional supplies and the AWPF (discussed in Section 4.1.3 of this TM), and that energy costs are addressed in the assessment (discussed in TM2 Section 3.2.1.3.

4.2.2 Purified Water Goals

Purified water must meet the treatment goals set forth by the CCR Title 22 Division 4, Chapter 3, Article 5.2 for IPR and groundwater replenishment through subsurface application. In addition, product water must meet the Basin Plan groundwater objectives for minerals and drinking water MCLs and Recycled Water Policy requirements regarding the SNMP, maximum benefit, and monitoring constituents of CECs in the Upper Santa Ana River basin (hydraulic sub area 801.21). Table 4-6 summarizes the treated water goals based on this regulatory framework.

Table 4-6. Purified Water Goals for IPR Groundwater Replenishment via Subsurface Injection in the Upper Santa Ana River Basin

Parameter	Criteria	Regulation
Enteric Virus	≥12 log reduction	CCR
Giardia cysts	≥10 log reduction	CCR
Cryptosporidium oocysts	≥10 log reduction	CCR
TOC	≤ 0.25 mg/l in 95% of weekly samples within first 20 weeks ≤ 0.5 mg/L 20-week running average and average of last 4 weekly samples	CCR
Total Nitrogen	≤ 10 mg/L average of twice weekly samples	CCR

Table 4-6. Purified Water Goals for IPR Groundwater Replenishment via Subsurface Injection in the Upper Santa Ana River Basin		
Parameter	**Criteria**	**Regulation**
Nitrate (as N)[1]	≤ 4.2 mg/L 5-year running average	Basin Plan
1,4-dioxane	≥0.5 log reduction by AOP	CCR
Inorganic Chemicals in Table 64431-A, except for nitrogen compounds	≤ MCLs in quarterly samples	CCR
Radionuclide Chemicals in Tables 64442 and 64443	≤ MCLs in quarterly samples	CCR
Organic Chemicals in 64444-A	≤ MCLs in quarterly samples	CCR
Disinfection Byproducts in Table 64533-A	≤ MCLs in quarterly samples	CCR
Lead and Copper	90th percentiles ≤ Action Levels	CCR
Secondary Drinking Water Contaminants in Tables 64449-A and 64449-B	≤ sMCLs in annual samples	CCR
Priority Toxic Pollutants in 40 CFR Section 131.38	≤ DDW-specified priority toxic pollutants and NLs(2) in quarterly samples	CCR
DDW-Specified Chemicals based on Engineering Report, Affected Groundwater Basin(s), and Wastewater Source Control	As specified by DDW in quarterly samples	CCR
NDMA	≤ 10 ng/L	CCR
TDS[1]	≤ 680mg/L	Basin Plan
Chloride	≤ 500 mg/L	Basin Plan
Sulfate	≤ 500 mg/L	Basin Plan
Boron	≤ 0.75 mg/L	Basin Plan
Sodium	≤ 180 mg/L for municipality use	Basin Plan
Sodium Absorption Ratio	≤ 9 for agricultural use	Basin Plan

Notes:

[1]Criteria applies the Basin Plan's "Maximum Benefit" objectives but if the Regional Board determines it is lowering the water quality and not a maximum benefit to the basin, the "Antidegradation" objectives will apply with Nitrate (as N) and TDS needing to meet 2.9 mg/L and 250 mg/L, respectively, for a 5-year running average (RWQCB – SA, 2019).

[2]Notable among which is the NDMA goal of 10 ng/L or less. (Listed as a separate row in this table for emphasis)

[3]A draft of the Lead and Copper Rule Long-Term Revisions was published in November 2019 and a final rule is expected to be released in fall 2020. Compliance is likely to begin around 2023.

4.2.3 Process Rationale

For potable reuse via subsurface groundwater replenishment, CCR requires full advanced treatment for all flow. As defined in CCR §60320.201, full advanced treatment included RO with on-going performance monitoring (e.g., conductivity or TOC) to indicate when the integrity of the process has been compromised. In addition to RO, full advanced treatment requires AOP that can achieve 0.5-log 1,4-dioxane removal with on-going performance monitoring via an established surrogate and/or operational parameters. To comply with full advanced treatment requirements, both alternatives proposed for the future AWPF include RO and UV-AOP.

MF is used as pretreatment to RO to remove suspended solids and reduce turbidity upstream of RO. Historically, MF is used to treat secondary or tertiary effluent prior to RO. Alternatively, a secondary MBR, which combines secondary treatment with MF, can provide adequate pretreatment upstream of RO and thereby eliminate the need of an additional intermediate MF system between the MBR and RO. However, DDW has not yet granted credit for pathogen reduction to MBR systems.

As discussed previously, RP-1 and RP-4 are the two IEUA sites that are being considered further for the AWPF. IEUA is planning to upgrade the secondary treatment systems at both plants with MBRs, although the RP-1 upgrade is planned in the near term (online by 2030) and RP-4 is in the long term (approximately 2040). Therefore, it is assumed if the AWPF is implemented at RP-1 that the treatment train would be MBR-RO-AOP and if the AWPF is implemented at RP-4 the treatment train would be MF-RO-AOP. IEUA could potentially convert an AWPF at RP-4 to MBR-RO-AOP when the MBR is implemented at RP-4.

These two process trains, MF-RO-AOP and MBR-RO-AOP, are described in the subsequent sections.

4.2.3.1 MF-RO-AOP at RP-4

All existing potable reuse facilities in California utilize MF as pretreatment for RO. MF removes suspended solids, reduces turbidity, and achieves credit for up to 4-log reduction of protozoa through daily integrity testing. If the AWPF is constructed at RP-4, then the treatment train would be MF-RO-AOP since the future conversion at RP-4 to MBR is planned for the long term.

Table 4-7 summarizes the rationale for the MF-RO-AOP treatment alternative proposed for the future AWPF.

Table 4-7. MF-RO-AOP Treatment Train Rationale

Process	Rationale
MF	• Reduces turbidity in secondary effluent to CCR §60301.320 required level of less than: — 0.2 NTU more than 5% of the time within a 24-hour period; and — 0.5 NTU at any time. — Removes pathogens via size exclusion and disinfection with chlorine added upstream of MF. — Provides necessary pretreatment upstream of RO similar existing California potable reuse plants.
RO	• Removes TOC per CCR §60320.201 startup requirement to achieve 0.25 mg/L during the first 20 weeks of operation and §60320.218 long term requirement not to exceed 0.5 mg/L based on: — 20-week running average of all TOC results; and — Average of the last four TOC results. • Reduces salinity per CCR §60320.201 and to meet the secondary MCL of 500 mg/L. • Decreases level of high molecular weight, uncharged CECs. • Removes pathogens via size exclusion. • Reduces influent nitrogen below 10 mg/L as N per CCR.
UV-AOP	• Provides disinfection for pathogen removal. • Achieves oxidation requirement per CCR §60320.201 by providing no less than 0.5-log (69 percent) reduction of 1,4-dioxane. • Provides final chemical abatement of remaining CECs, including 1,4-dioxane and NDMA.

Table 4-8 summarizes the anticipated pathogen log removal credits each AWPF process will claim compared to the minimum regulatory requirements. If desired, IEUA could claim additional virus credit through final chlorine disinfection though not required at this time.

Table 4-8. Anticipated MF-RO-AOP Pathogen Log Removal Credits

Process	**Virus**	***Giardia* cysts**	***Cryptosporidium* oocysts**
MF	-	4.0	4.0
RO(1)	1.5	1.5	1.5
UV-AOP	6.0	6.0	6.0
Pipeline Chlorination(2)	0+	0+	-
Groundwater Retention Time(3)	6.0	-	-
Total	**13.5+**	**11.5+**	**11.5**
Minimum Required	**12**	**10**	**10**

Notes:

(1) Based on TOC reduction across the RO system, as monitored by online analyzers on the combined influent and combined permeate.

(2) Though not required, IEUA could capitalize on the chlorine disinfection that will take place from the product water pump station to the injection wells for additional pathogen removal redundancy.

(3) Based on 6-month travel time to be confirmed by a tracer study.

4.2.3.2 MBR-RO-AOP at RP-1

IEUA is planning to replace its existing secondary treatment process at RP-1 with an MBR to be online before 2030. MBR uses similar membranes to that of MF that can provide adequate pretreatment upstream of RO and thereby eliminate the need of an additional intermediate MF system. Therefore, an MBR-RO-AOP treatment train is being considered for the AWPF at RP-1.

DDW has not yet granted credit for pathogen reduction to MBR systems. An Australian study presented a three-tiered approach for granting pathogen reduction credit to MBR systems, summarized below (AWRCE 2016):

- **Tier 1** provides conservative pathogen reduction credit based on the lower 5th percentile of historical MBR data collected by Branch and Le-Clech (2015) for a broad range of MBR systems and operational conditions. Tier 1 credits are thus lower and more conservative then Tier 2 or Tier 3 credits. Tier 1 pathogen credits do not directly correlate online water quality monitoring or membrane integrity testing to pathogen reduction.
- **Tier 2** conducts site and membrane manufacturer specific testing to determine minimum anticipated pathogen reduction. Tier 2 credits, being MBR specific and based upon extensive data sets for a particular supplier, are anticipated to be higher than Tier 1 credits. Tier 2 pathogen credits do not directly correlate with online water quality monitoring or membrane integrity testing to pathogen reduction.
- **Tier 3** has not yet been attempted but requires challenge testing to demonstrate the correlation between online parameter(s) and pathogen removal performance of the MBR to establish critical limits specific to the pathogen reduction claimed. Tier 3 credits may be similar to Tier 2 credits. If successful, claiming pathogen reduction under Tier 3 would be independent of membrane supplier and provide greater confidence in pathogen removal in real time

DDW has expressed a willingness to accept the Australian Tier 1 approach, which establishes default LRVs for MBRs shown in Table 4-9. These default LRVs apply to MBRs with a nominal pore size of 0.04-0.1 µm operating within the envelope shown in Table 4-10.

Table 4-9. Australian Tier 1 Default LRVs

Pathogen Type	Credited Log of Pathogen Reduction
Viruses	1.5
Protozoa	2
Bacteria	4

Table 4-10. Australian Tier 1 Operating Envelope

Parameter	Units	Minimum	Maximum
Bioreactor pH	-	6	8
Bioreactor Dissolved Oxygen	mg/L	1	7
Bioreactor Temperature	°C	16	30
Solids Retention Time	d	11	-
Hydraulic Retention Time (HRT)	h	6	-
Mixed Liquor Suspended Solids (MLSS)	g/L	3	-
Transmembrane Pressure	kPa	3	-
Flux	$L/m^2/h$	-	30
Turbidity	NTU	-	0.2

The pathogen reduction credit provided by Tier 1 would not allow the proposed treatment train of MBR, RO, and UV-AOP to satisfy the required 10.0 LRV of *Cryptosporidium oocysts* and *Giardia* cysts. IEUA could attempt testing required by Tier 2 or 3 to achieve the protozoa reduction required. Alternatively, IEUA could attempt additional pathogen reduction credit through primary treatment or enhanced RO monitoring (i.e., daily indigenous chemical sampling or online fluorescent dye injection and monitoring). Other studies have indicated that the actual LRVs are higher than the Australian Tier 1 values.

Though a formal MBR validation pathway has yet to be formalized in California, several potable reuse projects are moving forward with MBR as a critical process for pathogen reduction. These projects include the MWD Regional Recycled Advanced Water Purification Center, the City of Morro Bay Water Reclamation Facility, and the City of Los Angeles Bureau of Sanitation Hyperion MBR Pilot Facility. Results from these ongoing projects could provide input to a potential, similar project at IEUA if the MBR-RO-AOP option is selected.

Table 4-11 summarizes the anticipated pathogen log removal credits each AWPF process will claim compared to the minimum regulatory requirement. To make up for the 0.5-log shortfall for each protozoa, IEUA could attempt testing required by Tier 2 or 3 or additional pathogen reduction credit through primary treatment or enhanced RO monitoring (i.e., daily indigenous chemical sampling or online fluorescent dye injection and monitoring). The most conservative approach would utilize an online fluorescent dye injection and monitoring system, such as Nalco's TRASAR, which DDW has approved at a baseline of 3.0-log for virus, *Giardia* cysts, and *Cryptosporidium oocysts*. Employing the TRASAR system would raise the pathogen LRV totals well above the minimum required to 18.0, 12.5, and 12.5, respectively.

Table 4-11. Anticipated MBR-RO-AOP Pathogen Log Removal Credits			
Process	**Virus**	***Giardia* cysts**	***Cryptosporidium* oocysts**
Primary Treatment(1)	0+	0+	0+
MBR(2)	1.5	2.0	2.0
RO(3)	1.5-3.0	1.5-3.0	1.5-3.0
UV-AOP	6.0	6.0	6.0
Pipeline Chlorination(4)	0+	0+	-
Groundwater Retention Time(5)	6.0	-	-
Total	**15.0-16.5+**	**9.5-11.0+**	**9.5-11.0+**
Minimum Required	**12**	**10**	**10**

Notes:

(1) IEUA would need to conduct microbial testing to quantify predicted pathogen log removal values from primary treatment if pathogen LRVs are desired.

(2) Based on default Tier 1 values (AWRCE 2016).

(3) Based on TOC reduction across the RO system, as monitored by online analyzers on the combined influent and combined permeate. Higher log removals are achievable for RO with the use of an online monitoring system, such as TRASAR.

(4) Though not required, the City could capitalize on the chlorine disinfection that will take place from the product water pump station to the injection wells for additional pathogen removal redundancy.

(5) Based on 6-month travel time to be confirmed by a tracer study.

4.2.4 AWPF Capacity and Redundancy Assumptions

The most economical approach to size an AWPF is to provide a near constant flow of approximately 17.0 TAFY to produce the purified water goal of 15.0 TAFY. As discussed in Section 4.1, additional tertiary recycled water source supplies are being considered for the CBP to provide constant flow to the AWPF to avoid the need for seasonal storage or to oversize the AWPF to accommodate seasonal fluctuations. Diurnal flow equalization is assumed at both RP-1 and RP-4 to provide a constant water supply to the AWPF.

Figure 4-3 shows the required flow rates and assumed recoveries for the two primary AWPF alternatives: MF-RO-AOP at RP-4 and MBR-RO-AOP at RP-1, respectively. For the RP-4 alternative, MF backwash waste would return to the upstream wastewater treatment plant in order to minimize losses through the system. With an assumed online factor of 95 percent and 138 AFY of losses of RO permeate for other process use (i.e., RO flush, membrane cleanings, and analyzer waste), the required RO system recovery in order to produce 15.0 TAFY is approximately 93 percent. Similar facilities typically target a RO system recovery between 80 to 85 percent. As an exception, Water Replenishment District of Southern California owns two potable reuse facilities with high recovery RO:

- Leo J. Vander Lans Advanced Water Treatment Facility, which started operation in 2014 and has achieved 92.7 percent recovery through a non-proprietary three-stage RO system, and
- Albert Robles Center for Water Recycling, which started up in 2019, is designed to achieve 92.8 percent recovery through a non-proprietary three-stage RO system.

While available proprietary and non-proprietary high recovery RO treatment technologies could conceivably achieve 93 recovery, pilot testing achievable recovery on the anticipated water quality and corresponding impacts to concentrate disposal is recommended before constructing a full-scale system.

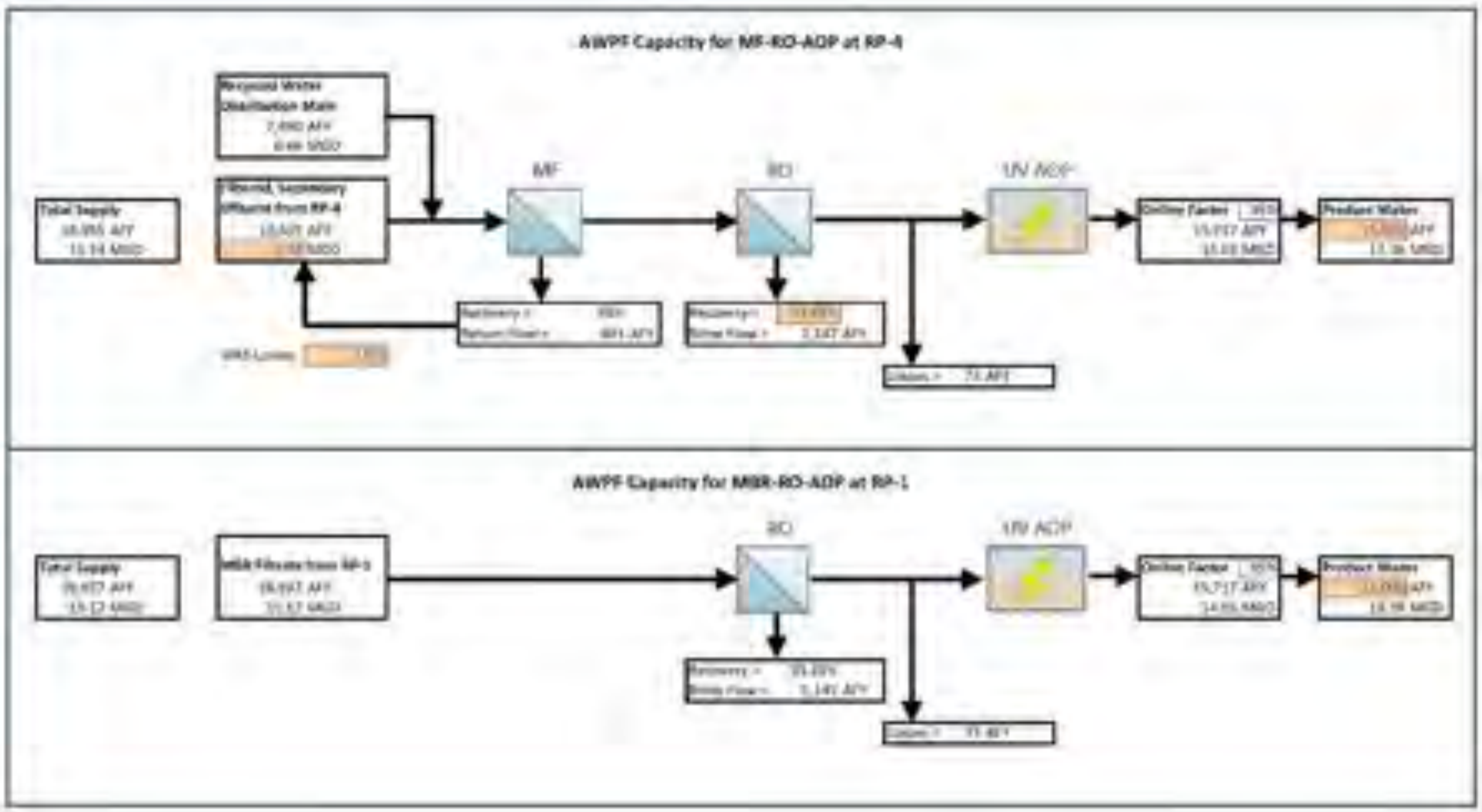

Figure 4-3. AWPF Capacities for MF-RO-AOP at RP-1 and MBR-RO-AOP at RP-1

The RP-1 with MBR alternative requires construction of either all or a portion of the future MBR trains to provide adequate flow for the AWPF. As described in the RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report (Carollo, April 2019), RP-1 has a treatment capacity of 25 and 27.5 mgd with all six aeration basins and all six secondary clarifiers. Adding four MBR trains of the ten planned for full secondary conversion would supply the future AWPF with adequate supply of 14.4 mgd (17.0 TAFY). The partial MBR system would require adequate capacity in a dedicated aeration system upstream with fine screening, return activated sludge (RAS), and waste activated sludge (WAS) separate from the existing secondary system. To maintain RP-1's overall treatment capacity, at least 13.1 mgd of existing aeration and secondary clarification would need to remain in place. The need to keep the conventional existing and new MBR secondary treatment processes separate without losing treatment capacity creates complications with phasing the MBR system. Full conversion to MBR by constructing all ten MBR trains at once with complete dedication of Systems A, B, and C for upstream aeration is recommended for the least complicated and costly approach. Since the AWPF is planned to be constructed by 2026, the cost for the AWPF at RP-1 includes the portion of the MBR needed for the AWPF. It is assumed that the remainder of the MBR cost would be funded by IEUA's CIP.

Redundancy requirements are established by the function of the facility and criticality of continuous full capacity operations. In order to maintain the high online factor required to reliably produce 15.0 TAFY with limited supply, the design includes fully redundant trains for all processes. Table 4-12 summarizes the redundancy planned for the AWPF along with the anticipated offline time.

Table 4-12. Redundancy Requirements

Process	Duty + Standby	Online Factor	Required Downtime
MF System			
MF Feed Tanks	1 + 0	98.6%	5 days per year to drain, clean, and inspect
MF Feed Pumps	3 + 1	100%	21 days per 5 years per pump
MF Strainers	3 + 1	100%	14 days per year per strainer
MF Trains	7 + 2	100%	12 days per year per train for CIP; 7 days per year per train for maintenance; 100 minutes per day for MC/backwash/PDT
MF Backwash Pumps	1 + 1	100%	21 days per 5 years per pump
MF Backwash Blowers	1 + 1	100%	2 days per year per blower
RO System			
RO Feed Tank	1 + 0	98.6%	5 days per year to drain, clean, and inspect
RO Feed Pumps	4 + 1	100%	21 days per 5 years per pump
Cartridge Filters	4 + 1	100%	1 day per 3 months per cartridge filter
RO Trains	4 + 1	100%	1 day per train per year for CIP; 28 days per 5 years per train for maintenance
RO Interstage Booster Pumps	4 + 1	100%	21 days per 5 years per pump
RO Flush Tank	1 + 0	98.6%	5 days per year to drain, clean, and inspect
RO Flush Pumps	1 + 1	100%	21 days per 5 years per pump

Table 4-12. Redundancy Requirements			
Process	**Duty + Standby**	**Online Factor**	**Required Downtime**
UV-AOP System			
UV Reactors	1 + 1	100%	14 days per year per reactor for bulb, sleeve, and ballast replacement
Factor to Account for Time to Switch Over to Duty Train in the Event of Failure		99.5%	20 failures per year; 2 hours to recover from each
Anticipated Online Time		**95.4%**	

4.2.5 Brine Disposal

The AWPF requires brine disposal for the brine stream generated by RO treatment. This section summarizes the brine disposal approach for the AWPF depending on its location at either RP-1 or RP-4, and the potential smaller AWPF at the MVWD Plant 28 site. Brine disposal is discussed in more detail in TM3 Brine Disposal System.

IEUA operates the NRWS, which conveys brines and other non-reclaimable high-strength wastewater to facilities in Los Angeles and Orange Counties for eventual discharge to the Pacific Ocean. The NRWS is comprised of three trunklines: NRWS and Etiwanda Wastewater Line (EWL), which discharge to the Los Angeles County Sanitation Districts (LACSD) wastewater collection system, and the Inland Empire Brine Line (IEBL), which discharges to the Orange County Sanitation District (OCSD) wastewater collection system. The NRWS is shown in Figure 4-4, and described further below:

- NRWS and EWL: this system collects industrial and high-salinity wastewater in the northern portion of IEUA's service area and portions of the conveyance system run by RP-1, RP-4, and the MVWD Plant 28 site. The NRWS and EWL convey the wastewater to the LACSD sewer system for treatment and disposal.
- IEBL: the IEBL, formerly called the Santa Ana Regional Interceptor (SARI), collects non-reclaimable wastewater from industrial customers in the Santa Ana River Watershed including high-salinity waste flows from IEUA's southern service area. IEBL flows are conveyed to OCSD's sewer system for treatment and disposal.

Since the NRWS runs adjacent to both RP-1 and RP-4 and near the MVWD Plant 28 site, the NRWS was selected as the brine disposal location for the PUT alternatives. Additional details about the NRWS infrastructure, available capacity, existing connections, future considerations for brine conveyance and scaling mitigation, design considerations for new connections, and system costs for connection capacity and operations are discussed further in TM3 Brine Disposal System.

Figure 4-4. IEUA Non-Reclaimable Wastewater System

4.3 Groundwater Recharge

The PUT alternatives include recharging purified water to the Chino Basin to achieve two goals: capitalizing on storage within the basin as well as reducing the overall salinity of the basin. The groundwater recharge component includes both where to recharge the water and how to recharge the water.

This section discusses the groundwater recharge assumptions for the PUT alternatives, which are presented in the following sections:

- Recharge locations in the Chino Basin (Section 4.3.1), which need to consider the characteristics of the Chino Basin, groundwater quality, and recovery of the stored water.
- Recharge method, including injection wells and recharge basins (Section 4.3.2).
- Monitoring wells (Section 4.3.3).

4.3.1 Recharge Locations

The northern portion of MZ-2 was identified as the primary recharge location for purified water since it had been evaluated previously as part of the SFI (WEI, October 2018). The area is also generally outside of known areas of contamination and does not have subsidence or low groundwater levels. The SFI also included managed storage and recovery programs within operational bands 2, 3, and 4. For these storage and recovery programs, groundwater replenishment using wells was assumed in the northern MZ-2 area in two east-west alignments in Rancho Cucamonga.

For the PUT alternatives, two sets of potential injection well locations in MZ-2 were identified, which are as follows:

- Initially, potential injection well locations were identified in MZ-2 in Rancho Cucamonga in similar locations as assumed for the SFI. One east-west alignment was assumed on the Pacific Electric Inland Empire Trail and one along Foothill Boulevard.
- In order to reduce the infrastructure required to convey the purified water from the AWPF to the injection wells, a second set of injection well locations were identified in MZ-2. These were located further south than the initial set (closer to both RP-1 and RP-4) to reduce the overall purified water pipeline lengths. The east-west alignments of injection wells were assumed along Foothill Boulevard and Arrow Route in Rancho Cucamonga.

As described in TM2 Section 2, preliminary groundwater modeling was completed for both sets of preliminary injection well locations and results indicate that both alternatives align with the OBMP objectives and the SFI. The second set of injection wells (located on Foothill Boulevard and Arrow Route) are assumed for the PUT alternatives to reduce the overall infrastructure costs.

Injection wells in MZ-1 and MZ-3 were also investigated as part of the project:

- MZ-1: Injection wells in MZ-1 were assumed to be located near the Montclair Basins, which are north of the proposed AWPF at MVWD Plant 28. The Montclair Basins were originally assumed as a potential recharge location for purified water as part of the Feasibility Study of Recycled Water Interconnections Between the City of Pomona, MVWD, and IEUA (Carollo, January 2016). Insufficient groundwater travel time was identified between the recharge basins and nearby extraction wells. Due to the travel time issue and the need to prioritize stormwater recharge at these basins, injection wells are assumed for MZ-1.
- MZ-3: Injection well locations were identified in MZ-3 north of the JCSD wellfield. This area has experienced historically low groundwater levels and injection wells were considered in this area to potentially improve groundwater levels, as well as to support the program.

The injection well locations that were assumed for the PUT alternatives are discussed further in Section 2.

4.3.2 Recharge Method

Existing recharge basins are used to recharge a combination of stormwater, tertiary recycled water, and imported water into the basin. These recharge basins are highly utilized, especially seasonally during storm events, and do not have sufficient year-round capacity for the additional purified water (15 TAFY) to be recharged as part of the CBP. The PUT alternatives were developed assuming injection wells would be used to recharge purified water.

The following subsections discuss injections well assumptions, as well as additional information about recharge basins and opportunistic connections to backup injection wells as the primary recharge approach.

4.3.2.1 Injection Wells

Injection wells will be used to recharge purified water to the Chino Basin drinking water aquifers. Injection wells allow for consistent recharge of specific aquifers and are not subject to stormwater capacity restraints like recharge basins. This section describes the assumptions and considerations for the proposed injection wells to recharge 15.0 TAFY

Each injection well will be constructed to the State of California regulations. Each well site will include a concrete pad, superstructure, necessary safety features, signage, and flowmeters. Each injection well is estimated to require a site space of 100 feet by 100 feet (0.23 acres) that will accommodate the initial well construction, the wellhead equipment, and future well maintenance and redevelopment. It is assumed that land would need to be purchased for each injection well. An example injection well site is shown in Figure 4-5.

Figure 4-5. Example Injection Well Site

The capacity of each injection well is assumed to be 50 percent of the average pumping rate of nearby production wells. Based on the data included in the Storage Framework Investigation (WEI, October 2018) and the characterization of each management zone, the estimated injection wells capacities for each management zone are summarized in Table 4-13. In TM2, injection well capacities are used to estimate the number of injection wells for the PUT alternatives.

Table 4-13. Estimated Injection Well Capacity by Management Zone		
Management Zone	Estimated Capacity per Injection Well	
	gpm	AFD
MZ-1	850	3.65
MZ-2	830	3.77
MZ-3	1,130	3.99

Injection well capacities are dependent on the well maintenance and other operational assumptions. Standard injection well operational procedures include assuming wells do not sit idle for longer than one week, are exercised near design flow rates, are backflushed for approximately one hour a week, and are rehabbed every three to five years. Redundant injection wells are recommended to allow for backflushing and well rehabilitation while meeting the continuous recharge rate of 15.0 TAFY. Test injection wells are recommended to collect site specific information to guide injection well design.

The recommended redundancy for injection wells is one standby well for every three active wells. For example, if all 15.0 TAFY (41.1 acre-feet per day (AFD)) is proposed to be recharged in MZ-2, then 12 operating wells and four standby wells (16 wells total) are recommended based on the estimated MZ-2 injection well capacity in Table 4-13 and the recommended redundancy requirements. One example operating scenario would be to group the wells into four sets of four wells each where at any one time three wells would be active and one standby. The active wells would be cycled on a weekly basis to make sure that each well is not inactive for more than a week.

4.3.2.2 Recharge Basins

As discussed previously, due to the need to recharge stormwater when available, the existing recharge basins do not have sufficient year-round capacity to consistently recharge the purified water to the Chino Basin. As part of this project, WEI identified potential recharge basins that have excess capacity and could be used to recharge the purified water, which are summarized in Table 4-14. While these basins potentially have capacity during non-storm periods, they would not be able to recharge water year-round due to the need to prioritize recharge of stormwater during storm events.

Table 4-14. Recharge Capacity of Existing IEUA Basins		
Management Zone	Spreading Basin	Annual Recharge (TAFY)
MZ 1	Montclair Basins	3.0
	Subtotal	**3.0**
MZ 2	Lower Day	1.0
	San Sevaine	2.2
	Victoria	0.7
	Etiwanda Debris Basin	1.4
	Hickory	0.6
	Banana	0.7
	Turner	0.8
	Subtotal	**7.4**

Table 4-14. Recharge Capacity of Existing IEUA Basins		
Management Zone	**Spreading Basin**	**Annual Recharge (TAFY)**
MZ 3	IEUA RP-3	3.0
	Declez	1.6
	Subtotal	4.6
Total		**15.0**

As part of the PUT alternatives development, the feasibility of using the recharge basins presented in Table 4-14 as backup for the active injection wells (instead of standby injection wells) was evaluated. This would allow fewer standby injection wells, although the purified water recharge rate would be lower during winter months when the recharge basins are prioritized for stormwater. Extending purified water pipelines to the recharge basins in the northern portion of MZ-2 (i.e., Lower Day, San Sevaine, Victoria, and Etiwanda Debris Basin) would require approximately 10 miles of 8-inch to 16-inch diameter pipelines and additional 600-hP pump station near the Victoria recharge basin, which exceeded the cost of the standby injection wells and increased the annual operating costs. Therefore, using the recharge basins as backup to the injection wells was not included in the PUT alternatives. There may be opportunities to connect to existing recharge basins near the purified conveyance alignments to the injection well fields (i.e., Hickory and Banana basins) to increase overall recharge capacity and reliability.

In addition, the potential for new recharge basins has been studied by the Watermaster as part of the Recharge Master Plan and subsequent updates, which determined that there are few opportunities for new recharge basins in the Chino Basin. Therefore, new recharge basins were not evaluated further as part of this project.

4.3.3 Monitoring Wells

Per the Title 22 regulations for groundwater replenishment using recycled water, monitoring wells are required to monitor water quality in the groundwater basin. The regulations require that at least two monitoring wells be constructed downgradient of the replenishment location. One must be located at least two weeks but no more than six months downgradient travel time through the aquifer and at least 30 days upgradient from the nearest drinking water well, and the second well must be located between the replenishment location and the nearest downgradient drinking water well. A total of four monitoring wells were included in each PUT alternative to comply with these requirements.

Section 5: TAKE Assumptions

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. The assumptions that were used to develop the TAKE components are discussed in this section, except for conveyance, which is discussed for both PUT and TAKE components in Section 6.

The TAKE components are as follows, with the corresponding section noted:

- **Groundwater extraction and treatment:** discussed in Section 5.1.
- **Potable water pumping and conveyance:** conveyance for both PUT and TAKE components is discussed in Section 6.
- **Potable water usage:**
  - **MWD pump back:** discussed in Section 5.2.
  - **In lieu usage:** discussed in Section 5.3.

To support the development of the PUT, TAKE, and program alternatives, WEI completed initial groundwater modeling for the PUT and TAKE components. The initial groundwater modeling results are discussed in TM2 Section 2.

5.1 Groundwater Extraction and Storage

The goal of the TAKE components is to deliver the 375 TAF of potable water from the Chino Basin over the 25-year life of the project. The 375 TAF is to replace water supply that would otherwise be imported from the Sacramento-San Joaquin Delta (Delta), which will be done either by delivering extracted groundwater to MWD's regional facilities for eventual distribution to member agencies (MWD pump back), or by delivering groundwater directly to member agencies for their use in-lieu of receiving imported water deliveries from MWD, which is referred to as In-Lieu CBP.

The 375 TAF would be used during dry years (call years) when less water is imported from the Delta. Two groundwater extraction scenarios were assumed for the TAKE alternatives:

- Standard delivery (no pre-delivery): Assuming a maximum pumping rate of 50.0 TAFY, 7.5 call years would occur over the 25-year life of the project. For this extraction scenario, the TAKE facilities were sized to deliver 50.0 TAFY of groundwater from the Chino Basin to MWD regional facilities or directly to member agencies.
- Pre-delivery: Pumping groundwater during non-call years was also considered to reduce the required size and capacity of the TAKE facilities. For pre-delivery, it was assumed that 10.0 TAFY would be delivered to MWD and/or member agencies during the 17.5 non-call years, and 26.7 TAFY would be delivered to MWD and/or member agencies during the 7.5 call years, totaling 375.0 TAF for the 25-year project life. For alternatives with pre-delivery, the capacity of the TAKE facilities was reduced from 50.0 TAFY to 26.7 TAFY. With pre-delivery, the water would be stored in MWD's system during non-call years for use during call years. Therefore, alternatives with pre-delivery include a wheeling charge from MWD to compensate for storage.

An alternative to directly delivering extracted CBP groundwater to member agencies for in-lieu use is to provide new local wells or wellhead treatment to existing wells, which is referred to as In-Lieu Local. Examples for this type of in-lieu use include adding groundwater treatment to wells in Chino and Chino Hills that are currently offline due to groundwater contamination. These example projects were included as example projects in some of the TAKE alternatives to demonstrate how existing wells with new wellhead treatment could be incorporated into the program. For these example In-Lieu Local projects, it was assumed that up to 3.0 TAFY could be treated for either Chino or Chino Hills wells, for a total of 6.0 TAFY if two such projects are implemented. This 6.0 TAFY would already be within Chino and Chino Hills' service areas and would not require any additional infrastructure other than wellhead treatment. This would reduce the total amount of water required to be extracted from the proposed extraction wellfield and conveyed through TAKE facilities by up to 6.0 TAFY.

This section discusses the groundwater extraction wells and the blending and storage reservoir assumptions for the TAKE alternatives.

5.1.1 Extraction Wells

Multiple extraction wells are required to meet baseline (50.0 TAFY) and pre-delivery options (20.7 to 26.7 TAFY depending on the size of In-Lieu Local projects). The following sections summarize the assumptions used for the conceptual design of the extraction wells.

5.1.1.1 Site Selection and Sizing

The location of potential extraction well sites was determined through the identification of land within the Chino Basin with the following attributes:

- Undeveloped parcels.
- Parcels located at the intersection of streets. These sites would provide for easy access to the site during construction, maintenance, and rehabilitation activities.
- Located within the groundwater MZ desired for extraction well options (predominantly MZ-2 as evaluated in the SFI [see Section 2.3.1.2]).

It was assumed that the minimum extraction well size would need to be a minimum of 100 feet by 100 feet (0.23 acres) to allow for construction, periodic well rehabilitation, and the drilling of a new well, should the original well fail and need to be replaced. Figure 5-1 is a photo of a well site measuring 100 feet by 100 feet during well rehabilitation. As shown, well rehabilitation (and drilling) activities required adequate space for pump column laydown, well rig placement, spoils placement, and decant tanks for well development.

Figure 5-1. Well Rehabilitation Activities

5.1.1.2 Production Capacity

In locating new extraction wells, existing well data was used to determine existing production well pump capacity. Data from multiple existing wells surrounding the proposed well field have demonstrated to produce between 2,000 gpm and 2,900 gpm. Therefore, the maximum capacity of proposed extraction wells was conservatively estimated at 2,000 gpm to accommodate wells that will produce less than existing nearby production wells.

Initially, it was desired to determine the specific capacity of neighboring wells but this data was not available. Specific capacity is the pumping capacity (in gpm) for each foot of water table drawdown during operation.

The following assumptions were made concerning the characteristics of new extraction wells:

- The specific capacity of a new well should be in the range of 10-20 gpm/ft, or more.
- Overall pumping draw-down (difference between static and dynamic pumping levels) should not exceed 100 feet. This is to prevent excessive drawdown of the water table and increased pumping costs.
- Well casing and screening materials should be 316 stainless steel to promote long life.

A simplified well construction diagram is presented in Figure 5-2.

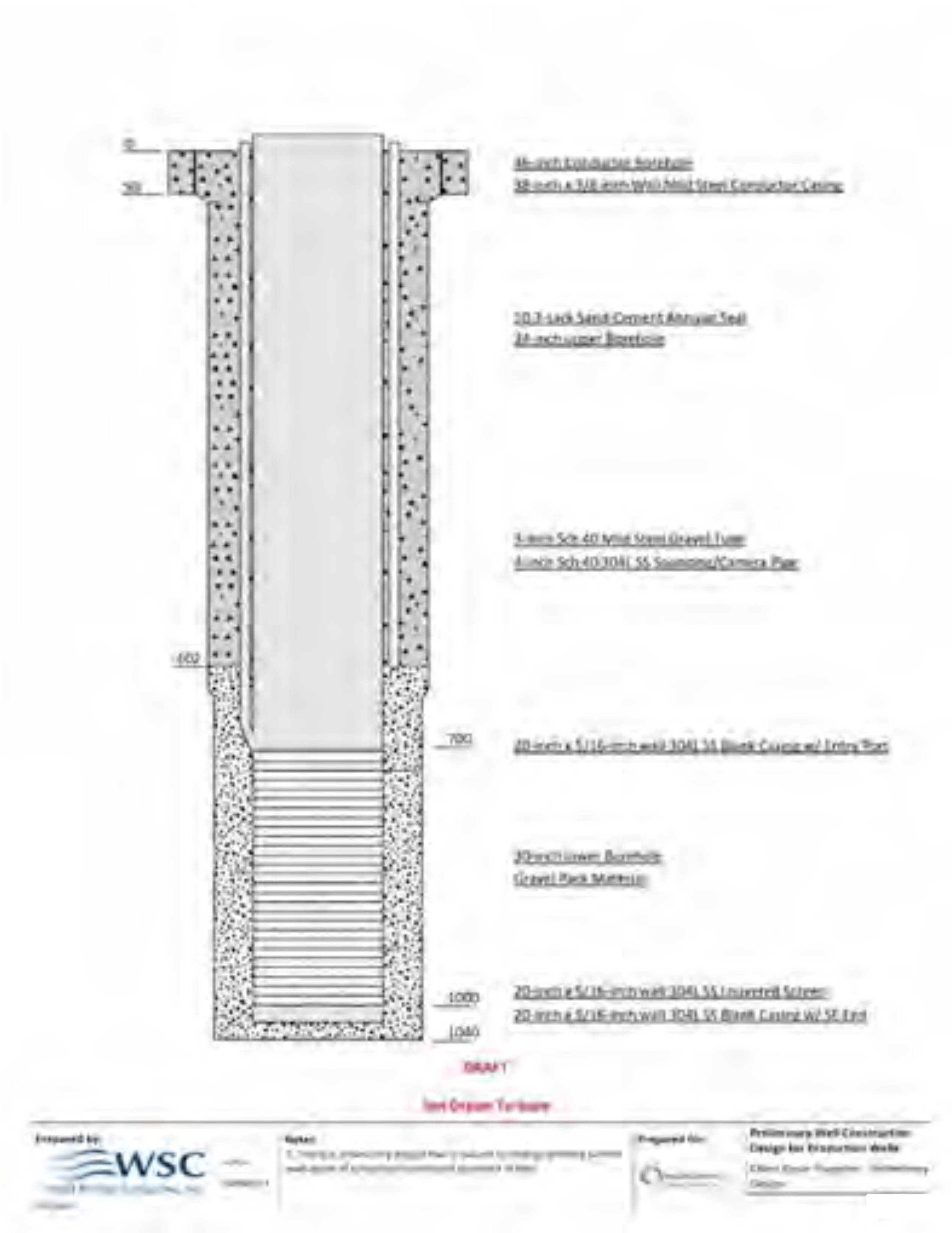

Figure 5-2. Example Extraction Well Design

5.1.1.3 Redundancy Requirements

It is assumed that one redundant well would be required for each alternative to accommodate capacity loss from hydrogeologic conditions, poor water quality, or maintenance shutdowns. In the event multiple wells are offline or have reduced production capacity at a given time, the online wells can be pumped at a higher rate until the wells are back online. The extraction wells design should include variable frequency drives (VFD) and the ultimate design point should be at maximum drawdown and lowest anticipated static groundwater level so that additional production is possible.

5.1.2 Blending and Storage Reservoir

A storage reservoir is recommended near the extraction wellfield to collect groundwater from all proposed wells prior to MWD pump back and/or in-lieu usage by agencies. The storage reservoir will have two purposes:

1. If an extraction well begins to pump contaminated groundwater, the reservoir will provide an opportunity for blending, which can avoid taking the well offline or the need for treatment.
2. The storage reservoir will serve as a forebay for the pump station that will be needed to boost water to elevations well above the extraction well field, and to break head for water to be delivered to lower elevations. This will also provide a constant head for the wells to pump against, rather than having the variability of discharge pressure that may come from having the wells pump directly into a high-pressure transmission line.

The reservoir would provide short-term storage and blending. Because the reservoir will primarily be used for blending and not storage, it is assumed that the reservoir volume would be determined based on retention time, and not hours of stored water available to meet demands. For blending purposes, it is assumed the retention time would need to be three hours. The reservoir outlet(s) will serve as the sampling point for water quality analyses for potable water.

Groundwater treatment for centralized extraction wells is not anticipated due to the groundwater extraction locations being focused in the better water quality areas of MZ-2, blending in the storage reservoir, and water quality in MWD's Rialto Pipeline (see Section 5.3.1 of this TM). But, in the event that treatment is needed in the future, the land acquired for the reservoir is recommended to be large enough to accommodate a future treatment system.

5.2 Groundwater Treatment

Groundwater treatment for the centralized extraction wells is not anticipated (see Section 5.3.1) but could be needed for In-Lieu Local projects where wellhead treatment is added to existing wells that are out of service due to groundwater contamination. This section discusses potential groundwater treatment technologies that could be used for wellhead treatment for potential In-Lieu Local projects, including reverse osmosis, advanced oxidation, ion exchange, GAC, and biological treatment.

Two example In-Lieu Local projects were included in the TAKE alternatives, which are wellhead treatment systems for out of service wells in the cities of Chino and Chino Hills. These are discussed in TM2 Section 4.2.2.

Based on the potential groundwater contaminants that may be found in the Chino Basin, a wide variety of treatment processes must be evaluated; these processes all have various degrees of efficacy depending on the mix of contaminants present. Groundwater treatment technologies may include more conventional best available technologies (BAT) or biological treatment, the latter being an emerging treatment technology in the water sector. Figure 5-3 shows the range of conventional treatment technologies that are available for various groundwater contaminants.

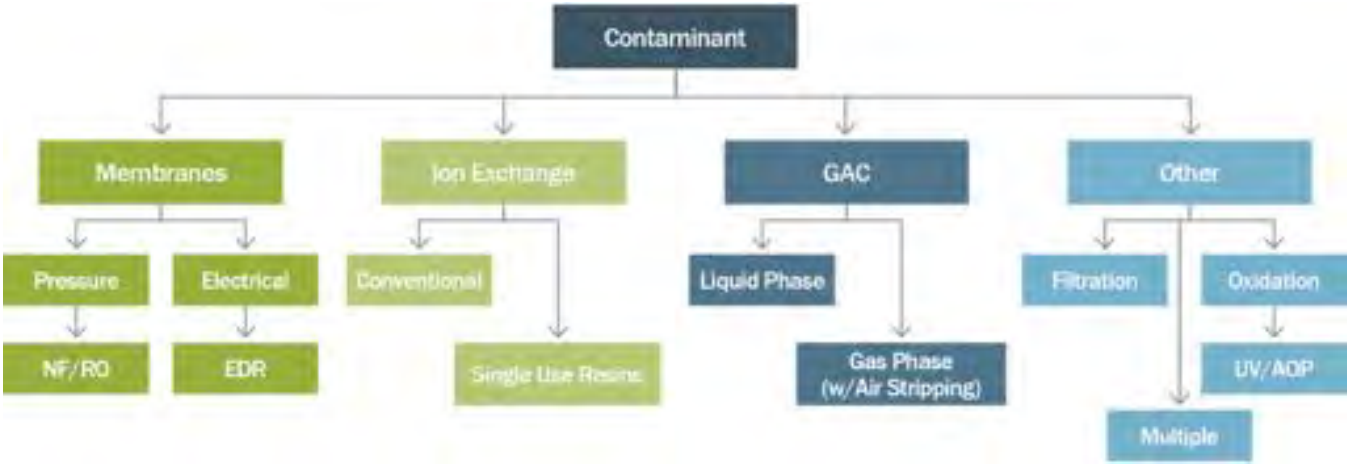

Figure 5-3. The Universe of Conventional Groundwater Contaminant Treatment Options

Membrane processes, especially RO, will remove many contaminants but is limited to higher molecular weight compounds and generally ineffective for the removal of compounds like NDMA and 1,4-dioxane. Ion exchange, while typically utilized by engineers for the removal of nitrate, perchlorate, hexavalent chromium, and some TDS, will be ineffective at volatile organic carbon (VOC) removal. GAC is often the treatment option of choice for VOCs but can become a costly option for some poorly absorbed compounds such as 1,2,3-TCP and trichloroethylene (TCE) and will require frequent change outs to meet effluent water quality objectives. Finally, advanced oxidation processes, such as UV-AOP, are well suited for some difficult to treat compounds like 1,4-dioxane and NDMA but cannot treat compounds such as 1,2,3-TCP and carbon tetrachloride (CTC) without using extremely high UV doses, which will result in significant power consumption. PFAS, a large class of emerging contaminants including PFOS and PFOA, has been detected in drinking water supplies across the United States and now have NLs and RLs established in California. GAC or IX are the two main treatment technologies used for PFAS; RO is also effective for PFAS removal, but more expensive to construct and operate.

Table 5-1 summarizes the efficacy of various treatment processes for different, nd common, groundwater contaminants.

Table 5-1. Candidate Technologies to Remove Possible Constituents of Concern								
Constituent	Treatment Technologies							Most Common Processes for this Constituent
	GAC	Air Stripping (A/S) + Vapor Phase GAC	IX	RO	AOPs	Biological (Fixed Bed/ Fluidized Bed)	MBR	
Organic Constituents								
TCE	✓	✓		✓	✓	✓	✓	A/S & GAC
Perchloroethylene (PCE)	✓	✓		✓	✓	✓	✓	A/S & GAC
MTBE	✓				✓	✓	✓	GAC
1,4-dioxane					✓	✓	✓	AOP
NDMA					✓	✓	✓	UV
1,2,3-TCP	✓				✓	✓		GAC
PFAS	✓		✓	✓				GAC/IX
Inorganic Constituents								
Nitrate			✓	✓		✓	✓	IX
Hexavalent Chromium			✓	✓		✓	✓	IX
Perchlorate			✓	✓		✓	✓	IX
Iron								Oxidation & Filtration
Manganese								Oxidation & Filtration

5.2.1 Reverse Osmosis

An RO system will remove a significant portion of the dissolved solids and some fraction of VOCs in groundwater sources. Thin-film composite polyamide membranes with 8-inch diameter and 400 square feet of membrane area are also typically used in reuse applications. RO systems are designed so that groundwater feedwater flows across the membrane surface in a cross-flow configuration on the feed-brine side of the membrane. High pressure on the feed-brine side of the membrane drives clean water through the membrane to the low-pressure permeate side of the membrane and becomes permeate. The concentrated reject water (brine) leaves the tail end of the membrane for disposal.

Permeate flows from the RO skids require post treatment stabilizing for alkalinity to meet applicable corrosion indices. RO permeate may also pass through decarbonators, which are essentially air strippers used to remove excess carbon dioxide. The advantages of using decarbonators is that the use of downstream stabilization chemicals (typically caustic soda) is reduced and additional VOCs, if present in the permeate, can be further removed.

5.2.2 Advanced Oxidation – UV-AOP

UV-AOP includes generation of hydroxyl radicals at ambient temperature and pressure in order to facilitate oxidation of organic compounds. Hydroxyl radicals react rapidly with organics, making UV-AOP an effective strategy for reducing the concentration of trace organic compounds and recalcitrant compounds. Hydroxyl radicals are generated through photolysis of an oxidant by UV light, which helps in the degradation of compounds such as NDMA and 1,4-dioxane.

UV-AOP systems can use both hydrogen peroxide and chlorine (sodium hypochlorite) although hydrogen peroxide is typical for direct groundwater treatment. For groundwater treatment using peroxide, catalytic carbon pressure vessels are used to remove residual hydrogen peroxide from the treated water stream. Currently, the Los Angeles Department of Water and Power is undertaking the construction of several groundwater treatment projects that utilize hydrogen peroxide UV-AOP for the removal of various groundwater VOCs.

A UV-AOP system would include a UV reactor, an electrical cabinet with ballasts and control panel, and an oxidant dosing system, an acid feed system for pH adjustment, and associated instrumentation for monitoring, control, and performance validation.

5.2.3 Ion Exchange

Ion exchange removes charged particles (ions) from solution in the feed water as it passes through a synthetic resin. An ion exchange process in water treatment depends on the reversible adsorption of charged molecules in solution to immobilized functional groups of opposite charge on an ion exchange resin. These resins are typically synthetic with either positively or negatively charged functional groups. Positively charged functional groups are used to remove negatively charged ions (anions) from water and are called anionic exchangers. Negatively charged functional groups are used to remove positively charged ions (cations) from water and are called cationic exchangers.

Ion exchanges can be unselective or have binding preferences for certain ions or classes of ions, depending on their chemical structure. This can be dependent on the size of the ions, their charge, or their structure. Typical examples of ions that can bind to ion exchangers are single-charged monatomic ions like sodium, potassium, and chloride; double-charged monatomic ions like calcium and magnesium (the main contributors to hardness) and; polyatomic inorganic ions like sulfate and phosphate.

The ion exchange process is typically implemented as a fixed bed in water treatment. As water flows from the top of the resin bed to the bottom, perchlorate, nitrate, sulfate, and other compounds may each be exchanged for one or more sodium ions, which is released into the effluent water. Ion exchange is a reversible process (Figure 5-4) and the ion exchange resin can be regenerated with a brine solution, which needs to be hauled off-site or discharged to a brine line.

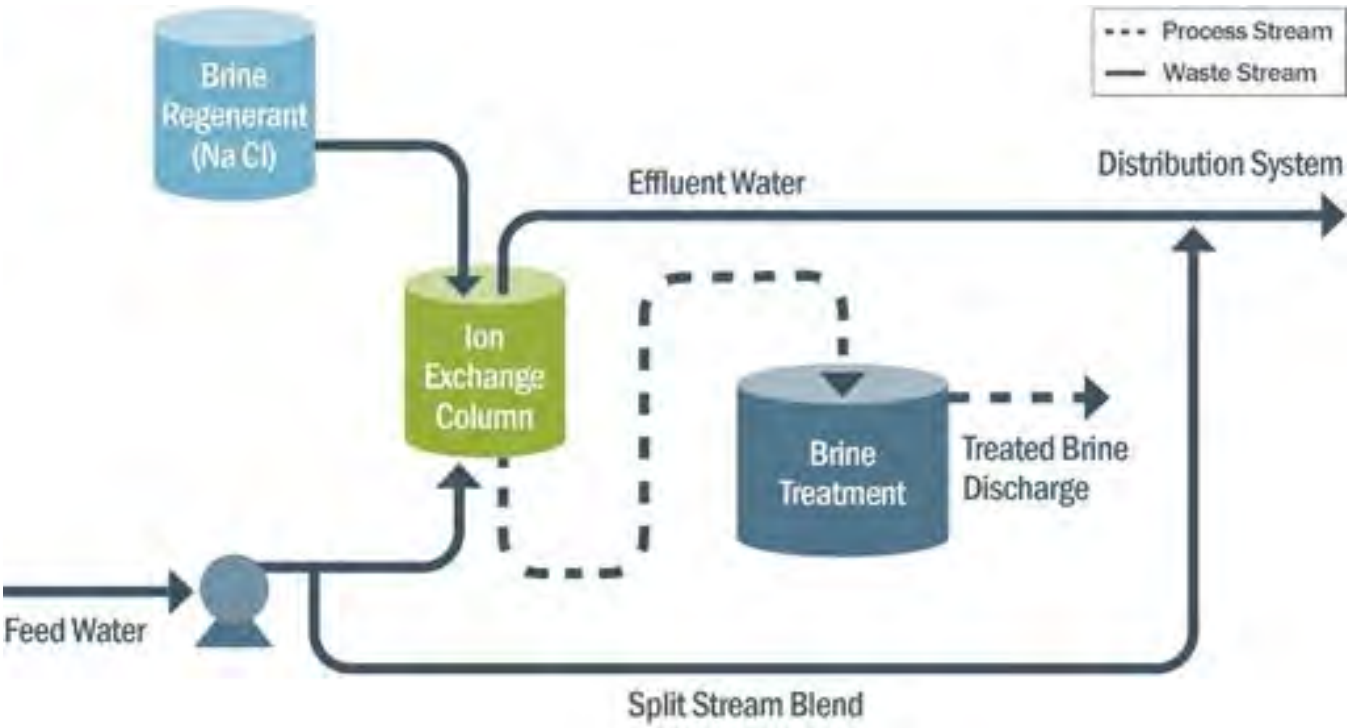

Figure 5-4. Schematic of Regeneratable Ion Exchange Process

Once the resin is exhausted or reaches a predetermined effluent breakthrough of contaminants of concern, the resin is regenerated with a brine solution, usually consisting of sodium chloride, or an inorganic acid, such as hydrochloric acid. The regenerant may be applied using co-current or countercurrent flow (as compare to the service flow). The high concentration of sodium of hydrogen ions in the regenerant causes them to displace the cations adsorbed on the resins, returning the resin to its original state. Under normal operating conditions (with no oxidants present), a resin may continuously operate for several years without deterioration of physical and chemical properties.

One disadvantage of the IX is the very frequent regeneration cycles that would be required. This will result in the delivery of tons of salts to the site and several unloading operations, which can be very loud given that salt must be blown into the salt storage tank and noise impacts need to be evaluated for the proposed groundwater treatment locations. The scaling of spent regenerant piping is a common problem in addition to equipment corrosion. The exchange of chloride ions for contaminant ions means that chloride is released into the potable water supply, increasing TDS.

Single pass and offsite regeneration are also options, but both would lead to more frequent media changeouts. Offsite regeneration needs to make sure that there is brine line with sufficient capacity for disposal of the brine solution.

For perchlorate treatment and hexavalent chromium treatment, many facilities use a single use ion exchange resin, which is simply replaced after break-through of the contaminant. However, careful attention must be giving to constituents in the raw water stream that may compete for exchange sites and that may accumulate to levels requiring special resin disposal (i.e., uranium).

5.2.4 GAC-Based Treatment

GAC systems have the advantage of being a simple technology that may be used to remove several VOCs and PFAS from drinking water through the adsorption of contaminants to activated carbon. The process may be used in the liquid phase or vapor phase after air stripping, the latter used for the removal of highly volatile compounds such as CTC. GAC and air stripping have a proven track record with lower costs than other removal methods (i.e., reverse osmosis and electrodialysis reversal).

Liquid phase GAC adsorbers are typically installed in a lead-lag arrangement, which provides an additional barrier to prevent contaminant breakthrough. Once effluent contaminant levels reach a predetermined level, the lead GAC carbon is replaced and the order of vessel operation is switched. GAC is either regenerated on site or at a regeneration facility.

Multiple contaminants can be difficult to remove based on isotherm data (i.e. 1,2,3-TCP). New, poorly adsorbed contaminants would lead to more frequent carbon change outs or would require larger contactors and/or more vessels to provide more GAC and longer contact time to obtain the desired removal. The presence of multiple contaminants creates competition for adsorption sites and thus less opportunity for the poorly adsorbed constituents to be removed, accelerating breakthrough than if just that singular contaminant is present. For some groundwater treatment facilities, the use of UV-AOP for final contaminant removal or reduction of VOC prior to liquid phase GAC may be required, especially if chemicals such as 1,4-dioxane are in the groundwater.

Oxidation and air stripping processes need to be evaluated along with, and in combination with, adsorptive processes. While all the processes discussed may be applicable, some of those may be eliminated from further considerations based on potential fatal flaws or excessive cost. For example, air stripping is most likely not feasible due to the requirement to treat the vapor phase for TCE and PCE using GAC. In that case, the costs tend to be similar to straight GAC adsorption in the liquid phase. In addition, neighborhood impacts of air stripping towers may be unacceptable. Approval from regulating agencies may also be daunting.

5.2.5 Biological Treatment

Biological treatment can be an efficient, robust, and environmentally sustainable approach for addressing numerous organic and inorganic contaminants in groundwater and should be considered as a viable alternative to many of the groundwater treatment processes discussed in this section.

A fixed bed biological treatment system, which is shown schematically in Figure 5-5, is a two-step biological process for multiple contaminant removal: 1) Aerobic biological treatment to convert compounds such as PCE and TCE to vinyl chloride and nitrate and perchlorate to nitrogen. This is accomplished by adding an electron donor, such as acetic acid, to create the necessary reducing conditions, and 2) Aerobic biological treatment to further convert compounds such as vinyl chloride to carbon dioxide. The second stage also achieves final filtration and re-oxygenation.

Another huge benefit of this system is its ability to remove hexavalent chromium and arsenic from water sources. These compounds are reduced to their unstable, and particle form in the first stage of the reactor and backwashed out of the system. Especially in the case of hexavalent chromium , this process is much simpler to employ than other chemically intensive treatment processes such removal using reduction/coagulation/filtration processes or weak base anion or strong base anion IX.

This technology has been approved conditionally by DDW for the use in nitrate, perchlorate, and VOC removal. Proof-of-concept pilot testing is required before implementation and DDW approval.

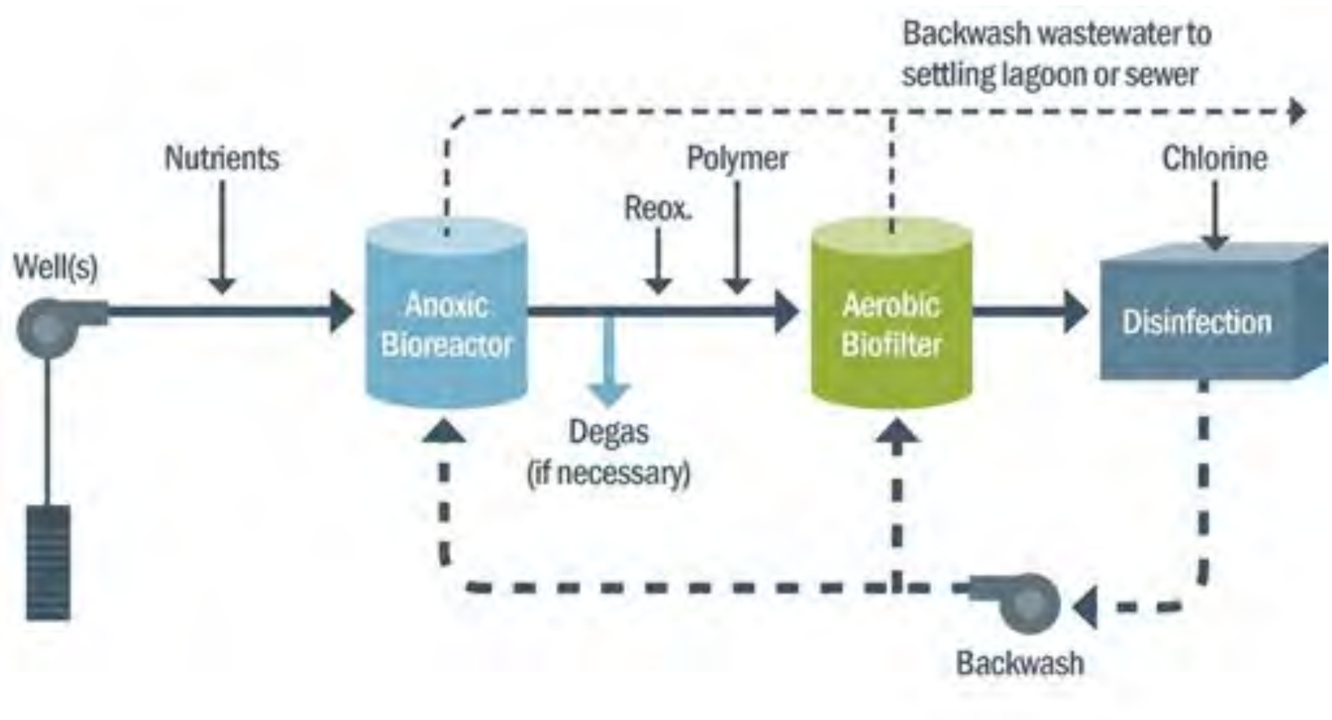

Figure 5-5. Schematic of Fixed Bed Biological Treatment System

The main advantage of biological treatment of VOCs is that no GAC replacement is required, contaminants are fully converted to carbon dioxide, and eliminating the need for brine disposal. Furthermore, the process results in ultimate destruction of contaminants and not sequestration (i.e. IX and GAC), where contaminated media must be processed or disposed of in an environmentally responsible manner. Other biologically processes are available on the market, such as fluidized bed biological reactors; these systems will not remove all of the contaminants that can be removed by fixed bed systems. The main disadvantages of biological treatment are higher capital costs than other treatment technologies and the requirement for proof-of-concept pilot testing.

5.3 MWD Pump Back

MWD operates three raw water transmission pipelines near the project area shown in Figure 5-6 that could all be suitable for MWD Pump Back:

- Rialto Pipeline
- Upper Feeder
- Etiwanda Pipeline

Under normal operation, the Rialto Pipeline delivers raw water from the Devil Canyon Afterbay (which receives water from the East Branch of the State Water Project) westerly to turnouts at the FWC Sandhill WTP, CVWD Lloyd W. Michael WTP, CVWD Royer Nesbit WTP (currently offline), WFA Agua de Lejos WTP, and Three Valleys Municipal Water District (TVMWD) Miramar WTP. The Rialto Pipeline also delivers raw water to various spreading basins for groundwater recharge in the Cucamonga Basin and northern areas of the Chino Basin. After turnouts to those agencies, the Rialto Pipeline delivers raw water west to the MWD F.E. Weymouth WTP (Weymouth), for ultimate delivery to Los Angeles and Orange Counties.

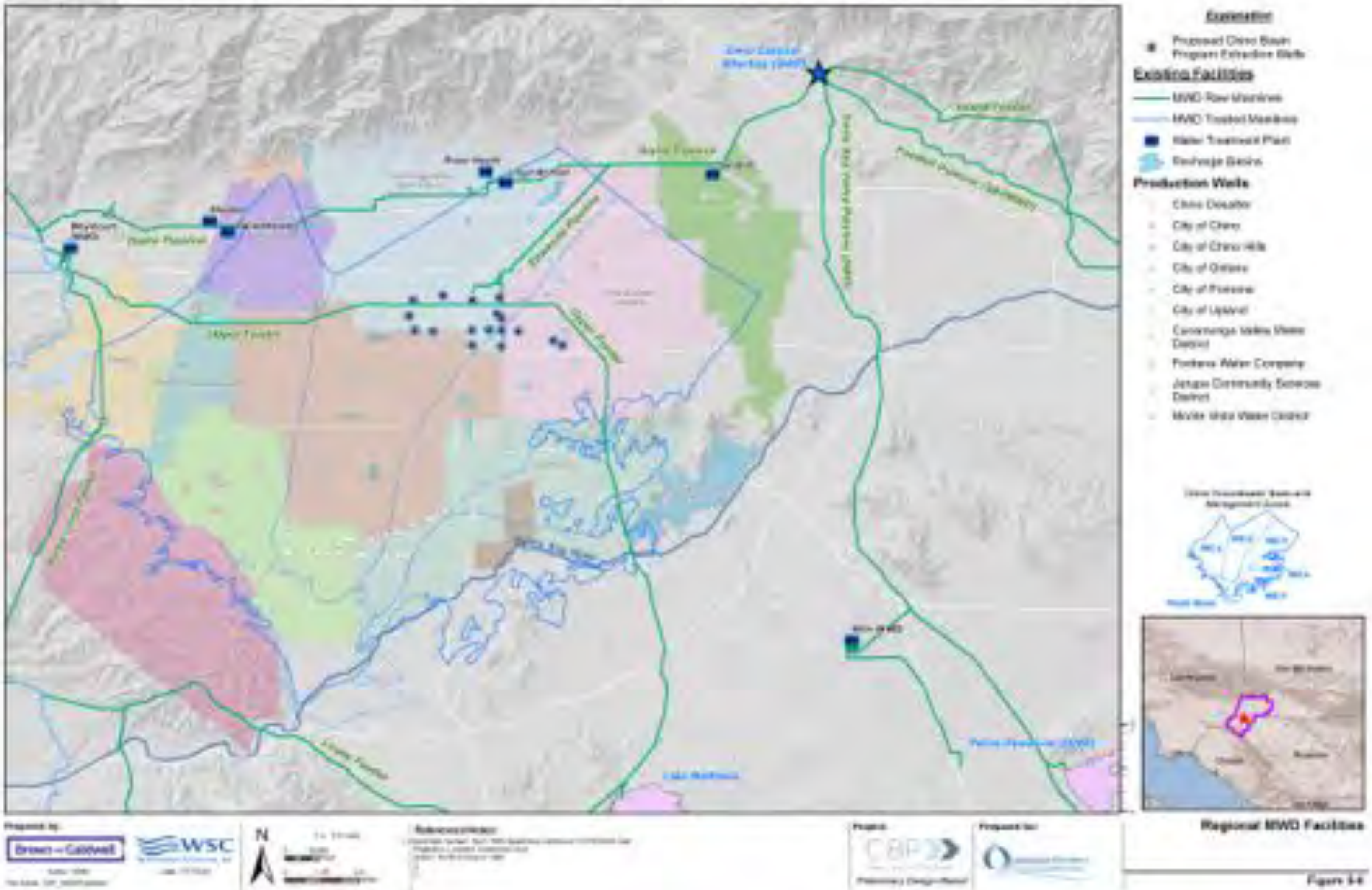

Figure 5-6. CBP Assumptions Regional MWD Facilities

The Upper Feeder is primarily used by MWD as a raw water transmission main from Lake Mathews to Weymouth, and the Etiwanda Pipeline is used as a means of delivering raw water from the Rialto Pipeline to the Upper Feeder as well as generating power from the high head of the Devil Canyon Afterbay. Because the Upper Feeder ultimately delivers water to Los Angeles and Orange Counties, the Rialto Pipeline is the only appropriate pipeline to pump CBP potable water into in order to keep reclaimed water within the Chino Basin. Since the Rialto Pipeline is a raw water pipeline, the potable water generated by CBP would be considered raw water once pumped into the Rialto Pipeline. Note that there are no MWD treated water pipelines near the proposed extraction wellfield.

TAKE alternatives that include MWD Pump Back will require a pump station to lift extracted groundwater from the elevation of the reservoir at the extraction wellfield (between 1,000 ft and 1,200 ft above mean sea level (AMSL) to the static HGL of the Rialto Pipeline of 1,936 ft AMSL. While the HGL of the Rialto Pipeline decreases from 1,936 ft AMSL as it flows west due to headloss, MWD requested the pump back facilities be capable of pumping to the Devil Canyon Afterbay static head of 1,936 ft AMSL to maintain operational flexibility. MWD Pump Back will also require a large-diameter pipeline from the extraction wellfield to the Rialto Pipeline, and a new or retrofitted turnout into the Rialto Pipeline. Assumptions for conveyance include pipelines and pump stations are included in Section 6.5.

5.3.1 Water Quality Considerations

The extracted groundwater being delivered to the Rialto Pipeline must be of quality not to significantly diminish the quality of existing raw water in the Rialto Pipeline and, per MWD requirements, must meet primary and secondary MCLs. Water quality data from existing production wells near the proposed extraction wellfield in northern MZ-2 were collected to estimate the water quality of extracted CBP groundwater. Likewise, water quality data from the Devil Canyon Afterbay were provided by MWD to represent Rialto Pipeline water quality. The blended Rialto Pipeline/CBP water quality was calculated using a mass balance based on the maximum annual CBP delivery of 50.0 TAFY and typical Rialto Pipeline flow of 614 mgd. The estimated water quality for CBP water, the Rialto Pipeline water quality, and the blended CBP and Rialto Pipeline water quality is presented in Table 5-2 along with treated water quality from MWD's Henry J. Mills Treatment Plant in Riverside, California for comparison.

Table 5-2. Blended Water Quality

Constituent	CBP Blended Extraction Wells[1]	Rialto Pipeline[2]	CBP/Rialto Pipeline Blend[3]	Mills Treatment Plant Effluent	Primary *(Secondary)* MCL
TDS (mg/L)	235.6	254.0	252.8	272.0	*(500.0)*
Nitrate-N (mg/L)	3.3	0.4	0.6	0.6	10.0
Hardness (mg/L)	146.7	94.0	97.6	92.0	-
EC (µS/cm)	3844.4	457.0	452.1	516.0	*(900.0)*
pH	7.8	8.1[4]	8.1	8.5	-
Calcium (mg/L)	45.1	20.0	21.8	18.0	-
Magnesium (mg/L)	7.7	11.0	10.8	12.0	-
Sodium (mg/L)	19.6	52.0	49.8	62.0	-

Table 5-2. Blended Water Quality					
Constituent	**CBP Blended Extraction Wells[1]**	**Rialto Pipeline[2]**	**CBP/Rialto Pipeline Blend[3]**	**Mills Treatment Plant Effluent**	**Primary *(Secondary)* MCL**
Potassium (mg/L)	1.8	N/A	N/A	2.8	-
Bicarbonate (mg/L)	178.7	72.0	79.2	70.0	-
Chloride (mg/L)	9.4	72.0	67.8	85.0	*(250.0)*
Sulfate (mg/L)	15.1	33.0	31.8	40.0	*(250.0)*
Perchlorate (µg/L)	2.4	0[5]	0.2	N/A	6.0
Hexavalent Chromium (µg/L)	3.4	0[5]	0.2	N/A	10.0[6]

Notes:

[1]Based on 5-10 years water quality data of nearby production wells.

[2]Rialto Pipeline water quality assumed to be equivalent to Devil Canyon Afterbay water quality as provided in MWD Bulletin 132-13 from April 2015, Table 4-1.

[3]Calculated by mass balance of typical Rialto Pipeline flowrate (614 mgd) and maximum proposed CBP flowrate (50.0 TAFY, 44.64 mgd). CBP water would account for approximately 6.8% of the combined flow.

[4]CVWD LWMWTP Master Plan, October 2010

[5]No data, which suggests that these constituents were not sampled because not typically present in surface water. For this analysis, they were assumed to be zero.

[6]The hexavalent chromium MCL was rescinded but is anticipated to be re-proposed at this same level in the future. Total chromium has an MCL of 60 µg/L.

Table 5-2 shows that the projected, blended water quality for the CBP extraction wells is of high quality and, in many cases, the extraction well water quality exceeds that in Rialto Pipeline. The lack of perchlorate and hexavalent chromium data for the Rialto Pipeline suggests that these constituents were not sampled. These constituents are not typically present in surface water and for this analysis it is assumed that they have low or zero concentration in the Rialto Pipeline. The projected levels for the CBP water alone are below the MCL for perchlorate and the assumed future MCL for hexavalent chromium. Considering the significant dilution that will occur in the Rialto Pipeline once the CBP water is pumped in, treatment was assumed to not be required and was not included in the TAKE alternatives.

It is assumed that the CBP water would be sampled and monitored at or near the turnout into the Rialto Pipeline. It is anticipated that MWD will provide a list of constituents to be monitored at regular intervals to verify the quality of water being delivered. Constituents to be monitored may include TDS, nitrate, hardness, chloride, sulfate, perchlorate, hexavalent chromium, 1,2,3-TCP, and other contaminants that may present treatment challenges or that have primary and secondary MCLs for drinking water.

PFAS. At the time that the water quality analysis was originally completed (summer 2019), limited PFAS data was available. Additional sampling was completed in 2019 and 2020 and results are forthcoming. The following describe sampling that has been undertaken to date:

- The only sampling completed on Chino Basin groundwater to date was through UCMR3, which was for 30 active wells.

- All UCMR3 data showed that all samples were non-detect. However, UCMR3 data was analyzed using older analytical methods with a higher detection limit than the current NLs. Therefore, it is inconclusive as to whether the CBP groundwater will require treatment for PFOA and PFOS.
- The CBWM monitors some wells in Chino Basin and have added PFOA and PFOS sampling to their constituents. The first samples were collected in 2019.
- A couple of drinking water agencies in the Chino Basin area were served sampling orders from DDW and had to start quarterly sampling in June. These agencies are waiting to see data has been uploaded to DDW's online database.
- The CDA started sampling at desalter wells, but data is not yet available.

5.3.2 Operational Considerations

It is assumed that the MWD Pump Back would operate at a constant rate over the entire calendar year and would not vary to meet seasonal demands. For alternatives with pre-delivery, the CBP would deliver water constantly to the Rialto Pipeline at 26.7 TAFY (~16,600 GPM) during call years, and 10.0 TAFY (~6,200 GPM) during non-call years. For standard delivery (i.e., non-pre-delivery) alternatives, the system would deliver water at 50.0 TAFY (~31,100 GPM) constantly during call years and would not operate during non-call years.

The HGL in the Rialto Pipeline changes as flow varies seasonally so MWD would likely maintain operational control over the pump back conveyance system for more streamlined operation of the pump station with MWD's control system. The interconnection between the MWD Pump Back and the Rialto Pipeline will also include a backflow prevention mechanism to prevent raw water in the Rialto Pipeline from contaminating the potable water in the CBP conveyance system since the MWD Pump Back will not be hydraulically isolated from the In-Lieu CBP system delivering potable water to member agencies (see Section 5.4 of this TM).

Water may be delivered back to the Rialto Pipeline either by retrofit of an existing turnout off the Rialto Pipeline, or by a newly constructed tap into the Rialto Pipeline. There is currently one turnout off the Rialto Pipeline that is unused, CB-7, which has an 18-inch diameter and a capacity of approximately 6,944 GPM as stated in the Integrated Regional Plan. Alternatives that include a maximum pump back flowrate of 11.0 TAFY or less to MWD will consider pumping back through CB-7, or a new connection to the Rialto Pipeline. All alternatives that require more than 11.0 TAFY of pump back to MWD will require construction of a new turnout. A new turnout would likely be placed between connections CB-16 (Lloyd W. Michael WTP) and PM-21 (Miramar WTP) to reduce the length of pipe required between the Rialto Pipeline and the extraction wellfield and/or other potable water distribution facilities.

5.4 In-Lieu CBP and In-Lieu Local

CBP water could also be delivered directly to local agencies and used in-lieu of imported water. Member agencies would receive a direct delivery of CBP water for use instead of imported water that originates from the Rialto Pipeline. In-Lieu CBP would be water from the extraction wellfield delivered to agencies through a new conveyance system, and In-Lieu Local would be water from wellhead treatment on existing wells or new wells delivered using only existing conveyance infrastructure, such as for the example projects for Chino and Chino Hills.

TAKE alternatives that include In-Lieu CBP would have a regional conveyance system including pipelines, pump stations, and turnouts and would be owned and operated by IEUA to deliver extracted CBP groundwater from the extraction wellfield to turnouts into the member agencies' distribution systems. Each member agency receiving CBP water will have a direct turnout into their local distribution system, and alternatives requiring member agencies to use existing interconnections to deliver CBP water to other member agencies will be avoided. An effort will be made to design the regional conveyance system to deliver CBP water directly to member agencies in the pressure zone that they currently receive imported water in order to avoid requiring operational changes from shifting water sources. Member agencies may also request their CBP turnout to be in pressure zones in their system with higher demands if it will give them operational flexibility, water supply reliability, and/or relieve some capacity-constrained portions of their system.

5.4.1 Minimum Plant Flows

The amount of CBP water member agencies can receive in-lieu of Rialto Pipeline raw water is limited by the minimum flowrate required to keep each WTP operating reliably. Because In-Lieu Use involves member agencies taking CBP water directly rather than Rialto Pipeline raw water through their respective WTP, only so much can in-lieu water can be received before demand on the WTPs falls below their minimum acceptable flowrate. TM 2 Section 4.1.3.2 evaluates each member agency's WTP and projected imported water demands and establishes the maximum amount of in-lieu water they can receive from the CBP.

5.4.2 Water Quality Considerations

Extracted groundwater for in-lieu use would need to be of potable quality as it will be delivered directly to member agencies' distribution systems. Table 5-2 provides the anticipated quality of extracted groundwater based on samples from existing nearby potable wells in the previous 5 to 10 years. Based on this analysis, the CBP water is expected to meet primary and secondary MCLs and is assumed to not require treatment prior to delivery into each member agency's system. However, each well will include chlorine for disinfection, and the proposed reservoir at the extraction wellfield will also include chlorine to maintain chlorine residual in the tank and chlorine residual in the regional distribution pipelines.

The WFA Agua de Lejos WTP uses chloramines for disinfection at its WTP, leaving residual chloramine in the WFA distribution system and in its members' systems as well. There may be adverse water quality affects from mixing water with residual chlorine and residual chloramine, such as disinfection byproduct production. If concerns arise from mixing the two types of disinfected water, the disinfection strategy at turnouts from chlorinated regional CBP facilities to local agency systems using chloramine must be evaluated to determine the optimum blending strategy.

Water quality will be monitored in the potable water reservoir near the extraction wellfield. Water will also be sampled at various locations throughout the regional distribution system to ensure that water being delivered to member agencies meets drinking water quality requirements. It is anticipated that agreements will be made between member agencies and IEUA that provides a set of water quality requirements, or that the CBP water deliveries will only be required to meet the primary and secondary MCLs for drinking water.

5.4.3 Operational Considerations

The regional CBP delivery system for In-Lieu CBP, including wells, reservoirs, pump stations, pipes, and turnouts, would be owned and operated by IEUA. The system would primarily operate as a constant flow system, simultaneously pumping, conveying, and delivering groundwater to member agencies at the designated flowrate for either a call year or non-call year. The system would not have the ability to increase production to accommodate increased summertime demands, except in non-call years for alternatives that include pre-delivery, as the average flow rate for the non-call year would be less than the maximum capacity of the conveyance system.

If a well began producing water with a high level of a contaminant that could not be blended out by the rest of the production wells, a redundant well would be operated to make up the water deficit. If a redundant well is unavailable or already producing water, the production of the other well could be increased slightly to make up the deficit of the offline well.

TAKE alternatives that include In-Lieu CBP, i.e., direct deliveries of extracted groundwater in-lieu of imported water to member agencies, will include dedicated pipelines, pump stations, and turnouts owned and operated by IEUA. Turnouts will be metered to track deliveries of CBP water made to member agencies to accurately determine how much water member agencies are using in-lieu of imported water. Like In-Lieu CBP, water deliveries from In-Lieu Local projects would need to be metered to track deliveries of CBP water made to member agencies for accurate accounting.

Section 6: Conveyance Assumptions

This section presents the conveyance approach and assumptions for both the PUT and TAKE alternatives. This section includes:

- **General criteria and alignment assumptions:** discussed in Section 6.1.
- **Recycled water conveyances:** discussed in Section 6.2.
- **Purified water conveyance:** discussed in Section 6.3.
- **Brine conveyance:** discussed in Section 6.4.
- **Potable water conveyance:** discussed in Section 6.5.

6.1 General Criteria and Alignment Assumptions

In general, all proposed conveyance pipelines will be aligned through the public Right-of-Way (ROW) and properties owned or to-be acquired by IEUA to reduce the number of easements required for construction and maintenance. Parallel alignments through ROWs governed by the California Department of Transportation (Caltrans) will also be avoided (though not excluded from consideration) to reduce permitting efforts. Constructing in areas requiring additional permitting will be considered to avoid known utility conflicts and/or narrow segments of road, or to shorten the length of the overall alignment.

Many existing utilities could conflict with proposed conveyance pipelines, potentially leading to increases in construction time and cost. It is assumed that each stretch of public ROW will include at least one local water main and services, one local sewer main and laterals, local communication and electricity facilities in a duct bank, and one local gas distribution main and services. In addition, regional facilities have been mapped in to Figure 6-1 identify larger utility conflicts, including the following:

- Large water transmission mains operated by MWD, San Gabriel Valley Municipal Water District, and CDA
- IEUA sewer trunk lines and force mains
- IEUA recycled water pipelines fuel transmission lines
- Groundwater recharge basins
- Natural gas transmission and distribution pipelines
- Regional brine transmission lines
- Regional storm drainage facilities
- Properties owned by the Southern California Edison Company (Edison)

While avoiding all utility conflicts is not feasible, all conveyance pipelines will be aligned to avoid known parallel utility conflicts with as many existing regional utility facilities as possible. Pipelines may be aligned through utility conflicts if alternatives to avoid utilities require excessive increases in pipe length, excessive segments that require horizontal directional drilling to construct, or acquisition of easements that are considered more costly and challenging than avoiding the utility. Lots owned by Edison that cannot be purchased outright by IEUA are also not being considered due to Edison’s “No Permanent Facility” clause in its Transmission Line Right of Way Constraints and Guidelines.

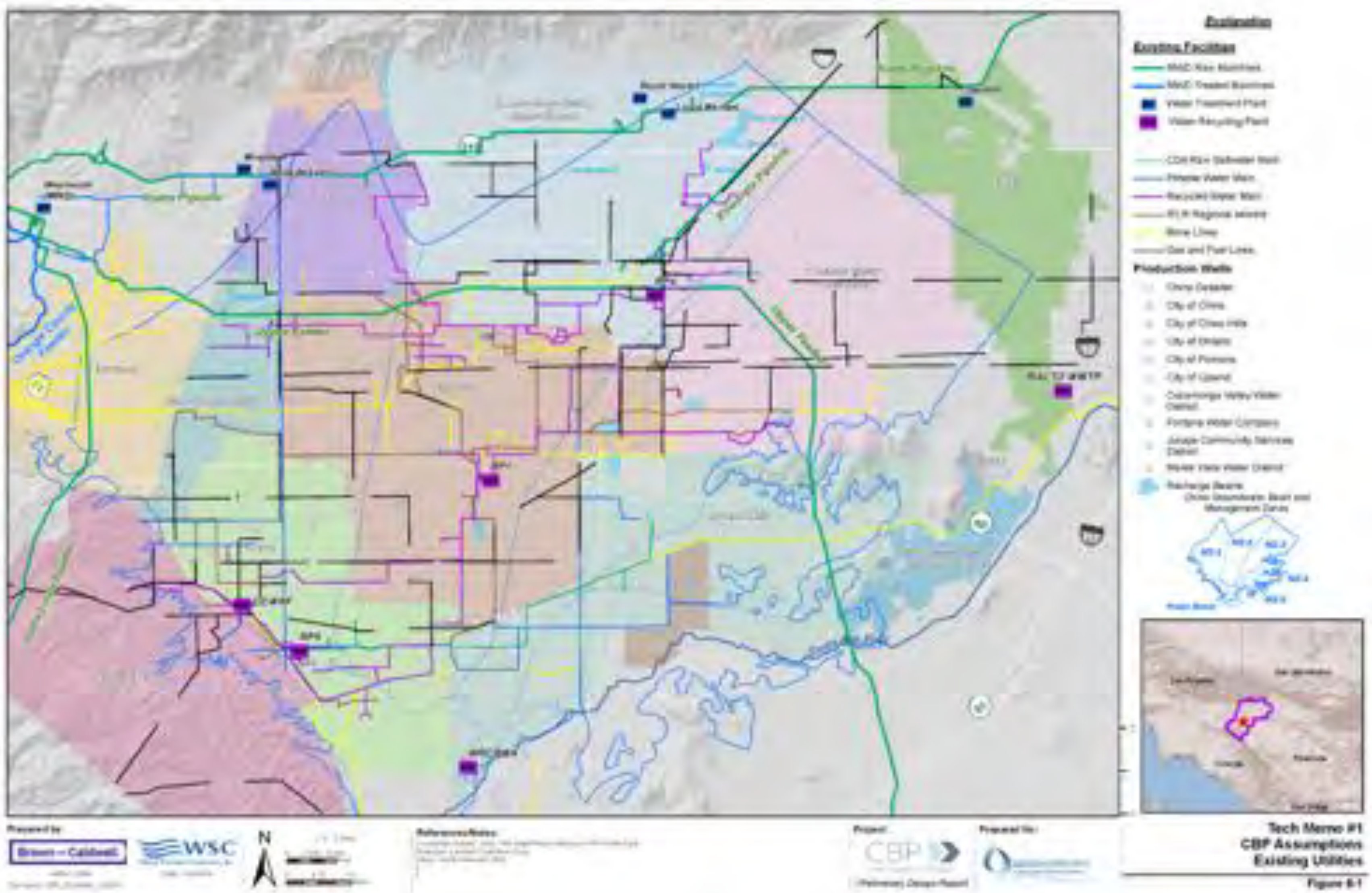

Figure 6-1. Existing Utilities Map

6.2 Recycled Water Conveyance

IEUA owns and operates a recycled water distribution system with five pressure zones to serve recycled water customers and deliver recycled water to recharge basins for groundwater replenishment. The proposed AWPFs are to be placed along existing recycled water mains; therefore no additional recycled water facilities will be required to move recycled water from IEUA's existing system to the AWPFs. However, due to the demand of the AWPFs on the existing recycled water system, IEUA will be receiving additional supply from Rialto WWTP and WRCRWA. Both new recycled water supply sources will require a pump station and pipeline to connect into the existing recycled water system. The assumptions and criteria for these recycled water pipelines and pump stations are listed below and in Table 6-1.

- Total dynamic head (TDH) required of pump stations to pump water into the existing recycled water system was calculated by the existing hydraulic model
  - The existing model uses the Hazen Williams equation used to determine friction head loss within pipelines
- Trenchless technologies will be required at freeway, flood channel, and railroad crossings
  - Jack and bore for lengths less than 500 feet
  - Horizontal directional drilling for lengths exceeding 500 feet

Table 6-1. Tertiary Recycled Water Pump Station and Pipeline Design Criteria and Planning Assumptions

Parameter	Criteria	Units	Demand Condition
Maximum System Velocity	5	fps	Constant Flow
Pipe Material, Diameter ≥ 16 in	Steel	-	-
Pipe Material, Diameter < 16 in	Unspecified	-	-
Hazen Williams Coefficient	120	-	-
Minor Losses (% of friction losses) (bends, valves, etc.)	5	%	-
Low water level plant and booster pump stations	20 ft below grade	-	-
Motor Efficiency	75	%	-
Pump Efficiency	93	%	
Total Pump Station Efficiency	70	%	

Because pump stations will be required to lift these recycled water sources into the appropriate pressure zone of the IEUA recycled water system, it is assumed that in-conduit hydropower facilities will not be applicable as there will be no surplus head to take advantage of.

6.2.1 Recycled Water Pipeline Alignment Assumptions

6.2.1.1 Connection from the Rialto WWTP

The connection from the Rialto WWTP is assumed to connect to IEUA's recycled water system near RP-4 within the 1158 pressure zone (HGL 1158 ft, typical). In scenarios with the AWPF located at RP-4, the pipeline connection from the Rialto WWTP will directly feed the AWPF. In order to make the connection near RP-4, the supply pipeline is required to cross the Union Pacific Railroad and Interstate 10. It is assumed that the pipeline will require jack-and-bore to cross both the railway and the freeway.

6.2.1.2 Connection from WRCWRA

The connection from WRCRWA to the IEUA recycled water system is assumed to connect within the 930 pressure zone near the 930/800 pressure reducing valve. This connection will allow the supplemental supply from WRCRWA to offset demands in the southern pressure zones where the highest agricultural demands exist and make available IEUA supply normally used to meet these demands to feed the AWPF. Due to limitation in how water can move between pressure zones, a connection to the 800 pressure zone would not allow for a maximum benefit of the new supply source. A connection within the 1158 pressure zone would allow the new supply to directly feed the AWPF if located near RP-1 but will also require about two additional miles of pipeline than a connection to the 930 pressure zone, making this connection cost prohibitive.

6.3 Purified Water Conveyance

The purified water distribution system consists of pump stations and pipelines. The treatment plant pump stations deliver water to injection wells and lower elevation recharge basins. Additional booster pump stations are required to deliver purified water to higher elevations and more distant recharge basins.

6.3.1 Pipelines

Purified water would be routed from the AWPF's located at either IEUA's RP-1, RP-4, or MVWD's Plant 28 site to injection wells located within the Chino Basin. Pipeline design criteria established for the purified water system in addition to the overall pipeline design criteria (Table 6-1) are shown in Table 6-2.

- Hazen Williams equation used to determine friction head loss within pipelines
- Trenchless technologies will be required at freeway, flood channel, and railroad crossings
  - Jack and bore for lengths less than 500 feet
  - Horizontal directional drilling for lengths exceeding 500 feet
- Pressure reducing valves will be included at each injection well to decrease head to the required residual pressure to feed the wells.

Table 6-2. Purified Recycled Water Pipeline Design Criteria and Planning Assumptions

Parameter	Criteria	Units	Demand Condition
Hazen Williams Coefficient	120	-	-
Maximum System Velocity	5	fps	Constant Flow
Pipe Material	Steel	-	-
Minor Losses (bends, valves, etc.)	5	%	-
Residual Head required at Injection Wells	10	psi	-

Table 6-2. Purified Recycled Water Pipeline Design Criteria and Planning Assumptions			
Parameter	**Criteria**	**Units**	**Demand Condition**
Low water level plant and booster pump stations	20 ft below grade	-	-
Motor Efficiency	75	%	
Pump Efficiency	93	%	
Total Pump Station Efficiency	70	%	-

6.3.2 Pump Stations

The proposed conveyance routings will require pump stations to deliver water to the injection wells in the event that an option including the recharge basins is selected. Only one pump station would be required to pump water from the AWPF to the conveyance pipeline to the injection wells. Design criteria for these pump stations is included in Table 6-2.

If a PUT alternative is developed that includes using recharge basins for groundwater replenishment of purified water, an additional pump station would be required to convey purified water to the northern recharge basins including Lower Day, Etiwanda Debris, and San Sevaine. The purified water conveyance system could be extended from the injection wells to Victoria, Hickory, and Banana recharge basins without an additional pump station (i.e., the purified water pump station could pump to the injection wells and these three recharge basins), if desired.

6.4 Brine Conveyance

RO concentrate created at IEUA's RP-1, RP-4, or Plant 28 AWPFs and brine concentrate from the example In-Lieu Local project for the City of Chino Hills wellhead treatment facility will be disposed of into the existing NRWS via the nearest existing manhole. Reference Section 4.2.5 and TM3 – Brine Disposal System for more information on the preferred brine disposal system for waste flows created at the proposed AWPF. The following assumptions were made to complete this phase of design:

- Hazen Williams equation used to determine friction head loss within pipelines
- RO concentrate will have sufficient pressure to deliver water from treatment plant to brine line discharge
- Jack and bore required at freeway crossings

Table 6-3. Brine Pipeline Design Criteria and Planning Assumptions			
Parameter	**Criteria**	**Units**	**Demand Condition**
Hazen Williams Coefficient	120	-	-
Maximum System Velocity	5	fps	Constant Flow
Pipe Material	HDPE	-	-
Minor Losses (bends, valves, etc.)	5	%	-

6.4.1 Pipelines

The RP-1 brine pipeline connection will connect into the NRWS pipeline via a pipeline parallel to the recycled water conveyance line also exiting the plant. The HDPE brine line will require one jack-and-bore trenchless crossing under the 60 freeway.

The RP-4 brine pipeline will connect into the NRWS pipeline via a pipeline on the southeastern side of the existing facility. No trenchless crossings are required for this pipeline.

The brine pipeline for the AWPF at MVWD's site would be routed parallel to the recycled water conveyance line also exiting the plant to connect to the EWL. No trenchless crossings are required for this pipeline.

The brine pipeline for the example In-Lieu Local project included for the City of Chino Hills wellhead treatment facility would connect into the IEBL via a pipeline on the southern side of the facility. The HDPE brine line would require one jack and bore trenchless crossing under the 71 Highway and Chino Creek.

The brine line design criteria can be found in Table 6-4.

Table 6-4. Brine Pipeline Design Criteria

Parameter	Diameter (in)	Approximate Length (ft)	Maximum Elevation (ft)
RP-1 Brine Line	8	3,900	835
RP-4 Brine Line	8	1,400	1,084
Plant 28 Brine Line	4	900	1,062
Example In-Lieu Local Project (City of Chino Hills Wellhead Treatment Facility)	8	6,800	657

6.5 Potable Water Conveyance

The potable water conveyance system will consist of extraction wells, a reservoir, pump stations, pipelines, and turnouts to member agencies and/or MWD. In general, the extraction wellfield will deliver potable water to a reservoir which will be used for blending and to break head between high and low HGL zones where potable water will be delivered. The reservoir will have two outlets – one directly into a proposed transmission main to deliver water to lower HGL member agencies, and one into the suction side of a proposed potable booster pump station to deliver water to higher HGL member agencies and/or into the Rialto Pipeline.

6.5.1 Pipelines and Pump Stations

For alternatives that include both MWD Pump Back and In-Lieu CBP, regional potable water facilities will be joined and used for both purposes to reduce costs. For instance, if water is to be pumped back to MWD at CB-7 and also delivered to CVWD at the Lloyd W. Michael WTP (about a half mile away from CB-7), a single pump station and pipeline with capacity for both deliveries would be installed to convey water from the extraction wellfield to the general area near CB-7 and Lloyd W. Michael WTP at which point the pipeline would diverge to two smaller diameter pipelines to deliver water to the each turnout.

The assumptions and criteria for the potable water pipelines and pump stations are listed below and in Table 6-5.

- Hazen Williams equation used to determine friction head loss within pipelines

- Pump suction side HGL set to 10 ft above ground elevation for pump stations with an open-atmosphere forebay
- Trenchless technologies will be required at freeway, flood channel, and railroad crossings
  - Jack and bore for lengths less than 500 feet
  - Horizontal directional drilling for lengths exceeding 500 feet
- For pre-delivery alternatives, pump stations and pipelines are sized based on their call year design flowrate.

Table 6-5. Potable Water Pump Station and Pipeline Design Criteria and Planning Assumptions			
Parameter	**Criteria**	**Units**	**Demand Condition**
Maximum System Velocity	5	fps	Constant Flow
Pipe Material, Diameter ≥ 16 in	Steel	-	-
Pipe Material, Diameter < 16 in	Unspecified	-	-
Hazen Williams Coefficient	120		
Minor Losses (% of friction losses) (bends, valves, etc.)	5	%	-
Motor Efficiency	75	%	-
Pump Efficiency	93	%	-
Total Pump Station Efficiency	70	%	-

6.5.2 In-Conduit Hydropower Facilities

In-conduit hydropower facilities may be considered in locations of the potable water distribution system where the system pressure needs to be reduced and energy can be produced. Due to the various pressure zones that the regional potable system will be pumping into, it is likely that in some cases a single pump station may deliver water to multiple local pressure zones with different HGLs, and in-conduit hydropower facilities may be appropriate to recapture some of the energy used to lift the water to the higher HGL. This would only be appropriate where the energy loss from pumping water to an HGL and then attempting to recover it with a hydropower facility would be less costly than to build a second pump station and pipeline to deliver water to the lower HGL without any unnecessary additional lift.

Locations ideal for in-conduit hydropower generations should have an available pressure between 25 and 260 psi. The power output at the facility will depend on the available head and flow rate. Three types of in-line hydropower facilities were identified for the CBP:

1. Pump Turbines. A pump turbine is a centrifugal pump running in reverse and is a typically used in small output applications less than 300 kW. Economically, these start to make sense with a minimum power output of 50 kW. They work best with stable and relatively constant flow rates.
2. In-line Francis Turbines. Francis type turbines are the most widely used in-line hydraulic turbines. In-line Francis Turbines can be dropped into an existing PRV location. Unlike pump turbines, Francis Turbines can operate over a wide flow range. These typically have an efficiency of 70-75%. Economically, installation of a Francis Turbine makes sense in locations that can generate 150 kW or greater.

3. Custom Francis Turbines. A custom Francis Turbine has a higher efficiency, typically 80-85%, and are generally installed in locations that can produce much high power 500 kW or greater. These can also cover a wide range in flow.

Under the Federal Power Act, non-federal hydropower resources are regulated under the Federal Energy Regulatory Commission (FERC). FERC issues three types of authorizations: conduit exemptions, 10-megawatt exemptions, and licenses. FERC approval is required to construct and operate small/low-impact hydropower projects while assuring adequate protection of environmental resources. The FERC Small/Low Impact Hydropower Projects program is intended for small projects that would results in minor environmental effects, such as projects that involve little change to water flow and use and are unlikely to affect threatened and endangered species. The CBP would likely be classified as a small/low-impact hydropower project or would qualify for a conduit exemption as all proposed hydropower generation would be from in-conduit turbines.

6.5.3 Blending and Storage Reservoir

A single reservoir is proposed near the extraction wellfield to allow for blending of groundwater and serve as a forebay for the pump station. The proposed reservoir near the extraction wellfield should provide a retention time of approximately three hours from the extraction wellfield for adequate blending. The reservoir was sized at 2.5 MG for TAKE alternatives with pre-delivery and 5 MG for TAKE alternatives without pre-delivery.

The location for a potential reservoir site was determined through identifying land in the Chino Basin near the extraction wellfield suitable for reservoir construction. A GIS shapefile of parcels in San Bernardino County provided by the Assessor’s Office was used to identify potential reservoir sites with the following attributes for use in developing the TAKE alternatives:

- Undeveloped parcels.
- Parcels located at the intersection of streets. These sites would provide for easy access to the site during construction, maintenance, and rehabilitation activities.
- Parcels greater than one acre for a 2.5-MG reservoir and greater than 1.75 acres for 5-MG reservoir.
- Parcels not planned for development (such as the former Empire Lakes Golf Course site).
- Parcels with a vacant land use designation.

Section 7: Cost Estimating Approach

This section explains the methodology and considerations for developing the planning-level cost estimates for PUT, TAKE, and program alternatives using a unit cost approach. A unit cost estimating approach allows cost comparisons between several conceptual alternatives to support the alternatives evaluation to identify the recommended PUT, TAKE, and program alternatives. A more detailed Class 4 cost estimate will be prepared for the recommended program alternative as part of the Study.

The unit costs were developed for each major infrastructure element within the program. The resulting PUT, TAKE, and program cost estimates for capital and O&M costs are presented in TM2 Section 3.3.7 (PUT alternatives), Section 4.3.7 (TAKE alternatives), and Section 5 (program alternatives).

This section includes the following:

- General assumptions, including the estimate classification and markups: discussed in Section 7.1.
- Unit costs assumptions for capital and annual O&M costs for the PUT and TAKE components, and common facilities: discussed in Section 7.2.
- Net present value (NPV) cost approach: discussed in Section 7.3.

7.1 General Assumptions

This section summarizes the general assumptions for the cost estimate, including the estimate classification, the basis for estimate, cost contingencies and factors, and unit power cost assumptions.

7.1.1 Estimate Classification (AACE Class 5 Estimate)

Since the cost estimates are based on preliminary concepts and are used for the purposes of comparing alternatives, the cost estimates developed for the PUT, TAKE, and program alternatives evaluations are aligned with the AACE International Cost Estimate Classification System criteria for a Class 5 estimate for concept screening. Class 5 estimates are based on a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate are -20 to -50 percent on the low end and +30 to +100 on the high end. An additional contingency cost is added to account for level of detail of the project concept and unknown or unforeseen construction cost (discussed further in Section 7.1.3 of this TM).

7.1.2 Basis for Estimate

The cost estimates are based on construction projects and estimates recently completed for IEUA and its member agencies, construction projects and estimates of similar projects performed in neighboring districts, equipment cost quotations from vendors, industry publications, client input, and engineering judgement. The developed unit costs include construction costs (equipment, labor, and contractor markup) and annual O&M costs.

All estimates were escalated to a current value based on Engineering News Record (ENR) Construction Cost Index (CCI). Values presented in this report are presented in August 2019 dollars, with an estimated Los Angeles ENR CCI value of 12,037.18.

7.1.3 Cost Contingencies and Factors

Cost contingencies and factors are added to estimated construction costs to account for unknown costs at the time of the estimate and to capture project implementation costs that are in addition to the construction costs associated with materials, labor, and construction administration. Two types of markups are included for the cost estimates for this Study: contingency and implementation.

7.1.3.1 Contingency Markup

A contingency markup is applied to the construction cost to account for unknown or unforeseen costs. In general, higher contingencies should be applied to projects of high risk or with significant unknown or uncertain conditions. Additionally, the lower the project definition at the time of the cost estimate generally leads to a higher contingency. The contingency will decrease as the design develops and many of the unknowns or uncertainties are defined and able to be estimated.

Since these are planning-level cost estimates based on a high-level of project definition, a contingency of 30 percent was used. The contingency was applied to the construction subtotal estimated for each alternative. The total construction cost is the sum of the construction subtotal plus the contingency.

7.1.3.2 Implementation Markup

An implementation markup is included to capture the entire capital costs associated with implementation of the project. This factor accounts for the costs of engineering services for design and during construction; client administration, including environmental documentation, permitting, legal, and administrative services; and construction management. This markup is applied to the total construction cost (which includes contingency). These costs vary based on many factors, such project type, project complexity (environmental, permitting, construction, etc.), financing approach, and other factors.

An implementation markup of 28% was assumed for this project, which is consistent with other planning studies, such as the Feasibility Study of Recycled Water Interconnections Between the City of Pomona, MVWD, and IEUA (Carollo, January 2016). The implementation markup was applied to the total construction cost for each alternative to estimate the implementation costs. The total capital cost is the sum of the total construction cost plus the implementation costs.

7.1.4 Unit Power Cost Assumption

Energy costs represent a significant amount of annual O&M costs to the program. Annual energy costs are included for PUT and TAKE components such as the AWPF, pump stations, and extraction wells.

Annual energy demands for the PUT and TAKE components were estimated using vendor quotes, existing facilities, and calculated based on motor horsepower and efficiency. The unit cost for energy was estimated by multiplying the annual energy demand by the assumed power cost. For this Study a power cost of $0.17 per kWh was assumed. The annual unit power costs are presented in Section 7.2.

7.2 Unit Costs Assumptions

This section introduces the methods used to develop unit costs and assumptions for the CBP cost components:

- PUT components – AWPFs, injection wells, monitoring wells, and recharge basin improvements
- TAKE components – turnouts and connections, extraction wells, wellhead treatment, pump back treatment, and MWD wheeling charge
- Common Facilities – piping (open cut and trenchless), pump stations, NRWS disposal, water storage tanks, and land acquisition

The following subsections will provide detailed information on the basis for each unit cost. The assumed unit costs are included in Appendix D for both construction costs and annual O&M costs.

7.2.1 Put Components

PUT facilities support the purification of recycled water supplies for groundwater replenishment through direct injection or spreading basins (see Section 4 of this TM for more information).

7.2.1.1 AWPFs

The primary AWPF facilities are assumed to be located at RP-1 or RP-4, with consideration of a smaller satellite AWPF at MVWD Plant 28. Locating an AWPF at an existing reclamation plant eliminates or reduces the cost associated with land acquisition and places the treatment facility at the major source of recycled water, thus reducing pipeline and pump station costs.

AWPF construction costs are expressed as a unit of dollars per gallons per day (gpd). Several treatment train options are provided to account for the most likely scenario for each alternative. For example, it was determined an AWPF placed at RP-1 would most likely utilize a purification treatment train of MBR-RO-AOP based on the RP-1 Master Plan recently performed under the RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report (Carollo, April 2019). Several recent Southern California projects were used as the basis for AWPF unit costs, including Orange County Water District's Groundwater Replenishment System and the City of San Diego's Pure Water Program North City Facility.

Additionally, special circumstances may require CBP to pay for the relocation of existing facilities to make room for the proposed AWPF. For example, PUT alternatives that include an AWPF at the MVWD Plant 28 site in MZ-1 assume an "MVWD In-Kind Contribution" to provide MVWD with an alternate site for the existing facilities at the Plant 28 site. Engineering judgement was used to determine a lump sum value for the relocation of facilities at MVWD.

Determining an O&M unit cost for AWPF facilities, similar to AWPF construction costs, requires breaking down the unit cost into smaller components to allow for flexibility to apply to various AWPF treatment scenarios. Unit cost values were derived from similar projects in Southern California and vendor input.

Table 7-1 and Table 7-2 summarize the AWPF construction and annual O&M costs, respectively.

Table 7-1. AWPF Construction Cost (August 2019 Dollars)

AWPF	Cost	Unit
AWPF with MBR	$8.30	gpd
AWPF with RO-AOP Only	$7.00	gpd
AWPF with MF	$8.10	gpd
Offsite AWPF with MF	$8.91	gpd
MVWD In-Kind Contribution	$2,000,000	Each

Table 7-2. AWPF Annual O&M Cost (August 2019 Dollars)

AWPF	Cost	Unit
MBR – Power (MBR)	1.25	kWh/1000 Gal
MBR – Power (BNR Air)	1.42	kWh/1000 Gal
MBR – Chemicals	$0.01	$/1000 Gal
MBR – Membrane Replacement	$0.30	$/1000 Gal
AWPF – Power (MF-RO-AOP)	2.52	kWh/1000 Gal
AWPF – Chemicals (MF-RO-AOP)	$0.42	$/1000 Gal
AWPF - Consumables (MF-RO-AOP)	$0.21	$/1000 Gal

Table 7-2. AWPF Annual O&M Cost (August 2019 Dollars)		
AWPF	**Cost**	**Unit**
AWPF - Power (RO-AOP)	2.28	kWh/1000 Gal
AWPF - Chemicals (RO-AOP)	$0.32	$/1000 Gal
AWPF - Consumables (RO-AOP)	$0.12	$/1000 Gal

7.2.1.2 Injection Wells

Injection wells deliver purified water to the groundwater basin. The size and placement of injections wells were determined by model runs predicting the effect each well would have on the basin.

Injection well construction costs are a function of the well development, equipping, and an optional building housing the injection well equipment. For this estimate we assumed that a building would be provided for all injection wells. A recently installed well for CVWD was used as the basis for this estimate due to its proximity to the proposed wells in this study. Well costs provided by CVWD were compared with a database of recently installed wells in Southern California and reviewed using engineering judgement.

An annual sum was applied to each injection well to account for the general O&M that would be required to keep the injection well in operation. The annual O&M unit cost was developed using engineering judgement.

Table 7-3 and Table 7-4 provide unit costs for injection well construction and annual O&M costs, respectively.

Table 7-3. Injection Well Construction Cost (August 2019 Dollars)		
Injection Well	**Cost**	**Unit**
Development	$1,500,000	Each
Equipping and Building	$500,000	Each

Table 7-4. Injection Well Annual O&M Cost (August 2019 Dollars)		
Injection Well	**Cost**	**Unit**
General O&M	$30,000	Each

7.2.1.3 Monitoring Wells

Monitoring wells are required by Title 22 regulations for groundwater replenishment using recycled water to monitor water quality in the groundwater basin. Monitoring well construction costs were developed using a database of recent and local monitoring well projects. Cost information was reviewed for engineering judgement. An annual sum was applied to each monitoring well to account for the general O&M that would need to be performed to keep the monitoring well in operation. The annual O&M unit cost was developed using engineering judgement.

Table 7-5 and Table 7-6 present the monitoring well construction and annual O&M costs, respectively.

Table 7-5. Monitoring Well Construction Cost (August 2019 Dollars)		
Monitoring Well	**Cost**	**Unit**
Development	$750,000	Each

Table 7-6. Monitoring Well Annual O&M Cost (August 2019 Dollars)		
Monitoring Well	**Cost**	**Unit**
General O&M	$10,000	Each

7.2.1.4 Recharge Basin Improvements

While none of the PUT alternatives use recharge basins for PUT activities, it was added to the cost model to provide flexibility should this option become necessary. If it is decided to use recharge basins for purified water recharge, improvements would most likely need to take place at the existing recharge basin before adequate recharge can occur. Table 7-7 provides a unit cost associated with recharge basin improvements. A lump sum would be applied to each recharge basin to be used. The lump sum provided is based on engineering judgement for what is anticipated to be an average scenario.

Table 7-7. Recharge Basin Construction Cost (August 2019 Dollars)		
Recharge Basin Improvement	**Cost**	**Unit**
Development	$750,000	Each

7.2.2 TAKE Components

TAKE facilities support the extraction of groundwater and delivering potable water to MWD's system or used for in-lieu purposes (see Section 5 of this TM for more information).

7.2.2.1 Turnouts and Connections

Turnouts and connections provide an access point for the CBP to deliver potable water to either MWD's system or the potable water systems of local member agencies. Table 7-8 and Table 7-9 provide unit costs associated with turnout and connection construction and O&M costs, respectively.

Unit cost estimates for the creating or connecting to an existing turnout were developed using engineering judgement. These unit cost values will need to be further refined with input from MWD and member agencies during subsequent stages of program development.

Similar to construction costs associated with turnouts and connections, the unit annual O&M cost estimate provided below were developed using engineering judgement and will need to be further refined with MWD and member agency input.

Table 7-8. Turnout/Connection Construction Cost (August 2019 Dollars)		
Turnout/Connections	**Cost**	**Unit**
Connection to Existing MWD Turnout	$500,000	Each
Construct New Local Turnout	$500,000	Each

Table 7-9. Turnout/Connection Annual O&M Cost (August 2019 Dollars)		
Turnout/Connections	**Cost**	**Unit**
Maintenance and Monitoring	1%	% of Construction Cost

7.2.2.2 Extraction Wells

Extraction wells pull water from the ground for use as potable water for MWD pump back or in-lieu use.

Similar to injection wells, construction costs associated with extraction wells are comprised of well development, well equipping, and an optional building to house the extraction well equipment. An option building was assumed to be included for all extraction wells proposed in this study. Separate unit costs were developed for well development, well equipping, and building. These unit costs were established from a recently installed well for CVWD and verified with similar installations in Southern California using engineering judgement.

The annual O&M costs for extraction wells include the pumping power and the general O&M. The pumping power was estimated using the pump horsepower, pump efficiency, operating duration, and the unit power cost assumption. The general O&M was assumed for each extraction well to keep the well in operation and extend the life of the equipment and building and was developed through engineering judgement.

Table 7-10and Table 7-11 provide unit costs associated with extraction well construction and O&M costs, respectively.

Table 7-10. Extraction Well Construction Cost (August 2019 Dollars)		
Extraction Well	**Cost**	**Unit**
Development	$1,900,000	Each
Equipping and Building	$600,000	Each

Table 7-11. Extraction Well Annual O&M Cost (August 2019 Dollars)		
Extraction Well	**Cost**	**Unit**
General O&M	$30,000	Each

7.2.2.3 Wellhead Treatment

Wellhead treatment is used to bring extracted groundwater to drinking water standards. The type of wellhead treatment varies based on the contaminants. Some areas within the basin will require wellhead treatment while others will not. The unit costs developed below are broad and anticipated to cover most if not all technologies to treat water quality conditions assumed to be found within the basin.

Additionally, if blended water quality does not meet water quality requirements, then an additional centralized polishing treatment facility would be needed prior to pumping CBP water into MWD's system. For this study it was determined that the CBP blended water quality will not require this additional treatment (discussed in Section 5.3 of this TM). Wellhead treatment is included in the two example In-Lieu Local projects, which are included in some of the TAKE alternatives (discussed in TM2 Section 4.4.2).

Wellhead treatment costs were developed using several recent projects and studies. Since a wide variety of conditions could be applied when treating well water, we used a broader search to capture more data points to minimize the effects on more extreme scenarios. Unit costs for the construction of wellhead treatment are expressed in units of gpd.

O&M costs for operating the wellhead treatment facility include power, consumables, mechanical maintenance, and waste disposal. Unit cost values were derived from vendor quotes and recent projects and studies. O&M costs are provided in terms of dollars per 1,000 gallons.

Table 7-12 and Table 7-13 provide unit costs associated with wellhead treatment construction and O&M costs, respectively.

Table 7-12. Wellhead Treatment Construction Cost (August 2019 Dollars)

Wellhead Treatment	Cost	Unit
IX – Single Pass	$1.52	gpd
IX - Regenerable	$2.08	gpd
Air Stripping	$0.69	gpd
Liquid Phase GAC	$1.04	gpd
Reverse Osmosis	$0.94	gpd
AOP	$2.43	gpd
Biological	$1.83	gpd

Table 7-13. Wellhead Treatment Annual O&M Cost (August 2019 Dollars)

Wellhead Treatment	Cost	Unit
IX – Single Pass	$1.52	$/1000 Gal
IX - Regenerable	$2.08	$/1000 Gal
Air Stripping	$0.69	$/1000 Gal
Liquid Phase GAC	$1.04	$/1000 Gal
Reverse Osmosis	$0.94	$/1000 Gal
AOP	$2.43	$/1000 Gal
Biological	$1.83	$/1000 Gal

7.2.2.4 Pre-Delivery Charge (MWD Wheeling Charge)

Pre-delivery of extracted groundwater during non-call years to reduce the required size and capacity of the TAKE facilities is included in some TAKE alternatives. With pre-delivery, the water would be stored in MWD's system during non-call years for use during call years. Therefore, alternatives with pre-delivery include a wheeling charge from MWD to compensate for storage . This fee is captured as an annual O&M cost for this project since it will be applied annually and could potentially vary from year to year, depending on the alternative selected.

This fee was determined with input from MWD and is a combination of system access fees and water stewardship fees expressed in units of dollars per acre-feet per year. Table 7-14 provides unit costs associated with MWD wheeling charges and are based on MWD fees for the 2019 calendar year.

Table 7-14. Pre-Delivery Charge (MWD Wheeling Charge) Annual O&M Cost (August 2019 Dollars)		
MWD Wheeling Charge	**Cost**	**Unit**
Wheeling charge	$411	$/AFY

7.2.3 Common Facilities

Common facilities are infrastructure that support both PUT and TAKE components. Common facilities include pipelines, pumping stations, NRWS disposal, water storage/equalization, and land acquisition.

Unit costs associated with pipelines are broken out by the method of pipeline installation since the effort and ultimately the costs vary significantly between methods. Open cut construction is the most common and affordable option for pipeline installation. Trenchless piping is generally a more expensive alternative to open cut piping however it may be necessary at locations where access to the pipe alignment may not be feasible or price effective such as crossing a freeway or river. Trenchless piping allows the contractor to install piping of certain stretches without having to dig a trench for the whole pipe alignment. There are several trenchless piping technologies, and two approaches were included in the CBP costs: jack and bore and horizontal directional drilling (HDD). Therefore, the piping costs are split into three categories:

- Pipelines – Open Cut
- Pipelines – Trenchless, Jack and Bore
- Pipelines – Trenchless, HDD

7.2.3.1 Pipelines – Open Cut

Constructing a pipeline using open cut technology is the most common and affordable option for pipeline installation. Open cut construction involves digging a trench to the depth of the pipe alignment, laying the pipe in the trench, and backfilling over the pipe. Many factors could affect the unit cost for open cut piping such as depth of pipe, trench location, material of pipe, access to the pipe alignment, etc. For the level of estimate in this study an average condition was applied based on several projects recently completed in the general area.

Open cut pipeline construction unit costs were developed as a cost per inch diameter linear foot for pipelines dependent on their diameter size. Unit costs were developed using recent construction projects local to the Program site as well as engineering judgement. An annual O&M unit cost is applied to the installed pipelines on a dollar per mile basis and accounts for closed-circuit television (CCTV) monitoring and general repairs and maintenance. Table 7-15 and Table 7-16 provide unit costs associated with open cut pipeline construction and O&M costs, respectively.

Table 7-15. Pipeline (Open Cut) Construction Cost (August 2019 Dollars)		
Pipeline (Open Cut)	**Cost**	**Unit**
0” to 14” diameter pipe	$24	In*LF
16” to 20” diameter pipe	$22	In*LF
24” to 60” diameter pipe	$19	In*LF

Table 7-16. Pipeline (Open Cut) Annual O&M Cost (August 2019 Dollars)		
Pipeline (Open Cut)	**Cost**	**Unit**
Pipeline Maintenance and Monitoring	$5,000	$/Mile

7.2.3.2 Pipelines – Trenchless, Jack and Bore

Jack and bore piping construction is used when the trenchless piping spans a relatively short span compared to HDD. For this study, jack and bore was limited to reaches of no more than 500 feet.

Jack and bore piping require a pit to be placed at the launching and receiving locations. These pits are accounted for as a lump sum value for each pit. Piping cost are provided in a unit cost of inch diameter linear feet. Unit costs were developed from a combination of recent project bid values and estimates both locally and throughout the country as well as engineering experience.

The annual O&M cost for Jack and bore piping is the same as for open cut piping. An annual O&M unit cost is applied to the installed pipelines on a dollar per mile basis and accounts for CCTV monitoring and general repairs and maintenance.

Table 7-17 and Table 7-18 provide unit costs associated with jack and bore pipeline construction O&M costs, respectively.

Table 7-17. Trenchless Piping (Jack and Bore) Construction Cost (August 2019 Dollars)		
Trenchless Piping (Jack and Bore)	**Cost**	**Unit**
Pipeline (all diameters)	$60	In*LF
Launching/Receiving Pits	$40,000	Each

Table 7-18. Trenchless Piping (Jack and Bore) Annual O&M Cost (August 2019 Dollars)		
Trenchless Piping (Jack and Bore)	**Cost**	**Unit**
Pipeline Maintenance and Monitoring	$5,000	$/Mile

7.2.3.3 Pipelines – Trenchless, HDD

HDD piping construction is used when the trenchless piping is required over a relatively long span compared to jack and bore. For this study we assumed that trenchless reaches of greater than 500 feet would use HDD.

HDD piping can be performed with or without a launching and receiving pit depending on the conditions and available space. For this study, we assumed that HDD piping would be performed without launching and receiving pits. Piping costs are provided using a unit cost of inch diameter linear feet. Unit costs were developed from a combination of recent project bid values and estimates both locally and throughout the country as well as engineering experience.

The annual O&M cost for HDD piping is the same as open cut piping. An annual O&M unit cost is applied to the installed pipelines on a dollar per mile basis and accounts for CCTV monitoring and general repairs and maintenance.

Table 7-19 and Table 7-20 provide unit costs associated with HDD pipeline construction O&M costs, respectively.

Table 7-19. Trenchless Piping (HDD) Construction Cost (August 2019 Dollars)

Trenchless Piping (HDD)	Cost	Unit
Pipeline (all diameters)	$90	In*LF

Table 7-20. Trenchless Piping (HDD) Annual O&M Cost (August 2019 Dollars)

Trenchless Piping (HDD)	Cost	Unit
Pipeline Maintenance and Monitoring	$5,000	$/Mile

7.2.3.4 Pumping Stations

Pumping stations are used to move recycled water, purified water, or potable water throughout the system to support the CBP program. The unit cost developed for this study will apply to all three types of pump stations.

Costs related to the construction of a new pump station can vary greatly from project to project. In order to come up with a unit cost that could be applied to all pump stations, an average cost was developed based on greater than 10 pump stations recently constructed in the area. Each pump station was reviewed as a price per horsepower so that the same factor could be applied to each proposed pump station in this study.

Annual O&M costs for pump stations include general O&M and power usage. General O&M consists of rehabilitation and scheduled maintenance of the equipment to keep the pump station running and is expressed as a percent of the overall construction cost. The general O&M cost is applied as an equal amount for each year the pump station is in service. Power usage is a variable O&M cost and is directly tied to the usage of the pump station. The power consumption was estimated as follows:

- Pumping stations for recycled water (external supplies), purified water, and potable water were estimated using the estimated horsepower for the new pump stations, pump efficiency, operating duration, and the unit power cost assumption.
- Pumping for recycled water within IEUA's recycled water system was estimated using the recycled water model (see Section 4.1.3 of this TM).

Table 7-21 and Table 7-22 provide unit costs associated with pumping station construction and O&M costs, respectively.

Table 7-21. Pumping Station Construction Cost (August 2019 Dollars)		
Pumping Station	**Cost**	**Unit**
Booster Pump Station	$5,000	HP

Table 7-22. Pumping Station Annual O&M Cost (August 2019 Dollars)		
Pumping Station	**Cost**	**Unit**
General O&M	3%	% of construction

7.2.3.5 NRWS Disposal

NRWS disposal is the cost associated with the disposal of waste generated from treatment systems such as AWPFs and some technologies used for wellhead treatments. These waste streams produce waste above the allowable limits for sewer disposal and will require these streams to be sent to a dedicated pipeline.

To have access to the LACSD NRWS disposal pipeline, the CBP must first purchase Non-Reclaimable Wastewater System Capacity Units (NRWSCU) to reserve capacity in the NRWS pipeline. While the purchasing of NRWSCU are not considered a construction cost, for this study they will be treated as such since it will be applied as a one-time purchase.

Similar to construction costs, the majority of annual O&M cost for NRWS disposal is not considered O&M but for this study will be treated as such to capture the annual cost associated with NRWS disposal. Annual costs for the use of the LACSD pipeline are provided by LACSD guidelines. The annual costs are a function of total volume discharged, discharged levels of chemical oxygen demand (COD) and total suspended solids (TSS), and a flat rate for agency O&M and charges for clean-in-place (CIP) cleaning.

Table 7-23 and Table 7-24 provide unit costs associated with NRWS disposal costs.

Table 7-23. NRWS Disposal Construction Cost (August 2019 Dollars)		
NRWS Disposal	**Cost**	**Unit**
NRWSCU Purchase Rate	$4,172	CU

Table 7-24. NRWS Disposal Annual O&M Cost (August 2019 Dollars)		
NRWS Disposal	**Cost**	**Unit**
Volumetric Charges	$0.94	1,000 Gal
Strength Charges - COD	$166	1,000 lbs (dry weight)
Strength Charges - TSS	$470	1000 lbs (dry weight)
Agency O&M and CIP Charges	$28.25	CU/Month

7.2.3.6 Water Storage/Equalization Tanks

Water storage tanks are used for both PUT and TAKE alternatives to provide equalization to AWPF flows and extracted groundwater.

Wherever possible, existing basins were used to reduce the construction costs and minimize program footprint. Existing equalization basins are assumed to be concrete basins. Unit costs were developed for modifications to an existing concrete equalization basin using engineering judgement. When a new tank is needed, it is assumed to be made of welded steel. Unit costs for a new welded steel tank were developed using estimates from recent projects and quotes from steel tank manufacturers.

Annual O&M costs are applied to welded steel tanks only and account for the periodic draining, cleaning, and recoating of the steel tank. Repairs to the concrete equalization basins are expected to be minimal and not reflected in this study.

Table 7-25 and Table 7-26 provide unit costs associated with water storage and equalization tank construction and O&M costs, respectively.

Table 7-25. Water Storage/Equalization Tanks Construction Cost (August 2019 Dollars)

Water Storage/Equalization Tanks	Cost	Unit
Welded Steel Tank	$1.30	Gal
Equalization Basin Modifications	$50,000	Each

Table 7-26. Water Storage/Equalization Tanks Annual O&M Cost (August 2019 Dollars)

Water Storage/Equalization Tanks	Cost	Unit
Recoating	$0.02	Gal

7.2.3.7 Land Acquisition

New facilities proposed for this program will be constructed on IEUA property whenever possible to reduce construction costs associated with purchasing of land. When a new facility is to be constructed outside of an IEUA property the program must take into consideration the cost to purchase the land. Table 7-27 provides unit costs associated with land acquisition. The unit cost was developed in dollars per acre by using recent projects in the area and engineering judgement as reference. Land acquisition costs will change as market conditions change and may change at a different rate than typical construction cost escalation.

Table 7-27. Land Acquisition Construction Cost (August 2019 Dollars)

Land Acquisition	Cost	Unit
Land Acquisition	$750,000	Acres

7.3 NPV Costs

The NPV costs for the PUT, TAKE, and program alternatives were developed using economic analysis tool that is described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). Benefits for each alternative were monetized and cost components were quantified to define the NPV of the benefits and costs associated with each alternative. Following is a summary of the primary NPV cost assumptions:

- Project life duration: 50 years
- Base year for capital, O&M, and NPV costs: 2019

- Proposition 1 WSIP funding: $206.9M
- Federal discount rate: 5% per year
- Economic growth rate: 5% per year
- Escalation rate: 3% per year
- O&M escalation rate: 5% per year
- Construction loan interest: 2.0% per year

The NPV costs for the PUT, TAKE, and program alternatives are presented in TM2 Sections 3.3.7, 4.3.7, and 5, respectively. Refer to the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020) for more information about the detailed NPV methodology and assumptions.

Section 8: Evaluation Approach

This section describes the evaluation approach for the PUT, TAKE, and program alternatives. The alternatives evaluations and results are presented in TM2.

The alternatives were evaluated using a two-step approach. In the first step, the PUT and TAKE were defined, developed, and evaluated in parallel using a multiple criteria evaluation approach, which includes NPV costs. The second step included the development and evaluation of program alternatives based on the preferred PUT and TAKE alternatives from the PUT and TAKE alternatives evaluations, respectively. Figure 8-1 illustrates the two-step evaluation approach.

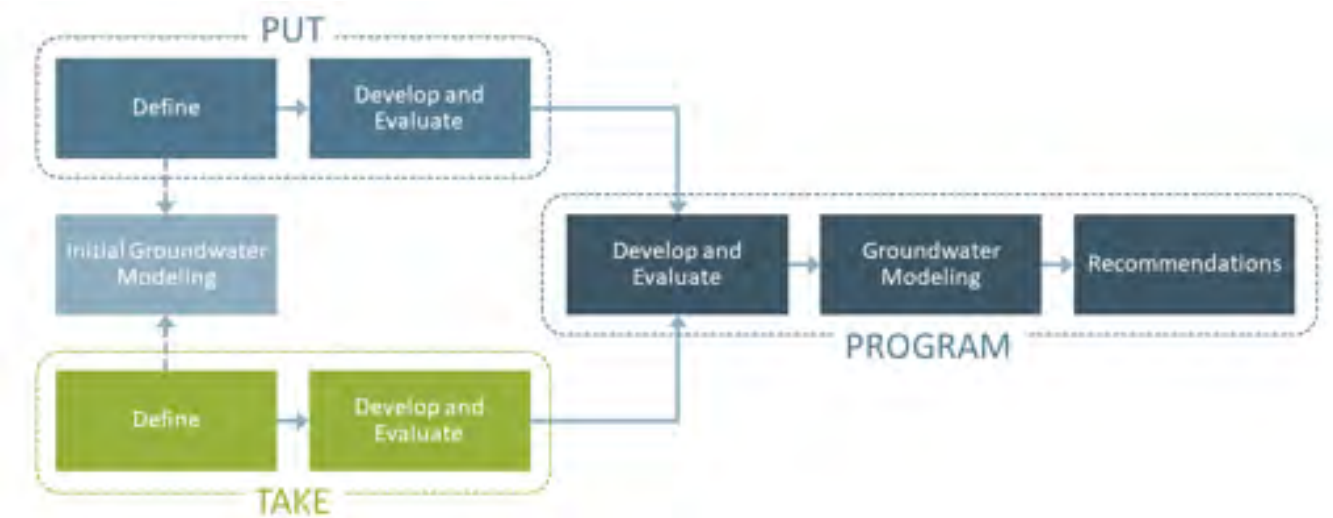

Figure 8-1. Two-Step Evaluation Approach

This two-step approach assists IEUA and stakeholders to identify the recommended program by analyzing the PUT and TAKE alternatives first and then combining the preferred PUT and TAKE alternatives into program alternatives. As part of the program alternatives evaluation, the program alternatives were evaluated to groundwater modeling to assess how the alternatives perform within the Chino Basin. This two-step process allows IEUA and stakeholders time to review and comment between steps and provide key input on the alternatives and the multi-criteria evaluation. The objective of the two-step approach is to:

1. Evaluate component alternatives to eliminate low scoring PUT and TAKE alternatives.
2. Combine the highest ranking PUT and TAKE alternatives into program alternatives for subsequent evaluation and to help identify the preferred program alternative.

The multi-criteria evaluation approach is aligned with the program objectives to directly demonstrate how well the alternatives meet the program objectives. The overall evaluation approach was developed based on the following elements:

- Establish minimum requirements that alternatives must meet to be considered.
- Organize the evaluation by critical objectives.
- Define evaluation criteria for each objective to measure how well each alternative performs against that objective and a normalized scoring approach for each criterion.
- Assign weighting factors to objectives and evaluation criteria to identify the relative importance of each objective and criterion within the overall evaluation.

- Complete scoring for each alternative and graphically display results.

The objectives and evaluation criteria were discussed with IEUA and stakeholders at CBP Workgroup meetings, and input was received by stakeholders on the weighting factors for the objectives to support a sensitivity analysis of the multi-criteria evaluation results.

The remainder of this section discusses the minimum requirements (Section 8.1) and the objectives and evaluation criteria and how the alternatives were scored (Section 8.2).

8.1 Minimum Requirements

All PUT, TAKE, and program alternatives must meet certain minimum requirements to be considered feasible for implementation and if an alternative does not meet these requirements, then it was revised or eliminated from consideration. The minimum requirements were developed with IEUA and stakeholder input and confirm that each alternative meets basin-wide objectives and regulatory requirements, and that CBP alternatives meet the program requirements that were the basis for the funding. The minimum requirements were split into two categories to allow both CBP and non-CBP alternatives to be compared using the same evaluation approach, if desired. Table 8-1 summarizes the minimum requirements and the CBP minimum requirements.

Table 8-1. Minimum Requirements for All Alternatives

Minimum Requirements (MR): Meet Basin-wide objectives and regulatory requirements	
MR-1	Meet Basin Plan objectives and requirements (TDS, Nitrogen)
MR-2	If the alternative includes a storage and recovery element, then align with OBMP objectives and Storage Framework Investigation (safe yield, existing contaminant plumes, water quality, land subsidence, hydraulic control).
MR-3	Meet NPDES Permit requirements.
MR-4	Meet groundwater replenishment and drinking water regulatory requirements.
MR-5	Meet SAR discharge obligation.
MR-6	In lieu project implementation does not impact a stakeholder's ability to meet planned water demands.
Chino Basin Plan Requirements: Provide water exchange for the benefit of the Delta Ecosystem	
CBP-1	Provide capacity of up to 50 TAFY as an exchange to MWD.
CBP-2	Store 15 TAFY for 25 years.
CBP-3	Meet CWC-approved physical benefits (TDS reduction and emergency supply).

8.2 Objectives and Evaluation Criteria

The multi-criteria evaluation was used for PUT, TAKE, and program alternatives that meet the minimum requirements. The evaluation criteria are developed from five key objectives that were identified based on stakeholder comments and overall goals for the program. The objectives are:

- Objective 1 – Develop Basin-wide water supply infrastructure
- Objective 2 – Increase water supply reliability
- Objective 3 – Streamline operations and maintenance
- Objective 4 – Minimize program complexity

- Objective 5 – Support cost effectiveness

Evaluation criteria were defined for each objective to measure how well each alternative performs against that objective. Baseline weightings were assigned for each objective and evaluation criterion. The objectives, evaluation criteria, and baseline weightings are presented in Table 8-2. Note that some evaluation criteria may apply to both PUT and TAKE alternatives or be mutually exclusive to either PUT or TAKE alternatives. If the criterion did not apply to either the PUT or TAKE alternatives, then the weighting for the criteria under that objective were adjusted accordingly.

Table 8-2. Objectives, Evaluation Criteria, and Baseline Weightings

Objectives			Evaluation Criteria					
No.	**Name**	**Baseline Weighting**	**No.**	**Name**	**PUT and/or TAKE**	**Baseline Weighting[1]**	**Baseline Weighting PUT[1]**	**Baseline Weighting TAKE[1]**
1	Develop Basin-wide water supply infrastructure	25%	1a	Create regional exchange opportunities	TAKE only	25%	0%	30%
			1b	Provide synergy with region's planned projects	PUT and TAKE	25%	50%	20%
			1c	Ability to meet future Direct Potable Reuse conveyance needs (raw water augmentation)	PUT only	10%	50%	0%
			1d	Enhance MWD Rialto Pipeline reliability	TAKE only	25%	0%	30%
			1e	Integrate with other storage programs	TAKE only	15%	0%	20%
			Subtotal			100%	100%	100%
2	Increase water supply reliability	15%	2a	Insurance water (critically dry year access to treatment and unused water) (access to emergency supply)	TAKE only	40%	0%	40%
			2b	Address CECs on the horizon (such as PFAS)	PUT and TAKE	20%	50%	20%
			2c	Increased potable water supply (beyond 25-year CBP)	PUT and TAKE	40%	50%	40%
			Subtotal			100%	100%	100%

Table 8-2. Objectives, Evaluation Criteria, and Baseline Weightings

Objectives			Evaluation Criteria					
No.	**Name**	**Baseline Weighting**	**No.**	**Name**		**Baseline Weighting[1]**	**Baseline Weighting PUT[1]**	**Baseline Weighting TAKE[1]**
3	Streamlined operations and maintenance	15%	3a	Minimize operational complexity	PUT and TAKE	40%		
			3b	Minimize impacts to water levels in existing wells	PUT and TAKE	25%		
			3c	Optimize energy use	PUT and TAKE	35%		
			Subtotal			100%		
4	Minimize program complexity	20%	4a	Minimize institutional complexity	PUT and TAKE	30%		
			4b	Minimize implementation complexity	PUT and TAKE	30%		
			4c	Leverage existing available land to minimize land acquisition	PUT and TAKE	40%		
			Subtotal			100%		
5	Support cost effectiveness	25%	5a	Minimize NPV costs (includes $206.9M funding for CBP alternatives) (with pre-delivery charge)	PUT and TAKE	40%		
			5b	Minimize capital costs	PUT and TAKE	30%		
			5c	Minimize annual O&M costs (with pre-delivery charge)	PUT and TAKE	30%		
			Subtotal			100%		
Total		**100%**						

[1]Baseline weightings were adjusted for the PUT and TAKE evaluations when certain criteria did not apply to either the PUT or TAKE evaluation, respectively. These adjustments are shown in TM2.

Each alternative was scored against each criterion. The scores were assigned as follows:

- Each alternative was analyzed for each criterion and assigned a score of 1 through 5, with 5 being most advantageous and 1 being the least advantageous.

- The evaluation criteria were scored either quantitatively or qualitatively. Quantitative criteria are those criteria that are scored based on attributes that can be measured, such as pipeline length. Qualitative criteria are scored based on an opinion of how well that alternative supports the evaluation criterion, such as the ability to meet future direct potable reuse (DPR) needs. Criteria that require qualitative scored with whole numbers, while criteria that are scored qualitatively have rational numbers as scores.

The overall score for each alternative was calculated as follows:

- The score for each objective was calculated by summing the weighting times the score for each criterion.
- The total score was calculated by summing the weight times the subtotal for each objective.

The following sections provide a description and scoring methodology for each criterion.

8.2.1 Objective 1 – Develop Basin-Wide Water Supply Infrastructure

The CBP program will require new infrastructure and facilities for both PUT and TAKE alternatives; so it is important to have the first objective analyze basin-wide water supply infrastructure to be inclusive of IEUA's and stakeholders' goals. Five criteria were developed show how well the PUT and TAKE alternatives support the objective. The criteria are listed below with an indication of which PUT and TAKE evaluations they apply to (i.e., PUT only, TAKE only, or PUT and TAKE):

- 1a – Create Exchange Opportunities within Chino Basin (TAKE only),
- 1b – Provide Synergy with Region's Planned Projects (PUT and TAKE),
- 1c – Ability to Meet Future Direct Potable Reuse Conveyance Needs (PUT only),
- 1d – Enhance MWD Rialto Pipeline Reliability (TAKE only), and
- 1e – Integrate with Other Storage Programs (TAKE only).

8.2.1.1 Create Regional Exchange Opportunities – TAKE Only

This criterion analyzes new TAKE connections that are developed basin wide. The performance is measured by the ability to have access to new potable water infrastructure via number of new interconnections added to existing infrastructure. TAKE alternatives that provide more interconnections score better than those that provide fewer interconnections. A summary of the scoring methodology for creating regional exchange opportunities is provided in Table 8-3.

Table 8-3. Summary of Scoring – Create Regional Exchange Opportunities (Criterion 1a)

Score	Description	Scoring Definition
5	Largest number of intercon-nections	TAKE alternative provides the largest number of interconnections.
4	More than average number of interconnections	TAKE alternative provides more than average number of interconnections.
3	Average number of inter-connections	TAKE alternative provides an average number of interconnections.
2	Less than average number of interconnections.	TAKE alternative provides less than average number of interconnections.
1	Fewest number of intercon-nections	TAKE alternative provides the fewest number of interconnections

8.2.1.2 Provide Synergy with Region's Planned Projects – PUT and TAKE

The ability to combine stakeholders' planned projects with the alternatives is a significant component in developing the basin-wide water supply infrastructure for the CBP since it would enable the stakeholders to achieve more from the program. The performance measure is based on the number of planned projects incorporated in the alternative. Alternatives that provide more synergies with stakeholders' planned projects scored higher than alternatives that provide fewer synergies. Because all PUT alternative include an AWPF, they will score a 5 and are compared against this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. For TAKE alternatives, The scoring criterion is based on current understanding of stakeholders' planned projects. The current planned projects include the following:

- Wellhead treatment: treatment projects for existing wells at Chino and Chino Hills (example In-Lieu Local projects)
- North-south (or northern) pipeline: Projects to include north-south pipeline to JCSD that can provide dual benefit for the program in-lieu as well as CVWD imported water to JCSD.
- East-west pipeline: Project to extend east-west pipeline.

A summary of the scoring methodology for synergy with stakeholders planned projects is provided in Table 8-4.

Table 8-4. Summary of Scoring (1b) Provide Synergy with Stakeholders' Planned Projects – PUT and TAKE Only

Score	Description	Scoring Definition	
		PUT Alternatives	TAKE Alternatives
5	Most synergy with stakeholders planned projects	PUT alternative provides the most infrastructure to multiple stakeholders based on their planned projects compared to other alternatives. An alternative with a score of 5 would include an AWPF.	TAKE alternative provides the most infrastructure to multiple stakeholders based on their planned projects compared to other alternatives. An alternative with a score of 5 would include Chino and Chino Hills well head treatment, N-S pipeline to JCSD, connection to TVMWD, E-W pipeline.
4	Higher than moderate synergy with stakeholders planned projects	N/A	N/A
3	Moderate synergy with stakeholders' planned projects	N/A	TAKE alternative provides an average amount infrastructure based on stakeholders' planned projects compared to other alternatives. An alternative with a score of 3 would include two of the following projects: Chino and Chino Hills well head treatment, N-S pipeline to JCSD, connection to TVMWD, E-W pipeline.
2	Minimal synergy with stakeholders planned projects	N/A	N/A
1	No synergy with stakeholders planned projects	PUT alternative does not provide any synergy infrastructure based on stakeholders' planned projects.	TAKE alternative provides an average amount infrastructure based on stakeholders' planned projects compared to other alternatives. An alternative with a score of 1 would include one of the following projects: Chino and Chino Hills well head treatment, N-S pipeline to JCSD, connection to TVMWD, E-W pipeline.

8.2.1.3 Ability to Meet Future Direct Potable Reuse Conveyance Needs – PUT Only

The ability to meet future DPR conveyance needs is an interest to the stakeholders since they may decide to produce recycled water in the future once regulations are developed. This would only affect the PUT alternatives as it is assumed that any future DPR project would be RWA and purified water would need to be pumped back to either the Rialto Pipeline or a water treatment plant. All PUT alternatives score the same as they all provide at least one AWPF. This evaluation will be used as a differentiator between CBP and non-CBP alternatives during the program alternatives evaluation. The scoring methodology for the ability to meet future direct potable reuse regulations is provided in Table 8-5.

Table 8-5. Summary of Scoring (1c) Ability to Meet Future Direct Potable Reuse Conveyance Needs – PUT Only

Score	Description	Scoring Definition
5	N/A	N/A
4	AWPF	PUT alternative provides at least one AWPF.
3	N/A	N/A
2	N/A	PUT alternative does not provide an AWPF.
1	N/A	N/A

8.2.1.4 Enhance MWD Rialto Pipeline Reliability – TAKE Only

The ability to increase the reliability of imported water deliveries during a shutdown of the MWD Rialto Pipeline is important in planning and developing Basin-wide water supply infrastructure. TAKE alternatives that enhance the reliability of the MWD Rialto Pipeline by providing parallel east-west conveyance for imported water during Rialto Pipeline shutdowns, thus supplementing the Rialto Pipeline, are scored higher than alternatives that do not enhance reliability. The lengths of the pipelines and diameter are considered in the scoring. The scoring methodology for the ability to enhance the MWD Rialto feeder reliability is provided in Table 8-6

Table 8-6. Summary of Scoring (1d) Enhance MWD Rialto Feeder Reliability – TAKE Only

Score	Description	Scoring Definition
5	Largest enhancement of MWD Rialto Pipeline reliability	TAKE alternative provides longest parallel conveyance pipeline with large pipeline diameter (>24”) for imported water to the Rialto Pipeline to enhance MWD Rialto feeder reliability
4	Large enhancement of MWD Rialto Pipeline reliability	TAKE alternative provides long parallel conveyance pipeline with small pipeline diameter (<24”) for imported water to the Rialto Pipeline to enhance MWD Rialto feeder reliability
3	Modest enhancement of MWD Rialto Pipeline reliability	TAKE alternative provides short parallel conveyance pipeline with large pipeline diameter (>24”) for imported water to the Rialto Pipeline to enhance MWD Rialto feeder reliability
2	Slight enhancement of MWD Rialto Pipeline reliability	TAKE alternative provides short parallel conveyance pipeline with small pipeline diameter (<24”) for imported water to the Rialto Pipeline to enhance MWD Rialto feeder reliability
1	No enhanced MWD Rialto Pipeline reliability	TAKE alternative does not have a conveyance pipeline parallel to the Rialto pipeline to increase reliability.

8.2.1.5 Integrate with Other Storage Programs – TAKE Only

The ability to transport more water to storage programs outside of Chino Basin is significant in evaluating pump back to MWD. The performance measure is standard delivery (e.g., no pre-delivery) alternatives and non in-lieu alternatives score higher since standard delivery alternatives move more water and MWD pump back alternatives convey water to MWD. This movement of water allows for other programs outside of Chino Basin to capture the water and use it in their storage programs. The most advantageous score would require 100% pump back and no pre-delivery while the least advantageous would score would require 100 percent in-lieu with pre-delivery. The scoring methodology for the ability to increase recycled water supplies is provided in Table 8-7 below.

Table 8-7. Summary of Scoring (1e) Integrate with Other Storage Programs – TAKE Only

Score	Description	Scoring Definition
5	Provides the most water to other storage programs	TAKE alternative is 100% pump back to MWD with no pre-delivery.
4	Provides large amount of water to other storage programs	TAKE alternative is 100% pump back with pre-delivery.
3	N/A	N/A
2	Provides some water to other storage programs	TAKE alternative is partial pump back to MWD and partial in lieu with pre-delivery or no pre-delivery.
1	Provides no water to other storage programs	TAKE alternative is 100% in lieu with pre-delivery.

8.2.2 Object 2 – Increase Water Supply Reliability

The CBP has the ability to diversify and increase the regional water supply portfolio for IEUA and stakeholders. This objective analyzes alternatives on the basis that it would increase the regions water supply and water quality. Three criteria were developed show how well the PUT and TAKE alternatives support the objective. The criteria are listed below with an indication of which PUT and TAKE evaluations they apply to (i.e., PUT only, TAKE only, or PUT and TAKE):

- 2a – Insurance Water (TAKE only),
- 2b – Address Contaminants of Emerging Concern (CECs) on the Horizon (PUT and TAKE), and
- 2c – Increased Potable Water Supply (PUT and TAKE).

8.2.2.1 Insurance Water (Criterion 2a) – TAKE Only

The ability to provide insurance water allows for the region to access unused water during critically dry years or during times of emergency. TAKE alternatives that provide more water to the Chino Basin score better than those that divert more water to MWD. Scores are based on Year 7 storage amounts for each TAKE alternative assuming that the first call year is Year 8. The TAKE alternative that has the largest storage volume score a 5 and the other alternatives were scaled proportional from the largest storage volume to their respective storage volumes. The scoring methodology for insurance water is provided in Table 8-8 below.

Table 8-8. Summary of Scoring (2a) Provide Insurance water – TAKE Only		
Score	**Description**	**Scoring Definition**
5	Supplies most water to the region	TAKE alternative provides the largest amount of emergency supply.
4	Supplies more than average amount of water to region	TAKE alternative provides more than average amount of emergency supply.
3	Supplies average amount of water to region	TAKE alternative provides average amount of emergency supply.
2	Supplies less than average amount of water to region	TAKE alternative provides less than average amount of emergency supply.
1	Supplies least amount of water to the region	TAKE alternative provides least amount of emergency supply.

8.2.2.2 Address CECs on Horizon (Criterion 2b) – PUT and TAKE

The ability to address CECs that are on the horizon are important as it allows for the technology to be implemented before a limit is placed by regulators. An example of a forthcoming CEC limit is for PFAS. PUT alternatives with full advanced treatment score better than those that do not since CECs are removed prior to groundwater discharge. Because all PUT alternative provide an AWPF, they all score a 5.0. The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation

TAKE alternatives that have standard delivery alternatives score better because more extraction occurs in better water quality areas. Similarly, alternatives with groundwater treatment (e.g., Chino and Chino Hills example In-Lieu Local projects) score better. All TAKE alternatives provide extraction wells in better water quality areas, however alternatives with standard delivery provide more wells and provide more access to better quality water than those that have pre-delivery. Wells that have fewer extraction wells score lower since not as much higher-quality potable water can be extracted.

The scoring methodology for both PUT and TAKE alternatives for the ability to address CECs is provided in Table 8-9 below.

Table 8-9. Summary of Scoring (2b) Address CECs on Horizon – PUT and TAKE			
Score	**Description**	**Scoring Definition**	
		PUT Alternative	**TAKE Alternative**
5	Manages future CECs the best	Provides at least one AWPF with full advanced treatment.	Provides groundwater treatment and have the most extraction wells in better water quality areas due to no pre-delivery.
4	Manages future CECs on average	N/A	Provides groundwater treatment and fewer extraction wells in better water quality areas due to pre-delivery.
3	Manages future CECs the least	N/A	Provides fewer extraction wells in better water quality area due to pre-delivery.
2	N/A	N/A	N/A.
1	N/A	N/A	N/A

8.2.2.3 Increase Potable Water Supply (Criterion 2c) – PUT and TAKE

The ability to increase potable water supply for the region beyond the 25-year CBP is based on IEUA and stakeholders capitalizing on the existing assets developed from the program. The performance measure is the amount of new potable water generated in the Chino Basin area. Since each PUT Alternative provides 15.0 TAFY of purified water for groundwater recharge, all score a 5.0. TAKE alternatives that provide infrastructure that allows for the largest amount of new potable water to be generated in the Chino Basin area score better than those that limit water production. Because all TAKE alternatives generate 375.0 TAF beyond the 25-year program, they all score a 5.0. Both PUT and TAKE alternatives are evaluated for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation.

The scoring methodology for the ability to increase potable water supply beyond 25-year CBP is provided in Table 8-10 below.

Table 8-10. Summary of Scoring (2c) Increase Water Supply Beyond 25-yr CBP – PUT and TAKE

Score	Description	Scoring Definition	
		PUT Alternatives	TAKE Alternatives
5	Provides the largest increase in water supply beyond 25 year CBP.	Provides the most TAFY of purified water for groundwater recharge.	Generates the most TAFY in the 25 years beyond the program.
4	N/A	N/A	N/A
3	N/A	N/A	N/A
2	N/A	N/A.	N/A.
1	N/A	N/A	N/A

8.2.3 Object 3 – Streamline Operations and Maintenance

The CBP would introduce new treatment processes and multiple wells that would need to be operated and maintained, thus the ability to streamline the alternative's operation and maintenance is an important third objective. Streamlining these efforts provides efficiency and a smoother transition to these new services amongst stakeholders. Three criteria were developed show how well the PUT and TAKE alternatives support the objective and all criteria apply to both the PUT and TAKE alternatives. The criteria are listed below:

- 3a – Minimize Operational Complexity,
- 3b – Minimize Impacts to Water Levels in Existing Wells, and
- 3c – Optimize Energy Use.

8.2.3.1 Minimize Operational Complexity (Criterion 3a) – PUT and TAKE

The ability to minimize operational complexity is important for both PUT and TAKE alternatives. The ability to minimize operational complexity's PUT performance measure is based on the intricacy of operations measured in number of AWPFs and injection wellfields. PUT alternatives that have fewer AWPFs and injection wells fields score better than those that have more. The TAKE alternative's performance measures are based on the complexity of operations measured in number of extraction wells and booster pump stations, and wellhead treatment.

Due to their different performance measures, the scoring methodology for the ability to minimize operational complexities is provided in Table 8-11 includes separate scoring definitions for the PUT and TAKE alternatives.

Table 8-11. Summary of (3a) Minimize Operational Complexity – PUT and TAKE		
Score	**Description**	**Scoring Definition**
5	Least operational complexity	PUT/TAKE alternative provides the fewest number of operational complexities.
4	Less than moderate operational complexity	PUT/TAKE alternative provides the less than moderate number of operational complexities.
3	Moderate operational complexity	PUT/TAKE alternative provides moderate number of operational complexities.
2	More than moderate operational complexity	PUT/TAKE alternative provides more than moderate number of operational complexities.
1	Most operational complexity	PUT/TAKE alternative provides the greatest number of operational complexities.

8.2.3.2 Minimize Impacts to Water Levels in Existing Wells (Criterion 3b) – PUT and TAKE

Impacts to water levels in existing wells can be caused by both PUT and TAKE alternatives. The PUT alternatives may positively impact nearby existing wells by increasing groundwater levels at the existing wells. The new TAKE extraction wells may negatively affect the groundwater basin by overdrawing and reducing water levels in nearby existing wells. This criterion is evaluated by reviewing well hydrographs and analyzing the water levels at nearby existing wells.

The scoring methodology for the ability to minimize impacts to water levels in existing wells is provided for PUT and TAKE alternatives in Table 8-12.

Table 8-12. Summary of (3b) Minimize Impacts to Water Levels in Existing Wells – PUT and TAKE			
Score	**Description**	**Scoring Definition**	
		PUT Alternatives	**TAKE Alternatives**
5	Most advantageous impacts to existing wells	N/A	Insignificant drawdown at nearby wells.
4	Slight advantageous impacts to existing wells	PUT alternative increases water at nearby wells	N/A
3	Least advantageous impacts to existing wells	No not increase water levels at nearby wells.	Minimal drawdown at nearby wells
2	N/A	N/A	N/A
1	N/A	N/A	N/A

8.2.3.3 Optimize Energy Use – PUT and TAKE

There will be many new processes in the alternatives that will demand energy, so it is important to analyze the ability to optimize energy uses for both PUT and TAKE alternatives. The performance measure is based on the energy demand in 1,000 kilowatt-hours (kWh). A lower energy demand results in a higher (better) score.

The PUT alternatives incorporate infrastructure requiring significant energy and optimization of that energy use must be considered. The performance measure is based on the total energy demand for the AWPFs and the recycled water and purified water pumping. The TAKE alternatives are evaluated by the energy demand for the extraction wells, wellhead treatment, and pump stations. Because each TAKE alterative has differing energy demands between normal (non-call) years and call years, the energy use for the alternatives were evaluated across the lifetime of the program. Across the entirety of the program, there are 7.5 call years and 17.5 normal (non-call) years. A lower energy demand scores higher in the evaluation.

The scoring methodology to optimize energy use is provided in Table 8-13 below.

Table 8-13. Summary of (3c) Optimize Energy Use – PUT and TAKE		
Score	**Description**	**Scoring Definition**
5	Lowest energy demand	PUT/TAKE alternative requires least amount of energy.
4	Less than moderate energy demand	PUT/TAKE alternative requires less than moderate amount of energy.
3	Moderate energy demand	PUT/TAKE alternative requires moderate amount of energy.
2	More than moderate energy demand	PUT/TAKE alternative requires more than moderate amount of energy.
1	Highest energy demand	PUT/TAKE alternative requires highest amount of energy.

8.2.4 Objective 4 – Minimize Program Complexity

The CBP program includes many shared components amongst stakeholders so a significant objective is to minimize program complexities. The CBP would be a complex program including many stakeholders. This objective measures the complexity of the proposed PUT and TAKE alternatives. Three criteria were developed show how well the PUT and TAKE alternatives support the objective and all criteria apply to both the PUT and TAKE alternatives The criteria are listed below:

- 4a – Minimize Institutional Complexity,
- 4b – Minimize Implementation Complexity, and
- 4c – Leverage Existing Available Land to Minimize Land Acquisition.

8.2.4.1 Minimize Institutional Complexity (Criterion 4a) – PUT and TAKE

The performance measure for the ability to minimize institutional complexity is based on the numbers of contracts/agreements needed with stakeholders. The fewer the agreements with stakeholders the better the score. The PUT alternatives evaluate the contacts required for the AWPFs and injection wells and the TAKE alternatives evaluate the delivery contracts between all the agencies. The scoring methodology to minimize institutional complexity is provided in Table 8-14.

Table 8-14. Summary of (4a) Minimize Institutional Complexity – PUT and TAKE			
Score	Description	Scoring Definition	
		PUT Alternatives	TAKE Alternatives
5	Least institutional complexity	N/A	Least amount of institutional complexity with the smallest number of contracts.
4	Less than moderate institutional complexity	Less than moderate institutional complexity with a minimal number of contracts.	Less than moderate institutional complexity with a minimal number of contracts.
3	Moderate institutional complexity	N/A	Moderate institutional complexity with a moderate number of contracts.
2	More than moderate institutional complexity	More than moderate institutional complexity with a larger number of contracts.	More than moderate institutional complexity with a large number of contracts.
1	Most institutional complexity	N/A	Most amount of instructional complexity with the largest number of contracts.

8.2.4.2 Minimize Implementation Complexity (Criterion 4b) – PUT and TAKE

The performance measure for the ability to minimize implementation complexity is based on the numbers of projects elements and permits for each alternative. The fewer the projects and permits, the better the score. The PUT alternatives evaluate the number of projects based on pump stations, miles of pipeline, and pipeline crossings. Crossings refer to pipeline that has to go below highways or train tracks. The TAKE alternatives evaluate the number of projects is based on pump stations, miles of pipelines, pipeline crossings, and wellhead treatment. Note that all PUT and TAKE alternatives require the same number of permits; since this is not a differentiator, this was not taken into account in the scoring. The scoring methodology to minimize institutional complexity is provided in Table 8-15 below.

Table 8-15. Summary of (4b) Minimize implementation complexity – PUT and TAKE		
Score	Description	Scoring Definition
5	Least implementation complexity	PUT/TAKE alternative provide least amount of implementation complexity with the smallest number of projects.
4	Less than moderate implementation complexity	PUT/TAKE alternative provide less than moderate implementation complexity with a minimal number of projects.
3	Moderate implementation complexity	PUT/TAKE alternative provide moderate implementation complexity with a moderate number of projects.
2	More than moderate implementation complexity	PUT/TAKE alternative provide more than moderate implementation complexity with a large number of projects.
1	Most implementation complexity	PUT/TAKE alternative provide most amount of implementation complexity with the largest number of projects.

8.2.4.3 Leverage Existing Available Land to Minimize Lan Acquisition (Criterion 4c) – PUT and TAKE

Since the CBP needs to be implemented by 2026, using existing available land for CBP facilities was identified as a critical element to keep the project on schedule by avoiding complications with land purchases and rezoning or permitting new parcels. Using existing land also helps reduce program costs. Alternatives that require less land acquisition score better than alternatives that require more land acquisition.

The PUT alternatives require land acquisition for injection wells, monitoring wells, and for the Plant 28 site. The TAKE alternatives may require land acquisition for extraction wells, pump stations, and equalization tank locations. The scoring methodology to leverage existing available land to minimize land acquisition is shown in Table 8-16.

Table 8-16. Summary of (4c) Leverage Existing Available Land to Minimize Land Acquisition – PUT and TAKE

Score	Description	Scoring Definition
5	Minimal land acquisition	PUT/TAKE alternative provide least amount of acreage required for land acquisition.
4	More than moderate land acquisition	PUT/TAKE alternative provide less than moderate amount of acreage required for land acquisition.
3	Moderate land acquisition	PUT/TAKE alternative provide moderate amount of acreage required for land acquisition.
2	Less than moderate land acquisition	PUT/TAKE alternative provide more than moderate amount of acreage required for land acquisition.
1	Significant land acquisition	PUT/TAKE alternative provide largest amount of acreage required for land acquisition.

8.2.5 Objective 5 – Support Cost Effectiveness

The ability to support cost effectiveness is an important factor in the multi-criteria evaluation. The PUT and TAKE alternatives costs were developed for each alternative as described in Section 7. Three criteria were developed show how well the PUT and TAKE alternatives support the objective and all criteria apply to both the PUT and TAKE alternatives. The criteria are:

- 5a – Minimize NPV costs,
- 5b – Minimize capital costs, and
- 5c – Minimize annual O&M costs.

8.2.5.1 Minimize NPV Costs (Criterion 5a) – PUT and TAKE

NPV costs were developed over a project lifecycle of 50 years using the economic analysis tool that is described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The NPV costs represent the present value of cash flow over the 25-year CBP and the 25 years following the CBP. The NPV costs include capital costs, replacement costs, annual O&M costs, non-recoverable wastewater disposal costs, and supplemental external source water cost (i.e., recycled water supplies from JCSD and City of Rialto). For the CBP alternatives, the NPV costs take into account the Proposition 1 Water Storage Investment Program (WSIP) funding of $206.9M. The NPV costs are in 2019 dollars.

The economic analysis tool was developed to calculate the NPV costs for overall CBP costs. Therefore, the program costs were estimated for the PUT alternatives assuming that the TAKE portion was TAKE-4c, and then the PUT portion of the NPV cost was separated out. Similarly the eight TAKE alternatives were estimated assuming that the PUT portion was PUT-5 and then the TAKE portion of the NPV cost was separated out.

The scoring methodology to minimize NPV costs is shown in Table 8-17 below. Alternatives with lower NPV costs score higher.

Table 8-17. Summary of (5a) Minimize NPV Costs – PUT and TAKE		
Score	**Description**	**Scoring Definition**
5	Least Expensive	PUT/TAKE alternative provides lowest NPV cost.
4	Less than moderately expensive	PUT/TAKE alternative provides less than moderate NPV cost.
3	Moderately Expensive	PUT/TAKE alternative provides moderate NPV cost.
2	More than moderately expensive	PUT/TAKE alternative provides more than moderate NPV cost.
1	Most Expensive	PUT/TAKE alternative provides highest NPV cost.

8.2.5.2 Minimize Capital Costs (Criterion 5b) – PUT and TAKE

Capital costs include the cost of equipment and construction costs including direct and indirect costs of all elements. The capital costs for the PUT and TAKE alternatives include all of the respective PUT and TAKE components. The PUT alternatives include recycled water conveyance for supplies from JCSD and the City of Rialto), the AWPF(s), purified water conveyance (pump station and pipelines), injection wells for groundwater recharge and monitoring wells, and brine conveyance. The TAKE alternatives include extraction wells, wellhead treatment, potable water conveyance, and potable water storage. The capital costs include contingency and project implementation costs for engineering services, client administration, and construction management. The capital costs are in 2019 dollars.

Alternatives with lower capital costs score better than alternatives with higher capital costs. The scoring methodology to minimize capital costs is shown in Table 8-18 below.

Table 8-18. Summary of (5b) Minimize Capital Costs – PUT and TAKE		
Score	**Description**	**Scoring Definition**
5	Least Expensive	PUT/TAKE alternative provides lowest capital cost.
4	Less than moderately expensive	PUT/TAKE alternative provides less than moderate capital cost.
3	Moderately Expensive	PUT/TAKE alternative provides moderate capital cost.
2	More than moderately expensive	PUT/TAKE alternative provides more than moderate capital cost.
1	Most Expensive	PUT/TAKE alternative provides highest capital cost.

8.2.5.3 Minimize Annual O&M Costs (Criterion 5c) – PUT and TAKE

O&M costs include annual costs to operate, manage, and maintain the equipment and infrastructure for each alternative. The annual O&M costs for the PUT alternatives include annual O&M costs for recycled water conveyances, the AWPFs, purified water conveyance, brine disposal, and injection well and monitoring wells. The annual O&M costs for the TAKE alternatives include annual O&M costs for extraction wells, wellhead treatment, potable water conveyance, and potable water storage. The annual O&M costs for the TAKE alternatives are split between fixed and variable O&M costs and summed for the total annual O&M cost, which was used for the alternatives evaluation. The annual O&M costs are in 2019 dollars.

The lower the O&M cost, the higher the score. The scoring methodology for minimize O&M costs is shown in Table 8-19.

Table 8-19. Summary of (5c) Minimize Annual O&M Costs – PUT and TAKE

Score	Description	Scoring Definition
5	Least Expensive	PUT/TAKE alternative provides lowest O&M cost.
4	Less than moderately expensive	PUT/TAKE alternative provides less than moderate O&M cost.
3	Moderately Expensive	PUT/TAKE alternative provides moderate O&M cost.
2	More than moderately expensive	PUT/TAKE alternative provides more than moderate O&M cost.
1	Most Expensive	PUT/TAKE alternative provides highest O&M cost.

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Appendix A: Summary of Title 22 Regulations for Groundwater Replenishment Using Recycled Water

<table>
<tr><th colspan="4">APPENDIX A – SUMMARY OF TITLE 22 REGULATIONS FOR GROUNDWATER REPLENISHMENT USING RECYCLED WATER</th></tr>
<tr><th>Title 22 Section(s)</th><th>Regulation</th><th>Article 5.1: Surface Applications - Spreading Basins</th><th>Article 5.2: Subsurface Applications - Injection Wells</th></tr>
<tr><td>60320.100
60320.200</td><td>General Requirements</td><td colspan="2">• Provide an alternative source of drinking water supply if water quality fails to meet drinking water standards or underground retention requirements for pathogen control.
• Sample affected aquifer(s) quarterly for at least one year for nitrogen compounds, regulated contaminants, physical characteristics, total organic carbon (TOC), priority toxic pollutants, DDW-specified chemicals, and DDW-specified chemicals with notification levels.
• Provide a hydrogeological assessment of the Groundwater Replenishment Reuse Project (GRRP) site(s) describing the groundwater basin’s geologic and hydrogeological setting, stratigraphy, composition, extent, and physical properties of the affected aquifers; based on at least four quarters of groundwater monitoring, the existing hydrogeology and anticipated hydrogeology with the GRRP, and maps showing quarterly groundwater elevation contours, vector flow directions, and calculate hydraulic gradients.
• Maintain underground retention time no less than the requirements for pathogen control and response retention time.
• Design and operate the GRRP to comply with the recycled municipal wastewater contributions (RWC) requirements at and beyond the primary boundary zone.
• Provide map(s) to DDW, RWQCB, and local well-permitting authorities showing recharge site(s), primary boundary zone(s) of controlled drinking water well construction, secondary boundary zone(s) of potentially controlled existing or future drinking water well(s), and all monitoring wells and drinking water wells within 2 years travel time of the GRRP site(s).
• Demonstrate project sponsor’s adequate technical, managerial, and financial capability to DDW and RWQCB.
• Demonstrate all treatment processes have been installed and can be operated to achieve their intended function per the Engineering Report.
• Submit available compliance monitoring and if incomplete, RWQCB shall determine water quality-related compliance based on available data.
• Comply with wastewater agency’s RWQCB permit effluent limits pertaining to groundwater replenishment.
• Suspend recharge if so directed by DDW or RWQCB and not resume recharge without DDW and RWQCB approval.</td></tr>
<tr><td>60320.201[1]</td><td>Advanced Treatment Criteria[1]</td><td></td><td>• Provide full advanced treatment of an oxidized wastewater using reverse osmosis (RO) and an oxidation treatment process that meets specified advanced treatment criteria.
• Use RO membranes that have achieved sodium chloride rejections of at least 99.0% as a minimum and 99.2% on average as demonstrated per the requirements of this section.
• Use RO membranes that produce permeate with no more than 5% of the sample results having TOC concentrations greater than 0.25 mg/L based on weekly or more frequent monitoring.
• Propose at least one form of continuous monitoring (e.g., electrical conductivity or TOC) to indicate when membrane integrity has been compromised by designating operational parameters or limits and alarm settings for DDW review and approval.</td></tr>
</table>

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Title 22 Section(s)	Regulation	Article 5.1: Surface Applications - Spreading Basins	Article 5.2: Subsurface Applications - Injection Wells
			• Demonstrate the oxidation process has been designed for implementation by (1) performing an occurrence study using at least 9 indicator compounds from the list in this section for DDW approval, (2) utilizing an oxidation process that achieves designated levels of removal of the indicator compounds, (3) establishing at least one surrogate or operating parameter representative of removal of at least 5 of the indicator compounds for continuous monitoring, and (4) conducting a full-scale test using challenge or spiking tests to confirm the findings of the occurrence study and removal capability of the oxidation process. • Demonstrate in lieu of the above occurrence study and testing, the oxidation process has been designed for implementation by conducting testing using challenge or spiking tests under normal full-scale operating conditions that the oxidation process will provide at least 0.5-log (69%) reduction of 1,4-dioxane, and establish a surrogate or operational parameter capable of being continuously monitored and recorded with alarms that indicate when the minimum 0.5-log 1,4-dioxane reduction criteria is not met. • Monitor the surrogate or operational parameter during the aforementioned full-scale testing to performance of the oxidation process. • Submit a report to DDW and RWQCB within 60 days after completing the initial 12-months of monitoring describing the efficacy of the surrogate or operational parameter to reflect the removal of the indicator compounds and an action plan if it fails to demonstrate the oxidation process performance. • Submit a report to DDW and RWQCB within 60 days after completing the initial 12-months of RO process operation describing the effectiveness of the membrane integrity monitoring. • Report to DDW and RWQCB quarterly the percentage of the results that did not meet the surrogate or operational parameter limits for proper on-going RO and oxidation process performance; if greater than 10% of the results indicate failure occurred, describe corrective actions and consult with DDW. • Analyze AWT effluent monthly for contaminants having MCLs and notification levels. Monitoring frequency may be reduced to quarterly with DDW approval after 12

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<tr><td></td><td></td><td></td><td>consecutive months of results not exceeding an MCL or NL. AWT effluent shall not exceed an MCL.</td></tr>
<tr><td>60320.102
60320.202</td><td>Public Hearing</td><td colspan="2">• Hold a public hearing prior to DDW submitting its recommendations to the RWQCB for the GRRP's permit.
• Hold a public hearing any time an increase in the maximum recycled water contribution (RWC) is proposed that was not addressed in a prior public hearing.
• Provide information for presentation at the public hearing to DDW for review and approval.
• Place approved public hearing information on project sponsor's website and in a publically accessible repository at least 30 days prior to the public hearing.
• Notify the public of: (1) the location and hours of operation of the repository, (2) internet address where information may be viewed, (3) purpose of the repository and public hearing, (4) manner for public to provide comments, and (5) date, time, and location of the public hearing. Public notice may be delivered via local newspaper(s), mail, statement in water bills, and/or television and/or radio.
• Notify via direct mail at a minimum the first downgradient drinking water well owner and well owners who drinking water well is within 10 years underground travel time from the GRRP.</td></tr>
<tr><td>60320.104
60320.204</td><td>Lab Analyses</td><td colspan="2">• Perform analyses for contaminants having primary or secondary MCLs using laboratories and methods approved by DDW.
• Perform analyses for other contaminants per the Operation Optimization Plan (OOP).</td></tr>
<tr><td>60320.106
60320.206</td><td>Wastewater Source Control</td><td colspan="2">• Ensure that the recycled municipal wastewater is from a wastewater management agency that administers an industrial pretreatment and pollutant source control program.
• Implement and maintain an enhanced source control program that includes: (1) assessment of DDW & RWQCB-specified chemicals through the treatment systems; (2) investigation and monitoring for DDW & RWQCB-specified chemicals; (3) outreach program to manage and minimize discharge of contaminants at the source; and (4) inventory of chemicals and contaminants that maybe discharged into the sewer system.</td></tr>
<tr><td>60320.108
60320.208</td><td>Pathogenic Microorganism Control</td><td>• Use at least 3 treatment processes that achieve at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction.
• Use at least three treatment processes that achieve at least 1.0-log reduction per process, and each process may be credited for up to 6-log reduction.
• <u>Filter and disinfect recycled municipal wastewater per §60301,320 and §60301.230, respectively</u>.[2]
• Retain recycled municipal wastewater or recharge water underground to be credited with 1-log virus reduction per month.
• Meet above filtration and disinfection requirements or provide advanced treatment for the entire flow and demonstrate at least 6 months underground retention to be credited with 10-log Giardia cyst reduction and 10-log Cryptosporidium oocyst reduction.</td><td>• Use at least 3 treatment processes that achieve at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction.
• Use at least three treatment processes that achieve at least 1.0-log reduction per process, and each process may be credited for up to 6-log reduction.
• Retain recycled municipal wastewater or recharge water underground to be credited with 1-log virus reduction per month.
• Meet above filtration and disinfection requirements or provide advanced treatment for the entire flow and demonstrate at least 6 months underground retention to be credited with 10-log Giardia cyst reduction and 10-log Cryptosporidium oocyst reduction.</td></tr>
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Title 22 Section(s)	Regulation	Article 5.1: Surface Applications - Spreading Basins	Article 5.2: Subsurface Applications - Injection Wells
		• Validate each treatment process (except for underground retention time <u>and SAT</u>)[2] for their ability to reliably achieve log reduction by submitting a report for DDW approval or conducting a challenge test approved by DDW. • Provide on-going monitoring using pathogens or microbial, chemical, or physical surrogates to verify performance of each treatment process (not including underground retention time and soil aquifer treatment (SAT)) for its ability to achieve its credited log reduction. Investigate and report any failures to meet pathogen log reduction requirements per §60320.108(i). • Conduct a tracer study representative of normal GRRP operations to demonstrate underground retention time measured as the difference from when the tracer is applied at the GRRP to: (1) 2% of the initial tracer concentration reaches the downgradient monitoring point, or (2) 10% of the peak tracer unit value at the downgradient monitoring point reached the monitoring point. • Calculate virus log-reduction credit by method used to estimate underground retention time to nearest downgradient drinking water well: (1) tracer study using an added tracer for full 1.0-log, (2) tracer study using an intrinsic tracer for 0.67-log, (3) numerical modeling for 0.5-log, or (4) analytical modeling for 0.25-log. • Use above method 3 or 4 for planning a GRRP with approval of DDW. • Initiate tracer study prior to the end of the third month of GRRP operation (above method 1 or 2). Submit tracer study protocol to DDW for approval. • Demonstrate underground retention time if changed hydrogeological or climatic conditions have occurred and DDW requires a new tracer study. • Cease recycled water recharge and notify DDW and RWQCB if GRRP achieves less than 10-log enteric virus reduction or 8-log Giardia cyst reduction or 8-log Cryptosporidium oocyst reduction. Resume recharge if so directed by DDW or RWQCB.	• Validate each treatment process (except for underground retention time) for their ability to reliably achieve log reduction by submitting a report for DDW approval or conducting a challenge test approved by DDW. • Provide on-going monitoring using pathogens or microbial, chemical, or physical surrogates to verify performance of each treatment process (not including underground retention time and soil aquifer treatment (SAT)) for its ability to achieve its credited log reduction. Investigate and report any failures to meet pathogen log reduction requirements per §60320.208(i). • Conduct a tracer study representative of normal GRRP operations to demonstrate underground retention time measured as the difference from when the tracer is applied at the GRRP to: (1) 2% of the initial tracer concentration reaches the downgradient monitoring point, or (2) 10% of the peak tracer unit value at the downgradient monitoring point reached the monitoring point. • Calculate virus log-reduction credit by method used to estimate underground retention time to nearest downgradient drinking water well: (1) tracer study using an added tracer for full 1.0-log, (2) tracer study using an intrinsic tracer for 0.67-log, (3) numerical modeling for 0.5-log, or (4) analytical modeling for 0.25-log. • Use above method 3 or 4 for planning a GRRP with approval of DDW. • Initiate tracer study prior to the end of the third month of GRRP operation (above method 1 or 2). Submit tracer study protocol to DDW for approval. • Demonstrate underground retention time if changed hydrogeological or climatic conditions have occurred and DDW requires a new tracer study. • Cease recycled water recharge and notify DDW and RWQCB if GRRP achieves less than 10-log enteric virus reduction or 8-log Giardia cyst reduction or 8-log Cryptosporidium oocyst reduction. Resume recharge if so directed by DDW or RWQCB.
60320.110 60320.220	Nitrogen Compounds Control	• Sample recycled municipal wastewater or recharge water <u>throughout the spreading area</u>[2] before or after application at least twice per week, at least 3 days apart, and analyze for nitrogen compounds.	• Sample recycled municipal wastewater or recharge water before or after application at least twice per week, at least 3 days apart, and analyze for nitrogen compounds.

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Title 22 Section(s)	Regulation	Article 5.1: Surface Applications - Spreading Basins	Article 5.2: Subsurface Applications - Injection Wells
		• Investigate the cause and notify DDW and RWQCB if the confirmed result exceeds 10 mg/L total nitrogen; take corrective actions and initiate additional monitoring per the OOP to determine whether the elevated total nitrogen result may lead to an exceedance of a nitrogen-based MCL. • Suspend recycled municipal wastewater recharge if the average of four consecutive sample results exceeds 10 mg/L total nitrogen. After corrective actions, which may include utilization of a denitrification process as determined by DDW[2], recharge may resume if at least two consecutive sample results are less than 10 mg/L total nitrogen. • Initiate additional monitoring as determined by DDW to identify elevated concentrations of nitrogen compounds in the groundwater and spreading area[2] and determine if they may lead to an exceedance of a nitrogen-based MCL. • Initiate reduced monitoring frequencies for total nitrogen with approval of DDW and RWQCB. Apply for reduced monitoring frequencies if, for the recent 24 months: (1) average of all results did not exceed 5 mg/L total nitrogen; (2) average of a confirmed result did not exceed 10 mg/L total nitrogen. • Revert to original monitoring frequencies if the results for total nitrogen exceed the above criteria. Reduced monitoring frequencies may resume if the above criteria are met.	• Investigate the cause and notify DDW and RWQCB if the confirmed result exceeds 10 mg/L total nitrogen; take corrective actions and initiate additional monitoring per the OOP to determine whether the elevated total nitrogen result may lead to an exceedance of a nitrogen-based MCL. • Suspend recycled municipal wastewater recharge if the average of four consecutive sample results exceeds 10 mg/L total nitrogen. After corrective actions, recharge may resume if at least two consecutive sample results are less than 10 mg/L total nitrogen. • Initiate additional monitoring as determined by DDW to identify elevated concentrations of nitrogen compounds in the groundwater and determine if they may lead to an exceedance of a nitrogen-based MCL. • Initiate reduced monitoring frequencies for total nitrogen with approval of DDW and RWQCB. Apply for reduced monitoring frequencies if, for the recent 24 months: (1) average of all results did not exceed 5 mg/L total nitrogen; (2) average of a confirmed result did not exceed 10 mg/L total nitrogen. • Revert to original monitoring frequencies if the results for total nitrogen exceed the above criteria. Reduced monitoring frequencies may resume if the above criteria are met.
60320.112 60320.212	Regulated Contaminants and Physical Characteristics Control	• Analyze recycled municipal wastewater quarterly for primary MCLs: (1) inorganic chemicals in Table 64431-A, except for nitrogen compounds; (2) radionuclides in Tables 64442 & 64443; (3) organic chemicals in Table 64444-A; and (4) disinfection byproducts in Table 64533-A. • Analyze recycled municipal wastewater quarterly for action levels: lead and copper. • Recharge water (including recharge water after surface application)[2] may be monitored in lieu of recycled municipal wastewater for disinfection byproducts under designated conditions (§60320.112(b)). May require adjustments for dilution depending on fraction of recycled water in recharge water. • Analyze recycled municipal wastewater or recharge water[2] annually for secondary MCLs in Tables 64449-A and 64449-B.	• Analyze recycled municipal wastewater quarterly for primary MCLs: (1) inorganic chemicals in Table 64431-A, except for nitrogen compounds; (2) radionuclides in Tables 64442 & 64443; (3) organic chemicals in Table 64444-A; and (4) disinfection byproducts in Table 64533-A. • Analyze recycled municipal wastewater quarterly for action levels: lead and copper. • Recharge water may be monitored in lieu of recycled municipal wastewater for disinfection byproducts under designated conditions (§60320.212(b)). May require adjustments for dilution depending on fraction of recycled water in recharge water. • Analyze recycled municipal wastewater annually for secondary MCLs in Tables 64449-A and 64449-B.

Title 22 Section(s)	Regulation	Article 5.1: Surface Applications - Spreading Basins	Article 5.2: Subsurface Applications - Injection Wells
		• Confirm any exceedances of a primary MCL or action level by re-analyzing within 72 hours of receiving the initial result. • Notify DDW and RWQCB if the average of the initial and confirmation results exceeds the primary MCL or action level for constituents not based on a running annual average, and follow requirements of §60320.112((d)(1). • Initiate weekly monitoring if the average of the initial and confirmation results exceeds the primary MCL for constituents based on a running annual average until the running 4-week average no longer exceeds the MCL. And follow the requirements of §60320.112(d)(2). • Initiate quarterly monitoring if a result exceeds a contaminant's secondary MCL or upper limit. Describe the reason(s) for the exceedance and provide a schedule for corrective actions to DDW and RWQCB if the running average of quarterly-averaged results exceeds a contaminant's secondary MCL or upper limit. Resume annual monitoring if the running annual average of quarterly results does not exceed a contaminant's secondary MCL or upper limit. • Reduce monitoring for asbestos to once per 3 years if 4 quarterly results are below the detection limit in Table 64432-A. Resume quarterly monitoring if asbestos is detected.	• Confirm any exceedances of a primary MCL or action level by re-analyzing within 72 hours of receiving the initial result. • Notify DDW and RWQCB if the average of the initial and confirmation results exceeds the primary MCL or action level for constituents not based on a running annual average, and follow requirements of §60320.212((d)(1). • Initiate weekly monitoring if the average of the initial and confirmation results exceeds the primary MCL for constituents based on a running annual average until the running 4-week average no longer exceeds the MCL. And follow the requirements of §60320.212(d)(2). • Initiate quarterly monitoring if a result exceeds a contaminant's secondary MCL or upper limit. Describe the reason(s) for the exceedance and provide a schedule for corrective actions to DDW and RWQCB if the running average of quarterly-averaged results exceeds a contaminant's secondary MCL or upper limit. Resume annual monitoring if the running annual average of quarterly results does not exceed a contaminant's secondary MCL or upper limit. • Reduce monitoring for asbestos to once per 3 years if 4 quarterly results are below the detection limit in Table 64432-A. Resume quarterly monitoring if asbestos is detected.
60320.114 60320.214	Diluent Water Requirements	• Comply with these requirements to be credited as diluent water for calculating a recycled municipal wastewater contribution (RWC). • Monitor diluent water quarterly for nitrate and nitrite, except if diluent water is potable water. Confirm any exceedance of a primary MCL within 72 hours of receiving the initial results and follow requirements of §60320.114(a). Diluent water may not be credited towards the RWC calculation per §60320.114(a). • Conduct a source water evaluation, except if diluent water is potable water, per Cal-Nev AWWA's Watershed Sanitary Survey Guidance Manual of the diluent water for review and approval by DDW. • Ensure diluent water does not exceed a primary MCL, secondary MCL upper limit (unless historically used for recharge)[2], or a notification level (NL), and implement a DDW-approved water quality monitoring plan for DDW-specified contaminants to comply with primary MCLs,	• Comply with these requirements to be credited as diluent water for calculating a recycled municipal wastewater contribution (RWC). • Monitor diluent water quarterly for nitrate and nitrite, except if diluent water is potable water. Confirm any exceedance of a primary MCL within 72 hours of receiving the initial results and follow requirements of §60320.214(a). Diluent water may not be credited towards the RWC calculation per §60320.214(a). • Conduct a source water evaluation, except if diluent water is potable water, per Cal-Nev AWWA's Watershed Sanitary Survey Guidance Manual of the diluent water for review and approval by DDW. • Ensure diluent water does not exceed a primary MCL, secondary MCL upper limit, or a notification level (NL), and implement a DDW-approved water quality monitoring plan for DDW-specified contaminants to comply with primary MCLs, secondary MCLs (except for turbidity, color, and

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		secondary MCLs (except for turbidity, color, and odor) and NLs. Monitoring plan shall comply with §60320.114(c). • Determine the volume of credited diluent water and demonstrate how it will be used to comply with the GRRP's 120-month running monthly average RWC maximum limit at the primary boundary. Submit the methodology for diluent water management and RWC compliance including elements detailed in §60320.114(d) in the Engineering Report for DDW approval. • Demonstrate diluent water compliance with water quality and quantity requirements in §60320.114(e) and a source water evaluation to receive credit prior to the GRRP operation, but not to exceed 120 months. • Describe in the OOP how diluent water will be distributed to ensure compliance with the maximum RWC and actions to be taken in the event diluent water is curtailed or no longer available. • Monitor recharge water in lieu of a diluent water source if approved by DDW and if diluent water source cannot be monitored directly.	odor) and NLs. Monitoring plan shall comply with §60320.214(c). • Determine the volume of credited diluent water and demonstrate how it will be used to comply with the GRRP's 120-month running monthly average RWC maximum limit at the primary boundary. Submit the methodology for diluent water management and RWC compliance including elements detailed in §60320.214(d) in the Engineering Report for DDW approval. • Demonstrate diluent water compliance with water quality and quantity requirements in §60320.214(e) and a source water evaluation to receive credit prior to the GRRP operation, but not to exceed 120 months. • Describe in the OOP how diluent water will be distributed to ensure compliance with the maximum RWC and actions to be taken in the event diluent water is curtailed or no longer available. • Monitor recharge water in lieu of a diluent water source if approved by DDW and if diluent water source cannot be monitored directly.
60320.116 60320.216	Recycled Municipal Wastewater Contribution (RWC) Requirements	• Calculate each month the running monthly average (RMA) RWC based on the total volume of the recycled municipal wastewater and credited diluent for the preceding 120 months. For GRRPs in operation less than 120 months, calculate the RMA RWC commencing after 30 months of GRRP operation, based on the total volume of recycled municipal wastewater and credited diluent water introduced during the preceding months. • Ensure that the RMA RWC does not exceed the maximum RWC specified by DDW. • Ensure that the RMA RWC does not exceed the initial maximum RWC of 0.20 or an alternative initial RWC (up to 1.0) approved by DDW based on its review of factors in §60320.116(c).[2] • Increase the maximum RWC with DDW and RWQCB approval provided that the TOC 20-week running average for the previous 52 weeks has not exceeded 0.5 mg/L divided by the proposed maximum RWC[2]. • Update the Engineering Report and OOP prior to operating the GRRP at an RWC greater than 0.50 or 0.75 and provide evidence of compliance with monitoring well requirements in §60320.126(a).[2]	• Calculate each month the running monthly average (RMA) RWC based on the total volume of the recycled municipal wastewater and credited diluent for the preceding 120 months. For GRRPs in operation less than 120 months, calculate the RMA RWC commencing after 30 months of GRRP operation, based on the total volume of recycled municipal wastewater and credited diluent water introduced during the preceding months. • Ensure that the RMA RWC does not exceed the maximum RWC specified by DDW. • Demonstrate that the treatment processes will achieve TOC concentrations no greater than 0.5 mg/L for initial maximum RWC limit up to 1.0 based on DDW's review of the Engineering Report and information at the public hearing. • Increase the maximum RWC with DDW and RWQCB approval provided that the TOC 20-week running average for the previous 52 weeks has not exceeded 0.5 mg/L.

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		• Notify DDW and RWQCB within 7 days if the RMA RWC exceeds the maximum RWC with the reason(s) for the exceedance and corrective action(s) to be taken, and implement the corrective action(s) and report to DDW and RWQCB within 60 days of the exceedance.	• Notify DDW and RWQCB within 7 days if the RMA RWC exceeds the maximum RWC with the reason(s) for the exceedance and corrective action(s) to be taken, and implement the corrective action(s) and report to DDW and RWQCB within 60 days of the exceedance.
60320.118 60320.218	Total Organic Carbon (TOC) and Soil Aquifer Treatment (SAT) Process Requirements	• Assess the SAT process performance by monitoring TOC, indicator compounds, and surrogate parameters, as approved by DDW.[2] • Analyze TOC at least once per week from representative 24-hr composite samples of: (1) undiluted recycled municipal wastewater (prior to recharge or within zone of percolation); (2) diluted percolated recycled municipal wastewater, with the value amended to negate the effect of diluent water; or (3) undiluted recycled municipal wastewater prior to recharge, with the value amended by an SAT factor based on demonstration studies of the SAT removal efficiency and approved by DDW.[2] • Substitute grab samples for 24-hr composite samples if grab sample is representative throughout the 24-hr period or entire recycled municipal wastewater flow stream has been treated by RO per §60320.201(a) and (b). • Ensure that TOC results do not exceed 0.5 mg/L divided by the RMA RWC based on the 20-week running average of all TOC results, and the average of the last 4 TOC results. • Suspend recycled municipal wastewater recharge if the 20-week running average of all TOC results exceeds the approved limit until at least 2 consecutive results taken 3 days apart are less than the limit. Notify DDW and RWQCB and follow requirements in §60320.118(d). • Submit a report to DDW and RWQCB within 60 days of exceeding the TOC limit based on the average of the last 4 results and describe the reason(s) for the exceedance and corrective action(s), which shall include reduction of the RWC and/or additional treatment to reduce TOC.[2] • Conduct a study to determine the occurrence of indicator compounds in the recycled municipal wastewater prior to the GRRP initial operation and every 5 years thereafter and propose at least 3 indicator compounds for use in evaluating SAT performance.[2] • Monitor quarterly recycled municipal wastewater or recharge water prior to and after SAT (30 days or less	• Analyze TOC at least once per week from representative 24-hr composite samples of recycled municipal wastewater (prior to replenishment). • Substitute grab samples for 24-hr composite samples if grab sample is representative throughout the 24-hr period or entire recycled municipal wastewater flow stream has been treated by RO per §60320.201(a) and (b). • Ensure that TOC results do not exceed 0.5 mg/L divided by the RMA RWC based on the 20-week running average of all TOC results, and the average of the last 4 TOC results. • Suspend recycled municipal wastewater recharge if the 20-week running average of all TOC results exceeds the approved limit until at least 2 consecutive results taken 3 days apart are less than the limit. Notify DDW and RWQCB and follow requirements in §60320.218(c). • Submit a report to DDW and RWQCB within 60 days of exceeding the TOC limit based on the average of the last 4 results and describe the reason(s) for the exceedance and corrective action(s), which shall include reduction of the RWC.

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Title 22 Section(s)	**Regulation**	**Article 5.1: Surface Applications - Spreading Basins**	**Article 5.2: Subsurface Applications - Injection Wells**
		downgradient) for the 3 indicator compounds. If less than 90% reduction of the indicator compounds is found (excluding effects of dilution), investigate the reason(s) and report to and consult with DDW per §60320.118(h).[2] • Obtain DDW approval if alternative wastewater chemical(s) in lieu of TOC is proposed.	• Obtain DDW approval if alternative wastewater chemical(s) in lieu of TOC is proposed.
60320.120 60320.220	Additional Chemical and Contaminant Monitoring	• Analyze quarterly the recycled municipal wastewater and groundwater from downgradient monitoring wells (per §60320.126) for: (1) priority toxic pollutants (chemicals listed in 40 CFR section 131.38 "Establishment of numeric criteria for priority toxic pollutants for the State of California", as may be amended) specified by DDW; and (2) chemicals specified by DDW. • Analyze quarterly the recycled municipal wastewater for NLs specified by DDW. Recharge water (including recharge water after surface application)[2] may be substituted per §60320.120(b) requirements. If the average of the initial and confirmation result exceeds a NL, initiate weekly monitoring and follow requirements in §60320.120(b). • Analyze annually the recycled municipal wastewater for indicator compounds specified by DDW and RWQCB. • Notify DDW and RWQCB of any chemical or contaminant detected as a result of the above monitoring no later than the following quarter.	• Analyze quarterly the recycled municipal wastewater and groundwater from downgradient monitoring wells (per §60320.226) for: (1) priority toxic pollutants (chemicals listed in 40 CFR section 131.38 "Establishment of numeric criteria for priority toxic pollutants for the State of California", as may be amended) specified by DDW; and (2) chemicals specified by DDW. • Analyze quarterly the recycled municipal wastewater for NLs specified by DDW. Recharge water may be substituted per §60320.220(b) requirements. If the average of the initial and confirmation result exceeds a NL, initiate weekly monitoring and follow requirements in §60320.220(b). • Analyze annually the recycled municipal wastewater for indicator compounds specified by DDW and RWQCB. • Notify DDW and RWQCB of any chemical or contaminant detected as a result of the above monitoring no later than the following quarter.
60320.122 60320.222	Operation Optimization Plan (OOP)	• Submit an OOP for approval by DDW and RWQCB prior to operation of a GRRP. OOP shall include elements set forth in §60320.122(a) or §60320.222(a) and be representative at all times of current operations, maintenance, and monitoring of the GRRP. • Operate all treatment processes during the first year of the GRRP operation to provide optimal reduction of: (1) microbial contaminants; (2) regulated contaminants specified in §60320.112 or §60320.212; (3) nitrogen compounds pursuant to §60320.110 or §60320.210; and (4) chemicals and contaminants required per §60320.120 or §60320.220. • Update the OOP within 6 months following the first year of operation, and anytime thereafter, to include changes in operational procedures and submit to DDW for review.	
60320.124 60320.224	Response Retention Time (RRT)	• Retain recycled municipal wastewater underground for a period no less than the response retention time (RRT) approved by DDW. RRT shall allow sufficient response time to identify treatment failures and implement actions, including providing an alternative drinking water supply per §60320.100(b) or §60320.200(b), necessary to protect public health. RRT shall be no less than 2 months. • Conduct a tracer study representative of normal GRRP operations to demonstrate that the underground retention time is no less than the approved RRT. Tracer study shall be initiated within the first 3 months of GRRP operation and be based on a protocol approved by DDW. Underground retention time shall be measured as the difference from when the tracer is applied	

<table>
<tr><th colspan="4">APPENDIX A – SUMMARY OF TITLE 22 REGULATIONS FOR GROUNDWATER REPLENISHMENT USING RECYCLED WATER</th></tr>
<tr><th>Title 22 Section(s)</th><th>Regulation</th><th>Article 5.1: Surface Applications - Spreading Basins</th><th>Article 5.2: Subsurface Applications - Injection Wells</th></tr>
<tr><td></td><td></td><td colspan="2">at the GRRP to (1) 2% of the initial tracer concentration reaches the downgradient monitoring point, or (2) 10% of the peak tracer unit value at the downgradient monitoring point reached the monitoring well.
• Receive tracer study credits for RRT compliance for each month of underground retention depending upon the methodology set forth in §60320.124(c) or §60320.224(c): (1) utilizing an added tracer for full 1.0 RRT credit/month, (2) utilizing an intrinsic tracer for 0.67 RRT credit/month, (3) numerical modeling for 0.5 RRT credit/month, or (4) analytical modeling for 0.25 RRT credit/month.
• Use above method 3 or 4 for planning a GRRP with approval of DDW, prior to the GRRP commencing operation and conducting the required tracer study using method 1 or 2.
• Submit protocol to establish RRT compliance to DDW for approval.
• Demonstrate underground retention time if changed hydrogeological or climatic conditions have occurred and DDW requires a new tracer study.</td></tr>
<tr><td>60320.126
60320.226</td><td>Monitoring Well Requirements</td><td>• Construct at least 2 monitoring wells downgradient of the GRRP complying with requirements in §60320.126(a).
• Locate at least 1 monitoring well: (1) at least 2 weeks but no more than 6 months downgradient travel time through the saturated zone[2] of the aquifer affected by the GRRP; and (2) at least 30 days upgradient from the nearest drinking water well.
• Locate at least 1 additional monitoring well between the GRRP and the nearest downgradient drinking water well.
• Sample groundwater from the monitoring wells from each aquifer that will receive the GRRP's recharge water and that can be validated as receiving recharge water.
• Sample groundwater from the monitoring wells two times prior to GRRP operation and analyze for total nitrogen, nitrate, nitrite, secondary MCLs, any chemicals and contaminants specified by DDW or RWQCB, and priority toxic pollutants specified in §60320.120.
• Sample groundwater from the monitoring wells quarterly after GRRP operation begins and analyze for total nitrogen, nitrate, nitrite, secondary MCLs, any chemicals and contaminants specified by DDW or RWQCB, and priority toxic pollutants specified in §60320.120.
• Confirm any results from the above monitoring that exceed 80% of a nitrate, nitrite, nitrate plus nitrite MCL, and if the average of the initial and confirmation results exceeds the contaminant's primary MCL, notify DDW and RWQCB and suspend recharge of recycled municipal wastewater until corrective actions have been taken or evidence is provided to DDW and RWQCB that the contamination was not caused by the GRRP.</td><td>• Construct at least 2 monitoring wells downgradient of the GRRP complying with requirements in §60320.226(a).
• Locate at least 1 monitoring well: (1) at least 2 weeks but no more than 6 months downgradient travel time through the aquifer affected by the GRRP; and (2) at least 30 days upgradient from the nearest drinking water well.
• Locate at least 1 additional monitoring well between the GRRP and the nearest downgradient drinking water well.
• Sample groundwater from the monitoring wells from each aquifer that will receive the GRRP's recharge water and that can be validated as receiving recharge water.
• Sample groundwater from the monitoring wells two times prior to GRRP operation and analyze for total nitrogen, nitrate, nitrite, secondary MCLs, any chemicals and contaminants specified by DDW or RWQCB, and priority toxic pollutants specified in §60320.220.
• Sample groundwater from the monitoring wells quarterly after GRRP operation begins and analyze for total nitrogen, nitrate, nitrite, secondary MCLs, any chemicals and contaminants specified by DDW or RWQCB, and priority toxic pollutants specified in §60320.220.
• Confirm any results from the above monitoring that exceed 80% of a nitrate, nitrite, nitrate plus nitrite MCL, and if the average of the initial and confirmation results exceeds the contaminant's primary MCL, notify DDW and RWQCB and suspend recharge of recycled municipal wastewater until corrective actions have been taken or evidence is provided to DDW and RWQCB that the contamination was not caused by the GRRP.</td></tr>
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<tr><td></td><td></td><td>• Ensure that the laboratory for DDW-specified chemicals electronically submits results to DDW's database.
• Reduce groundwater monitoring frequency for the above chemicals and contaminants from quarterly to annually following DDW's review and approval of the most recent 2 years' of monitoring results.</td><td>• Ensure that the laboratory for DDW-specified chemicals electronically submits results to DDW's database.
• Reduce groundwater monitoring frequency for the above chemicals and contaminants from quarterly to annually following DDW's review and approval of the most recent 2 years' of monitoring results.</td></tr>
<tr><td>60320.128
60320.228</td><td>Reporting</td><td colspan="2">• Submit an annual report no later than 6 months after the end of each calendar year to DDW, RWQCB, and public water systems and drinking water well owners within 10 years downgradient travel time of the GRRP. Annual report shall include information specified in §60320.128(a) or §60320.228(b).
• Update the Engineering Report every 5 years following approval of the initial Engineering Report to address any changes and submit to DDW and RWQCB. Updated Engineering Report shall include information specified in §60320.128(b) or §60320.228(b).</td></tr>
<tr><td>60320.130
60320.230</td><td>Alternatives</td><td>• Use an alternative to any requirement in Article 5.1 if the project sponsor: (1) demonstrates to DDW that the proposed alternative assures at least the same level of public health protection; (2) receives written approval from DDW prior to implementation of the alternative; and (3) conducts a public hearing on the proposed alternative pursuant to §60320.102(b) and (c).
• Include with the aforementioned demonstration a review of the proposed alternative by an independent scientific advisory panel per the requirements in §60320.130(b).
• Increase the TOC limit if: (1) the increased TOC limit is approved by DDW and RWQCB; (2) the GRRP has been in operation for the most recent 10 consecutive years; (3) the project sponsor submits a proposal to DDW complying with §60320.130(c); and (4) the project sponsor performs a health effects evaluation assessing the health risks to consumers of water impacted by the GRRP and any anticipated water quality changes resulting from the proposed increased TOC, including information required in §60320.130(c) and reviewed by an independent scientific peer review advisory panel.[2]</td><td>• Use an alternative to any requirement in Article 5.2 if the project sponsor: (1) demonstrates to DDW that the proposed alternative assures at least the same level of public health protection; (2) receives written approval from DDW prior to implementation of the alternative; and (3) conducts a public hearing on the proposed alternative pursuant to §60320.202(b) and (c).
• Include with the aforementioned demonstration a review of the proposed alternative by an independent scientific advisory panel per the requirements in §60320.230(a).</td></tr>
</table>

[1] Advanced treatment criteria in §60320.201 are not applicable to surface applications.
[2] Underlining denotes significant differences between requirements for surface applications in comparison with subsurface applications.
Note: This summary is not intended to be a substitute for the actual Title 22 Regulations.

Appendix B: Summary of Drinking Water Regulations in California

APPENDIX B – SUMMARY OF DRINKING WATER REGULATIONS IN CALIFORNIA		
Reference	**Regulation**	**Selected Requirements[1]**
Title 17, Chapter 5, Subchapter 1, Group 4 Drinking Water Supplies		
Article 2	Protection of Water System	• Provide devices to prevent backflow into the public water system commensurate with the degree of hazard that exists on the user's premises. Backflow prevention devices in increasing level of protection are: double check valve assembly (DC), reduced pressure principal backflow prevention device (RP), and an air gap separation (AG). See §7604, Table 1 "Type of Backflow Protection Required". • Provide backflow preventers that have been tested by a SWRCB-approved organization. • Provide a DC conforming to AWWA standards. Location shall be as close as practical to the user's connection and installed above grade where it can be readily tested and maintained. • Provide an RP conforming to AWWA standards. Location shall be as close as practical to the user's connection and between 12 and 36-inches above grade. • Provide an AG at least double the diameter of the supply pipe, measured vertically above the overflow level of the receiving vessel (at least 1-inch separation). Location shall be as close as practical to the user's connection and all piping between the user's connection and the receiving tank shall be visible. • Backflow preventers shall be tested and maintained per §7605.
Article 5	Domestic Water Supply Reservoirs	• Recreational use on or around the reservoir is prohibited unless specifically authorized in a water supply permit. Application procedures are in §7626-7629. • SWRCB may approve recreational use at domestic water supply reservoirs from which water is: (1) continuously and reliably filtered and chlorinated, or (2) withdrawn by open channels and subsequently stored again in reservoirs where the water is continuously and reliably filtered and chlorinated prior to distribution.
Title 22, Division 4, Chapter 13 Operator Certification		
Article 2	Operator Certification Grades	• Water treatment facility staff certification requirements are dependent on the treatment facility classification and specified as minimum levels for chief operators and shift operators in §63765. The 5 treatment facility operator certification grades range from T1 (lowest) to T5 (highest). Facility classifications are similar (See Chapter 15). • Distribution system staff certification requirements are dependent on the distribution system classification and are specified as minimum levels for chief operators and shift operators in §63770. The 5 distribution system operator certification grades range from D1 (lowest) to D5 (highest). Distribution system classifications are similar (See Chapter 15). • Duties of distribution system operators are restricted to those in §63770. • Eligibility criteria for taking certification exams are presented in Articles 3, 4, and 5.
Title 22, Division 4, Chapter 14 Water Permits		
Article 1	Water Permit Applications	• Submit an application for a permit or amended permit per Health and Safety Code Section 116525 or 116550.
Article 3	State Small Water Systems	• Requires a permit from local health officer to operate. • Submit a technical permit with the permit application per §64211. • Requires bacteriological and chemical monitoring and reporting per §64212 and §64213. • Limits service connections to 14 maximum. Greater than 14 service connections becomes a public water supply. • Demonstrate to the local health officer that a sufficient water supply exists (minimum 3 gpm for at least 24 hours per service connection).

APPENDIX B – SUMMARY OF DRINKING WATER REGULATIONS IN CALIFORNIA		
Reference	**Regulation**	**Selected Requirements[1]**
		• Requires continuous disinfection for use of a surface water supply. • Local primacy agency requirements per Article 4.
Title 22, Division 4, Chapter 14.5 Fees		
Article 1	Public Water System Annual Fees	• Pay annual fees to the SWRCB set forth in §64305. Fees are listed by water system type in Table 64305-A.
Title 22, Division 4, Chapter 15 Domestic Water Quality and Monitoring Regulations		
Article 2	General Requirements	• Provides classification of water treatment facilities in Table 64413-A based on the calculation of total points for the facility using factors for: (1) source water (groundwater and/or purchased treated water, or surface water and/or groundwater under the direct influence of surface water); (2) influent microbiological quality (median coliform density); (3) influent turbidity (for surface water or groundwater under the direct influence of surface water); (4) influent perchlorate, nitrate and nitrite; (5) influent chemical and radiological contaminants; (6) surface water filtration method; (7) disinfection process; (8) disinfection/oxidation treatment without inactivation credit; (9) any other treatment processes; and (10) flow rate. • Provides classification of distribution systems in Table 64413.3-A by population served. Classes are upgraded by one level depending on the number of pressure zones, disinfectants, largest single pump, number of reservoirs, existence of any uncovered reservoirs, and use of non-potable water in the service area. • Treatment facility staff certification requirements are presented in §64413.5. • Distribution system staff certification requirements are presented in §64413.7. • Comply with monitoring and reporting requirements for standby sources (§64414). • Use laboratories certified by the SWRCB to perform the required analyses using EPA-approved methods. • Submit a sampling plan for all monitoring except bacteriological.
Article 2.5	Point-of-Use Treatment	• Requirements for point-of-use treatment devices at a single tap.
Article 2.7	Point-of-Entry Treatment	• Requirements for point-of-entry treatment devices for drinking water entering a house or building.
Article 3	Primary Standards – Bacteriological Quality	• Develop a sample siting plan per §64422. Collect samples as required in §64423, 64424, and 64425, conduct analyses at an approved laboratory, and report the results per §64426 and 64426.1. • Notify the SWRCB when an increase in coliform bacteria occurs. • Comply with the total coliform MCL in §64426.1 and related reporting and notification requirements.
Article 3.5	Ground Water Rule	• Comply with the Ground Water Rule in 40 CFR 71, as amended and as may be modified by CCR Title 22.
Article 4	Primary Standards – Inorganic Chemicals	• Comply with primary MCLs in Table 64431-A (inorganic chemicals). • Conduct monitoring and reporting for compliance with primary MCLs in accordance with §64432 (inorganics), 64432.1 (nitrate and nitrite), 64432.2 (asbestos), and 64432.3 (perchlorate). Detection limits for purposes of reporting (DLRs) are defined in Table 64432-A. • Notify the SWRCB of results exceeding the MCL in accordance with the requirements in §64432(g), (h) and (i). • Monitoring frequency for certain chemicals may be reduced or waived with SWRCB approval.
Article 4.1	Fluoridation	• Install and operate fluoridation systems at public water systems with 10,000 service connections or more. • Comply with optimum fluoride levels in §64433.2 and monitor and report per §64433.3 and 64433.7.

APPENDIX B – SUMMARY OF DRINKING WATER REGULATIONS IN CALIFORNIA		
Reference	Regulation	Selected Requirements[1]
		• Submit a fluoride system operations contingency plan including operation, corrective actions, investigation steps, notification procedures, and public notification measures.
Article 5	Radioactivity	• Comply with primary MCLs in Table 64442 (radium-226, radium-228, gross alpha particle activity (excluding radon and uranium), and uranium). • Conduct monitoring and reporting for compliance with primary MCLs in accordance with §64442. DLRs are defined in Table 64442. • Comply with primary MCLs in Table 64443 (beta/photon emitters, strontium-90, and tritium). • Conduct monitoring and reporting for compliance with primary MCLs in accordance with §64443. DLRs are defined in Table 64443.
Article 5.5	Primary Standards – Organic Chemicals	• Comply with primary MCLs in Table 64444-A (organic chemicals). • Conduct monitoring and reporting for compliance with primary MCLs in accordance with §64445, 64445.1. DLRs are defined in Table 64445.1-A.
Article 12	Best Available Technologies (BAT)	• Utilize BAT for achieving compliance with microbiological contaminants, primary MCLs for inorganic chemicals, radionuclides, organic chemicals,
Article 14	Treatment Techniques	• Certify annually if using acrylamide and/or epichlorohydrin in water treatment processes that the dose does not exceed specified levels.
Article 15	Secondary Drinking Water Standards	• Comply with secondary MCLs in Tables 64449-A (consumer accepted levels) and Table 64449-B (level ranges). • Conduct monitoring and reporting for compliance with secondary MCLs in accordance with §64449. For community water systems, seek waiver for secondary MCL compliance per §64449.2.
Article 18	Notification of Water Consumers and the SWRCB	• Give public notice to users of the water system and the SWRCB of violations according to a tiered structure. • Give Tier 1 public notice as described in §64463.1for violation of the total coliform MCL, nitrate, nitrite, or total nitrate and nitrite MCLs, or maximum allowable turbidity levels (secondary MCL). • Give Tier 1 public notice of a waterborne microbial disease outbreak, significant interruption of treatment system, natural disaster disrupting the water treatment or distribution system, or chemical spill or pathogenic contamination in the source water that may adversely affect human health as a result of short-term exposure (acute). • Give Tier 1 public notice for violation of the perchlorate MCL or chlorite MCL per resampling requirements in §64463.1. • Give a Tier 2 public notice for any violation of the MCL, maximum residual disinfection level (MRDL), and treatment technique requirements, except where a Tier 1 public notice is required, in accordance with §64463.4. • Give a Tier 3 public notice for monitoring violations, non-compliance with testing procedures, or operation variance or exemption in accordance with §64463.7. • Follow the requirements for public notice content, format, and suggested language in §64465.
Article 19	Records, Reporting and Recordkeeping	• Comply with reporting requirements and maintain records for at least 5 years.
Article 20	Consumer Confidence Report	• Prepare and deliver a consumer confidence report annually that contains specified information about the water delivered: source, type, source water assessment, definitions of terminology, detections of contaminants with MCLs, action levels, MRDL, treatment techniques for regulated contaminants, levels for monitored, but unregulated contaminants, microbial contaminants, sodium, and hardness.

APPENDIX B – SUMMARY OF DRINKING WATER REGULATIONS IN CALIFORNIA		
Reference	**Regulation**	**Selected Requirements[1]**
Title 22, Division 4, Chapter 15.5 Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors		
Article 2	MCLs for Disinfection Byproducts and Maximum Residual Disinfection Levels	• Comply with primary MCLs for disinfection byproducts shown in Table 64533-A (total trihalomethanes, haloacetic acids (five), bromate, and chlorite) • Conduct monitoring and reporting for compliance with primary MCLs in accordance with §64533. DLRs are defined in Table 64533-A. • Use BAT for disinfection byproducts as described in Table 64533-B. • Calculate MRDLs per §64533.5.
Article 3	Monitoring Requirements	• Perform analyses at approved laboratories per §64534. • Monitor for disinfection byproducts at the frequencies specified in Table 64534.2. Reduced monitoring frequency may be approved as described in Table 64534.3. • Submit a monitoring plan to the SWRCB for approval and follow the approved plan.
Article 4	Compliance Requirements	• Use the methodology presented in §64535 and 64535.2 for determining compliance with primary MCLs and MRDLs.
Article 5	Treatment Technique for Control of Disinfection Byproduct Precursors	• Comply with alternative compliance criteria in §64536 or systems using surface water and conventional filtration. TOC removal requirements are specified in §64536.2 for enhanced coagulation or enhanced softening. • Calculate disinfection byproduct precursor levels per §64536.4 and follow public notification requirements as needed per §64536.6.
Article 6	Reporting and Recordkeeping Requirements	• Comply with reporting requirements and maintain records.
Title 22, Division 4, Chapter 16 California Waterworks Standards		
Article 1.5	Waivers and Alternatives	• Demonstrate to the SWRCB that the proposed alternative would provide at least the same level of protection of public health. • Secure written approval from the SWRCB prior to implementing the alternative.
Article 2	Permit Requirements	• Apply for initial domestic public water system permit as applicable per §64552. • Public water systems shall have sufficient capacity to meet the system's maximum day demand. • Public water systems with 1,000 or more service connections shall be able to meet 4 hours of peak hourly demand with source capacity, storage capacity and/or emergency connections. • Public water systems with 1,000 or more service connections shall have storage capacity equal to or greater than the maximum day demand. • Follow permit application, reporting, and testing requirements of §64554. • Amend a domestic water supply permit if necessary, following provisions in §64556. • Prepare a source capacity planning study if so directed by the SWRCB based on its determination that an existing or potential problem is observed. Study shall include anticipated growth of the water system over the next 10 years, estimates of water demands, maps, descriptions of facilities, water rights, surface water availability, wells, groundwater availability, source water assessment(s), descriptions of treatment and distribution systems,

APPENDIX B – SUMMARY OF DRINKING WATER REGULATIONS IN CALIFORNIA		
Reference	Regulation	Selected Requirements[1]
Article 3	Water Sources	• Provide a technical report to support an application to the SWRCB for a new or amended domestic water supply permit for a proposed well. Report shall include a source water assessment, documentation of the well site control zone (50-ft radius), design plans and specifications, CEQA documentation. • Provide information to the SWRCB pertaining to the well construction permit, pump tests, water quality analyses, and other information required by §64560 for each new public water supply well. • Destroy any public water supply well per Department of Water Resources Bulletins 74-81 and 74-90. • Install a flow meter for each water source and record the quantity of water flow from each source. Maintain monthly production records from each source.
Article 4	Materials and Installation of Water Mains and Appurtenances	• Comply with materials and installation standards of the American Water Works Association per §64570. • Separate new water mains by at least 10 ft horizontally from and 1 ft vertically above from parallel sewers (raw wastewater), primary or secondary treated wastewater pipelines, disinfected secondary recycled water pipelines, and hazardous fluids (fuels, industrial wastes, and wastewater sludge) pipelines per §64572(a). • Separate new water mains by at least 4 ft horizontally from and 1 ft vertically above from parallel disinfected tertiary recycled water pipelines and storm drains per §64572(b). • Install new raw water supply lines at least 4 ft horizontally from and 1 ft below any water main per §64572 (c). • Comply with other separation and installation requirements for water mains crossing other pipelines conveying the aforementioned fluids or located near the edge of any landfill, wastewater ponds, or hazardous waste sites per §64572(d), (e), (f), and (g). Exemptions may be approved by the SWRCB for certain circumstances per §64572(h). • Install water mains that are a minimum nominal diameter of 4 inches. • Provide flushing valves or blowoffs at the ends of dead-end water mains. • Install air release, air vacuum, and combination valves in accordance with §64576. • Install isolation valves on water mains in the distribution system at minimum distances and locations specified in §64577. • Install valve boxes over buried valve stems to locate and operate the valves.
Article 5	Disinfection Requirements	• Disinfect new water mains prior to use or water mains that have been taken out of service for maintenance or repair. Sample for bacteriological quality. Results shall be negative for coliform bacteria prior to planning the new water main in service. • Disinfect new distribution reservoirs prior to use or distribution reservoirs that have been taken out of service for maintenance or repair. Sample for bacteriological quality, and resample if results are positive for coliform bacteria. Submit the results to the SWRCB for approval prior to placing the reservoir in service. • Sample new or repaired wells or wells that have not been in service for more than 3 months for bacteriological quality prior to use. If results are positive for coliform bacteria, disinfect the well in accordance with American Water Works Association C654-03, resample, and submit test results to the SWRCB for approval prior to placing the well in service.
Article 6	Distribution Reservoirs	• Design and construct distribution reservoirs in accordance with requirements in §64585.
Article 7	Additives	• Any chemical or product directly added to drinking water shall be certified as meeting National Science Foundation International/American National Standard Institute (NSF/ANSI) standards. • Comply with provisions set forth in §64591 for indirect additives (chemicals, materials, lubricants or other products in the production, treatment or distribution of drinking water). • Use uncertified chemicals, materials, or products as allowed under §64593.

APPENDIX B – SUMMARY OF DRINKING WATER REGULATIONS IN CALIFORNIA		
Reference	**Regulation**	**Selected Requirements[1]**
Article 8	Distribution System Operation	• Submit a Water System Operations and Maintenance Plan to the SRWCB if directed to do so based on an identified deficiency. The Plan shall include information listed in §64600. • Operate the distribution system to maintain a minimum operating pressure in the water main at the user service line of at least 20 psi at all times. Expansions to existing distribution systems shall be designed to provide at least 40 psi of operating pressure at all times excluding fire flow. • Maintain "as built" plans, maps, and drawings. Prepare a schematic drawing or map showing locations of each water source, treatment facility, pumping plant, reservoir, water main and isolation valve. Update these documents as changes occur. • Maintain records of water main flushing and distribution reservoir inspections and cleanings for at least 3 years.
Title 22, Division 4, Chapter 17 Surface Water Treatment		
Article 2	Treatment Technique Requirements, Watershed Protection Requirements, and Performance Standards	• Provide multiple barrier treatment that meets the requirements set forth in §64652. • Provide treatment that reliability achieves at least: (1) 99.9% (3-log) reduction of *Giardia lamblia* cysts through filtration and disinfection; (2) 99.99% (4-log) reduction of viruses through filtration and disinfection; and (3) 99% (2-log) removal of *Cryptosporidium* oocysts through filtration. • Provide filtration of an approved surface water unless all the criteria of §64652.5 to avoid filtration have been met, including site inspections and approvals by the SWRCB. • Use filtration for approved surface water: (1) conventional filtration treatment, (2) direct filtration treatment, (3) diatomaceous earth filtration, or (4) slow sand filtration, unless an alternative process has been approved by the SWRCB. • Provide information to the SWRCB on any recycle flows per §64653.5. • Use continuous disinfection treatment that ensures inactivation of *Giardia lamblia* cysts and viruses in conjunction with the removals achieved by filtration. Comply with disinfection treatment performance standards in §64654.
Article 3	Monitoring Requirements	• Monitor source (raw) water and recycled filter backwash (if any) for turbidity and total coliform per §64654.8. • Conduct turbidity monitoring to determine compliance with filtration performance standards per §64655 • Monitor temperature and pH if chlorine id used, disinfectant contact time, and residual disinfectant concentration in accordance with the provisions of §64656.
Article 4	Design Standards	• Submit an engineering report to the SWRCB describing new or modified filtration and disinfection treatment facilities and how they are designed to comply with Chapter 17 requirements and criteria in §64658. • Include reliability features in all new or modified surface water treatment plants.
Article 5	Operation	• Comply with staffing requirements and operating criteria for surface water treatment plant including: (1) operator certifications, (2) filtration rates, and (3) disinfection failure prevention. • Operate the treatment plant in accordance with an operations plan that has been approved by the SWRCB. • Maintain operation records for at least 3 years that include: (1) water quality and treatment process monitoring results, (2) filter maintenance and inspections, (3) quantity of water produced, flow rates, filtration rates, operating hours, and backwash rates, and (5) dates and descriptions of major equipment and process failures and corrective actions taken.
Article 6	Reporting	• Notify the SWRCB if any exceedances described in §64663 occur. • Submit monthly reports signed by the chief water treatment plant operator, plant superintendent, or other responsible person to the SWRCB that include information listed in §64664.

APPENDIX B – SUMMARY OF DRINKING WATER REGULATIONS IN CALIFORNIA		
Reference	Regulation	Selected Requirements[1]
		• Submit supplemental reports if necessary per §64664.2
Article 7	Sanitary Surveys	• Conduct a sanitary survey of the watershed(s) at least every 5 years and submit the report to the SWRCB. Required elements of the survey and report are described in §64665.
Article 8	Public Notification	• Notify the public whenever a failure of the treatment systems occur that violate treatment or performance standards.
Article 9	Indirect Potable Reuse: Surface Water Augmentation	• Comply with the requirements of Article 9 when the approved surface water source of supply is augmented by a Surface Water Source Augmentation Project (SWSAP). (See Title 22, Chapter 3, Article 5.3) • Submit an application for a domestic water supply permit or permit amendment and have an approved joint plan between the SWSAP Public Water System (PWS) and SWSAP Water Recycling Agency (WRA). • Revise the emergency plan and operations plan to include elements of the joint plan to ensure a reliability supply of water is delivered that meets all drinking water standards in any of the events in §64668.10(b) should occur. • Demonstrate to the SWRCB and RWQCB that the SWSAP PWS has sufficient control over the operation of the augmented reservoir to comply with the requirements of Article 9 and Title 22, Chapter 3, Article 5.3. • Notify the SWRCB of a SWSAP WRA failing to meet a requirement in the SWSAP WRA's permit or Title 22, Chapter 3, Article 5.3. • Conduct at least 3 public hearings with the SWRCB and the SWSAP WRA. • Comply with the SWSAP augmented reservoir requirements set forth in §64668.30: (1) operating as an approved surface water supply for at least 5 years (or a minimum of 2 years with SWRCB approval); and (2) calculate and record monthly the theoretical retention time (in days) by dividing the volume of water in the reservoir at the end of each month by the total outflow/withdrawals from the reservoir during the month. Comply with an initial approved minimum theoretical retention time of at least 180 days with exceptions as allowed under §64668.30 for an alternative theoretical retention time and as approved by the SWRCB, and in no case less than 60 days (e.g. additional treatment at the SWSAP WRA to achieve an additional 1-log reduction in pathogens [virus, *Giardia* cysts, and *Cryptosporidium* oocysts} for theoretical retention time less than 120 days) • Conduct tracer studies and hydrodynamic modeling of the augmented reservoir to demonstrate to the SWRCB that at all times and under all operating conditions the volume of water withdrawn from the reservoir contains no more than: (1) 1% by volume of recycled municipal wastewater during any 24-hr period; or (2) 10% by volume of recycled municipal wastewater that was delivered to the reservoir during any 24-hr period, with the SWSAP WRA providing additional treatment that achieves 1-log of additional reduction in pathogens (virus, *Giardia* cysts, and *Cryptosporidium* oocysts). Requirements for additional treatment are described in §64668.30(c). • Utilize an independent scientific advisory panel to review the SWSAP per §64668.30(f). • Develop a plan for SWRCB approval describing the actions to be taken by the SWSAP PWS to address potential impacts of using advanced treated water as a source water supply for the SWSAP PWS's surface water treatment plant and distribution system. Details of the plan are described in §64668.30(g).
Title 22, Division 4, Chapter 17.5 Lead and Copper		
Article 1	General Requirements and Definitions	• Requirements of this chapter are applicable to community water systems and non-transient –non-community water systems. • Exceeding an action level shall not constitute a violation of this chapter. • Conduct analyses using methods in §64670(c). • Follow defined terminology for action level exceedances, corrosion control treatment, etc. in this Article.

APPENDIX B – SUMMARY OF DRINKING WATER REGULATIONS IN CALIFORNIA		
Reference	**Regulation**	**Selected Requirements[1]**
Article 2	Requirements According to System Size	• Comply with sampling and reporting requirements for small and medium-size water systems per §64673, and for large water systems per §64674.
Article 3	Monitoring for Lead and Copper	• Sample for lead and copper at sites specified in Table 64675-A, and at frequencies in §64675.5. • Follow the methodology in this article for selection of tap sampling sites, DLRs, and determination of exceedances of lead and copper action levels. Monitoring may be reduced or waived for small systems.
Article 4	Water Quality Parameter Monitoring	• Select tap sampling sites to be representative of the entire distribution system. • Monitor pH, alkalinity, orthophosphate, silica, calcium, conductivity, corrosion control inhibitor (if used), and temperature in systems using corrosion control treatment. • Monitoring frequency may be reduced if no exceedances of lead and copper action levels are identified.
Article 5	Corrosion Control	• Evaluate types of corrosion control treatment methods by following study procedures outline in §64683. Submit a report to the SWRCB indicating the study findings and recommended corrosion control treatment. • Install and operate the corrosion control treatment approved by the SWRCB. • Monitor the distribution system to validate performance for compliance with this Article.
Article 6	Source Water Requirements for Action Level Exceedances	• Sample and analyze the source water(s) for lead and copper within 6 months of an exceedance of an action level in the distribution system. • Comply with the SWRCB requirements for treatment and monitoring of source water if so directed by the SWRCB.
Article 7	Public Education Program for Lead Action Level Exceedances	• Conduct a lead public education program that includes elements described in this Article.
Article 8	Lead Service Line Replacements for Action Level Exceedances	• Replace lead service lines if the lead action level is exceeded after installing corrosion control treatment and/or source water treatment. • Conduct an assessment of piping materials in the distribution system. • Sample service lines for lead per §64689.
Article 9	Reporting and Recordkeeping	• Report results of lead and copper sampling and maintain records for at least 12 years.
Other Title 22 Requirements		
Addendum A	California Ground Water Rule	• Reference to text adopted pursuant to §64430.
Addendum B	California Long Term 2 Enhanced Surface Water Treatment Rule	• Reference to text adopted pursuant to §64650(f).
Appendix A	Endnotes	• See list at: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Lawbook.html

[1] Note: This summary is not intended to be a substitute for the actual Regulations.

Appendix C: Summary of DDW 2015 Draft Update of Process Memo 97-005 for Direct Domestic Use of Extremely Impaired Sources

APPENDIX C – SUMMARY OF DDW[1] 2015 DRAFT UPDATE OF PROCESS MEMO 97-005 FOR DIRECT DOMESTIC USE OF EXTREMELY IMPAIRED SOURCES		
Section[2]	Title	Summary
A.	General Philosophy	• Basic principle is that only the best quality sources of water reasonably available to a water utility should be used for drinking. • Sources presenting the least risk to public health should be utilized and protected against contamination. • Whenever possible, lower quality source waters should be used for non-consumptive uses. • Use of contaminated water as a drinking water source always poses a greater health risk and hazard to the public than the use of an uncontaminated source because of the chance that the necessary treatment may fail. • Use of an extremely impaired source should not be approved unless the additional health risk, relative to the use of other available drinking water sources, are known, minimized, and considered acceptable. • Extremely impaired sources contain or are likely to contain high concentrations of contaminants, multiple contaminants, or unknown contaminants (such as groundwater subject to contamination from a Superfund site). • Drinking water quality and public health shall be given greater consideration than costs or cost savings when evaluating alternative drinking water sources or treatment processes. • Extremely impaired sources exist that need to be remediated and for which the resulting product water represents a significant resource that should not be wasted. • Consideration of treated extremely impaired sources for domestic use may be reasonable, particularly where other sources may be unavailable. If the water cannot be reliably treated, or if the potential public health risk exceeds acceptable levels, the extremely impaired source should not be permitted for domestic use.
B.	Purpose of Policy Memo 97-005	• Original 1997 Memo was issued to provide DDW guidance in addressing proposals to use water generated from large remediation projects (e.g. Superfund sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)). • Sets forth the position and basic tenets by which DDW would evaluate proposals, establish appropriate permit conditions, and approve the use of an extremely impaired source for direct potable use.
C.	Extremely Impaired Sources	• Extremely impaired source meets two or more of the following criteria: o Contains a contaminant that exceeds 10 times its Maximum Contaminant Level (MCL) based on chronic health effects, o Contains a contaminant that exceeds 3 times its MCL based on acute health effects (e.g., nitrate or perchlorate), o Contains a contaminant that exceeds 10 times its Notification Level (NL) based on chronic health effects, o Contains a contaminant that exceeds 3 times its NL based on acute health effects, o Contains one or more contaminants that meet any of the four criteria above and has not been adequately characterized, o Is a surface water that requires more than 4 log Giardia/5 log virus reduction, o Is a surface water that on an annual average contains more than 5% treated wastewater, unless it is associated with an approved drinking water-related surface water augmentation project, o Is extremely threatened with contamination due to proximity to known contaminating activities within the long term, steady-state capture zone of a drinking water well or within the watershed of a surface water intake, o Contains a mixture of contaminants of health concern beyond what is typically seen in number and concentration of contaminants, o Is designed to intercept known contaminants of health concern. • Examples include: o Extremely contaminated ground water,

APPENDIX C – SUMMARY OF DDW[1] 2015 DRAFT UPDATE OF PROCESS MEMO 97-005 FOR DIRECT DOMESTIC USE OF EXTREMELY IMPAIRED SOURCES		
Section[2]	**Title**	**Summary**
		o Sewage effluent dominated surface water, o Oilfield produced water, o Water that is predominantly recycled water (unless associated with an approved drinking water-related project using groundwater replenishment or surface water augmentation), o Urban storm drainage, treated or untreated wastewater, or agricultural return water, o Products of toxic site cleanup programs. • Proposals for the use of extremely impaired sources will be considered on a case-by-case basis.
D.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source	• DDW's evaluation process consists of a series of sequential steps • Each step should include clear, specific detailed statements of finding, interpretations, and conclusions as they relate to the goal of each step
D.1.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 1. Drinking Water Source Assessment and Contaminant Assessment	• Source Assessment o Purpose is to determine the extent to which the aquifer or surface water is vulnerable to contaminating activities in the area. Assessment should: ▪ Delineate the source water capture zones (groundwater) or watershed areas (surface water) ▪ Identify contaminant sources • Contaminant Assessment o Purpose is to provide a characterization of the contamination of soils and groundwater at and around the contamination and former contamination sites located within the long-term capture zone or watershed areas of the drinking water source. Assessment should: ▪ List known and potential drinking water contaminants (e.g., Title 22 regulated and unregulated chemicals, chemicals with NLs, chemicals in Safe Drinking Water and Toxic Enforcement Act of 1986, microbiological quality, priority pollutants, hazardous wastes, chemicals of emerging concern (CEC), et al.) ▪ Identify all contaminants with potential health effects ▪ Prepare Raw Water Quality Characterization with estimates of contaminant treatability
D.2.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 2. Full Characterization of the Raw Water Quality	• Characterize raw water quality for proper design of the treatment system. Evaluate: o Title 22 drinking water regulated and unregulated chemicals o All chemicals for which drinking water NLs are established o All chemicals listed pursuant to Safe Drinking Water and Toxic Enforcement Act of 1986 o Microbiological quality o Priority pollutants o Gross contaminant measures [total organic carbon (TOC), etc.] o Hazardous wastes and constituents in 40 CFR Part 261, including Appendices VII and VIII o CECs recommended by the SWRCB o Additional contaminants of concern from Step 1 Contaminant Assessment • Any additional contaminant detected in the raw water quality full characterization (Step 2) should be reassessed by the source and contaminant assessments in terms of that contaminant (Step 1).

Section[2]	Title	Summary
		• Determine variability of contaminant concentrations with time (seasonal and long term), pumping rate, or other variable that may change its concentration in the raw water to be treated. • List additional potential contaminants associated with the contaminating activities.
D.3.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 3. Drinking Water Source Protection	• If the use of an extremely impaired source is to be approved, the source of the contamination must be controlled to prevent the level of contamination from rising and to minimize the dependence on treatment for contaminant removal. • Best management practices for waste handling and waste reduction should be required at a minimum to control the level of contamination at its origin. • Evaluate cleanups, mitigations, and remediations within the capture zone of the source water to demonstrate releases of contaminants are not continuing. • Develop a program to protect all drinking water sources. • Include a source treatment facility at the origin of the contamination for low flow, hot spot treatment that will not be used as a domestic water source. • Monitoring between the origin of the contamination and the drinking water source should be conducted (e.g., monitoring well(s)) to determine the level of contamination, to reasonably assure that the contamination level will not increase at extraction/production wells.
D.4.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 4. Effective Treatment and Monitoring	• Treatment o Submit a treatability assessment for all contaminants projected to be at the extraction/production well(s). o Treatment of the extremely impaired source prior to direct domestic water system usage must be commensurate with the degree of risk associated with the contaminants present. o Treatment shall use best available treatment technology defined for the contaminant(s) by the Environmental Protection Agency or DDW and have reliability features consistent with the type and degree of contamination. o Treatment processes must be optimized to reliably produce water that contains the lowest concentration of contaminants feasible at all times. o Entire flow from the extremely impaired source must pass through the complete treatment process(es) unless a reasonable alternative is available. o Any water from other sources available for blending prior to entry into the distribution system should be used to provide an additional safety factor. o Multi-barrier treatment is a set of independent treatment processes placed in series, and designed and operated to reduce the levels of a contaminant. Each barrier should effectively reduce the contaminant by a significant fraction of the total required reduction. Treatment processes should address all contaminants of public health concern in an extremely impaired source. Multi-barrier treatment may be appropriate when: ▪ Primary treatment is not sufficiently reliable, ▪ Primary treatment is of uncertain effectiveness, ▪ There is no direct way to measure the contaminant (e.g., pathogenic microorganism), ▪ Health effect of the contaminant is acute, and/or ▪ Very large reductions in contaminant concentration are required. o Where there is a regional or basin-wide contaminant (e.g. nitrates or TDS) not coming from contamination areas, blending with another source not involved in the cleanup may be considered.

APPENDIX C – SUMMARY OF DDW[1] 2015 DRAFT UPDATE OF PROCESS MEMO 97-005 FOR DIRECT DOMESTIC USE OF EXTREMELY IMPAIRED SOURCES

Section[2]	Title	Summary
		• Monitoring o More extensive monitoring in terms of frequency of testing and numbers of contaminants will likely be required for use of an extremely impaired source than is associated with typical drinking water sources. o Detection and reporting limits should be as low as practicable. o Testing for regulated drinking water contaminants must use drinking water analytical methods. o Supplemental monitoring wells are typically required to provide an early warning of unexpectedly high concentrations or new contaminants moving towards the extraction/production wells. A water quality surveillance plan including specific monitoring well locations and a sampling and analysis plan. o Submit a sampling and analysis plan for the drinking water source and at appropriate locations in the treatment plant as well as for the plant effluent. • Treatment and Monitoring Program Proposal should include: o Performance standards (using a field measurable indicator of treatment efficiency): ▪ Identify level to assure compliance with the treatment objective, ▪ Treatment objective for all contaminants should be optimized to the lowest extent feasible and must assure compliance with the MCL at all times. ▪ Treatment should be optimized to reduce unregulated contaminants below NLs ▪ Facilities for treating water containing specific contaminants for which the MCL is higher than the public health goal (PHG) should be designed and operated to meet the PHG where this can be accomplished in a cost-effective manner. o Operations plan: ▪ Identify all operational procedures, failure response triggers, and loading rates, and include a process monitoring plan, process optimization procedures, established water quality objectives or goals, level of operator qualification, and frequent inspections of equipment. o Reliability features: ▪ Response Plan for failure to meet the treatment objective, ▪ Alternative disposal methods, ▪ Shutdown triggers and restart procedures. o Compliance monitoring and reporting program o Notification plan o Surveillance plan that includes water quality monitoring between the origin of the contamination and the extremely impaired source proposed for use as drinking water. • DDW Staff Evaluation of Treated Water Objectives or Goals o Describes DDW's methodology for evaluating the treatment objectives or goals of the combined effluent of the proposed facility to ensure the cumulative risk of multiple contaminants under normal operation has been reasonably addressed (for details see 2015 Draft Update of 97-005 Memo, part 4.d) ▪ Use of MCL-Equivalents to Evaluate Treated Water Goals ▪ Detection Limits for Reporting (DLRs) Limit the Required Levels of Treatment ▪ Consideration of Background Credit for Naturally-Occurring Contaminants

APPENDIX C – SUMMARY OF DDW[1] 2015 DRAFT UPDATE OF PROCESS MEMO 97-005 FOR DIRECT DOMESTIC USE OF EXTREMELY IMPAIRED SOURCES		
Section[2]	Title	Summary
D.5.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 5. Human Health Risks Associated with Failure of Proposed Treatment	• Treatment technologies are not failure-proof, and insufficiently treated or untreated water may, on occasion, pass through the treatment process and into the distribution system. An assessment must be performed that includes: o Evaluation of the risks of failure of the proposed treatment system. ▪ Proposed treatment system must be evaluated in terms of its probability to fail, thereby exposing customers to insufficiently-treated or untreated drinking water from the extremely impaired source. o Assessment of potential health risks associated with failure of the proposed treatment system. Health assessment must take into account: ▪ Duration of exposure to contaminated drinking water that would result from such a failure ▪ Human health risks associated with such exposure to insufficiently treated or untreated water over the course of that failure, considering the risks of disease from microbiological organism, and the risks of acute and chronic effects (including non-cancer and cancer risks) from chemical contaminants ▪ Potential cumulative risks, due to multiple failures ▪ When risks of adverse health effects from treatment failure are not acceptable, then additional treatment safeguards must be used for the protection of public health, or the proposal must be rejected by DDW.
D.6.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 6. Completion of CEQA	• Complete California Environmental Quality Act (CEQA) review of the project.
D.7.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 7. Submittal of Permit Application	• Public water system(s) collecting, treating and distributing water from the extremely impaired source must submit a permit application for the use of the extremely impaired source that includes the items identified in steps 1-6.
D.8.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 8. Public Hearing	• Hold a public hearing to identify concerns of consumers who will be served water from the extremely impaired source and to assure that all parties have a chance to provide relevant information. • Early public outreach activities are strongly recommended.
D.9.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 9. DDW Evaluation	• DDW staff will conduct an evaluation of the application and make recommendations.
D.10.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source	• DDW must make the following findings for approval to use an extremely impaired source:

APPENDIX C – SUMMARY OF DDW[1] 2015 DRAFT UPDATE OF PROCESS MEMO 97-005 FOR DIRECT DOMESTIC USE OF EXTREMELY IMPAIRED SOURCES		
Section[2]	Title	Summary
	Step 10. Requirements for DDW Approval	o Drinking water MCLs and action levels for lead and copper, and NLs will not be exceeded if the permit is complied with, and o The potential for human health risk is minimized by treatment and the risk from treatment failure is minimized through good engineering practices that may involve redundancies in treatment, and efficiencies in maintenance, inspections, monitoring and alarms.
D.11.	Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source Step 11. Issuance or Denial of Permit	• DDW either issues a permit or denies a permit for the use of the extremely impaired source. If a permit is issued, it must include all necessary treatment, compliance monitoring, operational, and reporting requirements.

[1] State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW)
[2] For reference, section numbers and titles are from the 2015 Draft Update of 97-005 Process Memo.
Note: This summary is not intended to be a substitute for DDW's actual Policy Memo 97-005 "Policy Guidance for Direct Domestic Use of Extremely Impaired Sources" dated November 5, 1997, [by Department of Health Services at that time] or DDW's Draft Update of 97-005 Process Memo "Addressing the Direct Domestic Use of Extremely Impaired Sources" dated March 25, 2015.

Appendix D: Unit Costs Assumptions

Construction Cost Criteria

AWPF		**Cost**	**Unit**	**Notes**
AWPF with MBR		$8.30	GPD	Incl modifying exist BNR basins
AWPF with RO-AOP Only		$7.00	GPD	RP-5 MBR facility constuct by others
AWPF with MF		$8.10	GPD	
Offsite AWPF (with MF)		$8.91	GPD	
MVWD In-Kind (Plant 28)		$2,000,000	Each	Incl modifying exist BNR basins
RPU Contribution		$20,000,000	Each	
Pipeline		**Cost**	**Unit**	**Notes**
Open Cut				
- Range(in):	0 14	$24	Inch*LF	
- Range(in):	16 20	$22	Inch*LF	
- Range(in):	24 60	$19	Inch*LF	
Jack and Bore		$60	Inch*LF	
- Launch/Receiving Pit		$40,000	Each	
Horizontal Direction Drill		$90	Inch*LF	
Turnout/Connections		**Cost**	**Unit**	**Notes**
Connection to Existing MWD Turnou		$500,000	Each	
Construct New MA Turnout		$500,000	Each	
Pumping Station		**Cost**	**Unit**	**Notes**
Booster Pump Station		$5,000	HP	Includes Standby Capacity
Extraction Well		**Cost**	**Unit**	**Notes**
Development		$1,900,000	Each	
Equipping and Building		$600,000	Each	
Injection Well		**Cost**	**Unit**	**Notes**
Development		$1,500,000	Each	
Equipping and Building		$500,000	Each	
Monitoring Well		**Cost**	**Unit**	**Notes**
Development		$750,000	Each	
Wellhead Treatment		**Cost**	**Unit**	**Notes**
IX - Single Pass		$1.52	GPD	
IX - Regenerable		$2.08	GPD	Assume ISEP
Air Stripping		$0.69	GPD	includes gas phase GAC
Liquid Phase GAC		$1.04	GPD	
Reverse Osmosis		$0.94	GPD	
AOP		$2.43	GPD	
Biological		$1.83	GPD	
Pump Back Treatment		**Cost**	**Unit**	**Notes**
Central Treatment		$0	GPD	
CVWD Contribution		$10,000,000	Each	
MWD Wheeling Charge		**Cost**	**Unit**	**Notes**
NRW Disposal		**Cost**	**Unit**	**Notes**
NRWSCU Purchase Rate		$4,172	CU	
Water Storage Tanks/ Equalization		**Cost**	**Unit**	**Notes**
Welded Steel Tank		$1.30	Gal	
EQ Basin Modifications		$50,000	Each	
Recharge Basin Improvements		**Cost**	**Unit**	**Notes**
Misc Improvements		$25,000	Each	
Land Acquisition		**Cost**	**Unit**	**Notes**
Land Acquisition		$750,000	Ac	Excludes RP-1, RP-4, and Plant #28

O&M Annual Cost Criteria

AWPF	**Cost**	**Unit**	**Notes**
MBR - Power	1.25	kWh/1000 Gal	
MBR - Power - BNR Air	1.42	kWh/1000 Gal	
MBR - Chemicals	$0.01	$/1000 Gal	
MBR - Membrane Replacement	$0.30	$/1000 Gal	
AWPF - Power (MF-RO-AOP)	2.52	kWh/1000 Gal	
AWPF - Chemicals (MF-RO-AOP)	$0.42	$/1000 Gal	
AWPF - Consumables (MF-RO-AOP)	$0.21	$/1000 Gal	
AWPF - Power (RO-AOP)	2.28	kWh/1000 Gal	
AWPF - Chemicals (RO-AOP)	$0.32	$/1000 Gal	
AWPF - Consumables (RO-AOP)	$0.12	$/1000 Gal	
Pipeline	**Cost**	**Unit**	**Notes**
Pipeline Maint and Monitoring	$5,000	$/Mile	
Turnout/Connections	**Cost**	**Unit**	**Notes**
Maint and Monitoring	1%	% Construction	
Pumping Station	**Cost**	**Unit**	**Notes**
General	3%	% Construction	
Extraction Well	**Cost**	**Unit**	**Notes**
General O&M	$30,000	Each	
Injection Well	**Cost**	**Unit**	**Notes**
General O&M	$30,000	Each	
Monitoring Well	**Cost**	**Unit**	**Notes**
General O&M	$10,000	Each	
Wellhead Treatment	**Cost**	**Unit**	**Notes**
IX - Single Pass	$0.22	$/1000 Gal	
IX - Regenerable	$0.34	$/1000 Gal	
Air Stripping	$0.20	$/1000 Gal	
Liquid Phase GAC	$0.08	$/1000 Gal	
Reverse Osmosis	$0.58	$/1000 Gal	
AOP	$0.27	$/1000 Gal	
Biological	$1.53	$/1000 Gal	
Pump Back Treatment	**Cost**	**Unit**	**Notes**
Pump Back Treatment O&M	$0.00	$/1000 Gal	
MWD Wheeling Charge	**Cost**	**Unit**	**Notes**
Annual Pre-delivery amount	10000	AFY	
Wheeling Charge	$411	$/AFY	
NRW Disposal	**Cost**	**Unit**	**Notes**
Volumetric Charges	$0.94	1000 Gal	
Strength Charges - COD	$166	1000 Lbs (Dry Wt)	
Strength Charges - TSS	$470	1000 Lbs (Dry Wt)	
Agency O&M and CIP charges	$28.25	CU/Month	
Water Storage Tanks/ Equalization	**Cost**	**Unit**	**Notes**
Recoating	$0.02	Gal	
Recharge Basin Improvements	**Cost**	**Unit**	**Notes**
Misc Recharge Basin Improv.	$0	Each	
Land Acquisition	**Cost**	**Unit**	**Notes**
Land Acquisition	$0	Ac	

General Cost Criteria

General	**Cost**	**Unit**	**Notes**
Energy Cost	$0.17	kW-Hr	
Online Factor	100%	%	
Escalation	2%	%	
Financing Amortization Period	25	Years	
Financing Discount Rate	3%	%	
Mid-Point of Construction	2024	Year	
PUT Year Delivery	15,000	AFY	
TAKE Year Delivery	50,000	AFY	
Markups	**Cost**	**Unit**	**Notes**
Contigency	30%	%	
Engineering, Admin, CM	28%	%	

APPENDIX 2

CBP PUT, TAKE, and Program Alternatives Evaluation Technical Memorandum #2

Brown AND Caldwell

IN ASSOCIATION WITH WSC WATER SYSTEMS CONSULTING, INC.

DRAFT FINAL

Chino Basin Program PUT, TAKE, and Program Alternatives Evaluation

Technical Memorandum No. 2

October 2021

Prepared for

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

CBP CHINO BASIN PROGRAM

DRAFT

Technical Memorandum

18500 Von Karman Avenue, Suite 1100
Irvine, CA 92612
T: 714.730.7600

Prepared for: Inland Empire Utilities Agency

Project Title: Chino Basin Program PDR

Project No.: 153489.080.004

Technical Memorandum No. 2

Subject: Chino Basin Program – PUT, TAKE, and Program Alternatives Evaluation

Date: October 20, 2021

To: Sylvie Lee, P.E., Manager of Planning & Environmental Resources

Liza Munoz, P.E., Project Manager

From: Andrew Lazenby, P.E., Director/Sr. Project Manager, Brown and Caldwell

Prepared by: ____
Jennifer K. Thompson, P.E., Sr. Project Manager
License No. C64820, Expiration 6/30/2023

Reviewed by: ____
Andrew Lazenby, Director/Sr. Project Manager, Brown and Caldwell

**List of Additional Contributors and Reviewers are on the following page.*

List of Additional Contributors and Reviewers

Contributors:

Lauren Bray, Brown and Caldwell

Hannah Ford, P.E., Brown and Caldwell

Kirstin Byrne Kale, P.E., Brown and Caldwell

Windsor Lee, Brown and Caldwell

Marcus Maltby, P.E., Brown and Caldwell

Taylor McCauley, Brown and Caldwell

Elizabeth Orozco, Brown and Caldwell

Adam Zacheis, P.E., Brown and Caldwell

Aimee Zhao, Brown and Caldwell

Troy Arashiro, WSC

Laine Carlson, P.E., WSC

Michael Cruikshank, PG, CHG, WSC

Heather Freed, P.E., WSC

Aaron Morland, WSC

Patricia Olivas, WSC

Jeroen Olthof, P.E., WSC

Reviewed By:

Katie Porter, P.E., Brown and Caldwell

Kirsten Plonka, P.E., WSC

Rob Natoli, P.E., WSC

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List of Abbreviations

AFM	acre-feet per month
AFY	acre-feet per year
AWPF	advanced water purification facility
CBP	Chino Basin Program
CBWM	Chino Basin Watermaster
CCR	California Code of Regulations
CCWRF	Carbon Canyon Water Recycling Facility
CECs	constituents of emerging concern
CVWD	Cucamonga Valley Water District
DDW	Division of Drinking Water
DLR	detection limit for reporting purposes
DP	discharge point
EW	extraction well
ft	feet
fps	feet per second
FWC	Fontana Water Company
FY	fiscal year
gpd	gallons per day
gpm	gallons per minute
GWR	groundwater recharge

HGL	hydraulic grade line
hP	horsepower
IEUA	Inland Empire Utilities Agency
in	inches
IW	injection well
JCSD	Jurupa Community Services District
kWh	kilowatt hour
lbs	pounds
MBR	membrane bioreactor
MCL	maximum contaminant level
mgd	million gallons per day
MWD	Metropolitan Water District of Southern California
NDMA	N-Nitrosodimethylamine
NL	notification level
NRW	Non-Reclaimable Wastewater
PDR	preliminary design report
PFAS	Per- and Polyfluoroalkyl Substances
PS	pump station
RP-1	Regional Water Recycling Plant No. 1
RP-2	Regional Water Recycling Plant No. 2
RP-4	Regional Water Recycling Plant No. 4
RP-5	Regional Water Recycling Plant No. 5
RW	recycled water
RWQCB	Regional Water Quality Control Board
SAR	sodium absorption ratio
sMCL	secondary maximum contaminant level
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAFM	thousand acre-feet per month
TAFY	thousand acre-feet per year
TDH	total dynamic head
TDS	total dissolved solids
TM	technical memorandum
TM1	Technical Memorandum 1
TM2	Technical Memorandum 2
TM3	Technical Memorandum 3
TVMWD	Three Valleys Municipal Water District
Watermaster	Chino Basin Watermaster
Western	Western Municipal Water District
WRCRWA	Western Riverside County Regional Wastewater Authority
WRP	water reclamation plant
WSIP	Water Storage Investment Program
WTP	water treatment plant
WWTP	wastewater treatment plant
$M	millions of dollars

Section 1: Introduction

The Chino Basin Program (CBP or Program) is an innovative local water supply project that combines local infrastructure needs and salinity management with groundwater storage and water supply needs in Northern California. This project is being led by the Inland Empire Utilities Agency (IEUA) to develop necessary infrastructure within the IEUA service area and the area of the Chino Groundwater Basin (Chino Basin). This project, the CBP Technical Feasibility Study (Study), is being completed to advance the projects that comprise the CBP. This project includes two main elements:

1. Identification and evaluation of PUT, TAKE, and program alternatives to identify the preferred CBP approach.
2. The conceptual design for elements of the recommended program.

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. The PUT and TAKE components are summarized in Table 1-1.

Table 1-1. Summary of PUT and TAKE Components

PUT Components	TAKE Components
• Tertiary recycled water supply and conveyance • Advanced water purification facility (AWPF) • Purified water pumping and conveyance • Groundwater recharge (injection wells and/or recharge basins)	• Groundwater extraction and treatment • Potable water pumping and conveyance • Potable water usage (MWD pump back or in-lieu)
The CBP will comprise both PUT and TAKE components.	

The Study will be the primary deliverable for the overall project and will present the overall findings of the project, including the conceptual design for elements of the recommended program. The alternatives evaluation of the PUT, TAKE, and program alternatives, which will define the recommended CBP for documentation in the Study, is documented in the following technical memoranda (TM):

- **TM1 – CBP Assumptions:** documents the assumptions used to develop the PUT and TAKE alternatives and presents the approach used to evaluate the PUT, TAKE, and program alternatives.
- **TM2 – PUT, TAKE, and Program Alternatives Development and Evaluation (this TM):** presents the development and formation of the PUT and TAKE alternatives and evaluation and the selected program alternative for the overall CBP.

These TMs will be appended to the Study. The relationship between the three CBP documents is shown graphically in Figure 1-1.

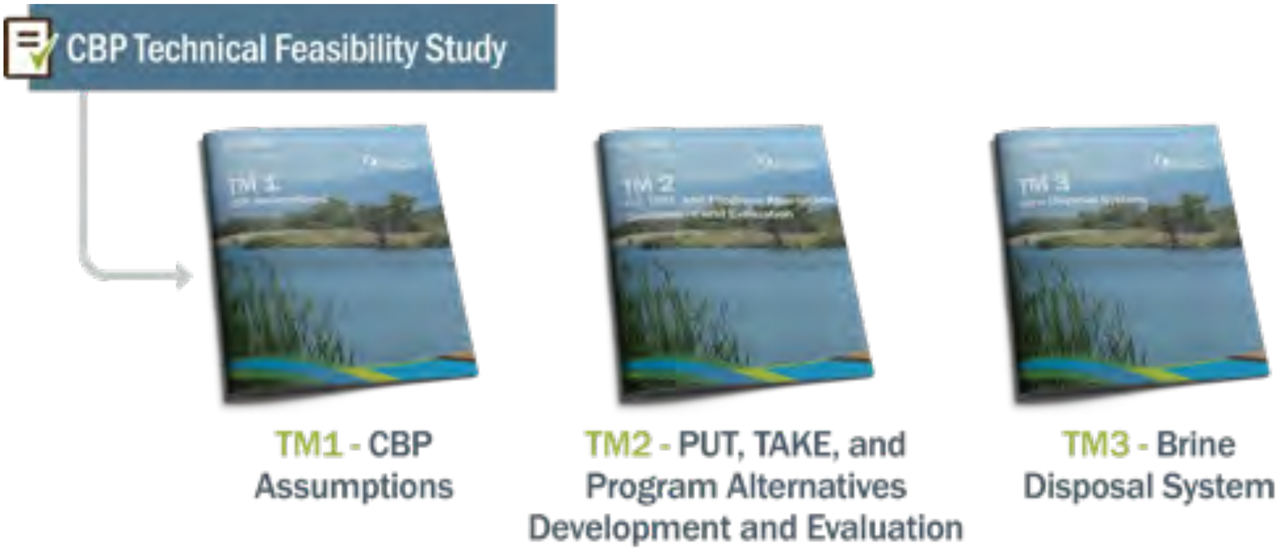

Figure 1-1. CBP Documents

The following information is presented in TM2:

- **Section 2: Initial Groundwater Modeling** – summarizes the characteristics of the Chino Basin and presents optimum locations for PUT and TAKE alternative infrastructure to maximize basin storage capacity and minimize and/or mitigate material physical injury to the basin and its surrounding area.
- **Section 3: PUT Alternatives** – presents an overview of the six PUT alternatives and components, including tertiary recycled water supply, AWPF, purified water conveyance, and groundwater recharge with injection wells. Each alternative includes a description, evaluation, and recommendations for inclusion in the recommendation CBP alternative.
- **Section 4: TAKE Alternatives** – presents an overview of the TAKE alternatives including alternative components, delivery mechanism, and delivery conditions for each alternative. Each alternative includes a description and recommendations for inclusion in the recommended CBP alternative.
- **Section 5: Program Recommendations** – presents the recommended program alternative developed from the recommended PUT and TAKE alternatives.

Section 2: Initial Groundwater Modeling

The project was planned to have groundwater modeling completed for the four program alternatives. However, during development of the PUT and TAKE alternatives it was determined that initial, interim modeling would be beneficial to help guide the alternatives development process. Wildermuth Environmental, Inc. (WEI) completed four interim groundwater modeling scenarios for the initial PUT and TAKE concepts to determine if potential program elements align with the Optimum Basin Management Plan (OBMP) objectives and the Storage Framework Investigation. The modeling also identified potential pumping constraints in the existing well fields with the new extraction wells and evaluated groundwater travel time requirements between recharge locations (i.e., injection wells) and extraction wells. This early modeling input allowed the team to modify the PUT and TAKE components to better align with Chino Basin requirements.

The modeling runs evaluated the following PUT and TAKE components:

- Potential PUT locations, including initial and refined injection well locations in MZ-2.
- Potential TAKE locations in MZ-1, MZ-2, and MZ-3.
- Asymmetrical PUT and TAKE with the majority of the groundwater recharge in MZ-2 and extraction in MZ-2 and MZ-3.

The following results were determined from the initial groundwater modeling:

- Confirmed that injection wells located in the northern portion of MZ-2 can support the level of TAKE in the CBP.
- The initial model runs showed that the PUT and TAKE components achieved hydraulic control and minimized impact to pumping sustainability and net recharge.
- The refined MZ-2 injection well locations (selected to reduce purified water conveyance infrastructure) were acceptable and meet travel time requirements. The initial and refined injection well locations are discussed further in Section 3.2.4.
- Asymmetrical PUT and TAKE is acceptable for recharge in MZ-2 and extraction in MZ-2 and MZ-3.
- TAKE in MZ-1 is feasible with symmetric, upgradient PUT.

Table 2-1 summarizes the initial groundwater modeling runs with the PUT and TAKE assumptions and the corresponding results. The order of the model runs was dictated by the development of the overall CBP concepts with the formulation and refinements of the PUT and TAKE alternatives.

Table 2-1. Summary of Initial Groundwater Modeling

Model Run	PUT Assumptions	TAKE Assumptions[1]	Results
1	• 15.0 TAFY • Recharge assumptions ○ MZ-1: 3.0 TAFY via 3 injection wells ○ MZ-2: 9.0 TAFY via recharge basins2 ○ MZ-3: 3.0 TAFY via 3 injection wells	• No pre-delivery (50.0 TAFY) • Extraction assumptions ○ MZ-1: 4.0 TAFY ○ MZ-2: 34.3 TAFY ○ MZ-3: 11.7 TAFY • Call occurs in last 3 years of a 10-year cycle (e.g., Years 8-10)	• TAKE in MZ-1 is feasible with symmetric, upgradient PUT • PUT and TAKE facilities should be closer together in MZ-2 • Utilize injection wells in MZ-2 • Identified potential pumping constraints in the existing MZ-2 and MZ-3 well fields • Achieved hydraulic control • TAKE in MZ-3 requires more evaluation
2	• 15.0 TAFY via 16 injection wells in MZ-2[3]	• No pre-delivery (50.0 TAFY) • Extraction in MZ-2 • Call occurs in last 3 years of a 10-year cycle (e.g. Years 8-10)	• Identified potential pumping constraints in the existing well fields • Identified travel time constraints • Achieved hydraulic control

Table 2-1. Summary of Initial Groundwater Modeling

Model Run	PUT Assumptions	TAKE Assumptions[1]	Results
3	• 15.0 TAFY • Recharge assumptions ○ 12.0 TAFY via 12 injection wells in MZ-2[3] ○ 3.0 TAFY via 3 injection wells in MZ-3	• No pre-delivery (50.0 TAFY) • Extraction in MZ-2 • Call occurs in last 3 years of a 10-year cycle (e.g. Years 8-10)	• Achieved hydraulic control • Elevated groundwater levels in MZ-3 and satisfied the sustainability criteria in existing well fields • Identified potential pumping constraints in the existing MZ-2 well fields
4	• 15.0 TAFY via 16 injection wells in MZ-2[4]	• No pre-delivery (50.0 TAFY) • Extraction in MZ-2 • Call occurs in last 3 years of a 10-year cycle (e.g. Years 8-10)	• Tightened the distribution of injection wells and extraction wells to reduce the conveyance infrastructure. • Achieved hydraulic control • Minimized impact to sustainability constraints • Meets travel time requirements

Notes:

[1]No pre-delivery was assumed for all initial model runs since this is the most conservative extraction assumption. Pre-delivery would have less impacts on the Chino Basin.

[2]Model Run #1 included recharge basins for the following reasons, 1) provide insight on the effectiveness of utilizing the recharge basins, 2) determine if the location of the basins was conducive to a corresponding TAKE, and 3) a preference to utilize existing facilities to reduce cost. The use of recharge basins in the CBP was not considered after Model Run 1 primarily because the capacity of the recharge basins to accept CBP water through the storm season was not feasible without modifying the existing operations at the recharge facilities, the CBP water recharged at the recharge basins takes too long to reach the extraction facilities due to the thick vadose zone in MZ-2, and the proximity to the extraction well field exceeded the sustainability constraints in the MZ-2 well fields.

[3]Injection wells assumed in two east-west alignments on the Pacific Electric Inland Empire Trail and Foothill Boulevard (initial alignments).

[4]Injection wells assumed in two east-west alignments on Foothill Boulevard and Arrow Route (refined alignments).

Section 3: PUT Alternatives

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. Each PUT alternative includes the following components:

- Tertiary recycled water supply,
- Tertiary recycled water conveyance,
- Advanced water purification,
- Purified water pumping and conveyance, and
- Groundwater recharge with injection wells.

The PUT alternatives were developed based on the assumptions presented in TM1 Section 4 PUT Components and TM1 Section 6 Conveyance Approach. The components were refined during the alternatives development process based on the initial groundwater modeling that was completed using the Chino Basin Groundwater Model (TM2 Section 2:) to optimize the injection and extraction well locations to minimize infrastructure costs.

This section includes PUT alternative development details, an overview and detailed description of each alternative, as well as the evaluation of the PUT alternatives and recommendation of which PUT alternatives to carry forward into the program alternatives.

3.1 PUT Alternatives Development Approach and Overview

PUT alternatives were identified to compare the tradeoffs between the locations for recharging the purified water and the AWPFs. These tradeoffs are as follows:

- **Recharge approaches:** The PUT alternatives were developed assuming injection wells to recharge the purified water into the Chino Basin. The recharge approaches were developed in alignment with the Storage Framework Investigation (WEI, October 2018), which included managed storage and recovery programs. For these storage and recovery programs, active storage and recovery (ASR) wells were assumed in the northern MZ-2 area. Therefore, the PUT alternatives were developed assuming the majority of the purified water would be recharged into MZ-2. Additionally, some purified water was also assumed to be recharged into MZ-1 or MZ-3. These areas are not preferred for large storage and recovery activities due to subsidence and pumping sustainability concerns, respectively.
- **AWPF locations**: As presented in TM1 Section 4.2, RP-1 and RP-4 were identified as the two potential locations for the main AWPF. These locations have tradeoffs in terms of conveying purified recycled water to the primary recharge location in MZ-2 (i.e., RP-4 is closer to the MZ-2 recharge location, but an AWPF at RP-1 may require fewer additional processes since RP-1 will be expanded with an MBR). These AWPF locations are paired up with the potential recharge locations to create the PUT alternatives. For PUT alternatives that include recharge in MZ-1, a small AWPF at Monte Vista Water District (MVWD) Plant 28 is included to create the purified water closer to the recharge location and minimize pipeline needs.

Six PUT alternatives were developed to compare the proposed recharge locations and the AWPF locations. The PUT alternatives were developed with the primary AWPF at either RP-1 (Alternatives 1 through 3) or RP-4 (Alternatives 4 through 6). These two groups of alternatives were then distinguished by how the purified water is recharged to the Chino Basin as summarized below and in Table 3-1:

- **Alternatives 1 and 4:** 12.0 TAFY of purified water would be recharged into MZ-2 and 3.0 TAFY would be recharged into MZ-3 supplied from a single AWPF at RP-1 or RP-4, respectively.
- **Alternatives 2 and 5:** All 15.0 TAFY of the purified water would be recharged into MZ-2 supplied from a single AWPF at RP-1 or RP-4, respectively.
- **Alternatives 3 and 6:** 12.0 TAFY of purified water would be recharged into MZ-2 and 3.0 TAFY would be recharged into MZ-1. The purified water would be provided by two AWPFs: a larger AWPF at either RP-1 or RP-4, respectively, and a smaller, satellite AWPF at the MVWD Plant 28 site.

Table 3-1. PUT Alternatives Summary									
PUT Alternatives		AWPF (s)				Recharge			
		AWPF Location/Production Capacity (TAFY)				MZ Recharge Location/Quantities (TAFY)			
		RP-1	RP-4	MVWD	Total	MZ-1	MZ-2	MZ-3	Total
AWPF at RP-1	PUT-1	15.0	-	-	15.0	-	12.0	3.0	15.0
	PUT-2	15.0	-	-	15.0	-	15.0	-	15.0
	PUT-3	12.0	-	3.0	15.0	3.0	12.0	-	15.0
AWPF at RP-4	PUT-4	-	15.0	-	15.0	-	12.0	3.0	15.0
	PUT-5	-	15.0	-	15.0	-	15.0	-	15.0
	PUT-6	-	12.0	3.0	15.0	3.0	12.0	-	15.0

3.2 PUT Components

PUT Alternatives 1 through 6 were then developed using the PUT components. These components build upon the assumptions included in TM1 and include the following:

- Tertiary recycled water,
- AWPF,
- Purified water conveyance, and
- Groundwater recharge with injection wells.

3.2.1 Tertiary Recycled Water

Tertiary recycled water is the source water for the program. As discussed in TM1 Section 4.1, additional tertiary recycled water supplies have been identified to supplement IEUA's recycled water system and create the AWPF supply. The tertiary recycled water supplies are included in each PUT alternative and include water from Jurupa Community Services District (JCSD) through its recycled water from Western Riverside County Regional Wastewater Authority (WRCRWA) Treatment Plant and the City of Rialto.

In addition, IEUA's recycled water system operations must be adjusted to incorporate these external supplies into the system and to supply tertiary recycled water to the new AWPF as well as existing and future tertiary recycled water customers and groundwater replenishment. The system operation and associated recycled water pumping was evaluated for both AWPF locations (RP-1 or RP-4), and the pumping costs were incorporated into the PUT alternatives evaluation.

These two new recycled water supplies and the evaluation of IEUA's tertiary recycled water system operations are discussed in this section.

3.2.1.1 WRCRWA Supply

JCSD is in discussions to provide up to 5.0 TAFY of recycled water to the CBP from WRCRWA Treatment Plant. The elements associated with moving recycled water supply from WRCRWA to IEUA's recycled water system are as follows:

- Usage: WRCRWA would provide recycled water to support the CBP in two ways:
  - Six months of the year WRCRWA would provide recycled water to the IEUA recycled water system for the CBP AWPF for purification and groundwater recharge.

  - The other six months of the year WRCRWA would provide recycled water to the Santa Ana River, helping IEUA meet its discharge obligation.
- Tie-in Location: Recycled water from WRCRWA would be pumped into the IEUA 930 pressure zone.
- Pump Station: A 7.2 million gallons per day (mgd) pump station would be constructed at the WRCRWA Treatment Plant to deliver the additional flow to IEUA's system.
  - 4.5 mgd would be pumped into the IEUA 930 pressure zone.
  - A maximum flow of 2.7 mgd would be pumped into JCSD's recycled water system to deliver JCSD 1.0 TAFY.
  - The pump station would be designed to be expanded in the future from 7.2 mgd to 10.7 mgd.
- Pipelines: There are two pipelines associated with WRCRWA recycled water supply:
  - A 24-inch diameter pipe extending 16,300 linear feet from the WRCWRA Treatment Plant to the American Heroes Park. Note that this segment of pipeline would be designed for the future flow of 10.7 mgd.
  - A 24-inch diameter pipeline extending 10,000 linear feet from American Heroes Park to the IEUA 930 pressure zone.

3.2.1.2 City of Rialto Supply

The City of Rialto has committed to providing 3.5 TAFY of recycled water from the Rialto Wastewater Treatment Plant (WWTP) to the CBP. Recycled water will only be available to the CBP for six months of the year from May through October. The elements associated with moving the supply from Rialto Water Services to IEUA's recycled water system are as follows:

- Tie-in Location: Recycled water from the Rialto WWTP would enter the IEUA recycled water system at RP-4.
- Pump Station: A proposed pump station would be located at the Rialto WWTP to convey 3.5 TAFY to IEUA's recycled water system. The pump station would be designed to be expanded from 6.3 mgd to 11 mgd.
- Pipelines: A 24-inch diameter pipeline extending approximately 58,700 linear feet from the Rialto WWTP to the IEUA recycled water system (note: includes additional capacity for potential, future increase in supply availability).

3.2.1.3 IEUA's Existing Recycled Water System

As described in TM1 Section 4 PUT Components, IEUA's recycled water hydraulic model was used to evaluate the PUT Alternatives. A goal of the modeling was to maintain the tertiary recycled water system's operations and continue to meet existing demands, including groundwater recharge, with the implementation of the CBP. This requires the transfer of recycled water from the southern portion of the IEUA system north to the recharge basins, resulting in additional energy costs to convey the tertiary recycled water.

The hydraulic model was used to evaluate the difference in recycled water pumping costs when the AWPF is located at RP-1 and when it is located at RP-4. Three scenarios were used in the recycled water pumping analysis, including a baseline 2026 scenario with no CBP, a 2026 CBP scenario with the AWPF at RP-1, and a 2026 CBP scenario with the AWPF at RP-4. Because the recycled water system demands change seasonally and Rialto supplemental supply will only be available from May to October, four seasonal supply and demand alternatives were used to model annual energy consumption in the recycled water system: (1) Summer, (2) Fall/ Spring with Rialto, (3) Fall/ Spring without Rialto, and (4) Winter.

Each of the three scenarios (2026 baseline, AWPF at RP-1 and AWPF at RP-4) were run under each of the four seasonal supply and demand alternatives. Table 3-2 includes the modeled supplies and demands for each modeled scenario. Assumptions were required to distribute the demands appropriately, listed below:

1. Supplies and demands were developed for year 2026 using monthly demand factors based on the supply and demand distribution in Fiscal Year (FY) 2016-17 (the time period last used to calibrate the hydraulic model) with adjustments to reduce the need for seasonal storage.
2. The use of groundwater recharge (GWR) basins in the summer scenarios was based on GWR basins used during the calibration scenario in the hydraulic model (August 2016), with additional GWR demand distributed to Turner Basin after other basins met their maximum GWR flowrate.
3. GWR Basins in the fall/ spring and winter scenarios were based on projected recycled water recharge in year 2026 by basin as listed in the 2018 Storage Framework Investigation.
4. In summer conditions, Prado Discharges would occur at Discharge Point (DP) 002 to meet minimum discharge flows at RP-1. In the winter scenarios, Prado discharges were distributed based on historical discharge between the four discharge points.
5. Prado discharge demands (DP 001, 002, 003, and 004) are assumed to occur on the discharge side of pump stations and meeting these demands would contribute to energy consumption in the system.

The WRCRWA pump station was modeled with similar operations in the summer and winter scenarios. However, WRCRWA flows may be discharged to the Santa Ana River to meet Prado obligations at WRCRWA in the winter. This strategy would require less energy than pumping the recycled water up to the IEUA system and then discharging it to Prado.

Table 3-2. Recycled Water Energy Analysis Scenarios

		Recycled Water Supplies, MGD				Recycled Water Demands, MGD																			
						Groundwater Reuse																			
						Basins										Total GWR	Direct Use	Prado Discharge				Total Prado Discharge	AWPF		Total Demands
	Scenarios	IEUA	WRCWRA	Rialto	Total Supplies	7th & 8th St	Banana	Brooks	Declez	Ely	Hickory	RP-3	San Sevaine	Turner	Victoria			DP 001	DP 002	DP 003	DP 004		RP-1	RP-4	
Summer (August)	Baseline Scenario (2026)	57.9	0	0	**57.9**	0	1.4	0	0	3.1	4.9	0	0	1.4	0	**10.8**	**40.3**	0	0.5	0	0	**0.5**	**0.0**	**0.0**	**51.6**
	AWPF at RP-1	57.9	4.5	6.3	**68.7**	0	1.4	0	0	3.1	4.9	0	0	1.4	0	**10.8**	**40.3**	0	0.5	0	0	**0.5**	**15.2**	**0.0**	**66.8**
	AWPF at RP-4	57.9	4.5	6.3	**68.7**	0	1.4	0	0	3.1	4.9	0	0	1.4	0	**10.8**	**40.3**	0	0.5	0	0	**0.5**	**0.0**	**15.2**	**66.8**
Fall/Spring (with Rialto)	Baseline Scenario (2026)	53.3	0	0	**53.3**	2.0	1.4	2.7	1.7	1.5	2.2	5.9	1.1	1.5	2.1	**22.1**	**24.8**	0	0.5	0	0	**0.5**	**0.0**	**0.0**	**47.4**
	AWPF at RP-1	53.3	4.5	6.3	**64.1**	2.0	1.4	2.7	1.7	1.5	2.2	5.9	1.1	1.5	2.1	**22.1**	**24.8**	0	0.5	0	0	**0.5**	**15.2**	**0.0**	**62.6**
	AWPF at RP-4	53.3	4.5	6.3	**64.1**	2.0	1.4	2.7	1.7	1.5	2.2	5.9	1.1	1.5	2.1	**22.1**	**24.8**	0	0.5	0	0	**0.5**	**0.0**	**15.2**	**62.6**
Fall/Spring (without	Baseline Scenario (2026)	54.3	0	0	**54.3**	1.8	1.3	2.5	1.5	1.4	2.0	5.4	1.0	1.4	1.9	**20.2**	**14.4**	0	2.4	2.7	2.8	**7.9**	**0.0**	**0.0**	**42.5**
	AWPF at RP-1	54.3	4.5	0	**58.8**	1.8	1.3	2.5	1.5	1.4	2.0	5.4	1.0	1.4	1.9	**20.2**	**14.4**	0	2.4	2.7	2.8	**7.9**	**15.2**	**0.0**	**57.7**
	AWPF at RP-4	54.3	4.5	0	**58.8**	1.8	1.3	2.5	1.5	1.4	2.0	5.4	1.0	1.4	1.9	**20.2**	**14.4**	0	2.4	2.7	2.8	**7.9**	**0.0**	**15.2**	**57.7**
Winter (January)	Baseline Scenario (2026)	62.7	0	0	**62.7**	0.5	0.3	0.7	0.4	0.4	0.5	1.5	0.3	0.4	0.5	**5.4**	**5.5**	1.4	13.1	2.5	3.7	**20.7**	**0.0**	**0.0**	**31.6**
	AWPF at RP-1	62.7	4.5	0	**67.2**	0.5	0.3	0.7	0.4	0.4	0.5	1.5	0.3	0.4	0.5	**5.4**	**5.5**	1.4	13.1	2.5	3.7	**20.7**	**15.2**	**0.0**	**46.8**
	AWPF at RP-4	62.7	4.5	0	**67.2**	0.5	0.3	0.7	0.4	0.4	0.5	1.5	0.3	0.4	0.5	**5.4**	**5.5**	1.4	13.1	2.5	3.7	**20.7**	**0.0**	**15.2**	**46.8**

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The model was run for a 24-hour period under each scenario and the pump station information, including the individual pump flowrate, total dynamic head (TDH), and run time over the 24-hour period, was extracted from the model. Each pump station is comprised of two to seven individual pumps, and the total pump station energy was calculated using the information from each individual pump. The data extracted from the model was used to calculate the estimated energy consumption in kilowatt hours (kWh) and costs for the 24-hour model run with an assumed total pump efficiency of 70 percent and an energy rate of $0.16 per kWh. This analysis was based on a constant cost for electricity and did not incorporate time-of-use energy rates.

Since the energy consumption and costs were developed for a 24-hour period for each season, annual energy consumption and costs were calculated by multiplying the daily rates by 91.25 days. This assumes the daily costs in the 24-hour model scenario are representative of the entire season. The model scenarios are considered to be a conservative estimate of conditions since they use the maximum day demands for the summer scenario and the peak groundwater recharge months for the spring and fall scenarios. Therefore, the estimated annual energy consumption and costs, listed in Table 3-3, are therefore considered to be conservative estimates. For comparative purposes, the actual recycled water system energy consumption in 2013/2014 was 19,517,000 kWh, compared to an estimated 28,161,000 kWh in 2026 for the baseline scenario. Since energy costs and pumping requirements are expected to increase between now and 2026, this conservative estimate was considered reasonable. It is also worth noting that CBP scenarios would always have higher energy use than the baseline scenario because they include the addition of new WRCRWA and Rialto pump stations.

Table 3-3. Estimated Annual Recycled Water System Energy Consumption and Costs

Seasonal Scenario	Energy Consumption, kWh			Energy Costs		
	Baseline Scenario (2026)	AWPF at RP-1	AWPF at RP-4	Baseline Scenario (2026)	AWPF at RP-1	AWPF at RP-4
Summer (3 months)	7,930,000	8,678,000	10,996,000	$1,268,000	$1,387,000	$1,761,000
Fall/Spring with Rialto (3 months)	8,596,000	9,326,000	11,762,000	$1,378,000	$1,497,000	$1,889,000
Fall/Spring without Rialto (3 months)	7,063,000	8,057,000	10,074,000	$1,132,000	$1,296,000	$1,624,000
Winter (3 months)	4,572,000	5,055,000	7,318,000	$739,000	$812,000	$1,168,000
Total Annual Pumping Consumption & Costs	**28,161,000**	**31,116,000**	**40,150,000**	**$4,517,000**	**$4,992,000**	**$6,442,000**

Notes:

[1]Energy consumption assumes all pumps operate at 70% efficiency

[2]Energy costs based on a constant rate of $0.16/kWh

3.2.2 AWPF

The AWPF assumptions for the PUT alternatives are discussed in TM1 Section 4.2. The PUT alternatives are based on locating the 15.0-TAFY AWPF at either RP-1 or RP-4. Two alternatives also consider a smaller 3.0-TAFY AWPF in MZ-1 at the MWVD Plant 28 site combined with a larger 12.0-TAFY AWPF at either RP-1 or RP-4.

Different purification processes are assumed for the AWPF locations based on IEUA's Capital Improvement Program (CIP) to upgrade the existing treatment Plants. IEUA is planning to upgrade the RP-1 secondary process to a membrane bioreactor (MBR) within the timeframe of this program with the MBR anticipated to be online by 2030. RP-4 is also planned to be upgraded to an MBR in the future but is anticipated to have the existing conventional secondary treatment through 2040. The smaller AWPF at the MVWD Plant 28 site would be supplied with tertiary recycled water from the IEUA recycled water system. Therefore, the assumed treatment processes are as follows:

- RP-1: MBR, reverse osmosis (RO), and an ultraviolet (UV) advanced oxidation process (AOP) (MBR-RO-AOP); and,
- RP-4 and MVWD Plant 28: membrane filtration (MF), RO, and UV-AOP (MF-RO-AOP).

This section describes the preliminary sizing and AWPF layouts for RP-1, RP-4, and MVWD Plant 28 that were used as the basis for the PUT alternatives.

Each AWPF includes brine disposal to the Non-Reclaimable Wastewater System (NRWS), which runs near each of the AWPF locations.

3.2.2.1 AWPF at RP-1

If the AWPF is located at RP-1, then the treatment process would be MBR-RO-AOP. The sizing assumptions for the 15.0-TAFY AWPF at RP-1 are summarized in Table 3-4.

Table 3-4. Sizing Assumptions for 15.0-TAFY AWPF at RP-1

Process or Facility	Description	Units	Value[1]
Equalization	Equalization Lagoon[2]	MG	2.5
MBR	MBR system required production for AWPF	mgd	14.4
	Number of available 10 MBR trains needed to supply the AWPF	No.	4
RO System	RO system production capacity	mgd	14.1
	RO feed tank	gal	105,000
	RO feed pumps	No.	4 + 1
	Capacity, per pump	gpm	2,640
	Cartridge filters	No.	4 + 1
	Capacity, per cartridge filter	gpm	2,640
	RO trains	No.	4 + 1
	Permeate, per train	gpm	2,450
	RO interstage booster pumps	No.	1 Per Train
	Capacity, per pump	gpm	650
	RO flush tank	gal	18,900
	RO flush pumps	No.	1 + 1
	Capacity, per pump	gpm	900

Table 3-4. Sizing Assumptions for 15.0-TAFY AWPF at RP-1			
Process or Facility	**Description**	**Units**	**Value[1]**
UV-AOP System	UV-AOP system production capacity	mgd	14.10
	UV reactors	No.	2 + 1
	Flow, per reactor	gpm	4,900
Chemical Facilities	Sulfuric acid tank	No.	2
	Tank volume	gal	11,900
	Sodium hypochlorite tank	No.	2
	Tank volume	gal	13,100
	Caustic soda totes	No.	2
	Tote volume	gal	300
	Ammonium sulfate tank	No.	1
	Tank volume	gal	13,500
	Antiscalant tank	No.	1
	Tank volume	gal	6,100
	Hydrogen peroxide tank	No.	1
	Tank volume	gal	7,300
	Sodium bisulfite tote	No.	2
	Tote volume	gal	300
Post Treatment	Lime system	No.	2 + 0
	Decarbonator system	No.	2 + 0
CIP Systems	MF CIP system tanks	No.	2
	RO CIP system tanks	No.	2
	RO CIP cartridge filter	No.	1

Notes:

[1]Equipment quantities are shown in the format of duty + standby, i.e., MF feed pumps are 3 + 1, or 3 duty + 1 standby.

[2]It is assumed that one of the existing RP-1 lagoons can be modified to be used for equalization upstream of the AWPF.

The MBR is assumed as pretreatment for the RO system since RP-1 is planned to be upgraded to an MBR within the timeframe of the CBP. But, since the CBP is proposed to be online by 2026 and the MBR is proposed to be in service around 2030, the MBR at RP-1 would need to be constructed sooner than originally anticipated. Therefore, the PUT alternatives that include the AWPF at RP-1 (PUT-1, PUT-2, and PUT-3) assumed that the MBR capital cost would partially be funded by the CBP. The RP-1 MBR preliminary design was completed as part of the RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report (Carollo, April 2019) and is based on ten MBR trains to achieve 40-mgd capacity at RP-1. Four MBR trains are needed to supply 14.4 mgd of MBR filtrate to the RO treatment and that proportion of costs are included in the RP-1 AWPF costs. To maintain the overall RP-1 secondary treatment capacity of 40 mgd and avoid complications associated with phasing the MBR system, it is recommended that the entire MBR be constructed early instead of building a portion for the AWPF by 2026 and the rest of the system by 2030. It is assumed that the remainder of the MBR cost would be funded by IEUA's CIP.

The location of the AWPF at RP-1 would be on the southwestern corner of the site in place of the existing solar panels and the MBR in the southeast corner as proposed in the RP-1 Liquids & Solids Capacity Recovery Preliminary Design Report (Carollo, April 2019). Note that IEUA's solar contract ends in June 2029; if RP-1 was selected as the AWPF location, then IEUA would need to partner with the solar provider to discuss solutions. Costs associated with modifying the solar contract are not included in the AWPF costs.

Figure 3-1 shows the location of the 15.0-TAFY AWPF with the MBR. Figure 3-2 shows more detail of the RO and UV-AOP processes at the AWPF and the four MBR trains and their supporting facilities. For PUT-3, which combines a 12.0-TAFY AWPF at RP-1 with a 3.0-TAFY AWPF at MWVD Plant 28, the AWPF at RP-1 would be slightly smaller than the AWPF shown in Figure 3-1 and Figure 3-2.

Figure 3-1. RP-1 Site Layout with MBR

Figure 3-2. RP-1 AWPF and MBR Site Layout

3.2.2.2 AWPF at RP-4

If the AWPF is located at RP-4, then the treatment process would be MF-RO-AOP. The sizing assumptions for the 15.0-TAFY AWPF at RP-4 are summarized in Table 3-5.

Table 3-5. Sizing Assumptions for 15.0-TAFY AWPF at RP-4			
Process or Facility	**Description**	**Units**	**Value[1]**
Equalization	Equalization Tank	MG	1.2[2]
MF System	MF system production capacity	MGD	15.1
	MF feed pumps	No.	3 + 1
	Capacity, per pump	gpm	4,700
	MF strainers	No.	3 + 1
	Capacity, per strainer	gpm	4,700
	MF trains	No.	7 + 2
	Filtrate flow, per train	gpm	1,500
	MF backwash pumps	No.	1 + 1
	Capacity, per pump	gpm	2,010

Table 3-5. Sizing Assumptions for 15.0-TAFY AWPF at RP-4			
Process or Facility	**Description**	**Units**	**Value[1]**
RO System	RO system production capacity	MGD	14.1
	RO feed tank	gal	105,000
	RO feed pumps	No.	4 + 1
	Capacity, per pump	gpm	2,640
	Cartridge filters	No.	4 + 1
	Capacity, per cartridge filter	gpm	2,640
	RO trains	No.	4 + 1
	Permeate, per train	gpm	2,450
	RO interstage booster pumps	No.	1 Per Train
	Capacity, per pump	gpm	650
	RO flush tank	gal	18,900
	RO flush pumps	No.	1 + 1
	Capacity, per pump	gpm	900
UV-AOP System	UV-AOP system production capacity	MGD	14.1
	UV reactors	No.	2 + 1
	Flow, per reactor	gpm	4,900
Chemical Facilities	Sulfuric acid tank	No.	2
	Tank volume	gal	11,900
	Sodium hypochlorite tank	No.	2
	Tank volume	gal	13,100
	Caustic soda totes	No.	2
	Tote volume	gal	300
	Ammonium sulfate tank	No.	1
	Tank volume	gal	13,500
	Antiscalant tank	No.	1
	Tank volume	gal	6,100
	Hydrogen peroxide tank	No.	1
	Tank volume	gal	7,300
	Sodium bisulfite tote	No.	2
	Tote volume	gal	300
Post Treatment	Lime system	No.	2 + 0
	Decarbonator system	No.	2 + 0

Table 3-5. Sizing Assumptions for 15.0-TAFY AWPF at RP-4			
Process or Facility	**Description**	**Units**	**Value[1]**
CIP Systems	MF CIP system tanks	No.	2
	RO CIP system tanks	No.	2
	RO CIP cartridge filter	No.	1

Notes:

[1]Equipment quantities are shown in the format of duty + standby, i.e., MF feed pumps are 3 + 1, or 3 duty + 1 standby.

[2]Size is limited by available space near existing chlorine contact basins. The size and location of the equalization tank will be evaluated in more detail during future phases of the project.

IEUA is planning to upgrade and expand the secondary treatment process at RP-4 to an MBR around year 2040. Since the AWPF would be online by 2026, a conceptual MBR layout was developed and coordinated with IEUA in conjunction with the AWPF layout to avoid conflicts between the future facilities. The future MBR system will require new fine screens ahead of the existing oxidation basins and the new MBR facilities downstream of the existing oxidation basins. In addition, IEUA needs to expand the primary clarifier capacity and is planning to construct a new clarifier in the future. The location of the 15.0-TAFY AWPF at RP-4 would be on the western portion of the site and the future primary clarifier and MBR facilities would be integrated into the existing RP-4 process areas.

The AWPF would be in the vicinity of the existing wind turbine located on the western side of the plant. The layout incorporates a conservative minimum setback of about 25 feet from the turning radius of the turbine blades to any structures, which will be confirmed during final design. Note that the chemical facilities are located within the 25-foot setback, but outside of the 74-foot turbine blade radius. A new road would be constructed on the western edge of the plant to facilitate chemical deliveries and provide vehicle access around the entire AWPF. An equalization tank to equalize flows prior to MF is proposed in the southwest corner of the plant.

The MBR and AWPF facilities will be evaluated in more detail as they are advanced from planning-level evaluations into design. Two items that will require further evaluation are the location of the fine screens and the size and location of the AWPF equalization/MF feed tank.

- For the MBR process, fine screens are required downstream of the existing primary clarifiers and upstream of the existing oxidation basins. Three location options are shown and the preferred location is Alternative 3 (shown in Figure 3-3 and Figure 3-4), which is in the location of the existing polymer and ferric chemical facilities. This location is preferred because it is adjacent to the primary effluent pipeline and would require the least amount of piping modifications to convey primary effluent to the new screens. The polymer and ferric facilities could be relocated further south to the area Alternative 2 for the fine screens.
- For planning purposes, the AWPF equalization/MF feed tank is assumed to be 1.2 million gallons and is shown in the southwest corner of the plant near the AWPF. If a larger equalization volume is needed once the detailed hydraulic calculations are completed, then another option could be to segment the existing basin for off-specification recycled water into two portions: one for off-specification recycled water and one for AWPF equalization. This alternative would require improvements to the diversion capability at the RP-4 headworks to divert wastewater to RP-1.

Figure 3-3 shows the location of the 15.0-TAFY AWPF and the future improvements at RP-4 (new primary clarifier, fine screen location alternatives, MBR facility, and relocated polymer and ferric facilities). Figure 3-4 shows more detail of the MF, RO, and UV-AOP processes at the AWPF as well as the influent equalization and chemical storage area. For the PUT alternative that combines a 12.0-TAFY AWPF at RP-4 with a 3.0-TAFY AWPF at MWVD Plant 28 would be slightly smaller than the AWPF shown in Figure 3-3 and Figure 3-4.

Figure 3-3. RP-4 Site Layout

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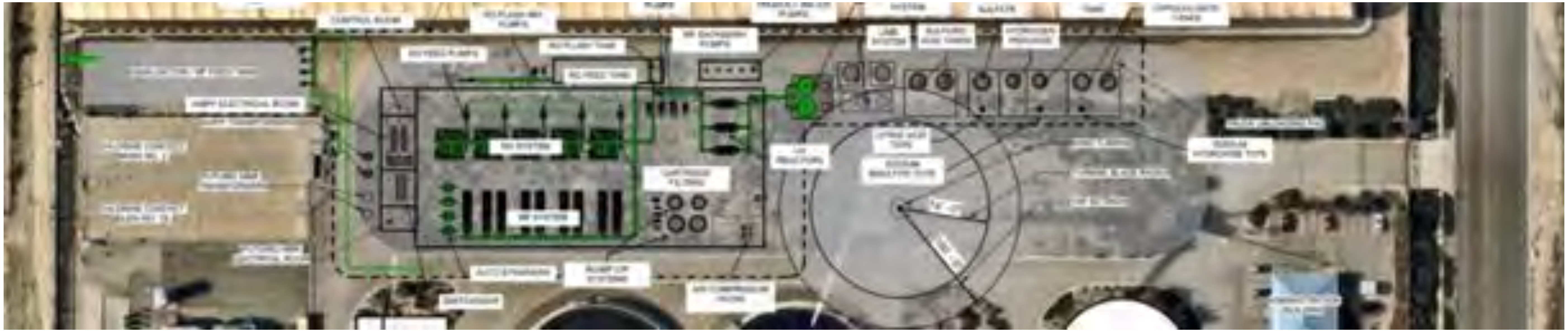

Figure 3-4. RP-4 AWPF Site Layout

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3.2.2.3 AWPF at MVWD Plant 28

MVWD's Plant 28 site was identified as a potential location for an AWPF in MZ-1 as part of the Feasibility Study of Recycled Water Interconnections Between the City of Pomona, Monte Vista Water District (MVWD), and IEUA (Carollo, January 2016). The CBP team confirmed with MVWD staff that the Plant 28 site may still be available as a suitable location for a satellite AWPF, provided any demolished facilities are replaced in kind. The cost to purchase new land for MVWD is included with the alternatives that include the AWPF at MVWD Plant 28.

The 3.0-TAFY AWPF was conceptually sized as part of the Feasibility Study of Recycled Water Interconnections Between the City of Pomona, MVWD, and IEUA (Carollo, January 2016) and the same sizing and layout was assumed for this evaluation. Figure 3-5 shows the layout of the 3.0-TAFY AWPF at MVWD Plant 28 with MF, RO, and UV AOP processes, and supporting facilities. PUT alternatives that include the AWPF at MVWD Plant 28 are coupled with a 12.0-TAFY AWPF at either RP-1 or RP-4.

Figure 3-5. AWPF at MWVD Site 28 (Carollo, January 2016)

3.2.3 Purified Water Conveyance

The PUT alternatives include purified water conveyance (pump stations and pipelines) to convey the purified water produced from AWPFs to recharge locations. The purified recycled water conveyance system would be dedicated to purified water to meet the regulatory requirements for injection wells recharging water into the Chino Basin. The design criteria for conveyance systems are presented in TM1 Section 6. As described in TM1 Section 6, all proposed conveyance pipelines would be aligned through the public Right-of-Way (ROW) and properties would be owned or acquired by IEUA to reduce the number of easements required for construction and maintenance. Pipe routings were developed with a focus on minimizing community impacts and avoiding major freeway and river crossings.

3.2.4 Groundwater Recharge with Injection Wells

The PUT alternatives assume that the purified water would be recharged to the Chino Basin using injection wells. As summarized in Section 3.1, the following recharge amounts are assumed in each groundwater management zone.

- MZ-1: 0 or 3.0 TAFY
- MZ-2: 12.0 TAFY (when combined with MZ-1 or MZ-3 recharge) or 15.0 TAFY (when only MZ-2 recharge)
- MZ-3: 0 or 3.0 TAFY

TM1 Section 4.3 presents the maximum assumed injection well capacities for each groundwater management zone based on production data for nearby groundwater extraction wells. For planning purposes, it is assumed that the capacity of an injection well is 50 percent of the extraction rate of nearby extraction wells. The injection well siting approach, and the injection well locations and quantities in each management zone are summarized in the following sections.

3.2.4.1 Injection Well Siting Criteria

The injection well fields must be located upgradient of the extraction well fields to allow for the TAKE portion of the program to occur without causing material physical injury (MPI) to the Chino Basin as defined by the Watermaster. The CBP built on the assumptions described in the Storage Framework Investigation (WEI, October 2018).

The main criteria used to determine injection well locations are listed below:

- Proximity to existing agency wells (production or injection) to reduce the possibility of hydraulic interference and to meet travel time requirements.
- Arrangement of the injection wells in clusters was considered to allow for less conveyance infrastructure and reduced monitoring costs.
- Access to public right-of-way, and alignment with member agency infrastructure planning.
- Site footprint to confirm sufficient available space to accommodate a concrete pad, wellhead, above-ground piping and appurtenances, signage, and safety features. The minimum area needed to construct an injection well is approximately 0.25 acres.
- The spacing between injection wells was set at a minimum of approximately 1,000 feet to prevent interference.

Injection well locations need to consider nearby groundwater extraction well locations to confirm that there is sufficient travel time between the injection well and groundwater extraction well to meet regulatory requirements. Under the Title 22 Regulations for Groundwater Replenishment Using Recycled Water, purified recycled water must have a minimum response retention time (i.e., minimum period of time recycled water is retained underground, or travel time) of at least two months as demonstrated with tracer study after construction (see TM1 Appendix A, Summary of Title 22 Regulations for Groundwater Replenishment Using Recycled Water). Also in accordance with the Title 22 regulations, numerical modeling is granted 50% credit of a tracer test and must demonstrate four months of travel time between injection and extraction wells. A minimum travel time of six months between the injection wells and extraction wells was assumed for the initial groundwater modeling to be conservative. Some of the preliminary injection well locations were adjusted based on the initial groundwater modeling results to provide sufficient travel time between the injection and extraction wells.

The injection well locations for MZ-1, MZ-2, and MZ-3 were identified using satellite images from Google Earth (completed in fall/winter 2019). The preliminary locations shown in each groundwater management zone are in open lots, large fields (e.g., large athletic fields associated with facilities such as schools and churches), large parking lots, and other similar areas. These locations are preliminary and assumed to be representative for injection well locations in the target recharge areas. Land ownership and availability have not been investigated for these representative locations. Land acquisition costs are assumed for each injection well (land acquisition cost assumptions are discussed in TM1 Section 7).The next phase of this program will include more extensive siting studies for injection wells for the selected PUT alternative.

The MZ-1, MZ-2, and MZ-3 injection well locations are discussed in the following sections.

3.2.4.2 MZ-1 Injection Wells

The injection wells in MZ-1 were assumed to be located near the Montclair Basins, which are north of the proposed AWPF at MVWD Plant 28.

The Montclair Basins were originally assumed as a potential recharge location for purified water as part of the Feasibility Study of Recycled Water Interconnections Between the City of Pomona, Monte Vista Water District (MVWD), and IEUA (Carollo, January 2016). Insufficient groundwater travel time was identified between the recharge basins and nearby extraction wells. Due to travel time issues and the need to prioritize stormwater recharge at these basins, injection wells are assumed for MZ-1.

Table 3-6 summarizes the MZ-1 injection wells assumed for the PUT alternatives. The number of injection wells was determined using the maximum capacity per well defined in TM1 Section 4.3.

Table 3-6. MZ-1 Injection Wells

Recharge Goal (TAFY)	Maximum Capacity per Injection Well (gpm)[1]	Conceptual Design	
		Number of Injection Wells	Capacity per Injection Well (gpm)
3.0	850	Duty = 3, Standby = 1 Total = 4	620

Note:

[1]From TM1 Section 4.3.

3.2.4.3 MZ-2 Injection Wells

The northern portion of MZ-2 was identified as the primary recharge location for purified water since it had been evaluated previously as part of the Storage Framework Investigation (WEI, October 2018). The northern portion of MZ-2is generally outside of known areas of contamination, and does not have subsidence constraints or significant pumping depressions. The Storage Framework Investigation also included managed storage and recovery programs within operational bands 2, 3, and 4. For these storage and recovery programs, ASR wells, which can be used for both injection and extraction, were assumed in the northern MZ-2 area in two east-west alignments in Rancho Cucamonga. ASR wells were not considered in the CBP because current regulations do not allow ASR wells to inject and extract purified recycled water.

For the PUT alternatives, two sets of potential injection well locations in MZ-2 were identified, which are as follows:

- Initially, potential injection well locations were identified in MZ-2 in Rancho Cucamonga in similar locations as assumed for the Storage Framework Investigation. One east-west alignment was assumed on the Pacific Electric Inland Empire Trail and one along Foothill Boulevard.
- In order to reduce the infrastructure required to convey the purified water from the AWPF to the injection wells, a second set of injection well locations were identified in MZ-2. These were located further south

than the initial set (closer to both RP-1 and RP-4) to reduce the overall purified water pipeline lengths. The east-west alignments of injection wells were assumed along Foothill Boulevard and Arrow Route in Rancho Cucamonga.

As described in Section 2:, preliminary groundwater modeling was completed for both sets of preliminary injection well locations and results indicate that both alternatives align with the OBMP objectives and the Storage Framework Investigation. The second set of injection wells (located on Foothill Boulevard and Arrow Route) are assumed for the PUT alternatives to reduce the overall infrastructure costs.

Table 3-7 summarizes the MZ-2 injection wells assumed for the PUT alternatives. The number of injection wells was determined using the maximum capacity per well defined in TM1 Section 4.3.

Table 3-7. MZ-2 Injection Wells

Recharge Goal (TAFY)	Maximum Capacity per Injection Well (gpm)[1]	Conceptual Design	
		Number of Injection Wells	Capacity per Injection Well (gpm)
12.0	830	Duty = 9, Standby = 3 Total = 12	830
15.0	830	Duty = 12, Standby = 4 Total = 16	775

Note:

[1]From TM1 Section 4.3.

3.2.4.4 MZ-3 Injection Wells

Injection well locations were identified in MZ-3 north of the JCSD well field. This area has experienced pumping sustainability challenges and injection wells were considered in this area to potentially improve groundwater levels, as well as support the program.

Table 3-8 summarizes the MZ-3 injection wells assumed for the PUT alternatives. The number of injection wells was determined using the maximum capacity per well defined in TM1 Section 4.3.

Table 3-8. MZ-3 Injection Wells

Recharge Goal (TAFY)	Maximum Capacity per Injection Well (gpm)[1]	Conceptual Design	
		Number of Injection Wells	Capacity per Injection Well (gpm)
3.0	1,130	Duty = 2, Standby = 1 Total = 3	930

3.3 PUT Alternatives Descriptions

PUT Alternatives 1 through 6 are described in the following sections. Section 3.3.7 includes a detailed facilities summary and cost summary (capital, O&M, and NPV costs) for the six alternatives.

3.3.1 PUT Alternative 1

PUT Alternative 1 (PUT-1) assumes that the AWPF is located at RP-1, where 15.0 TAFY of purified recycled water is produced and recharged into MZ-2 and MZ-3. The elements of PUT Alternative 1 are as follows:

- Recharge locations
  - MZ-2: The majority of the purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
  - MZ-3: A smaller portion of water would be recharged via injection wells in MZ-3.
- AWPF
  - The AWPF (MBR-RO-AOP) would be located at RP-1. The preliminary RP-1 AWPF layout is shown in Figure 3-2.
- Conveyance
  - Purified water would be pumped from the AWPF to the injection well sites in MZ-2 and MZ-3.
  - Brine from the AWPF would be pumped in to the NRWS pipeline which conveys non-reclaimable waste to the Los Angeles County Sanitation Districts (LACSD) for disposal.

PUT Alternative 1 is summarized in Table 3-9 and shown in Figure 3-6.

Table 3-9. PUT Alternative 1

Parameter	Description
Recharge Locations	MZ-2, MZ-3
AWPF	
Location	RP-1
Process	MBR/RO/UV-AOP
Capacity (TAFY)	15.0
Purified water conveyance	
Pipelines	16.2 miles (8-inch to 30-inch)
Pump station	
Location	RP-1
Size	2,600 HP
Number of injection wells	15 (11 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS
Pipeline	3,900 ft (8-inch)

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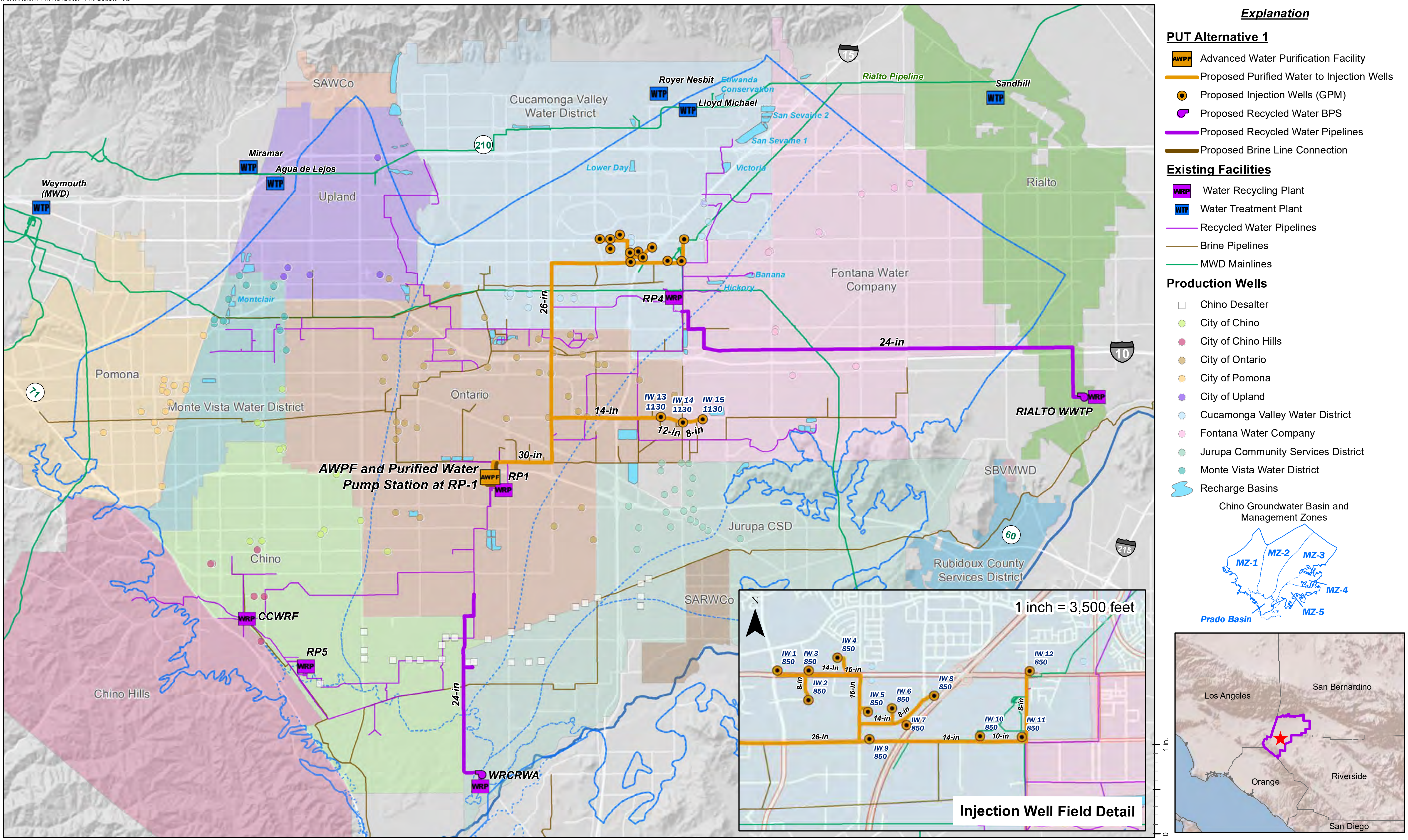

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

Date: 5/22/2020

File Name: CBP_PUTAlternative1

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1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 1

Figure 3-6

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3.3.2 PUT Alternative 2

PUT Alternative 2 (PUT-2) assumes that the AWPF is located at RP-1, where 15.0 TAFY of purified recycled water is produced and recharged into MZ-2. The elements of PUT Alternative 2 are as follows:

- Recharge location
  - MZ-2: All purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
- AWPF
  - The AWPF (MBR-RO-AOP) would be located at RP-1. The preliminary AWPF layout at RP-1 is shown in Figure 3-2.
- Conveyance
  - Purified water would be pumped from the AWPF to the injection well sites in MZ-2.
  - Brine from the AWPF would be pumped in to the NRWS pipeline and conveyed to LACSD for disposal.

PUT Alternative 2 is summarized in Table 3-10 and shown in Figure 3-7.

Table 3-10. PUT Alternative 2

Parameter	Description
Recharge Locations	MZ-2
AWPF	
Location	RP-1
Process	MBR/RO/UV-AOP
Capacity (TAFY)	15.0
Purified water conveyance	
Pipelines	14.1 miles (8-inch to 30-inch)
Pump station	
Location	RP-1
Size	2,700 HP
Number of injection wells	16 (12 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS
Pipeline	3,900 ft (8-inch)

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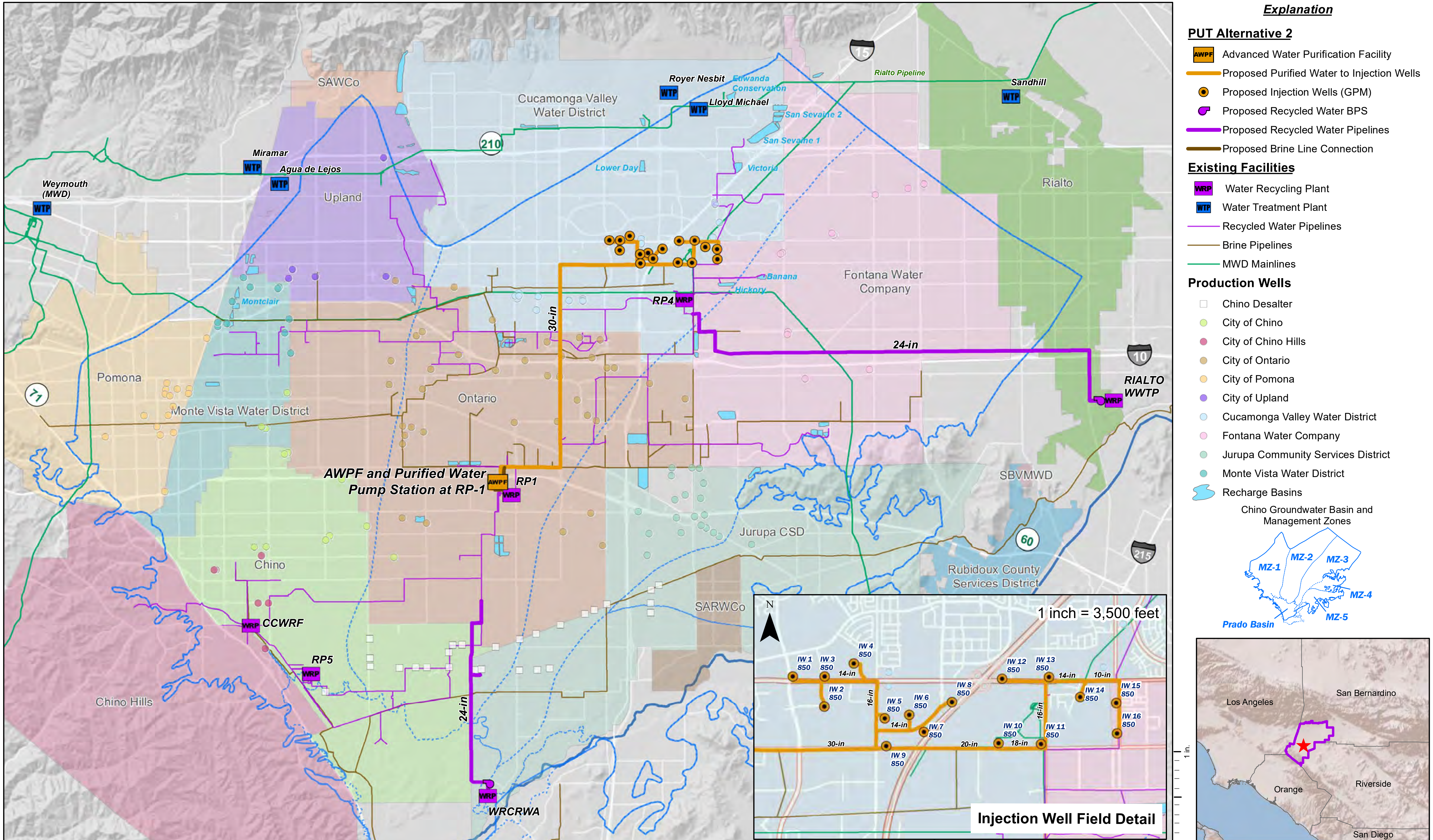

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Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

File Name: CBP_PUTAlternative2

Date: 5/22/2020

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0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 2

Figure 3-.

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3.3.3 PUT Alternative 3

PUT Alternative 3 (PUT-3) assumes that the AWPFs are located at RP-1 and MVWD's Plant 28, where 12.0 TAFY and 3.0 TAFY of purified water is produced, respectively, and recharged into MZ-2 and MZ-1. The elements of PUT Alternative 3 are as follows:

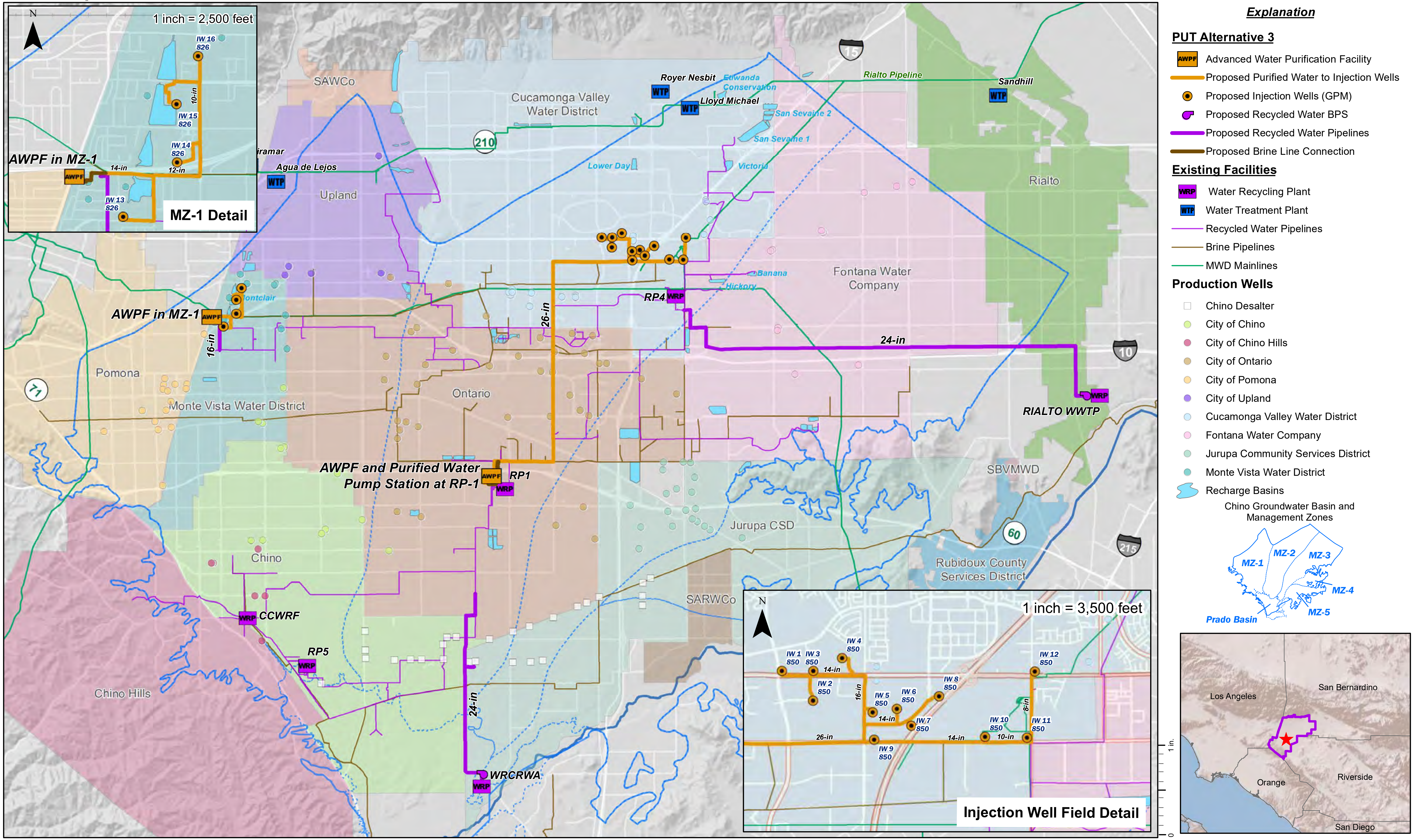
- Recharge locations
  - MZ-2: The majority of the purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
  - MZ-1: A smaller portion of water would be recharged via injection wells in MZ-1.
- AWPF
  - Two AWPFs would be developed for this alternative: the main AWPF (MBR-RO-AOP) at RP-1 and a smaller AWPF (MF-RO-AOP) at MVWD's Plant 28.
  - The preliminary AWPF layouts at RP-1 and Plant 28 are shown in Figure 3-2 and Figure 3-5, respectively.
- Conveyance
  - Purified water would be pumped from the RP-1 AWPF to the injection well sites in MZ-2, and from the MVWD Plant 28 AWPF to injection well sites in MZ-1.
  - Brine from the RP-1 AWPF would be pumped to the NRWS and brine from the MVWD Plant 28 AWPF would be pumped to the Etiwanda Wastewater Line (EWL); both the NRWS and EWL discharge into LACSD's system for disposal.

PUT Alternative 3 is summarized in Table 3-11 and shown in Figure 3-8.

Table 3-11. PUT Alternative 3

Parameter	Description
Recharge Locations	MZ-1, MZ-2
AWPF (MZ-1)	
Location	MVWD Plant 28
Process	MF/RO/UV-AOP
Capacity (TAFY)	3.0
AWPF (MZ-2)	
Location	RP-1
Process	MBR/RO/UV-AOP
Capacity (TAFY)	12.0
Purified water conveyance	
Pipelines	15.0 miles (8-inch to 26-inch)
Pump station	
Location	RP-1
Size	2,200 HP
Pump station	

Table 3-11. PUT Alternative 3	
Parameter	**Description**
Location	MVWD Plant 28
Size	150 HP
Number of injection wells	16 (12 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS (RP-1) EWL (Plant 28)
Pipeline	5,100 ft (4-inch to 8-inch)



Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

Date: 5/22/2020

File Name: CBP_PUTAlternative3

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 3

Figure 3-8

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3.3.4 PUT Alternative 4

PUT Alternative 4 (PUT-4) assumes that the AWPF is located at RP-4, where 15.0 TAFY of purified recycled water is produced and recharged into MZ-2 and MZ-3. The elements of PUT Alternative 4 are as follows:

- Recharge locations
  - MZ-2: The majority of the purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
  - MZ-3: A smaller portion of water would be recharged via injection wells in MZ-3.
- AWPF
  - The AWPF (MF-ROP-AOP) would be located at RP-4. The preliminary RP-4 AWPF layout is shown in Figure 3-4.
- Conveyance
  - Purified water would be pumped from the AWPF to the injection well sites in MZ-2 and MZ-3.
  - Brine from the AWPF would be pumped in to the NRWS pipeline and conveyed to LACSD for disposal.

PUT Alternative 4 is summarized in Table 3-12 and shown in Figure 3-9.

Table 3-12. PUT Alternative 4

Parameter	Description
Recharge Locations	MZ-2, MZ-3
AWPF	
Location	RP-4
Process	MF/RO/UV-AOP
Capacity (TAFY)	15.0
Purified water conveyance	
Pipelines	9.4 miles (8-inch to 26-inch)
Pump station	
Location	RP-4
Size	1,000 HP
Number of injection wells	15 (11 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS
Pipeline	1,400 ft (8-inch)

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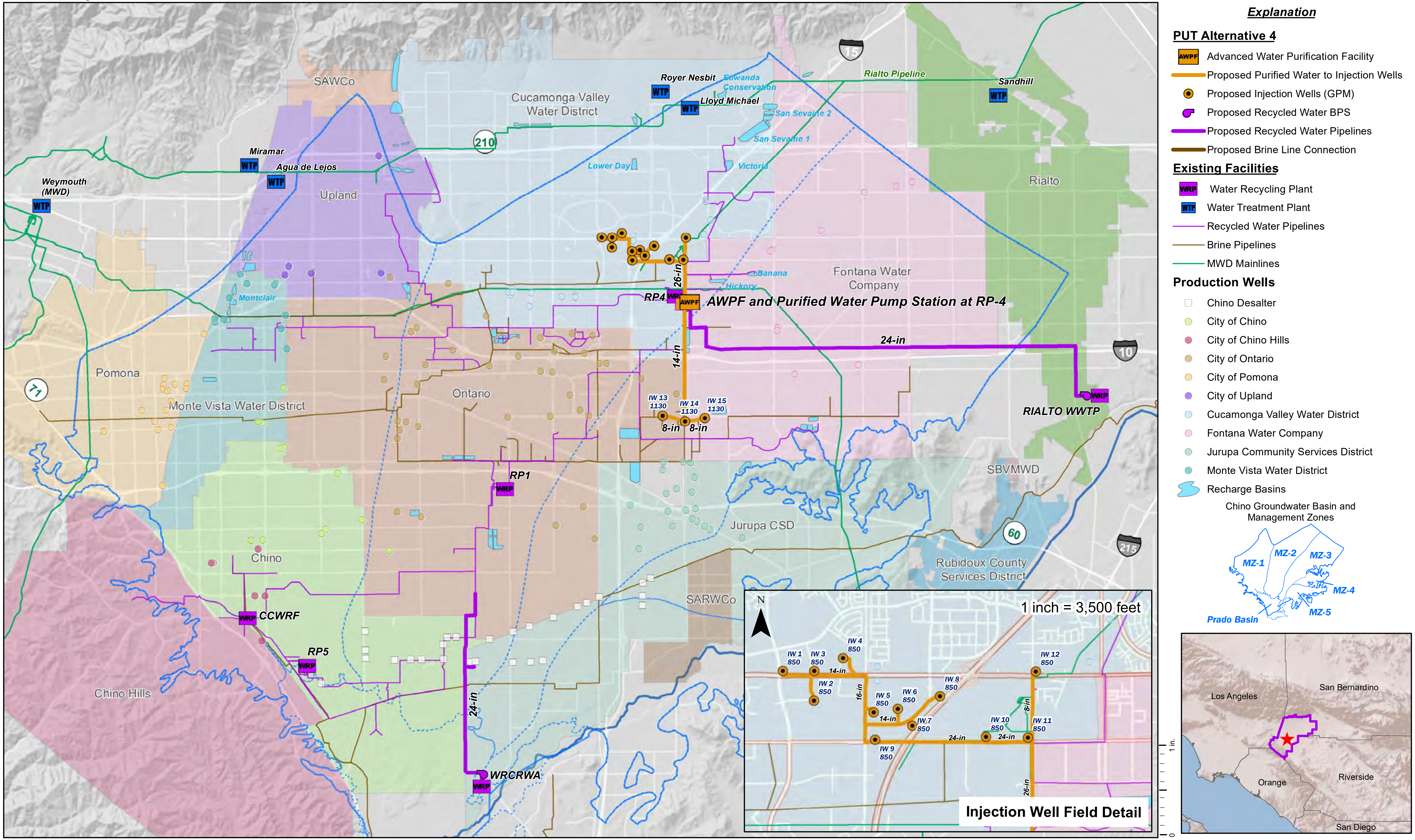

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

Date: 5/22/2020

File Name: CBP_PUTAlternative4

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 4

Figure 3-9

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3.3.5 PUT Alternative 5

PUT Alternative 5 (PUT-5) assumes that the AWPF is located at RP-4, where 15.0 TAFY of purified recycled water is produced and recharged into MZ-2. The elements of PUT Alternative 5 are as follows:

- Recharge location
  - MZ-2: All purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation .
- AWPF
  - The AWPF (MF-ROP-AOP) would be located at RP-4. The preliminary RP-4 AWPF layout is shown in Figure 3-4.
- Conveyance
  - Purified water would be pumped from the AWPF to the injection well sites in MZ-2.
  - Brine from the AWPF would be pumped in to the NRWS pipeline and conveyed to LACSD for disposal.

PUT Alternative 5 is summarized in Table 3-13 and shown in Figure 3-10.

Table 3-13. PUT Alternative 5

Parameter	Description
Recharge Locations	MZ-2
AWPF	
Location	RP-4
Process	MF/RO/UV-AOP
Capacity (TAFY)	15.0
Purified water conveyance	
Pipelines	7.1 miles (8-inch to 30-inch)
Pump station	
Location	RP-4
Size	1,500 HP
Number of injection wells	16 (12 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS
Pipeline	1,400 ft (8-inch)

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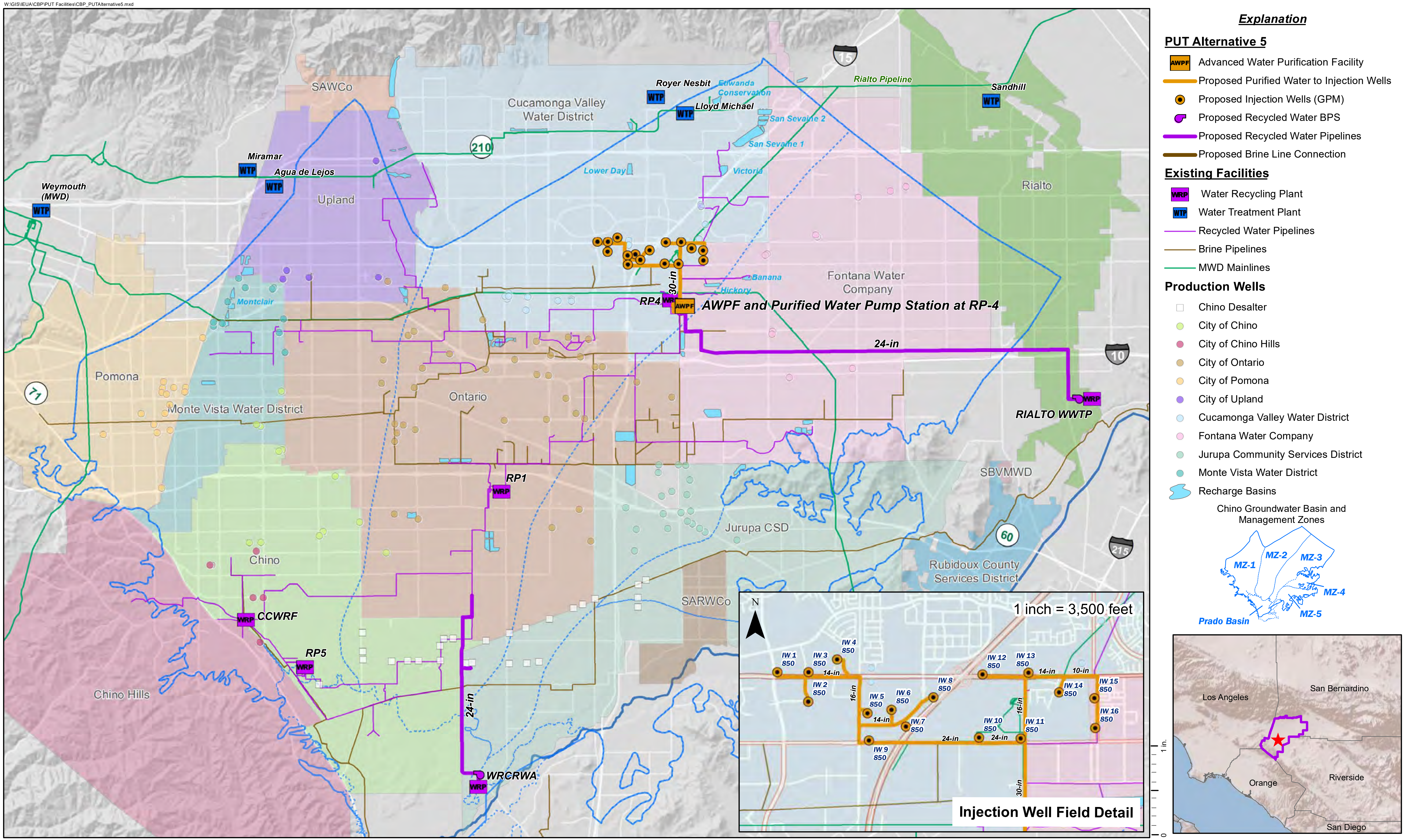

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

File Name: CBP_PUTAlternative5

Date: 5/22/2020

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 5

Figure 3-10

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3.3.6 PUT Alternative 6

PUT Alternative 6 (PUT-6) assumes that the AWPFs are located at RP-4 and MVWD's Plant 28, where 12.0 TAFY and 3.0 TAFY of purified water is produced, respectively, and recharged into MZ-2 and MZ-1. The elements of PUT Alternative 6 are as follows:

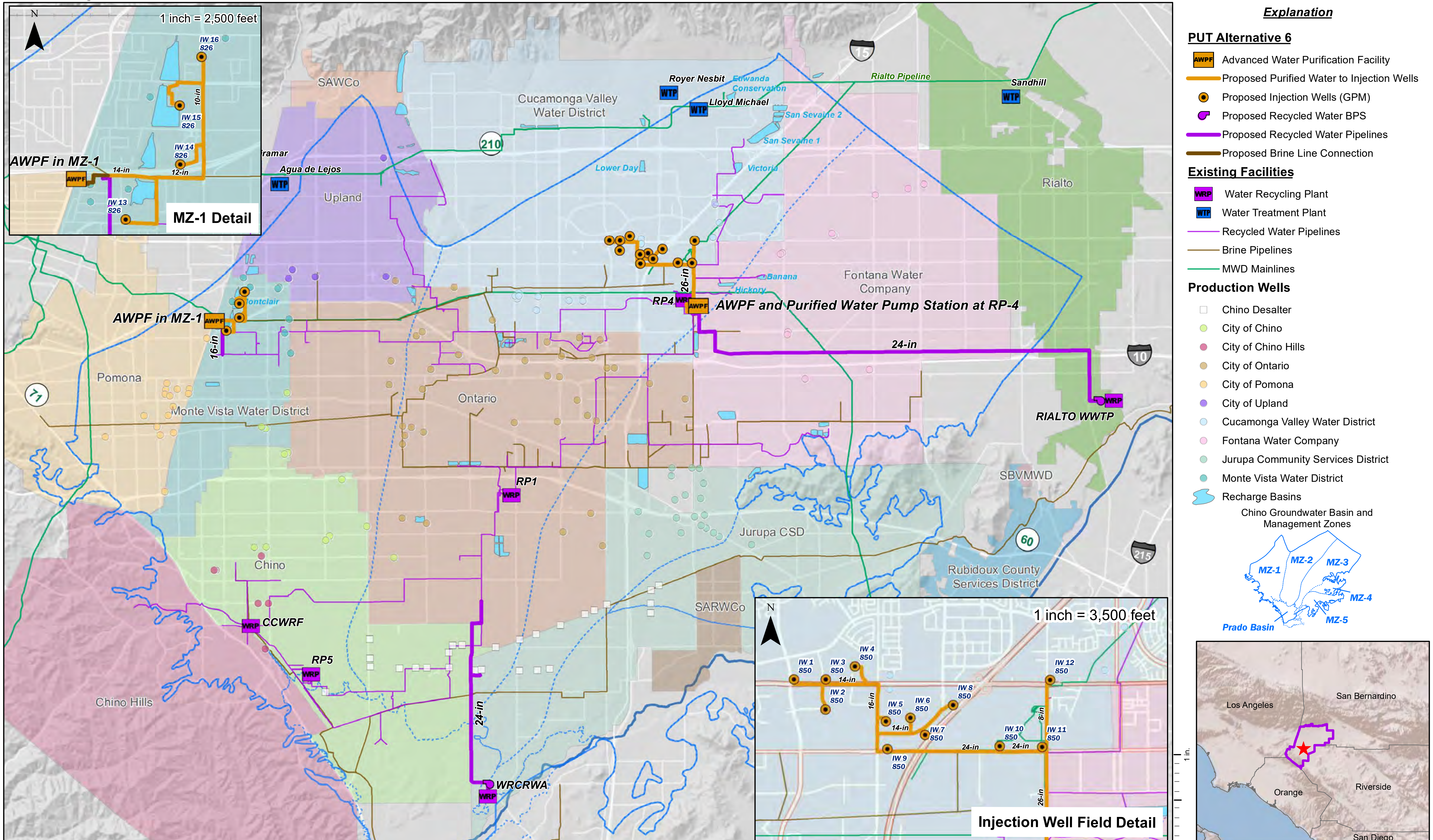
- Recharge locations
  - MZ-2: The majority of the purified water would be recharged via injection wells in MZ-2, which is consistent with the Storage Framework Investigation.
  - MZ-1: A smaller portion of water would be recharged via injection wells in MZ-1.
- AWPF
  - Two AWPFs would be developed for this alternative: the main AWPF (MF-RO-AOP) at RP-4 and a smaller AWPF (MF-RO-AOP) at MVWD's Plant 28.
  - The preliminary AWPF layouts at RP-4 and Plant 28 are shown in Figure 3-4 and Figure 3-5, respectively.
- Conveyance
  - Purified water would be pumped from the RP-4 AWPF to the injection well sites in MZ-2, and from the MVWD Plant 28 AWPF to injection well sites in MZ-1.
  - Brine from the RP-4 AWPF would be pumped to the NRWS and brine from the MVWD Plant 28 AWPF would be pumped to the EWL; both the NRWS and EWL discharge into LACSD's system for disposal.

PUT Alternative 6 is summarized in Table 3-14 and shown in Figure 3-11.

Table 3-14. PUT Alternative 6

Parameter	Description
Recharge Locations	MZ-1, MZ-2
AWPF (MZ-1)	
Location	MVWD Plant 28
Process	MF/RO/UV-AOP
Capacity (TAFY)	3.0
AWPF (MZ-2)	
Location	RP-4
Process	MF/RO/UV-AOP
Capacity (TAFY)	12.0
Purified water conveyance	
Pipelines	7.9 miles (8-inch to 26-inch)
Pump station	
Location	RP-4
Size	1,000 HP
Pump station	

Table 3-14. PUT Alternative 6	
Parameter	**Description**
Location	MVWD Plant 28
Size	150 HP
Number of injection wells	16 (12 duty, 4 standby)
Brine conveyance	
Disposal system	NRWS (RP-1) EWL (Plant 28)
Pipeline	2,200 ft (4-inch to 8-inch)



Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: HF

Date: 5/22/2020

File Name: CBP_PUTAlternative6

N

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. Diameters for purified water pipelines to injection wells not shown are 8 inch.
3. The proposed WRCRWA recycled water connection to the IEUA system includes a future direct use of 1,000 AFY by JCSD.

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PUT Alternative 6

Figure 3-11

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3.3.7 PUT Alternatives Summary and Costs

Major components of each PUT alternative are summarized in Table 3-15. This table includes the detailed assumptions for each PUT component for PUT Alternatives 1 through 6, including recycled water conveyance, AWPF(s), purified water conveyance, recharge approach, and brine conveyance.

The PUT alternatives conceptual capital cost estimates are summarized in Table 3-16 and O&M and NPV cost estimates are summarized in Table 3-17. The capital and O&M costs were developed for each major component using a unit cost basis, which is described in detail in TM 1 Section 7. The capital cost estimates are Class 5 estimates based on the AACE International Cost Estimate Classification System criteria, which corresponds to a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate are -20 to -50 percent on the low end and +30 to +100 on the high end. NPV costs were developed over a project life-cycle of 50 years using the economic analysis tool that is described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020).

The capital costs for the PUT alternatives range from a low of $306M (PUT-5) to a high $379M (PUT-3) (in 2019 dollars), the annual O&M costs range from a low of $10.9M/year (PUT-4) to a high of $14.7M/year (PUT-2), and the NPV costs range from $829M (PUT-4) to $1,064M (PUT-2). Following are observations of the estimated costs for the six PUT alternatives:

- The PUT alternatives that include the main AWPF at RP-1 (PUT-1, PUT-2, and PUT-3) are more expensive on capital, O&M, and NPV costs than the PUT alternatives that include the main AWPF at RP-4 (PUT-4, PUT-5, and PUT-6).
  - On a capital cost basis, the capital costs for PUT-1 to PUT-3 are $59-72M higher than PUT-4 to PUT-6: the capital costs for PUT-1 to PUT-3 range from $373M to $379M and PUT-4 to PUT-6 range from $306M to $320M. The higher capital costs for PUT-1 to PUT-3 are due to higher costs for the AWPF(s), pipelines, and pump stations.
  - On an O&M cost basis, the O&M costs for PUT-1 to PUT-3 are $2.5M/year to $3.6M/year higher than PUT-4 to PUT-6: the O&M costs for PUT-1 to PUT-3 range from $13.7M/year to $14.7M/year and PUT-4 to PUT-6 range from $10.9M/year to $11.4M/year. The higher O&M costs for PUT-1 to PUT-3 are due to the higher purified water pumping costs since RP-1 is further away from the injection wells than RP-4.
  - On an NPV basis, the NPV costs for PUT to PUT-3 are $161M to $222M higher than PUT-4 to PUT-6: the NPV costs for PUT-1 to PUT-3 range from $1,009M to $1,064M and PUT-4 to PUT-6 range from $829M to $855M.
- Within the RP-4 alternatives (i.e., PUT-4 to PUT-6), PUT-6 has the highest capital cost of the three alternatives, which is due to the higher costs for two AWPFs versus one AWPF in PUT-4 and PUT-5. PUT-6 has an estimated capital cost of $320M and PUT-4 and PUT-5 are $309M and $306M, respectively.
  - The same trend exists within the RP-1 alternatives (PUT-1 to PUT-3), but the cost differential between PUT-3 (the alternative with two AWPFs) is not as great when compared to PUT-1 and PUT-2, each with just one AWPF. PUT-3 has an estimated capital cost of $379M versus $373M and $378M for PUT-1 and PUT-2, respectively.

The costs for the PUT alternatives are incorporated into the alternatives evaluation, which is presented in the following section.

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Table 3-15. PUT Alternatives Summary

PUT Elements	Parameters	PUT Alternatives					
		1 AWPF at RP-1 Recharge in MZ2 and MZ3	2 AWPF at RP-1 Recharge in MZ2	3 AWPFs at RP-1 and in MZ1 Recharge in MZ1 and MZ2	4 AWPF at RP-4 Recharge in MZ2 and MZ3	5 AWPF at RP-4 Recharge in MZ2	6 AWPFs at RP-4 and in MZ1 Recharge in MZ1 and MZ2
Recycled Water Conveyance	Description	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •83,600 ft 16-inch •2,000 ft trenchless **•85,600 ft Total** **•16.2 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •83,600 ft 16-inch •2,000 ft trenchless **•85,600 ft Total** **•16.2 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •87,740 ft 16-inch •2,000 ft trenchless **•89,740 ft Total** **•17.0 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •83,600 ft 16-inch •2,000 ft trenchless **•85,600 ft Total** **•16.2 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •83,600 ft 16-inch •2,000 ft trenchless **•85,600 ft Total** **•16.2 miles Total**	*Pump Stations* •550 hP pump station near Rialto WWTP •400 hP pump station near WRCRWA •0.5 acres of land for each pump station *Pipelines* •87,740 ft 16-inch •2,000 ft trenchless **•89,740 ft Total** **•17.0 miles Total**
AWPF(s)	Description	*RP-1* •14.03-mgd AWPF (MBR/RO/UVAOP) (95.5% online factor) •Equalization: Modification of existing RP-1 lagoon *RP-4* •None *MZ1 at MVWD Plant 28 Site* •None	*RP-1* •14.03-mgd AWPF (MBR/RO/UVAOP) (95.5% online factor) •Equalization: Modification of existing RP-1 lagoon *RP-4* •None *MZ1 at MVWD Plant 28 Site* •None	*RP-1* •11.20-mgd AWPF (MBR/RO/UVAOP) (95.5% online factor) •Equalization: Modification of existing RP-1 lagoon *RP-4* •None *MZ1 at MVWD Plant 28 Site* •2.83-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 0.75-MG tank	*RP-1* •None *RP-4* •14.03-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 2.5-MG tank *MZ1 at MVWD Plant 28 Site* •None	*RP-1* •None *RP-4* •14.03-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 2.5-MG tank *MZ1 at MVWD Plant 28 Site* •None	*RP-1* •None *RP-4* •11.20-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 2.5-MG tank *MZ1 at MVWD Plant 28 Site* •2.83-mgd AWPF (MF/RO/UVAOP) (95.5% online factor) •Equalization: 0.75-MG tank
Purified Water Conveyance to Injection Wells & Recharge Basins	Description	*RP-1 AWPF Pump Station* •2,600 hP pump station *Pipelines* •8-inch:13,020 ft •10-inch: 2,234 ft •12-inch: 2,757 ft •14-inch: 20,304 ft •16-inch: 2,861 ft •20-inch: 720 ft •26-inch: 27,566 ft •30-inch: 16,065 ft •Trenchless: 11,170 ft **•Total: 85,527 ft** **•Total: 16.2 miles**	*RP-1 AWPF Pump Station* •2,700 hP pump station *Pipelines* •8-inch: 11,113 ft •10-inch: 2,757 ft •14-inch: 4,325 ft •16-inch: 5,411 ft •18-inch: 1,689 ft •20-inch: 5,517 ft •30-inch: 43,631 ft •Trenchless: 10,400 **•Total: 74,443 ft** **•Total 14.1 miles**	*RP-1 AWPF Pump Station* •2,200 hP pump station *Pipelines* •8-inch: 10,203 ft •10-inch: 2,234 ft •14-inch: 7,248 ft •16-inch: 2,861 ft •20-inch: 720 ft •26-inch: 43,620 ft •Trenchless: 9,950 ft **•Total: 66,886 ft** **•Total: 12.7 miles** *MVWD Plant 28 AWPF PS* •150 hP pump station at Plant 28 *Pipelines* •8-inch: 6,038 ft •10-inch: 1,741 ft •12-inch: 2,305 ft •14-inch: 2,199 ft •Trenchless: 1,180 **•Total: 12,283 ft** **•Total: 2.3 miles**	*RP-4 AWPF Pump Station* •1,000 hP pump station *Pipelines* •8-inch: 15,686 ft •10-inch: 545 ft •12-inch: 76 ft •14-inch: 17,117 ft •16-inch: 2,458 ft •20-inch: 1,120 ft •24-inch: 6,269 ft •26-inch: 6,496 ft •Trenchless: 3,700 ft **•Total: 49,766 ft** **•Total: 9.4 miles**	*RP-4 AWPF Pump Station* •1,500 hP pump station *Pipelines* •8-inch: 11,113 ft •10-inch: 2,757 ft •14-inch: 4,325 ft •16-inch: 5,230 ft •20-inch: 1,120 ft •24-inch: 6,269 ft •30-inch: 6,496 ft •Trenchless: 2,650 ft **•Total: 37,310 ft** **•Total: 7.1 miles**	*RP-4 AWPF Pump Station* •1,000 hP pump station *Pipelines* •8-inch: 10,016 ft •10-inch: 545 ft •14-inch: 2,854 ft •16-inch: 2,458 ft •20-inch: 1,120 ft •24-inch: 6,269 ft •26-inch: 6,496 ft •Trenchless: 2,200 ft **•Total: 29,758 ft** **•Total: 5.6 ft** *MVWD Plant 28 AWPF PS* •150 hP pump station at Plant 28 *Pipelines* •8-inch: 6,038 ft •10-inch: 1,741 ft •12-inch: 2,305 ft •14-inch: 2,199 ft •Trenchless: 1,180 ft **•Total: 12,283 ft** **•Total: 2.3 miles**
Recharge Approach	Description	*MZ1* •None *MZ2* •12 injection wells (9 duty, 3 standby) •1,333 AFY (830 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ3* •3 injection wells (2 duty, 1 standby) •1,500 AFY (930 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells	*MZ1* •None *MZ2* •16 injection wells (12 duty, 4 standby) •1,250 AFY (775 gpm) injection capacity/well •0.23-acres land purchase/well •4 monitoring wells *MZ3* •None	*MZ1* •4 injection wells (3 duty, 1 standby) •1,000 AFY (620 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ2* •12 injection wells (9 duty, 3 standby) •1,333 AFY (830 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ3* •None	*MZ1* •None *MZ2* •12 injection wells (9 duty, 3 standby) •1,333 AFY (830 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ3* •3 injection wells (2 duty, 1 standby) •1,500 AFY (930 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells	*MZ1* •None *MZ2* •16 injection wells (12 duty, 4 standby) •1,250 AFY (775 gpm) injection capacity/well •0.23-acres land purchase/well •4 monitoring wells *MZ3* •None	*MZ1* •4 injection wells (3 duty, 1 standby) •1,000 AFY (620 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ2* •12 injection wells (9 duty, 3 standby) •1,333 AFY (830 gpm) injection capacity/well •0.23-acres land purchase/well •2 monitoring wells *MZ3* •None
Brine Conveyance	Description	*RP-1 Pipeline* •8-inch: 3,907 ft •Trenchless: 400 ft *MZ1 Pipeline at MVWD Plant 28 Site* •None	*RP-1 Pipeline* •8-inch: 3,907 ft •Trenchless: 400 ft *MZ1 Pipeline at MVWD Plant 28 Site* •None	*RP-1 Pipeline* •8-inch: 3,907 ft •400 ft trenchless *MZ1 Pipeline at MVWD Plant 28 Site* •4-inch: 819 ft	*RP-4 Pipeline* •8-inch: 1,358 ft *MZ1 Pipeline at MVWD Plant 28 Site* •None	*RP-4 Pipeline* •8-inch: 1,358 ft *MZ1 Pipeline at MVWD Plant 28 Site* •None	*RP-4 Pipeline* •8-inch: 1,358 ft *MZ1 Pipeline at MVWD Plant 28 Site* •819 ft 4-inch

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Table 3-16. PUT Alternatives Conceptual-Level Capital Cost Estimates						
Parameter	**PUT Alternatives ($M)**					
	PUT-1	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
AWPF(s)	$116.5	$116.5	$120.2	$113.7	$113.7	$117.9
Pipelines[1]	$52.5	$53.7	$50.7	$21.3	$16.9	$19.7
Pump Stations	$12.6	$13.4	$11.3	$5.0	$7.1	$5.6
Injection Wells	$30.0	$32.0	$32.0	$30.0	$32.0	$32.0
Monitoring Wells	$4.5	$3.0	$4.5	$4.5	$3.0	$4.5
AWPF Equalization Tank(s)	$0.05	$0.05	$1.0	$3.3	$3.3	$4.2
Brine Disposal (NRWS)	$10.9	$10.9	$10.9	$10.9	$10.9	$10.9
Land	$2.6	$2.8	$2.8	$2.6	$2.8	$2.8
Subtotal	$229.7	$232.3	$233.4	$191.2	$189.5	$197.6
Contingency (30%)[2]	$64.8	$65.6	$65.9	$53.3	$52.7	$55.2
Subtotal	$294.5	$297.9	$299.3	$244.5	$242.2	$252.8
Implementation (28%)[2]	$78.7	$79.6	$80.0	$64.7	$64.0	$66.9
Total Capital Cost ($M)						
Total Capital Cost ($2019)	**$373.3**	**$377.5**	**$379.3**	**$309.1**	**$306.2**	**$319.7**
Total Capital Cost ($2024)[3]	$412.1	$416.8	$418.8	$341.3	$338.1	$353.0

Notes:

[1]Includes purified water and brine pipelines. Recycled water pipeline accounted for under external supplies.

[2]Brine disposal (NRW) and land costs not included in contingency or implementation calculations.

[3]2024 is the estimated mid-point of construction.

[4]Costs for external recycled water supplies are not included in the PUT Alternatives Conceptual-Level Cost Estimates.

Table 3-17. PUT Alternatives Conceptual-Level Annual O&M Cost Estimates						
Parameter	**PUT Alternatives ($M/year)**					
	PUT-1	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
PUT - Subtotal						
AWPF[1]	$8.5	$8.5	$7.9	$5.4	$5.6	$5.3
Pipelines[2]	$0.09	$0.08	$0.08	$0.05	$0.04	$0.05
Pumping – Purified Water	$3.2	$3.4	$2.8	$1.2	$1.8	$1.4
Pumping – Recycled Water (IEUA System)	$0.5	$0.5	$0.7	$2.0	$2.0	$2.2
Injection/Monitoring Wells	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5
NRW Disposal	$1.3	$1.3	$1.3	$1.3	$1.3	$1.3
External supplies – subtotal						
Pipelines – Recycled Water	$0.08	$0.08	$0.08	$0.08	$0.08	$0.08
Pump Stations – Recycled Water	$0.4	$0.4	$0.4	$0.4	$0.2	$0.4
Annual O&M Cost ($2019) ($M/year)	**$14.5**	**$14.7**	**$13.7**	**$10.9**	**$11.4**	**$11.2**
NPV Cost[3] ($2019) ($M)	**$1,051**	**$1,064**	**$1,009**	**$829**	**$855**	**$848**

Notes:

[1]Includes purified water pump station and equalization tank.

[2]Includes purified water and brine pipelines.

[3]From the economic analysis tool, Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The PUT NPV costs were estimated on a program basis assuming TAKE-4c for the TAKE alternative.

[4]Costs for external recycled water supplies are not included in the PUT Alternatives Conceptual-Level Cost Estimates.

3.4 PUT Alternatives Evaluation

Alternatives were evaluated using a multi-criteria approach, which allows for the quantification and visualization of the relative performance of each individual alternative so they can be compared with one another on a common basis. This approach is organized with five overarching program objectives that encompass the CBP goals, each with associated evaluation criteria to measure how well each alternative meets the objectives. All PUT alternatives were developed to meet the two minimum requirements for alternatives, which include (1) meet Basin-wide objectives and regulatory requirements and (2) provide water exchange for the benefit of the Delta Ecosystem. The minimum requirements are described in more detail in TM1 Section 8

This section summarizes the PUT alternatives evaluation for PUT-1 through PUT-6 with scores assigned for each alternative for each criterion. The following Sections 3.4.1 through 3.4.5 describe the scoring rationale for all evaluation criteria, organized by the five project objectives. The scores were assigned as follows:

- Each alternative was analyzed for each criterion and assigned a score of 1 through 5, with 5 being most advantageous and 1 being the least advantageous.
- The evaluation criteria are scored either quantitatively or qualitatively. Quantitative criteria are those criteria that are scored based on attributes that can be measured, such as pipeline length. Qualitative criteria are scored based on an opinion of how well that alternative supports the evaluation criterion, such as the ability to meet future direct potable reuse (DPR) needs. Criteria that require qualitative scored with whole numbers, while criteria that are scored qualitatively have rational numbers as scores.

Note that the evaluation criteria were defined for the program alternatives and some individual criteria do not apply to the PUT alternatives. In addition, some of the criteria are non-differentiators when applied to the CBP alternatives alone but would show differentiation if used to compare CBP and non-CBP alternatives. These non-differentiating criteria were included in this evaluation and are described in the following sections. The scoring approach for all criteria is further detailed in TM1 Section 8.

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Table 3-18. PUT Alternatives Evaluation

Objectives			Evaluation Criteria			Alternatives					
No.	Name	Baseline Weighting (%)	No.	Criteria	Baseline Weighting (%)	PUT - 1	PUT - 2	PUT - 3	PUT - 4	PUT - 5	PUT - 6
					AWPF Location(s)	*RP-1*	*RP-1*	*RP-1 & MZ1*	*RP-4*	*RP-4*	*RP-4 & MZ1*
					Recharge Location(s)	*MZ2 & MZ3*	*MZ2*	*MZ1 & MZ2*	*MZ2 & MZ3*	*MZ2*	*MZ1 & MZ2*
					Recharge Approach	*IWs Only*	*IWs Only*	*IWs Only*	*IWs Only*	*IWs Only*	*IWs Only*
1	Develop Basin-wide water supply infrastructure	25%	1a	Create regional exchange opportunities	0%	-	-	-	-	-	-
			1b	Provide synergy with region's planned projects	50%	5.0	5.0	5.0	5.0	5.0	5.0
			1c	Ability to meet future Direct Potable Reuse conveyance needs (raw water augmentation)	50%	4.0	4.0	4.0	4.0	4.0	4.0
			1d	Enhance MWD Rialto Pipeline reliability	0%	-	-	-	-	-	-
			1e	Integrate with other storage programs	0%	-	-	-	-	-	-
			Total - 1a through 1e (Must equal 100%)		100%	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**
2	Increase water supply reliability	15%	2a	Insurance water (critically dry year access to treatment and unused water) (access to emergency supply)	0%	-	-	-	-	-	-
			2b	Address CECs on the horizon (such as PFAS)	50%	5.0	5.0	5.0	5.0	5.0	5.0
			2c	Increased potable water supply (beyond 25-year CBP)	50%	5.0	5.0	5.0	5.0	5.0	5.0
			Total - 2a through 2c (Must equal 100%)		100%	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
3	Streamline operations and maintenance	15%	3a	Minimize operational complexity	40%	3.0	5.0	2.0	3.0	5.0	2.0
			3b	Minimize impacts to water levels in existing wells	25%	4.0	3.0	3.0	4.0	3.0	3.0
			3c	Optimize energy use	35%	3.0	3.0	4.0	3.0	2.0	3.0
			Total - 3a through 3c (Must equal 100%)		100%	**3.3**	**3.8**	**3.0**	**3.3**	**3.5**	**2.6**
4	Minimize program complexity	20%	4a	Minimize institutional complexity	30%	4.0	4.0	2.0	4.0	4.0	2.0
			4b	Minimize implementation complexity	30%	3.0	3.0	2.0	4.0	5.0	3.0
			4c	Leverage existing available land to minimize land acquisition	40%	5.0	4.8	1.0	5.0	4.8	1.0
			Total - 4a through 4c (Must equal 100%)		100%	**4.1**	**4.0**	**1.6**	**4.4**	**4.6**	**1.9**
5	Support cost effectiveness	25%	5a	Minimize NPV costs (includes $206.9 M funding for CBP alternatives) (with pre-delivery charge)	40%	1.2	1.0	1.9	5.0	4.6	4.7
			5b	Minimize capital costs	30%	1.3	1.1	1.0	4.8	5.0	4.3
			5c	Minimize annual O&M costs (with pre-delivery charge)	30%	1.2	1.0	2.1	5.0	4.5	4.7
			Total - 5a through 5c (Must equal 100%)		100%	**1.3**	**1.0**	**1.7**	**5.0**	**4.7**	**4.6**
Total Objectives 1 - 5 (Must equal 100%)		100%			**Total Score:**	**3.5**	**3.5**	**3.1**	**4.5**	**4.5**	**3.8**

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3.4.1 Objective 1 - Develop Basin-Wide Water Supply Infrastructure

PUT alternatives require new infrastructure and facilities, so it is important to have the first objective analyze basin-wide water supply infrastructure to be inclusive of IEUA's and stakeholders' goals. The evaluation criteria used for the objective to develop Basin-wide water supply infrastructure for the PUT alternatives are as follows:

- 1b – Provide Synergy with Region's Planned Projects and
- 1c – Ability to Meet Future Direct Potable Reuse Conveyance Needs.

Note that three criteria under Objective 1 do not apply to the PUT alternatives and, therefore, are not discussed. These include Create Regional Exchange Opportunities (Criterion 1a); Enhance MWD Rialto Feeder Reliability (Criterion 1d); and Integrate with Other Storage Programs (Criterion 1e) . The following sections discuss the applicable criteria, their performance measures, and the scores for each PUT alternative.

3.4.1.1 Provide Synergy with Region's Planned Projects (Criterion 1b)

The ability to combine stakeholders' planned projects with the CBP alternatives is a significant component in developing the basin-wide water supply infrastructure for the CBP since it would enable the stakeholders to benefit more from the program. The performance measured is based on number of planned projects incorporated in the alternative. Alternatives that provide more synergies with stakeholders' planned projects scored higher than alternatives that provide fewer synergies. Because all PUT alternatives provide at least one AWPF, they all score a 5.0 (note that this criterion has more relevance and relative comparison with the TAKE alternatives as described in Section 4.4.). The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The PUT alternatives scores are shown in Table 3-19

Table 3-19. PUT Alternatives – Scoring for Provide Synergy with Region's Planned Projects (Criterion 1b)

Alternative	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Criterion 1b Score	5.0	5.0	5.0	5.0	5.0	5.0

3.4.1.2 Ability to Meet Future Direct Potable Reuse Conveyance Needs (Criterion 1c)

The ability to meet future DPR conveyance needs is an interest to the stakeholders since they may decide to produce recycled water for DRP applications in the future once the regulations are developed. It is assumed that any future DPR project would be raw water augmentation (RWA) and purified water would need to be pumped back to either the Rialto Pipeline or upstream of a surface water treatment plant. This criterion is based on the locations of the AWPF and purified water conveyance infrastructure relative to water treatment plants and the Rialto Pipeline, where the alternatives that are closer to the water treatment plants and Rialto Pipeline score better than those further away. However, due to the limited number of AWPF and conveyance alternatives being considered, all PUT alternatives scored a 4.0. This score was applied over a score of 5.0 because the PUT alternatives would still require additional conveyance for RWA. The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The PUT alternative scores are shown in Table 3-20.

Table 3-20. PUT Alternatives – Scoring for Ability to Meet Future Direct Potable Reuse Conveyance Needs (Criterion 1c)						
Alternative	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
Criterion 1c Score	4.0	4.0	4.0	4.0	4.0	4.0

3.4.2 Objective 2 - Increase Water Supply Reliability

The CBP can diversify and increase the regional water supply portfolio for IEUA and stakeholders. This second objective analyzes alternatives on the basis that it would increase the region's water supply and water quality. The evaluation criteria used for the objective to increase water supply reliability for the PUT alternatives are as follows:

- 2b – Address CECs on the Horizon and
- 2c – Increased Potable Water Supply.

Provide Insurance Water (Criterion 2a) does not apply to PUT alternatives and is not discussed. The following sections discuss the applicable criteria, their performance measures, and the scores for each PUT alternative.

3.4.2.1 Address CECs on the Horizon (Criterion 2b)

The ability to address CECs that are on the horizon are important as it allows for the technology to be implemented before a limit is placed by regulators. An example of a forthcoming CEC limit is for Per- and Polyfluoroalkyl Substances (PFAS). PUT alternatives with full advanced treatment score better than those that do not since CECs are removed prior to groundwater discharge. Because all PUT alternative provide an AWPF, they all score a 5.0. The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The PUT alternative scores are shown in Table 3-21.

Table 3-21. PUT Alternatives – Scoring for Address CECs on the Horizon (Criterion 2b)						
Alternative	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
Criterion 2b Score	5.0	5.0	5.0	5.0	5.0	5.0

3.4.2.2 Increased Potable Water Supply (Criterion 2c)

The ability to increase potable water supply for the region beyond the 25-year CBP is based on IEUA and stakeholders capitalizing on the existing assets developed from the program. The performance measure is the amount of new potable water generated in the Chino Basin area. Since each PUT alternative provides 15.0 TAFY of purified water for groundwater recharge, all score a 5.0. The PUT alternatives are analyzed for this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The PUT alternatives scores are shown in Table 3-22.

Table 3-22. PUT Alternatives – Scoring for Increased Potable Water Supply (Criterion 2c)						
Alternative	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
Criterion 2c Score	5.0	5.0	5.0	5.0	5.0	5.0

3.4.3 Objective 3 - Streamline Operations and Maintenance

The CBP would introduce new treatment processes and multiple wells that would need to be operated and maintained, thus the ability to streamline the alternative's operation and maintenance is an important third objective. Streamlining these efforts provides efficiency and a smoother transition to these new services amongst stakeholders. The evaluation criteria used for the objective to streamline operations and maintenance for the PUT alternatives are as follows:

- 3a – Minimize Operational Complexity,
- 3b – Minimize Impacts to Water Levels in Existing Wells, and
- 3c – Optimize Energy Use.

The following sections discuss these criteria, their performance measures, and the scores for each PUT alternative.

3.4.3.1 Minimize Operational Complexity (Criterion 3a)

The ability to minimize operational complexity's PUT performance measure is based on the intricacy of operations measured in number of AWPFs and injection wellfields. PUT alternatives that have fewer AWPFs and injection wells fields score better than those that have more. Table 3-22 summarizes the number of AWPS, number injection wells, and scores for each PUT alternative. Note that each PUT alternative would provide the same purified water flow but may be split into multiple AWPF locations. When a PUT alternative requires two AWPFs, 1.0 point is deducted from the overall score. The addition of a second injection wellfield presents more complexity and, therefore, PUT alternatives with two injection wellfields have 2.0 points deducted from their overall score.

Table 3-23. PUT Alternatives – Scoring for Minimize Operational Complexity (Criterion 3a)						
Parameter	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
Number of AWPFs	1 (RP-1)	1 (RP-1)	2 (RP-1 and MZ-1)	1 (RP-4)	1 (RP-4)	2 (RP-4 and MZ-1)
Number of Injection Wellfields	2 (MZ-2 and MZ-3)	1 (MZ-2)	2 (MZ-1 and MZ-2)	2 (MZ-2 and MZ-3)	1 (MZ-2)	2 (MZ-1 and MZ-2)
Criterion 3a Score	3.0	5.0	2.0	3.0	5.0	2.0

3.4.3.2 Minimize Impacts to Water Levels in Existing Wells (Criterion 3b)

The PUT alternatives may positively impact nearby existing wells by increasing groundwater levels at the existing wells. This criterion is evaluated by reviewing well hydrographs and analyzing the water levels at nearby existing wells. When PUT alternatives have minimal changes to local groundwater levels, they were assigned an average score of 3.0. PUT alternatives that positively impact groundwater levels (i.e., increase groundwater levels) receive an increase to the average score by 1.0 point. Based on the preliminary groundwater modeling (see Section 2:), none of the PUT alternatives would negatively impact groundwater levels at nearby extraction wells. Table 3-24 summarizes the groundwater level impacts at nearby wells for each alternative and the associated score.

Table 3-24. PUT Alternatives – Scoring for Minimize Impacts to Water Levels in Existing Wells (Criterion 3b)

Parameter	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Groundwater Level Impacts at Nearby Wells	Increases level	None	None	Increases level	None	None
Criterion 3b Score	4.0	3.0	3.0	4.0	3.0	3.0

3.4.3.3 Optimize Energy Use (Criterion 3c)

The PUT alternatives incorporate infrastructure requiring significant energy and optimization of that energy use must be considered. The performance measure is based on the total energy demand in 1,000 kilowatt-hours (kWh) for the AWPFs and the recycled water and purified water pumping. A lower energy demand results in a higher (better) score. Table 3-25 summarizes the power consumption of the pump stations and AWPF. Note that the energy cost for the RP-1 AWPF does not include the energy required for the RP-1 MBR operation since that process would be both secondary treatment and pre-treatment for RO.

Table 3-25. PUT Alternatives – Scoring for Optimize Energy Use (Criterion 3c)

Component	Power Consumption (1,000 kWh)					
	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Recycled Water Pumping	16,500	17,500	13,900	6,500	9,200	12,900
Purified Water Pumping	2,960	3,000	4,000	12,000	12,000	6,400
AWPF	11,700	11,700	11,900	12,900	12,900	13,000
Total	31,160	32,200	29,800	31,400	34,100	32,300
Criterion 3c Score	3.0	3.0	4.0	3.0	2.0	3.0

3.4.4 Objective 4 – Minimize Program Complexity

The CBP would be a complex program including many stakeholders. This objective measures the complexity of the proposed PUT alternatives. The evaluation criteria used for the objective to minimize program complexity for the PUT alternatives are as follows:

- 4a – Minimize Institutional Complexity,
- 4b – Minimize Implementation Complexity, and
- 4c – Leverage Existing Available Land to Minimize Land Acquisition.

The following sections discuss these criteria, their performance measures, and the scores for each PUT alternative.

3.4.4.1 Minimize Institutional Complexity (Criterion 4a)

The performance measure for the ability to minimize institutional complexity is based on the numbers of contracts/agreements needed with stakeholders. The fewer the agreements with stakeholders the better the score. The Criterion 4a score is based on the number of contracts with stakeholders required for the recycled water, AWPFs, and injection wells. All alternatives would require contracts with JCSD and City of Rialto for tertiary recycled water and Cucamonga Valley Water District (CVWD) for injection wells in MZ-2. PUT-3 and PUT-6 would also require contracts with MVWD for the AWPF at MVWD's Plant 28 site and MVWD and the City of Montclair for the injection wells. Table 3-26 summarizes the contracts needed for each PUT alternative and the scores.

Table 3-26. PUT Alternatives – Scoring for 3.4.4.1 Minimize Institutional Complexity (Criterion 4a)

Parameter	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Required Contracts	JCSD[1], Rialto, CVWD	JCSD[1], Rialto, CVWD	JCSD[1], Rialto, CVWD, MVWD, City of Montclair	JCSD[1], Rialto, CVWD	JCSD[1], Rialto, CVWD	JCSD[1], Rialto, CVWD, MVWD, City of Montclair
Criterion 4a Score	4.0	4.0	2.0	4.0	4.0	2.0

Notes:

[1]For JCSD's recycled water from WRCRWA.

3.4.4.2 Minimize Implementation Complexity (Criterion 4b)

The ability to minimize implementation complexity is scored based on the numbers of project elements and permits for each PUT alternative. The fewer the projects and permits, the better the score. The PUT alternatives were evaluated using the number of projects based on pump stations, miles of pipeline, and pipeline crossings. Crossings refer to pipelines that are constructed below highways or railroad tracks. Each score was calculated individually for each element and then averaged and rounded to the whole number to determine the final score for each PUT alternative. Table 3-27 summarizes the number of AWPFs, pump stations, and crossings; miles of pipelines; and Criterion 1b scores. Note that all PUT alternatives require the same number of permits; since this is not a differentiator, this was not taken into account in the scoring.

Table 3-27. PUT Alternatives – Scoring for Minimize Implementation Complexity (Criterion 4b)

Parameter	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Number of Pump Stations	1	1	2	1	1	2
Number of AWPFs	1	1	2	1	1	2
Number of Crossings	12	11	12	4	4	5
Miles of Pipelines	32.4	30.3	32.0	25.6	23.3	24.9
Criterion 4b Score	3.0	3.0	2.0	4.0	5.0	3.0

3.4.4.3 Leverage Existing Available Land to Minimize Land Acquisition (Criterion 4c)

Since the CBP needs to be implemented by 2026, using existing available land for CBP facilities was identified as a critical element to keep the project on schedule by avoiding complications with land purchases and rezoning or permitting new parcels. Using existing land also helps reduce program costs. Alternatives that require less land acquisition score better than alternatives that require more land acquisition. The scores were calculated by evaluating the total acreage required for injection wells, monitoring wells, and to purchase an equivalent amount of land for MVWD for the Plant 28 site. AWPFs located at RP-1 or RP-4 would be located on IEUA property and no additional land is required. All pipelines would be constructed within public right-of-way. Table 3-28 summarizes the acreage for each component, total acreage, and score.

Table 3-28. PUT Alternatives – Scoring for Leverage Existing Available Land to Minimize Land Acquisition (Criterion 4c)

Component	Land Acquisition (Acres)					
	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Injection Wells	3.4	3.7	3.7	3.4	3.7	3.7
Monitoring Wells	0.09	0.06	0.09	0.09	0.06	0.09
MVWD Plant 28 Site	0	0	2.9	0	0	2.9
Total	3.5	3.7	6.7	3.5	3.7	6.7
Criterion 4c Score	5.0	4.8	1.0	5.0	4.8	1.0

3.4.5 Objective 5 - Support Cost Effectiveness

The ability to support cost effectiveness is an important objective in the multi-criteria evaluation. The cost estimates are summarized in Section 3.3.7 with the cost estimating approach presented in TM1 Section 7. Cost scores were calculated based on the highest cost was the lowest score of 1 and the lowest cost was the highest score of 5. The evaluation criteria used for this objective are as follows:

- 5a – Minimize NPV Costs,
- 5b – Minimize Capital Costs, and
- 5c – Minimize Annual O&M Costs.

For all cost criteria, lower costs result in higher (better) scores and higher costs result in lower (worse) scores. The following sections discuss these criteria, their performance measures, and the scores for each PUT alternative.

3.4.5.1 Minimize NPV Costs (Criterion 5a)

NPV costs were developed over a project lifecycle of 50 years using the economic analysis tool that is described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The NPV costs represent the present value of cash flow over the 25-year CBP and the 25 years following the CBP. The NPV costs include capital costs, replacement costs, annual O&M costs, non-recoverable wastewater disposal costs, and supplemental external source water cost (i.e., recycled water supplies from JCSD and City of Rialto). For the CBP alternatives, the NPV costs take into account the Proposition 1 Water Storage Investment Program (WSIP) funding of $206.9M. The NPV costs are in 2019 dollars.

The economic analysis tool was developed to calculate the NPV costs for overall CBP costs. Therefore, the program costs were estimated for the six PUT alternatives assuming that the TAKE portion was TAKE-4c, and then the PUT portion of the NPV cost was separated out. Table 3-29 summarizes the NPV costs and scores.

Table 3-29. PUT Alternatives – Scoring for Minimize NPV Costs (Criterion 5a)

Alternatives	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
NPV Cost ($M 2019)	$1,051	$1,064	$1,009	$829	$855	$848
Criterion 5a Score	1.2	1.0	1.9	5.0	4.6	4.7

3.4.5.2 Minimize Capital Costs (Criterion 5b)

Capital costs include the cost of equipment and construction costs including direct and indirect costs of all elements. The capital costs for the PUT alternatives include all PUT components as summarized in Table 3-15 PUT Alternatives Summary, which includes recycled water conveyance for supplies from JCSD and the City of Rialto), the AWPF(s), purified water conveyance (pump station and pipelines), injection wells for groundwater recharge and monitoring wells, and brine conveyance. The capital costs include contingency and project implementation costs for engineering services, client administration, and construction management. The capital costs are in 2019 dollars. Table 3-30 summarizes the capital costs and scores.

Table 3-30. PUT Alternatives – Scoring for Minimize Capital Costs (Criterion 5b)

Alternatives	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Capital Cost ($M 2019)	$373.3	$377.5	$379.3	$309.1	$306.2	$319.7
Criterion 5b Score	1.3	1.1	1.0	4.8	5.0	4.3

3.4.5.3 Minimize Annual O&M Costs (Criterion 5c)

O&M costs include annual costs to operate, manage, and maintain the equipment and infrastructure for each alternative. The annual O&M costs for the PUT alternatives include annual O&M costs for recycled water conveyances, the AWPFs, purified water conveyance, brine disposal, and injection well and monitoring wells. The annual O&M costs are in 2019 dollars. Table 3-31 summarizes the O&M costs and scores.

Table 3-31. PUT Alternatives – Scoring for Minimize Annual O&M Costs (Criterion 5c)

Alternatives	PUT-1	PUT-2	PUT-3	PUT-4	PUT-5	PUT-6
Annual O&M Cost ($M/year 2019)	$14.5	$14.7	$13.7	$10.9	$11.4	$11.2
Criterion 5c Score	1.2	1.0	2.1	5.0	4.5	4.7

3.5 PUT Alternatives Recommendations

Based on the results of the PUT alternatives evaluation, and as shown in Table 3-18 PUT Alternatives Evaluation, PUT Alternatives 4 and 5 were the highest ranked. Both alternatives locate the AWPF at RP-4 with the water recharged in both MZ-2 and MZ-3 under PUT-4 and in MZ-2 only in PUT-5.

PUT-1 through PUT-3, which all include the main AWPF at RP-1 and PUT-3 also includes a smaller AWPF in MZ-1, and PUT-6, which includes the main AWPF at RP-4 and a smaller AWPF in MZ-1, did not score as well for the following reasons:

- **AWPF at RP-1:** PUT-1 through PUT-3 (AWPF at RP-1) scored lower overall than PUT-4 through PUT-6 (AWPF at RP-4). The primary objective that differentiated the scores between these two sets of alternatives is Objective 5 – Support cost effectiveness. PUT-1 through PUT-3 scored between 1.0 and 1.7, whereas PUT-4 through PUT-6 scored in the range of 4.6 to 5.0. PUT-1 through PUT-3 are more costly than PUT-4 through PUT-6 due to the following differences:
    - Slightly higher AWPF costs at RP-1 due to early integration of MBR with the AWPF (MBR has a higher unit cost than MF). For the purpose of this conceptual-level cost evaluation, the proportion of the MBR costs associated with the AWPF are included as the CBP requires construction of the MBR retrofit earlier (online by 2026) than IEUA's capital planning indicates (online around 2030).
    - Higher purified water conveyance costs for PUT-1 through PUT-3 for both pipelines and the pump station because RP-1 is farther away from the injection wells than RP-4.
    - Higher annual O&M costs due to increased pumping costs from RP-1 to the injection wells.
- **AWPF at MVWD Plant 28:** PUT-3 and PUT-6 both include the 3.0-TAFY AWPF at MVWD Plant 28 in MZ-1, as well as the larger 12.0-TAFY AWPF at RP-1 and RP-4, respectively. Both of these alternatives did not score as well on Objective 3 – Streamline operations and maintenance or Objective 4 – Minimize program complexity because of the following:
    - Objective 3 – Streamline operations and maintenance: PUT-3 and PUT-6, which have two AWPFs, score lower because these alternatives are more operationally complex than PUT-1, 2, 5, and 6, which only have one AWPF.
    - Objective 4 – Minimize program complexity: PUT-3 and PUT-6 score lower because they are more institutionally complex with an AWPF located on MVWD's property, more complex implementation due to two AWPFs and two purified water conveyance systems, and would require land acquisition to replace the MVWD Plant 28 site for MVWD.

It should also be noted that the location of the AWPF at RP-1 would be on the southwestern corner of the site in place of the existing solar panels. IEUA's solar contract ends in June 2029, but the AWPF needs to be in service by 2026. The costs associated with modifying the solar contract for an earlier end date are not included in the AWPF costs. If these were included, then the PUT-1 through PUT-3 costs would increase and their overall scores would decrease.

Since PUT Alternative 4 scored equally to PUT Alternative 5, IEUA could consider advancing both concepts in the next stages of the project. The primary difference between these alternatives is the recharge approach: PUT Alternative 5 assumes all water is recharged in MZ-2 and PUT Alternative 4 assumes that 12.0 TAFY is recharged in MZ-2 and 3.0 TAFY is recharged in MZ-3. Advancing PUT Alternative 4 would include evaluating injection well locations in MZ-3 and pipeline alignments in parallel with advancing PUT Alternative 5. However, based on alignment with the Storage Framework Investigation and preferred injection locations (i.e., northern MZ-2), PUT Alternative 5 is recommended to carry forward as the PUT approach for the program alternatives.

Basis for AWPF Site Location – Expanded Summary

As described in TM1 Section 4.2, locations at RP-1, RP-4 and RP-5 were considered for the AWPF to meet CBP objectives and regulatory compliance. As discussed in IEUA's *"2020 Regulatory Challenges Memorandum,"* the need for an AWPF was established to meet both IEUA's wastewater NPDES Permit limit conditions for TDS and for its GWR Permit Regulations compliance for constituents such as 1,2,3-TCP and PFAS.

RP-5 was initially considered because of the impending expansion project at RP-5, which includes conversion to a Membrane Bio Reactor (MBR) treatment system which could be advantageous for planning a downstream AWPF, pending regulatory development and approval. If an AWPF is constructed at RP-5, it will address only the recycled water effluent NPDES permit limits; it will not address the use of recycled water within the basin and the GWR regulations compliance. Also since RP-5 is situated hydraulically low in the IEUA recycled water distribution system, the use of its advanced purified water would be limited to discharge of unused recycled water as effluent to the Chino Creek/Santa Ana River and would not provide the same operational flexibility and benefits of locating in the northern service area of either RP-1 or RP-4. If the AWPF is located at RP-5 in the far southern end of the service area, significant piping and pumping infrastructure would be needed to get this high-quality water to ideal recharge locations in the northern service area. Further, the Chino Basin Watermaster's 2018 Storage Framework Investigation (SFI) prioritized recharge ("PUTS") to occur in the north eastern portion of the Chino Basin (Management Zone 2) to minimize pumping sustainability challenges, minimize impacts of storage and recovery, preserve the current state of hydraulic control, and to take advantage of the groundwater storage capabilities in Management Zone 2.

As a result, RP-1 and RP-4 were identified as preferred options for modification to include advanced water purification as part of the CBP because of their advantages relative to operational flexibility and compatible future expansion plans. As part of PUT Alternative 5 (PUT-5), this TM identifies RP-4 to be the preferred AWPF location over RP-1 due to its proximity to recharge basins, its greater capacity to pump to recharge basins, future injection wells, space availability, ability to integrate with future direct potable reuse opportunities and proximity of surface water treatment plants, its consistency with the SFI recharge prioritization, and overall operational flexibility. An AWPF at RP-4 will meet regulatory and permit requirements.

Section 4: TAKE Alternatives

The CBP includes two main categories of facilities: PUT, the components to recharge purified water to the Chino Basin, and TAKE, the components to extract groundwater and convey potable water supply. Each TAKE alternative includes the following components:

- Groundwater extraction
- Blending and potential treatment of extracted groundwater
- Delivery of potable water to MWD and/or IEUA member agencies and neighboring agencies

The TAKE alternatives were developed based on the assumptions presented in TM1 Section 5 TAKE Components and TM1 Section 6 Conveyance Approach. The components were refined during the alternatives development process based on the initial groundwater modeling that was completed using the Chino Basin Groundwater Model (see Section 2:) to optimize the locations of the injection and extraction wells to minimize infrastructure costs.

This section describes how the TAKE alternatives were developed and provides both an overview and detailed description of each alternative, as well as the evaluation of the TAKE alternatives and recommendation of which TAKE alternatives to carry forward into the program alternatives.

4.1 TAKE Alternatives Development Approach and Overview

Six TAKE alternatives were created and evaluated to determine the best alternative for extracting and delivering stored CBP water. The following three variables were used to formulate the TAKE alternatives:

- Water delivery conditions (standard delivery or pre-delivery);
- Multiple available water delivery mechanisms (MWD pump back, In-Lieu CBP, and In-Lieu Local); and
- Physical limitations on IEUA member agencies' ability to use CBP water in-lieu of wet imported water.

The factors are discussed in the following sections, and a summary of the proposed alternatives is provided in Section 4.1.4.

4.1.1 Amount of Water to be Delivered

The WSIP funding agreement is based on delivering 375.0 TAF of water via in-lieu exchange to the Sacramento - San Joaquin Delta (Delta) from IEUA over the 25-year life of the Program. This is a contribution of raw water by IEUA from the Chino Basin directly to DWR for environmental benefit in the Delta in exchange for the WSIP funding. Over the 25-year Program, DWR would declare 7.5 years as call years, which require a reduction in pumping from the Delta by 50.0 TAF in that year, which equates to 375.0 TAF to the Delta over the Program duration. This is achieved through a transfer of water during call years from IEUA to DWR using MWD as its State Water Project Contractor and intermediate party, as follows:

1. DWR would declare a call year and, on behalf of IEUA, MWD would pump 50.0 TAF less water out of the Delta in that year, making MWD 50.0 TAF short of water.
2. IEUA would make MWD whole by extracting 50.0 TAF of water stored in the Chino Basin and delivering it to MWD by any one or a combination of the delivery mechanisms further described in Section 4.1.2. This delivery of water from IEUA to MWD constitutes the TAKE portion of the Project.

Item 2 above can be achieved by a simultaneous or a deferred exchange of water. A simultaneous exchange (i.e., delivering 50.0 TAFY in the call year) is considered standard delivery, and a deferred exchange (i.e., delivering water every year) is referred to as pre-delivery. Standard delivery and pre-delivery are described further below:

- **Standard delivery:** Under standard delivery (e.g., no pre-delivery), the multi-party transfer of water is a simultaneous or bucket-for-bucket transfer. When DWR declares a call year and MWD leaves 50.0 TAFY in the Delta for that year, IEUA immediately delivers 50.0 TAFY of water to MWD (or to IEUA member agencies on behalf of MWD, as discussed in TAKE Mechanisms Section 4.1.2). TAKE facilities would be sized to produce and convey 50.0 TAFY of stored groundwater to repay MWD for the 50.0 TAFY they are leaving in the Delta during call years. During the 17.5 non-call years, no water would be delivered from IEUA to MWD. The following equation summarizes how the 375 TAF of water transfer is delivered to MWD over the life of the project in this condition:

$$7.5\ Call\ Years\ \times \frac{50.0\ TAF}{Call\ Year} = 375.0\ TAF$$

- **Pre-Delivery:** Under pre-delivery, the multi-party transfer is a deferred exchange. When DWR declares a call year and MWD leaves 50.0 TAFY in the Delta for that year, IEUA would pay back 26.7 TAFY during that call year rather than 50.0 TAFY for standard delivery. During non-call years, even though MWD would not be leaving water in the Delta, IEUA would deliver 10.0 TAFY to MWD to complete the 375.0 TAF total transfer over the 25-year Program. Pre-delivery allows the TAKE infrastructure to be sized for a peak flow of 26.7 TAFY rather than 50 TAFY which reduces infrastructure costs, and also allows for more consistent delivery of water from year to year. Note that 10.0 TAFY was the assumed pre-delivery amount for developing the

TAKE alternatives. The following equations summarize how the 375.0 TAFY of water transfer is delivered to MWD over the life of the project in this condition:

$$7.5\ Call\ Years\ \times \frac{26.7\ TAF}{Call\ Year} = 200.0\ TAF$$

$$17.5\ Non\ Call\ Years\ \times \frac{10.0\ TAF}{Non\ Call\ Year} = 175.0\ TAF$$

$$7.5\ Call\ Years + 17.5\ Non\ Call\ Years = 25\ Years$$

$$200.0\ TAF + 175.0\ TAF = 375.0\ TAF$$

Table 4-1 provides an example breakdown of water delivery over the 25-year Program for both standard delivery and pre-delivery, as well as the assocated delivery from MWD to the Delta.

Table 4-1. Example Breakdown of Call Year and Non-Call Year Deliveries from IEUA to MWD and from MWD to the Delta

Year of Project	Call or Non-Call Year[1]	Standard Delivery (TAF)	Pre-Delivery (TAF)[2]	MWD Delivery to Delta (TAF)
1	Call	50.0	26.7	50.0
2	Non-Call	0	10.0	0
3	Non-Call	0	10.0	0
4	Non-Call	0	10.0	0
5	Call	50.0	26.7	50.0
6	Non-Call	0	10.0	0
7	Non-Call	0	10.0	0
8	Non-Call	0	10.0	0
9	Call	50.0	26.7	50.0
10	Non-Call	0	10.0	0
11	Non-Call	0	10.0	0
12	Non-Call	0	10.0	0
13	Non-Call	0	10.0	0
14	Call	50.0	26.7	50.0
15	Non-Call	0	10.0	0
16	Non-Call	0	10.0	0
17	Call	50.0	26.7	50.0
18	Non-Call	0	10.0	0
19	Non-Call	0	10.0	0

Table 4-1. Example Breakdown of Call Year and Non-Call Year Deliveries from IEUA to MWD and from MWD to the Delta

Year of Project	Call or Non-Call Year[1]	Standard Delivery (TAF)	Pre-Delivery (TAF)[2]	MWD Delivery to Delta (TAF)
20	Non-Call	0	10.0	0
21	Call	50.0	26.7	50.0
22	Non-Call	0	10.0	0
23	Call	50.0	26.7	50.0
24	Non-Call	0	10.0	0
25	Non-Call/Call Split	25.0	18.3[3]	25.0 AF
Total	17.5 Non-Call 7.5 Call	375.0 TAF	375.0 TAF	375.0 TAF

Notes:

[1]Call years listed here are an example only; the 7.5 call years that would actually occur would be determined by the DWR based on rainfall and other environmental conditions.

[2]Under pre-delivery, call year deliveries would total 26.7 TAF.

[3]The split year delivery equals one-half of a call year delivery plus one-half of a non-call year delivery.

With pre-delivery, if a call year is declared in Year 1, IEUA would have only delivered 26.7 TAFY to MWD in that year, while MWD would be responsible for leaving 50.0 TAFY to DWR in that year, meaning MWD would have a deficit of water until IEUA delivers more water during non-call years. Or conversely, if a call year is not declared until Year 7, IEUA would have pre-delivered 60.0 TAF total in the first six years while MWD would have not yet left any in the Delta for DWR, meaning MWD would store a surplus of water that would eventually be delivered to the Delta during the next call year.

Because of these deferrals, it is anticipated that MWD may charge IEUA either a storage surcharge for storing water in the MWD system before DWR declares a call year and it can be delivered to the Delta, or a water readiness surcharge for providing more water to the Delta that IEUA has yet delivered to MWD.

Due to operational and economic considerations and upon further evaluation and discussions with MWD, pre-delivery was later determined not to be feasible. Those TAKE alternatives developed during the evaluation that considered pre-delivery are no longer being considered for the CBP.

4.1.2 TAKE Mechanisms (MWD Pump Back, In-Lieu CBP, In-Lieu Local)

MWD provides imported water to IEUA and its member agencies. With the CBP, IEUA would be responsible for delivering water to MWD to replace what MWD leaves in the Delta. The CBP water could either be pumped back into MWD's system or used directly be IEUA's member agencies.

There are three delivery mechanisms by which IEUA can deliver CBP water to MWD:

- MWD pump back
- In-Lieu CBP
- In-Lieu Local

4.1.2.1 MWD Pump Back

MWD pump back involves extracting stored groundwater from a new dedicated wellfield and directly pumping the potable water into MWD's Rialto Pipeline. The Rialto Pipeline is a raw water pipeline so the CBP water would be blended with raw imported water and becomes raw water. The water in the Rialto Pipeline would then be distributed to IEUA member agencies via existing turnouts to water treatment plants. This mechanism uses the existing Rialto Pipeline and downstream infrastructure to convey water to individual member agencies. Water would be purchased from the Rialto Pipeline at the raw imported water rate as usual.

4.1.2.2 In-Lieu CBP

In-Lieu CBP involves extracting banked groundwater from a new dedicated wellfield and delivering it to IEUA's member agencies through a new regional conveyance system. In-lieu CBP requires the construction of conveyance infrastructure to move potable water around to agencies overlying the Chino Basin, but allows member agencies to use potable water directly without needing it to be treated again (the MWD pump back mechanism required treatment).

CBP water delivered in this mechanism would be purchased from MWD at the raw imported water rate since MWD would not be covering the cost of treatment and would therefore not be paid a Treatment Surcharge.

4.1.2.3 In-Lieu Local

In-Lieu Local allows member agencies to receive potable water by using their own existing or new wells and infrastructure to extract and deliver banked groundwater to their customers. This has the least TAKE infrastructure requirements as it leverages existing potable facilities, but it does not allow for robust accounting of water use.

The pricing schedule would be different for the locally supplied CBP water versus locally supplied groundwater. Since wells already in service to produce groundwater would also produce CBP water it would be challenging to determine how much water should be considered as being purchased from MWD and how much would be considered natural groundwater produced for any given well. Because of this, this mechanism is only feasible if an existing well is pumping 100% CBP water and not groundwater rights.

CBP water delivered in this mechanism would be purchased from MWD at the raw imported water rate since MWD would not be covering the cost of treatment and would therefore not be paid a Treatment Surcharge.

4.1.3 Delivery Capacity Limitations to Member Agencies and MWD

In each TAKE alternative, 50.0 TAFY or 26.7 TAFY of CBP water must be distributed between one or more of MWD, IEUA member agencies, or neighboring agencies overlying the Chino Basin under a standard delivery or pre-delivery scenario, respectively. Table 4-2 provides the list of all agencies that could accept CBP water in-lieu of imported water, as well as MWD (which would receive water via pump back).

Table 4-2. Possible Recipients of CBP Water

Agency	Agency Type	MWD Member Agency Wholesaler
Metropolitan Water District of Southern California	State Water Contractor/Regional Wholesaler	N/A
City of Chino	Retailer	Inland Empire Utilities Agency
City of Chino Hills	Retailer	Inland Empire Utilities Agency
City of Ontario	Retailer	Inland Empire Utilities Agency

Table 4-2. Possible Recipients of CBP Water		
Agency	**Agency Type**	**MWD Member Agency Wholesaler**
City of Upland	Retailer	Inland Empire Utilities Agency
Cucamonga Valley Water District	Retailer	Inland Empire Utilities Agency
Fontana Water Company	Retailer	Inland Empire Utilities Agency
Monte Vista Water District	Retailer	Inland Empire Utilities Agency
Jurupa Community Services District	Retailer	Western Municipal Water District
Western Municipal Water District	Wholesaler	Western Municipal Water District
Three Valleys Municipal Water District	Wholesaler	Three Valleys Municipal Water District

4.1.3.1 Minimum Allocation to MWD

For MWD pump back, MWD would track deliveries through a meter at the connection into the Rialto Pipeline. However, in-lieu use would require MWD to record the amount of CBP water that each member agency uses throughout each year from turnout meters (for In-Lieu CBP) or from well data from member agencies and historical well production data (for In-Lieu Local). For all alternatives, MWD would track the total amount of CBP water used in-lieu of imported water or directly pumped back to the Rialto Pipeline and track their own deliveries of water to the Delta. MWD would manage the accounting of these water exchanges and deliveries, which should be coordinated with IEUA. Additionally, for pump back, MWD would be responsible for integrating CBP systems into Rialto Pipeline operation, which would also require extensive coordination. This Study assumes that for any TAKE alternative involving MWD pump back, MWD would receive a minimum of 10.0 TAFY during call years to provide a sizeable enough amount of water to make the accounting and operation efforts by MWD worthwhile and to retain their support for the Program.

4.1.3.2 Maximum Allocation to Member Agencies

For alternatives that include in-lieu use (either In-Lieu Local or In-Lieu CBP), member agencies would receive a direct delivery of CBP water and use it instead of imported water from MWD’s Rialto Pipeline. The amount of CBP water that member agencies can receive in-lieu of Rialto Pipeline raw water is limited by the minimum flowrate required to keep each WTP operating reliably because In-Lieu CBP water is potable water and would not be treated at their WTPs.

The four active WTPs that treat raw water from the Rialto Pipeline and provide supply to IEUA member agencies and neighboring Three Valleys Municipal Water District (TVMWD) are the Fontana Water Company (FWC) Sandhill WTP, the CVWD Lloyd W. Michael WTP, the Water Facilities Authority (WFA) Agua de Lejos WTP, and TVMWD Miramar WTP. These agencies, the respective WTPs, and the minimum flowrate for each WTP are summarized in Table 4-3.

Table 4-3. Minimum WTP Flowrates for Rialto Pipeline Users

Agency	Wholesaler	WTP	Minimum Flowrate[1]	Converted Minimum Flowrate (acre-feet/month (AFM))
Cucamonga Valley Water District	IEUA	Lloyd W. Michael	10 mgd (15.5 cfs)	930
Fontana Water Company	IEUA	Sandhill	4 cfs (2.6 mgd)	240
Water Facilities Authority	IEUA	Agua de Lejos	9 mgd (13.9 cfs)	840
Three Valleys Municipal Water District	Three Valleys Municipal Water District	Miramar	10 cfs (6.5 mgd)	600

Note:

[1]*Minimum flow rates provided by each agency.*

Table 4-4 summarizes each Agency's projected demand from the SFI (WEI, September 2018), calculated minimum monthly imported water demand, minimum WTP flowrate, and total in-lieu capacity for CBP water. Each member agency provided imported water demand estimates through 2040 for the SFI. The projected imported water demand in 2025 (one year before the start of the CBP) for each member agency was taken from the SFI Table A-2. The project team assumed that the typical water demand of a member agency in the winter months is 60 percent of average monthly water demand based on historical monthly WTP production from Miramar WTP and the five WFA agencies (cities of Chino, Chino Hills, Upland, and Ontario, and the Monte Vista Water District). Low month imported water demand can be found be the following expression:

$$Low\ Month\ Imported\ Water\ Demand\ (TAFM)\ = \frac{\text{Annual Imported Water Demand (TAFY)} * 60\%}{12\ Months/Year}$$

For example, a member agency using 20.0 TAFY of imported water would have a low month demand of 1.0 TAFM AFM.

This equation was applied to each member agency's 2025 projected imported water demand. The calculated in-lieu capacities were rounded down to establish the assumed in-lieu capacity used in the analysis to account for possible variability in actual 2025 imported water demand from SFI projections in 2018. The sum of CBP water delivered to each WFA agency in-lieu of imported water may not exceed the total WFA capacity of 10.0 TAFY.

Table 4-4. In-Lieu Capacities of Member Agencies and TVMWD						
Agency	**SFI 2025 Projected Imported Water Demand (TAFY)**	**Low Month Imported Water Demand (TAFM)**	**Minimum WTP Flowrate (TAFM)**	**In-Lieu Capacity (TAFM)**	**In-Lieu Capacity (TAFY)**	**Assumed In-Lieu Capacity (TAFY)**
Cucamonga Valley Water District	33.1	1.65	0	0.72	8.6	**8.0**
Fontana Water Company	12.0	0.60	0.24	0.36	4.3	**4.0**
Water Facilities Authority	43.2	2.16	0.84	1.32	15.8	**10.0**
Three Valleys Municipal Water District[1]	N/A	1.00	0.60	0.40	4.8	**4.0**

Notes:

[1]Not included in the SFI report, however TVMWD provided historical WTP production rates which were used to estimate imported water demand in low-demand months.

4.1.3.3 Jurupa Community Services District and Western Municipal Water District Allocations

JCSD is a retail water provider in northwest Riverside County which does not currently have an imported water connection. JCSD's in-lieu capacity is not limited by a minimum water treatment plant flow rate. The project team assumed that JCSD's in-lieu capacity is no more than 2.5 TAFY assuming a mechanism to deliver imported water to JCSD is established prior to Program start.

Western Municipal Water District (Western) is an MWD member, and wholesaler and retailer of water in the western portion of Riverside County with imported water supplies from MWD from both the Colorado River Aqueduct and the State Water Project (SWP). Western could be a recipient of CBP water if they could modify operations to reduce SWP water when accepting deliveries from CBP. Because JCSD is a Western member agency, and interties exist between their two systems, CBP water would be delivered to Western by a direct delivery to JCSD, and JCSD and Western would be responsible for their own accounting of water deliveries to Western (either wet or by exchange). Because this approach depends on a connection to CBP through JCSD, Western can only receive deliveries in alternatives that include deliveries to JCSD. In a meeting with Western staff in August 2019, Western established that there was no limit to how much CBP water they could use in-lieu of imported water from the SWP. A maximum combined allocation between Western and JCSD of 5.0 TAFY was established by the project team to prioritize CBP water delivery within the IEUA service area.

4.1.3.4 Summary of Delivery Limitations

Table 4-5 provides boundaries for how much CBP water could be allocated to each agency. Limitations are based on call year deliveries. Non-call year deliveries would be within the limits shown in Table 4-5.

Table 4-5. Minimum and Maximum Call Year CBP Water Allocations		
Agency	Minimum CBP Call Year Delivery (TAFY)	Maximum CBP Call Year Delivery (TAFY)
Metropolitan Water District	10.0[1]	50.0
Cucamonga Valley Water District	0	8.0
Fontana Water Company	0	4.0
Water Facilities Authority	0	10.0
Three Valleys Municipal Water District	0	4.0
Jurupa Community Services District	0	2.5
Western Municipal Water District & Jurupa Community Services District Combined	0	5.0[2]
In-Lieu Total (without MWD)	--	33.5

Notes:

[1]MWD may be allocated 0 TAFY for any alternatives that do not include MWD pump back.

[2] A maximum allocation of 5.0 TAFY between Western and JCSD combined was established by the project team to keep as much CBP water within the IEUA service area as possible.

4.1.4 Alternatives Overview

The parameters discussed in Section 4.1 provided the framework for creating the TAKE alternatives. Six initial alternatives were developed based on the delivery mechanism (pump back or in-lieu) and the delivery condition (standard or pre-delivery). The six alternatives include the two bookends for the delivery mechanism with 100 percent pump back (TAKE-1 and TAKE-2) and 100 percent in-lieu (TAKE-5 and TAKE-6) as well as combination alternatives with partial pump back and partial in-lieu (TAKE-3 and TAKE-4). Each of these three delivery mechanisms were the combined with standard delivery and pre-delivery. For this Study, pre-delivery in non-call years was assumed to be 10.0 TAFY.

However, as noted previously, pre-delivery was later determined not to be feasible and is no longer being considered for the CBP. Two additional alternatives (TAKE-7 and TAKE-8) were developed following further discussions with interested, participating agencies and include both pump back and in-lieu. Also, TAKE-8 could be operated as 100 percent in-lieu. The preliminary TAKE alternatives are summarized in Table 4-6.

Table 4-6. Preliminary TAKE Alternatives Summary		
Alternative	**Pump Back and/or In-Lieu**	**Standard Delivery[1] or Pre-Delivery[2]**
TAKE-1	100% Pump Back	Standard
TAKE-2	100% Pump Back	Pre-Delivery
TAKE-3	Partial Pump Back and Partial In-Lieu	Standard
TAKE-4	Partial Pump Back and Partial In-Lieu	Pre-Delivery
TAKE-5	100% In-Lieu	Standard
TAKE-6	100% In-Lieu	Pre-Delivery
TAKE-7	0 to 100% Pump Back and/or In-Lieu with Expansion Capability	Standard
TAKE-8	Partial Pump Back and Partial In-Lieu or 100% In-Lieu (not including carriage water)	Standard

Notes:

[1]Standard delivery assumes water delivery would only during call years (50.0 TAFY) and there would be no delivery during non-call years.

[2]Pre-delivery assumes water would be pre-delivered during non-call years. A pre-delivery amount of 10.0 TAFY was assumed for this Study. Although included in the summary table above, alternatives relying on pre-delivery are no longer being considered for the CBP.

The preliminary alternatives were refined based on the evaluation of the member agencies' in-lieu capabilities (see Section 4.1.3). Alternative 5 (100 percent in-lieu with standard delivery) was determined infeasible because the combined in-lieu capacity of all member agencies and neighboring agencies (JCSD, Western, and TVMWD) was less than 50.0 TAFY (refer to Table 4-5) when accounting for the required minimum WTP flowrates. This is contrary to the aforementioned TAKE-8 that also assumes possible 100 percent in-lieu operation. However, TAKE-8 was developed in close coordination with specific, interested participating agencies and a reduced annual extraction when considering carriage water losses to meet the call year obligation (carriage water losses are introduced later in this section). In addition, predelivery was considered infeasible after further discussions with MWD. As a result, TAKE-2, TAKE-4, and TAKE-6 were determined infeasible.

IEUA preferred to have multiple delivery options for alternatives with in-lieu deliveries (e.g., TAKE-4 and TAKE-6) to consider different strategies for delivering the CBP water, which resulted in three approaches for TAKE-4 (TAKE-4a, TAKE-4b, and TAKE-4c) and two approaches for TAKE-6 (TAKE-6a and TAKE-6b). TAKE-7 also considers the option to increase the conveyance pipes to accommodate a potential future MWD water banking project.

The call year delivery in TAKE-8 was adjusted to account for carriage water. The conveyance of water across the Delta to the Delta export pumps requires additional water, known as carriage water, to be released upstream of the Delta export pumps. The carriage water is approximately 20 to 30 percent of the amount exported. Compared to normal operations, in-lieu delivery would lead to an accrual of carriage water savings in Lake Oroville. IEUA proposed that the carriage water savings be accounted for as 20 percent of the pulse flow release and applied towards the repayment of the flow. This would allow SWP water to be used for other purposes and allow 20 percent of the CBP water to be used locally. Accordingly, IEUA proposed that the maximum annual quantity of a CBP exchange be reduced from 50,000 acre-feet to 40,000 acre-feet.

Based on these refinements, eight TAKE alternatives were developed, which are summarized in Table 4-7. Since discussions with MWD determined that pre-delivery is not feasible, all alternatives with pre-delivery were eliminated. Thus, the remaining alternatives include TAKE-1, TAKE-3, TAKE-7, and TAKE-8 and are described in further detail in Section 4.3. Descriptions of the alternatives that have been determined infeasible (TAKE-2, TAKE-4, TAKE-5, and TAKE-6) are included in Appendix A.

Table 4-7. TAKE Alternatives Summary

TAKE Alternative	Description		Non-Call Year Deliveries (Pre-Delivery) (TAFY)	Call Year Deliveries (Includes Pre-Delivery)			Total Delivery over 25 Years		
	Pump Back and/or In-Lieu	Standard Delivery or Pre-Delivery		Pump Back (TAFY)	In-Lieu (TAFY)	Total (TAFY)	Pre-Delivery (TAF)	Call Year Deliveries (TAF)	Total (TAF)
TAKE-1	100% Pump Back	Standard	-	50.0	-	50.0	-	375.0	375.0
TAKE-2 Not feasible[1]		Pre-Delivery	10.0	26.7	-	26.7	250.0	125.0	375.0
TAKE-3	Partial Pump Back and Partial In-Lieu	Standard	-	25.5	24.5	50.0	-	375.0	375.0
TAKE-4: TAKE-4a TAKE-4b TAKE-4c Not feasible[1]		Pre-Delivery	10.0	10.0	16.7	26.7	250.0	125.0	375.0
TAKE-5 Not feasible[2]	100% In-Lieu	Standard	-	-	50.0	50.0	-	375.0	375.0
TAKE-6: TAKE-6a TAKE-6b Not feasible[1]		Pre-Delivery	10.0	-	26.7	26.7	250.0	125.0	375.0
TAKE-7[3] TAKE-7a TAKE-7b	0 to 100% Pump Back and/or In-Lieu with Expansion Capability	Standard	-	28.0	22.0	50.0	-	375.0	375.0
TAKE-8[4]	Partial Pump Back and Partial In-Lieu or 100% In-Lieu	Standard	-	0.0 – 10.0	30.0 – 40.0	40.0	-	300.0	300.0

Notes:

[1]Since discussions with MWD determined that pre-delivery is not feasible, all alternatives with pre-delivery (TAKE-2, TAKE-4, and TAKE-6) are no longer being considered for the CBP.

[2]TAKE-5 was determined not to be feasible due to in-lieu deliveries exceeding in-lieu capacity when accounting for the required minimum WTP flowrates.

[3]Two approaches for TAKE-7 were developed: TAKE-7a and TAKE-7b. TAKE-7b includes the option for MWD to extract an additional 50 TAFY banked by MWD.

[4]The TAKE-8 call year delivery was adjusted to account for carriage water (see discussion earlier in this section).100 percent in-lieu operation was determined feasible for TAKE-8 since it was developed in close coordination with specific, interested participating agencies and a reduced annual extraction when considering carriage water losses.

4.2 TAKE Components

This section describes the components that comprise each of the eight TAKE alternatives. The TAKE components are described within two categories: In-Lieu CBP and MWD pump back (Section 4.2.1) and In-Lieu Local (Section 4.2.2).

4.2.1 In-Lieu CBP and MWD Pump Back

Both In-Lieu CBP and MWD pump back involve the direct delivery of CBP water to a member agency or to MWD, respectively, from a dedicated regional potable CBP pipeline. Therefore, they are essentially the same regarding operations and construction of new facilities, the only difference being the location where the CBP water is being delivered. Both delivery mechanisms have three components:

- Component A – Groundwater Extraction and Blending, which includes extraction wells, well collector pipelines, and a blending and storage reservoir.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir, which includes pump stations, high-hydraulic grade line (HGL) potable water pipelines, and turnouts and in-conduit hydropower facilities.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir, which includes low-HGL potable water pipelines and turnouts and in-conduit hydropower facilities.

Each of these components is described in the following sections.

4.2.1.1 Component A – Groundwater Extraction and Blending

Component A includes the groundwater extraction wells, well collector pipe network, and storage and blending reservoir. Both In-Lieu CBP and MWD pump back require the construction and operation of an extraction well field to extract stored CBP water. For each TAKE alternative, an extraction well field is needed to extract stored groundwater, that is then collected through a network of well collector pipelines and discharged to a reservoir that provides blending and serves as the forebay for all CBP water deliveries made by In-Lieu CBP or MWD pump back.

4.2.1.1.1 Extraction Wells

A field of extraction wells is proposed in the general area north of the I-15/I-10 interchange to produce the CBP water for MWD pump back and/or In-Lieu CBP use. The amount of extraction wells required varies between eight and 17, producing between 20.7 TAFY (12,900 gpm) and 50.0 TAFY (31,100 gpm). The estimated flowrates of proposed wells in the area are between 1,500 gpm and 2,000 gpm, based on production data from other nearby wells. It is assumed that one redundant well would be constructed for each alternative such that the firm production capacity with the largest well offline would still produce the amount of CBP water required for the alternative. A sampling port would be installed at all wellheads to facilitate routine water quality sampling. Each well would be able to deliver water to an HGL between 1,100 and 1,350 feet (ft), which covers the expected range of operational water elevations of the proposed blending and storage reservoir, depending on its location. Chlorine would be injected at each wellhead to prevent biological growth in well collector pipelines.

4.2.1.1.2 Well Collector Pipelines

A network of pipelines would be installed to connect each well to the blending and storage reservoir. The collector pipeline diameters would range from 12- to 54-inch, and are sized to keep pipeline velocity below 5 feet per second (fps). Collector pipes are considered separately from the regional potable pipelines because they would convey raw groundwater to a reservoir for blending. After blending in the reservoir and addition of chlorine, the water would be considered potable. It is assumed that additional groundwater treatment would not be necessary as water quality in the proposed wellfield location meets drinking water standards. If additional treatment becomes necessary in the future, either a wellhead or centralized treatment facility can be integrated and located at either an individual well site or adjacent to the blending and storage reservoir.

4.2.1.1.3 Blending and Storage Reservoir

The reservoir would provide blending and storage of extracted groundwater and a constant head for the wells to pump into. Based on preliminary siting assumptions the reservoir would have an HGL of either 1,100 ft, 1,180 ft, or 1,350 ft, which is sufficient to deliver water to JCSD and some pressure zones of Ontario and FWC, as discussed in Section 4.2.1.3. The reservoir has been sized in each alternative to provide approximately three hours of retention time to complete blending, which also corresponds to three hours of storage time due to the constant-flow nature of the TAKE delivery systems.

The reservoir would constantly be filled by the extraction well field and would constantly provide water to member agencies and/or MWD, as discussed in Sections 4.2.1.2 and 4.2.1.3. Chlorine would be dosed within the tank and at the outlet(s) of the tank to provide disinfection and residual chlorine in the distribution system. Coordination may be required for those agencies that utilize chloramination (i.e., WFA agencies).

The land acquired for the reservoir is to be large enough to accommodate the future construction of a groundwater treatment facility. If the extraction well field begins producing low-quality water that cannot be blended out, a treatment facility may be constructed on the same site as the reservoir and would remove the contaminant(s) prior to discharging extracted groundwater into the reservoir.

4.2.1.2 Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir

Component B includes one or more pump stations, potable water pipelines, and turnouts and hydropower facilities to agencies with HGLs higher than the storage reservoir. The HGL of the Rialto Pipeline, as well as some member agencies pressure zones, is higher than the proposed storage and blending reservoir. To deliver In-Lieu CBP water or MWD pump back water to those pressure zones, a pump station and pressurized pipeline network is required above the reservoir. Coincidentally, the project area is on a south facing slope from the San Gabriel Mountain Range to the north, and all of the delivery locations that are higher in elevation than the proposed reservoir are north of the reservoir as well. The inverse is true that all delivery locations south of the proposed reservoir are lower in elevation than the reservoir.

Agencies that may receive water from the Component B facilities include the following with the HGL of the facility indicated:

- MWD: Rialto Pipeline – 1,936 ft
- CVWD: Zone III – 1,658 ft
- CVWD: Zone II – 1,420 ft
- FWC: Highland Zone – 1,504 ft
- FWC: Juniper Zone – 1,103 ft
- WFA Agencies: Agua de Lejos WTP Clearwell – 1,630 ft
- Upland: Agua de Lejos WTP Clearwell (Upland Zone II) – 1,632 ft
- TVMWD: Miramar WTP Clearwell – 1,630 ft

4.2.1.2.1 Pump Stations

TAKE alternatives include the construction of Potable Water Pump Station #1, which is to be located adjacent to the proposed reservoir and would use the reservoir as a forebay to provide suction head. Typically, Pump Station #1 would lift water up to the highest HGL of all of the Component B turnouts (Rialto Pipeline, HGL 1,936 ft). Because all other Component B turnouts are lower than the Rialto Pipeline, this would result in over-pressurizing some water which would require PRV stations or in-conduit hydropower facilities to reduce the head as discussed in Section 4.2.1.2.3.

In some alternatives, it is more cost effective to construct a second pump station (Potable Water Pump Station #2) to lift MWD's share of water to the HGL of the Rialto Pipeline (1,936 ft), rather than requiring Pump Station #1 to lift all water in Component B up to 1,936 ft. This was typically done when the allocation of water to MWD was low enough to make the cost of constructing Pump Station #2 lower than the cost of losing energy from over-pressurizing water to every other member agency turnout in Component B. In alternatives with Pump Station #2, Pump Station #1 lifts water to the HGL of the second highest turnout in Component B (CVWD Zone III – 1,658 ft), and Pump Station #2 takes only MWD's share of water and lifts it from 1,658 ft to the Rialto Pipeline HGL. The decision to construct a second pump station would be re-evaluated using a hydraulic model in the preliminary design phase once the preferred TAKE alternative has been selected.

4.2.1.2.2 High-HGL Potable Water Pipelines

A potable pipeline network is proposed north of the blending and storage reservoir to deliver water to the agencies and pressure zones listed in Section 4.2.1.2. The primary feature is the northern pipeline, which would comprise pipelines with diameters ranging from 30 and 54 inches and would align from the reservoir north along Milliken Avenue, east along Baseline Road, and north along Day Creek Boulevard to the general area of the CWWD Lloyd W. Michael WTP. The Lloyd W. Michael WTP is owned and operated by CVWD and is the location of some of CVWD's Zone III tanks. This northern pipeline would supply CVWD Zone III and the MWD Rialto Pipeline.

For alternatives that include delivery to FWC's Highland Zone, a 12- to 24-inch pipeline would branch off from the northern pipeline at the intersection of Day Creek Boulevard and Baseline Road and would align East in Baseline Road until reaching FWC's system.

For alternatives that include delivery to MVWD, Upland, CVWD Zone III, and/or TVMWD, a proposed 16- to 36-inch east-west pipeline would branch off from the northern pipeline at the intersection of Foothill Boulevard and Milliken Avenue. The east-west pipeline would align in Foothill Boulevard until turning North at Mountain Avenue in Upland, then turning west again at 18th Street toward the Agua de Lejos and Miramar WTPs. The east-west pipeline would terminate at its connections to Miramar and/or Agua de Lejos. Maps of all potable pipeline alignments are provided with the TAKE alternatives descriptions in Section 4.3.

4.2.1.2.3 Turnouts and In-Conduit Hydropower Facilities

MWD would receive delivery of CBP water into the Rialto Pipeline near the Lloyd W. Michael WTP in Rancho Cucamonga (off the northern pipeline) or the Miramar WTP in Claremont (off the east-west pipeline). In either case, a new turnout would need to be constructed from the regional CBP pipeline into the Rialto Pipeline. The turnout would include a sampling port for monitoring CBP water quality flowing into the Rialto Pipeline, and a backflow prevention device to prevent water from the Rialto Pipeline from entering the CBP pipeline. Because the CBP regional pipeline network is potable and Rialto Pipeline is raw, the Division of Drinking Water would need to be involved in the permitting of the interconnection between the Rialto Pipeline and the CBP pipeline. Very strict redundancy and safety requirements to ensure the potable pipelines are not contaminated with raw Rialto Pipeline water would be required.

CVWD Zone III would receive delivery of CBP water at the storage tanks on the Lloyd W. Michael WTP site from the northern pipeline. The HGL of the northern pipeline would be 1,936 ft (Rialto Pipeline) in some alternatives, and therefore the turnout to CVWD Zone III may include a PRV station or in-conduit hydropower facility to recapture energy. The CVWD Zone III turnout would include a sampling port to monitor water quality entering CVWD's system.

CVWD Zone II would receive delivery of CBP water via a turnout into a transmission main at the intersection of Archibald Avenue and Foothill Boulevard off the east-west pipeline. The HGL of the east-west pipeline would be at least 1,632 ft to reach other downstream turnouts, so CVWD's Zone II turnout (1,420 ft) would require a PRV or in-conduit hydropower facility to reduce pressure into CVWD Zone II. The CVWD Zone II turnout would include a sampling port to monitor water quality entering CVWD's system.

FWC Highland Zone would receive delivery of CBP water into a transmission main in Baseline Avenue (Baseline becomes "Avenue" East of the Fontana/Rancho Cucamonga city line). The HGL of the Highland Zone is 1,504 ft, and the FWC Highland turnout would always require a PRV station or in-conduit hydropower facility to reduce pressure to the Highland Zone HGL. The FWC Highland turnout would include a sampling port to monitor water quality entering FWC's system.

Upland and MVWD receive imported water currently from the Agua de Lejos WTP in Upland. The Agua de Lejos WTP has a clearwell with a surface elevation of 1,632 ft that provides water supply to both Upland Zone II and MVWD Z1. Upland Zone II is supplied from the clearwell by a set of pumps that pump treated water into Upland's system. MVWD Z1 is supplied via the Benson Avenue feeder, which carries treated water from Agua de Lejos to Ontario, MVWD, and Chino. MVWD uses a hydropower facility in Montclair to reduce the HGL from 1,632 ft to the MVWD Z1 HGL of 1,351 ft. The Agua de Lejos clearwell is the ideal location to deliver CBP water to MVWD and Upland because it provides the CBP water in the same location as imported water currently enters their systems. The turnout to MVWD and Upland would be a connection to the Agua de Lejos Clearwell from the east-west pipeline, including a sampling port to monitor water quality entering their systems.

TVMWD would receive delivery of CBP water at the Miramar WTP clearwell in Claremont, which has an HGL of 1,630 ft. The turnout to TVMWD from the east-west pipeline requires crossing CA-210, however a 48-inch sleeve already exists under the freeway which may be used to house the interconnection piping. The turnout to TVMWD would include a sampling port to monitor water quality entering the TVMWD system.

4.2.1.3 Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir

Component C includes the potable water pipelines and turnouts and hydropower facilities to agencies with HGLs lower than the storage reservoir. Some delivery locations, including JCSD's 1110 Zone, Ontario's 1010 Zone, and FWC's Juniper Zone (HGL 1,103 ft) are at HGLs below the proposed reservoir and can receive water via gravity.

4.2.1.3.1 Low-HGL Potable Water Pipelines

The southern pipeline would deliver CBP water from the proposed reservoir to Ontario's 1010 Zone and JCSD's 1110 Zone. The pipeline varies in size based on the delivery amount to those agencies in each alternative. The southern pipeline is proposed to be aligned in Milliken Avenue from the reservoir (near the intersection of Jersey Boulevard and Milliken Avenue) the Northwest edge of JCSD's service area at the intersection of Philadelphia Street and Milliken Avenue.

The southern pipeline also includes a branch pipeline to FWC's Juniper Zone (HGL 1,103 ft) in TAKE-4b, which would align in 4th Street. In all other Alternatives, FWC's delivery point is above the proposed reservoir.

4.2.1.3.2 Turnouts and In-Conduit Hydropower Facilities

The southern pipeline is proposed to terminate at a turnout to JCSD's 1110 Zone at the intersection of Philadelphia Street and Milliken Avenue. A turnout to Ontario's 1010 Zone is proposed along the southern pipeline near the intersection of Lowell Street and Milliken Avenue. Because of the high difference in HGL from the proposed reservoir (1,180 ft) to the Ontario 1010 Zone, an in-conduit hydropower facility should be considered at Ontario's turnout. There is not enough of a difference in head to justify an in-conduit hydropower facility at JCSD's turnout.

In TAKE-4b, a turnout to FWC's Juniper Zone is proposed at the end of the FWC branch of the pipeline. In-conduit hydropower would not be considered because there is not enough head differential between the southern pipeline HGL and the FWC Juniper Zone.

Sampling ports would be included at all turnouts to monitor water quality entering member agencies' systems.

4.2.2 In-Lieu Local

The In-Lieu Local delivery mechanism involves using either new or existing wells and piping to locally produce groundwater stored by CBP. If existing wells were used for In-Lieu Local, then it was assumed that only existing wells that are currently offline would be considered to exclusively to produce CBP water when they are brought back into service. In-Lieu Local is Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects).

For the purposes of this Study, two example In-Lieu Local projects were identified in Chino and Chino Hills. These projects are considered examples only for establishing the In-Lieu Local delivery concept. Chino and Chino Hills are far from the proposed extraction well field and proposed reservoir, making it costly to provide access to water via In-Lieu CBP use. Several offline wells in the Chino and Chino Hills service areas could be reinstated and retrofitted with wellhead treatment to remove nitrate and produce potable water. This In-Lieu Local water would be delivered to Chino and Chino Hills via the agencies' existing potable infrastructure. Because the wells are currently offline, all water produced by these wells and treated by the proposed wellhead treatment systems would be considered CBP water. The delivery amount to Chino and Chino Hills via this method varies from alternative to alternative, though they are always equivalent to each other.

These example projects were developed for existing wells, but new wells could also be considered for In-Lieu Local projects. The wells would be equipped with wellhead treatment if groundwater contamination exists in the proposed area.

The remainder of this section discusses the proposed groundwater treatment for these two In-Lieu Local projects for the cities of Chino and Chino Hills. These In-Lieu Local projects were included in all TAKE alternatives that include in-lieu use (TAKE-3, TAKE-4a, TAKE-4b, TAKE-4c, TAKE-6a, and TAKE-6b).

4.2.2.1 City of Chino

The City of Chino owns several groundwater extraction wells, including Wells 10, 12, and 14, that have water quality issues. Contaminants of concern include 1,2,3-Trichloropropane (1,2,3-TCP), nitrate, perchlorate, and hexavalent chromium. Instead of implementing wellhead treatment to meet new potable water standards, the City has relied on imported water. However, to reduce their dependence on imported water the City is now re-examining wellhead treatment with a proposed facility on the southwest corner of Philips Blvd and Central Ave. The City recently completed the City of Chino Water Quality Feasibility Study (Hazen and Sawyer, May 2019) that recommended granular activated carbon (GAC) and ion exchange (IX) for the wellhead treatment process.

The treatment approach was reviewed as part of this Study and a biological treatment system with an ion exchange polishing step is recommended to eliminate brine generated from the treatment system, and eliminate brine disposal costs. The proposed centralized wellhead treatment facility would have the following characteristics:

- Water Quality
  - Current concentrations of 1,2,3-TCP, nitrate, perchlorate, and arsenic are above the maximum contaminant level (MCL). Hexavalent chromium levels are also elevated and near or above current regulatory notification levels.

- Wellhead Treatment Facility
  - The proposed facility is located at the southwest corner of Philips Blvd and Central Ave, also known as the Philips Site. The Philips Site also includes Wells 1, 2, 3, 10 and 12; Reservoirs 2 and 4; and the Philips Booster Station.
  - The facility would treat 3.0 TAFY of groundwater from existing Wells 10, 12, and 14.
  - The proposed treatment process is a fixed-bed bioreactor (FXB) followed by a perchlorate-selective ion-exchange polishing step to treat the entire influent flow.

The City of Chino Wellhead Treatment Facility is summarized in Table 4-8 and shown in Figure 4-1.

Table 4-8. City of Chino Wellhead Treatment Facility

Parameter	Description
Location	Philips Site (Philips Blvd and Central Ave)
Treatment Capacity (Product Water) (TAFY)	3.0
Number of Extraction Wells (existing)	3 (Wells 10, 12, 14)
FXB Bioreactor System	
Number of Vessels	5 (1 per train)
Vessels Diameter (ft)	14
System Capacity (gpm)	1,956
Perchlorate-Selective IX System	
Type	Single-use
Number of Vessels	3
Vessels Diameter (ft)	11
Resin Life (years)	>2
System Capacity (gpm)	1,956

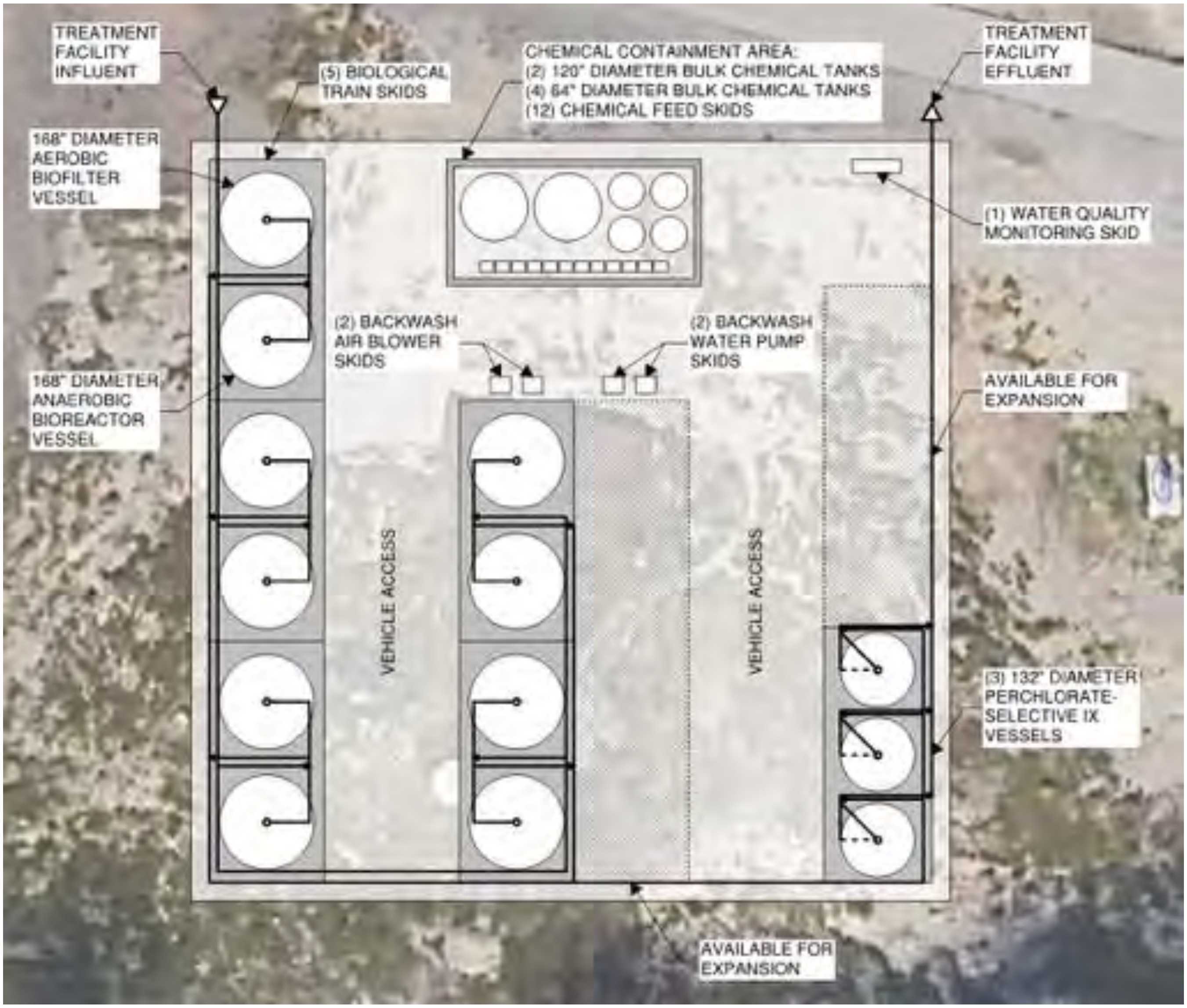

Figure 4-1. City of Chino Wellhead Treatment Facility (Example In-Lieu Local Project)

4.2.2.2 City of Chino Hills

The City of Chino Hills owns four wells that previously extracted potable water from the Chino Basin. The City of Chino Hills Booster 9 Pump Station historically received flow from the four extraction wells and pumped the potable water into the drinking water system. The wells are currently not in operation due to the concentrations of 1,2,3-TCP exceeding the MCL A wellhead treatment facility would be required to reduce the concentration of 1,2,3-TCP and resume operation of the four wells for potable water usage. The City recently completed the Preliminary Design Technical Memorandum for the Chino Hills 123-TCP Removal Project (Michael Baker International, December 2018) that recommended GAC for the wellhead treatment process.

The treatment approach was reviewed as part of this Study and GAC with an ion exchange polishing step to reduce the nitrate concentrations. The elements of the proposed facility would be as follows:

- Water Quality - The water quality of Booster 9 Pump Station discharge is regulated by the Domestic Drinking Water Supply Permit issued to the City of Chino Hills.

- The blended flow concentration of 1,2,3-TCP at Wells 1A, 7B, 7B, and 17 currently exceeds the MCL.
- The blended flow concentration of nitrate exceeds the treatment goal of 80 percent, or less, of the MCL set forth by the Domestic Drinking Water Supply Permit issued to the City of Chino Hills.

- Wellhead Treatment Facility
  - The proposed wellhead treatment facility would located adjacent to the City of Chino Hills Booster 9 Pump Station. The facility would produce at least 3.0 TAFY by treating flow from existing Wells 1A, 7A, 7B, and 17.
  - The proposed treatment process is GAC-IX to reduce the blended flow concentrations of 1,2,3-TCP and nitrate.
- Pipelines
  - Approximately 6,800 linear feet of 8-inch HDPE piping would be constructed to connect to the IEBL System for brine disposal.

The City of Chino Hills wellhead treatment facility is summarized in Table 4-9 and shown in Figure 4-2.

Table 4-9. City of Chino Chills Potential Wellhead Treatment Facility

Parameter	Description
Wellhead Treatment Facility	
Location	City of Chino Hills Booster 9 Pump Station site
Treatment Capacity (Product Water) (TAFY)	3.0
Number of Extraction Wells (existing)	4 (Wells 1A, 7A, 7B, 17)
GAC System	
Number of Vessels	4 total (2 pairs)
Vessels Diameter (ft)	12
System Capacity (gpm)	2,070
Media Type	Coconut Shell-Based Carbon
Media Weight per Vessel (lbs)	40,000
IX System	
Type	Regenerable
Number of Vessels	3
Vessel Diameter (ft)	6
System Capacity (gpm)	550
Resin Capacity in each Vessel (ft^3)	99
Brine Conveyance	
Disposal System	IEBL
Disposal Capacity (gpd)	4,900
Pipeline Length (ft)	6,800 (8-inch)

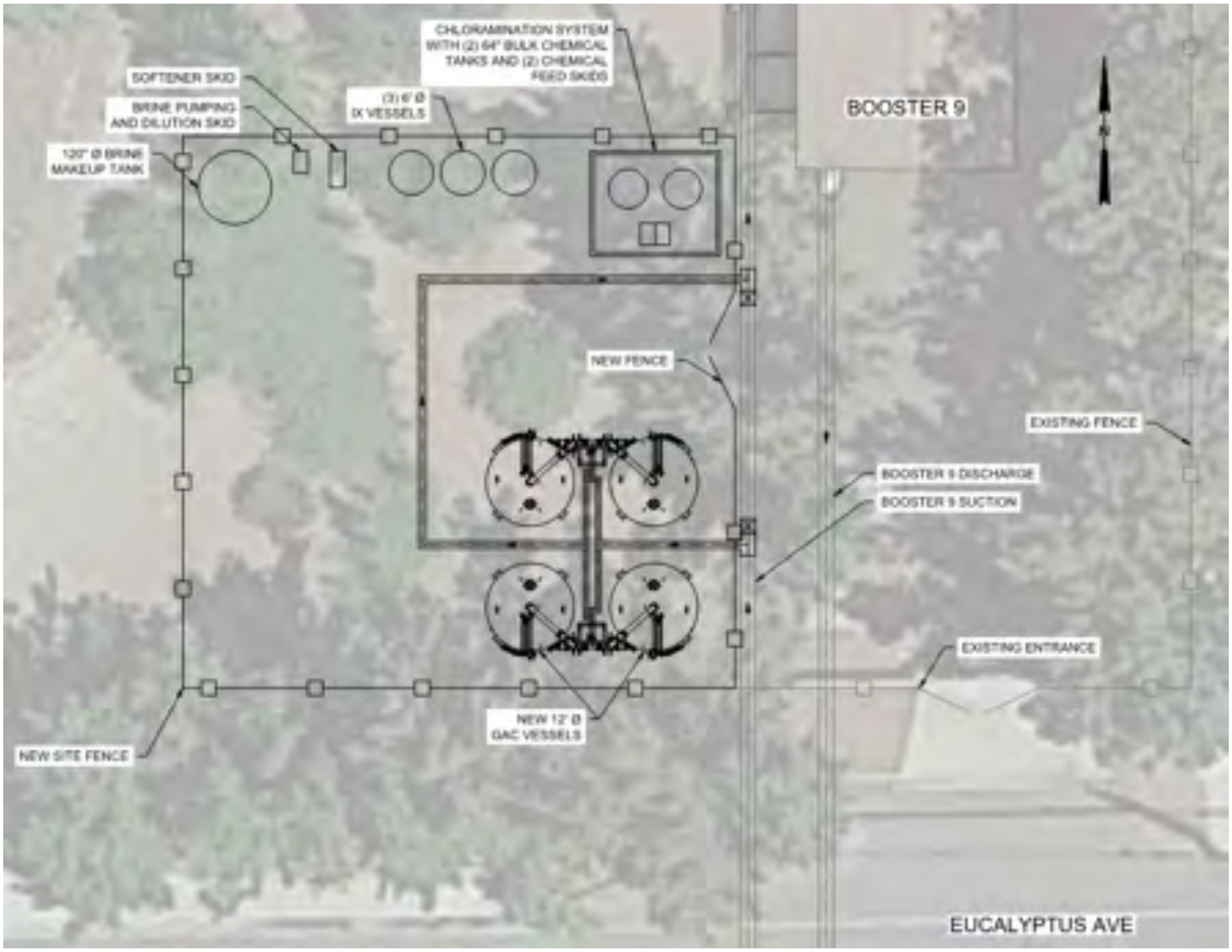

Figure 4-2. City of Chino Hills Wellhead Treatment Facility (Example In-Lieu Local Project)

4.3 TAKE Alternatives Descriptions

The four feasible TAKE alternatives, TAKE-1, TAKE-3, TAKE-7, and TAKE-8, are described in the following sections. The descriptions for each alternative are comprised of the TAKE components presented in Section 4.2 with minor modifications described in this section. Section 4.3.7 includes a detailed facilities summary and cost summary (capital and O&M costs) for the eight alternatives.

The alternatives descriptions for the initial TAKE alternatives that included pre-delivery and were determined to be infeasible (TAKE-2, TAKE-4, and TAKE-6) are included in Appendix A.

4.3.1 TAKE Alternative 1 – 100% MWD Pump Back, Standard Delivery

TAKE Alternative 1 (TAKE-1) includes delivery of 50.0 TAFY of CBP water to the Rialto Pipeline during call years, with standard delivery (i.e., no pre-delivery of CBP water during non-call years) and no delivery of CBP water to member agencies for in-lieu. Table 4-10 provides the breakdown of CBP water deliveries to MWD and the member agencies during call and non-call years.

Table 4-10. TAKE Alternative 1 Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	50.0	-
Cucamonga Valley Water District	-	-
Fontana Water Company	-	-
City of Chino[1]	-	-
City of Chino Hills[1]	-	-
City of Ontario[1]	-	-
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	-	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**50.0**	-

Note:
[1]Water supplied from the WFA Agua de Lejos WTP.

TAKE Alternative 1 includes the following facilities, shown on Figure 4-3:

- Component A – Groundwater Extraction and Blending
  - 17 extraction wells
  - 9 miles of 12- to 36-inch collector pipelines
  - 5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 9,300 HP, 31,100 gpm firm capacity, 823 ft TDH

  - 5 miles of 54-inch potable northern pipeline
  - Proposed 54-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - None
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - None
- Existing Facilities
  - Rialto Pipeline (HGL 1,936 ft)

TAKE Alternative 1 would be operated to deliver 50.0 TAFY to the Rialto Pipeline during call years. Although the facilities would not be operated for Program purposes during non-call years, the infrastructure would be available for local and/or regional uses. The operation of the TAKE-1 components during call years is described below.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 50.0 TAFY (about 31,100 gpm) of groundwater during call years (see Section 4.2.1.1).
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. During call years, Pump Station #1 would deliver 50.0 TAFY of water to the Rialto Pipeline through a proposed 54-inch northern pipeline and a proposed 54-inch turnout into the Rialto Pipeline.

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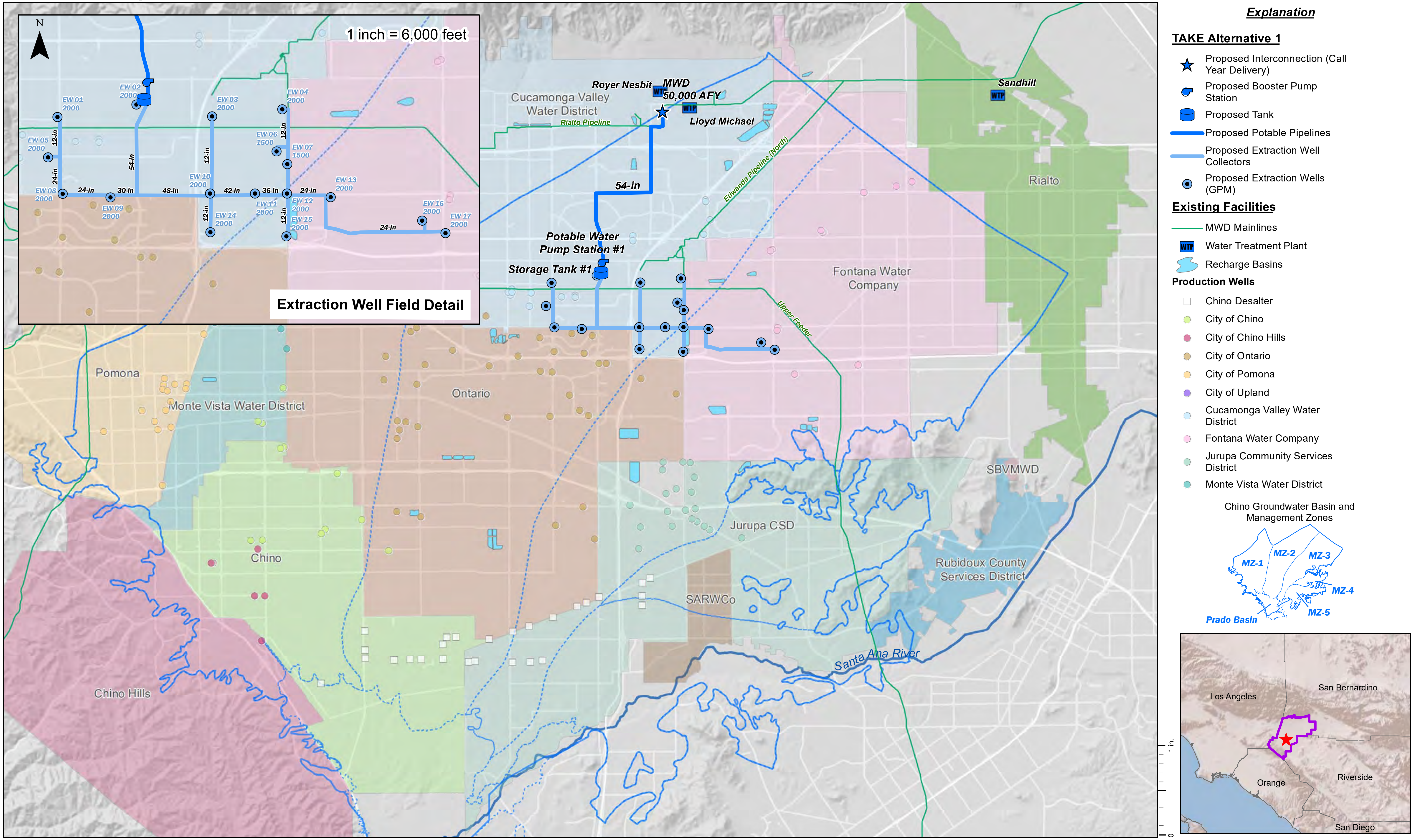

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative1

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1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:
CBP Chino Basin Program
Preliminary Design Report

Prepared for:
Inland Empire Utilities Agency A Municipal Water District

TAKE Alternative 1

Figure 4-3

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4.3.2 TAKE Alternative 3 – Partial MWD Pump Back and Partial In-Lieu, Standard Delivery

TAKE Alternative 3 (TAKE-3) involves the delivery of 50.0 TAFY combined during call years to the Rialto Pipeline, five member agencies, and Jurupa Community Services District. Since this alternative is based on standard delivery, no water would be delivered during non-call years. Table 4-11 provides the deliveries to each Agency in Alternative 3.

Table 4-11. TAKE Alternative 3 Deliveries to Each Agency (TAFY)		
Agency	**Call Year**	**Non-Call Year**
Metropolitan Water District	25.5	-
Cucamonga Valley Water District	8.0	-
Fontana Water Company	4.0	-
City of Chino[1]	3.0	-
City of Chino Hills[1]	3.0	-
City of Ontario[1]	4.0	-
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	2.5	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**50.0**	**-**

Note:

[1]Water supplied from the WFA Agua de Lejos WTP.

TAKE Alternative 3 includes construction or use of the following facilities, shown on Figure 4-4:

- Component A – Groundwater Extraction and Blending
  - 15 extraction wells
  - 9 miles of 12- to 42-inch collector pipelines
  - Storage Tank #1: 5 MG and in-conduit hydropower facility
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 7,000 HP, 23,300 gpm firm capacity, 823 ft TDH
  - 8 miles of 16- through 48-in potable northern pipeline (includes branches to FWC and CVWD)
  - Proposed 16-inch turnout to FWC Highland Zone (and optional hydropower facility)
  - Proposed 24-inch turnout to CVWD Zone III (and optional hydropower facility)
  - Proposed 36-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 12- through 24-inch potable southern pipeline
  - Proposed 24-inch turnout to Ontario 1010 Zone (and optional hydropower facility)

  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 3.0-TAFY wellhead treatment for Chino Well Nos. 10, 12, and 14
  - 3.0-TAFY wellhead treatment for Chino Hills Well Nos. 1A, 7A, 7B, and 17
- Existing Facilities:
  - Rialto Pipeline (HGL 1,936 ft)
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)

TAKE Alternative 3 would be operated to deliver 50.0 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years only. Although the facilities would not be operated for Program purposes during non-call years, the infrastructure would be available for local and/or regional uses. The operation of the TAKE-3 components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 44.0 TAFY (about 27,300 gpm) of groundwater during call years in (see Section 4.2.1.1).
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. During call years, Pump Station #1 would deliver 37.5 TAFY combined of water to the Rialto Pipeline, CVWD Zone III, and FWC Highland Zone through the proposed 7.1-mile northern pipeline network and turnouts to all three agencies.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - Potable Water Pump Station #1 is designed to lift water to an HGL of 1,936 ft to be able to deliver to the Rialto Pipeline. CVWD and FWC, who would both receive water from Pump Station #1, are at HGLs much lower than 1,936 ft. To recapture some of the lost energy from over-pumping, in-conduit hydropower facilities are proposed at both the CVWD and FWC turnouts. Preliminary calculations showed that the energy loss from over-pumping and recovering energy from hydropower facilities is less costly than the expense of constructing two additional pump stations designed to deliver water exactly to the HGLs of CVWD and FWC (1,658 ft and 1,504 ft, respectively).
  - 6.5 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone and JCSD's 1110 Zone along a proposed 24-inch southern pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not for JCSD's turnout.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 6.0 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 3 proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 3.0 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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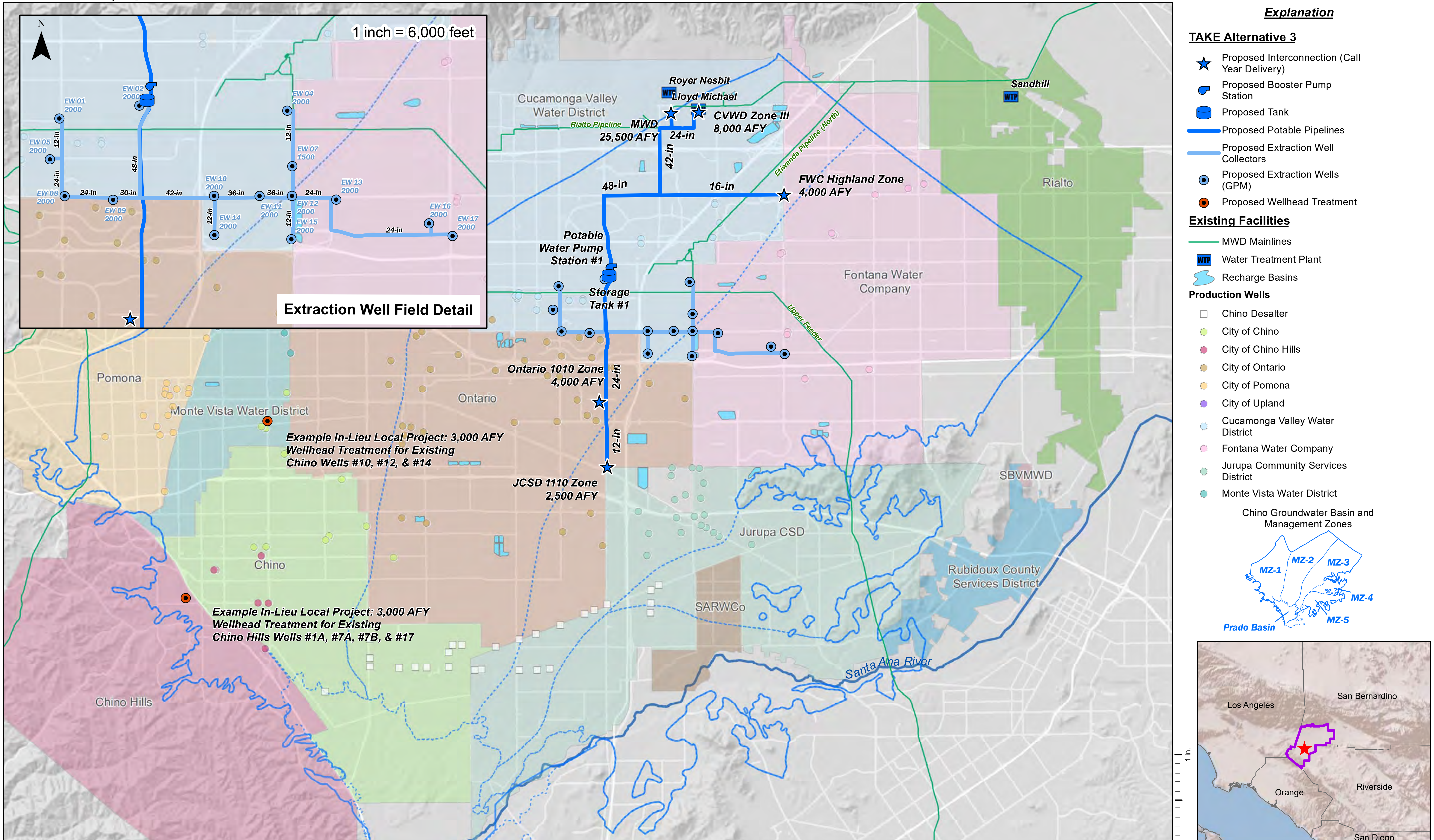

Prepared by:

Brown and Caldwell

WSC Water Systems Consulting, Inc.

Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative3

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

TAKE Alternative 3

Figure 4-4

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4.3.3 TAKE Alternative 7 – 0 to 100% Pump Back and/or In-Lieu with Expansion Capability, Standard Delivery

TAKE Alternative 7 (TAKE-7) involves the delivery of a total of 50.0 TAFY during call years to MWD through pump-back to the Rialto Pipeline and in-lieu deliveries to all 7 member agencies. Since this alternative is based on standard delivery, no water would be delivered during non-call years under CBP. Table 4-12 provides the deliveries to each Agency in Alternative 7.

Table 4-12. TAKE Alternative 7 Deliveries to Each Agency (TAFY)		
Agency	**Call Year**	**Non-Call Year**
Metropolitan Water District	28.0	-
Cucamonga Valley Water District	8.0	-
Fontana Water Company	4.0	-
City of Chino[1]	2.0	-
City of Chino Hills[1]	2.0	-
City of Ontario[1]	2.0	-
City of Upland[1]	2.0	-
Monte Vista Water District[1]	2.0	-
Jurupa Community Services District	-	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**50.0**	**-**

Note:

[1]Water supplied from the WFA Agua de Lejos WTP.

TAKE Alternative 7 includes construction or use of the following facilities, shown on Figure 4-5:

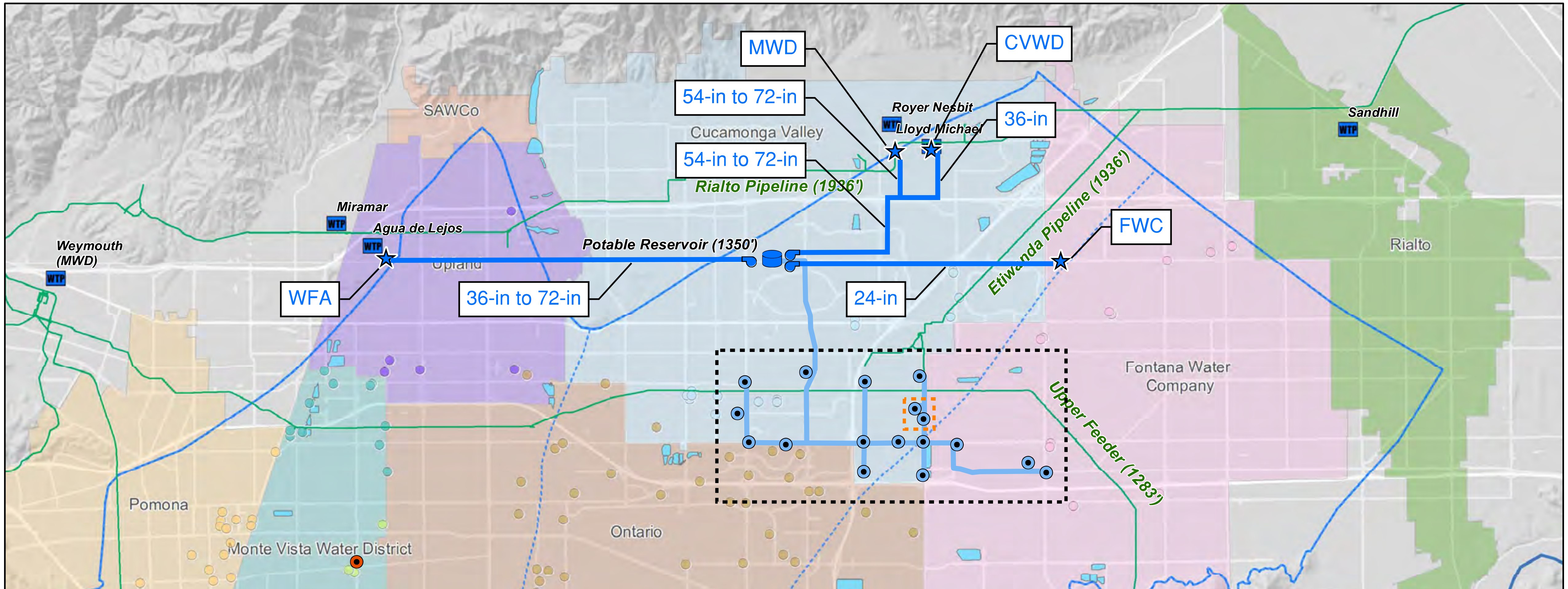
- Component A – Groundwater Extraction and Blending
  - 17 extraction wells
  - 14 miles of 12- to 54-inch collector pipelines
  - Storage Tank #1: 5 MG
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir (Storage Tank #1)
  - Potable Water Pump Station #1 – Reservoir to CVWD and MWD: 4,800 HP, 22,300 gpm firm capacity, 600 ft TDH
  - Potable Water Pump Station #2 – Reservoir to FWC F16 Tanks: 220 HP, 2,500 gpm firm capacity, 250 ft TDH
  - Potable Water Pump Station #3 – Reservoir to Agua de Lejos Clearwell: 830 HP, 6,200 gpm firm capacity, 370 ft TDH
  - 4.5 miles of 36- to 54-inch potable pipeline from reservoir to CVWD and MWD

- 7 miles of 24-inch potable pipeline from reservoir to FWC
- 7 miles of 36-inch potable pipeline from reservoir to Agua de Lejos clearwell. Existing infrastructure, including the Benson Avenue Feeder, will be used to convey water from Agua de Lejos to all 5 WFA member agencies.
- Proposed 54-inch turnout to the Rialto Pipeline
- Proposed 36-inch turnout to CVWD Zone III (and optional hydropower facility)
- Proposed 24-inch turnout to FWC Highland Zone
- Proposed 36-inch turnout to WFA Agua de Lejos clearwell

- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - No infrastructure
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - No infrastructure
- Existing Facilities:
  - Rialto Pipeline (HGL 1,936 ft)
  - Agua de Lejos clearwell (HGL 1,632 ft)
  - Benson Avenue Feeder (HGL 1,632 ft)

TAKE Alternative 7 would be operated to deliver 50.0 TAFY to the Rialto Pipeline and member agencies during call years only. Although the facilities would not be operated for Program purposes during non-call years, the infrastructure would be available for local and/or regional uses. The operation of the TAKE-7 components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 50.0 TAFY (about 31,100 gpm) of groundwater during call years in (see Section 4.2.1.1).
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Stations #1, #2, and #3.
  - Pump Station #1 would deliver 36.0 TAFY total to the Rialto Pipeline and CVWD Zone III.
  - Pump Station #2 would deliver 4.0 TAFY to the FWC Highland Zone.
  - Pump Station #3 would deliver 10.0 TAFY to the Agua de Lejos clearwell for distribution to the WFA agencies.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - No operations
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - No operations



Explanation

TAKE MWD Integration

- WSIP Interconnection (WSIP Call Year Delivery)
- Proposed Tank
- Proposed Extraction Well Collectors
- Proposed Extraction Wells
- Proposed Booster Station

Existing Production Wells

- Chino Desalter
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District

Delivery Points
1. WFA: Agua de Lejos Clearwell - HGL 1,632 ft
2. FWC: Highland Zone @ Baseline & Cherry - HGL 1,504 ft
3. CVWD: Lloyd Michael Clearwell - HGL 1,658 ft
4. MWD: Rialto Pipeline @ CB-7 (upsized) - HGL 1,936 ft

Pipeline Alignments
1. 36-in to 72-in WFA Pipeline: Baseline, Benson (7.0 miles)
2. 24-in FWC Pipeline: Baseline: (4.5 miles)
3. 54-in to 72-in & 36-in CVWD/MWD Pipeline: Baseline, Day Creek, Banyan, Etiwanda (4.5 miles)
4. 54-in to 72-in MWD Pipeline: Bluegrass (0.3 miles)

Pump Stations
1. WFA Booster: 1,700 HP
2. FWC Booster: 300 HP
3. CVWD/MWD Booster: 4,800 HP

Extraction Wells
1. 15x 2,000 gpm
2. 2x 1,500 gpm

53,000 AFY total production capacity
Average Well Pump HP: 600 HP

Delivery Schedule

WSIP Call Year

WFA: 10,000 AFY
FWC: 4,000 AFY
CVWD: 8,000 AFY
MWD: 28,000 AFY

Note 1: During WSIP Non-Call Years, MWD could use the facilities shown (smaller diameters) to extract up to 50,000 AFY from the Chino Basin and deliver it to the Rialto Pipeline, provided MWD had banked water in the basin previously.

Note 2: During WSIP Non-Call Years, MWD could use the facilities shown (larger diameters) to extract up to 100,000 AFY from the Chino Basin and deliver it to the Rialto Pipeline or Weymouth, provided MWD had banked the water in the basin previously.

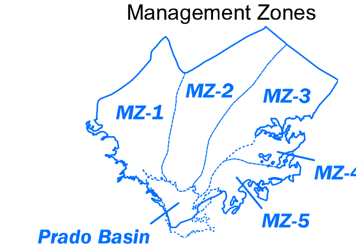
Further, for a 100,000 AFY banking program, MWD would need to install an additional 50,000 AFY of extraction well capacity, upsize the extraction well collector network, provide additional surface storage, upsize the CVWD/MWD Booster, upsize the WFA Booster (if delivering to Weymouth), and extend the WFA Pipeline to Weymouth (if delivering to Weymouth). These additional or upsized facilities are not included in this Environmental Impact Report.

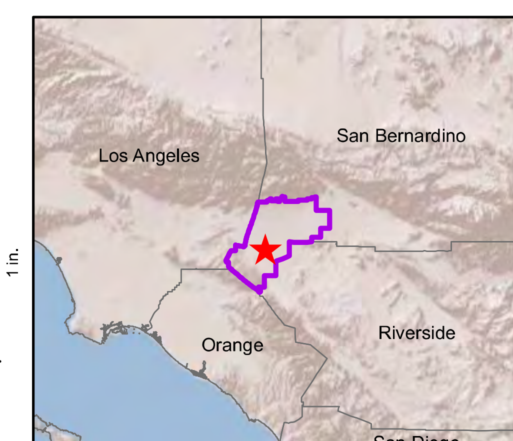
Assumptions
1. Diameters based on 5 fps.
2. Extraction wells will produce 2,000 gpm, except wells outlined in orange will produce 1,500 gpm.

Pipe Capacities by Diameter

12-in....................3,000 AFY
16-in....................5,000 AFY
24-in...................11,500 AFY
30-in...................18,000 AFY
36-in...................25,500 AFY
42-in...................35,000 AFY
48-in...................45,500 AFY
54-in...................57,500 AFY
60-in...................71,000 AFY
66-in...................86,000 AFY
72-in.................102,000 AFY

Chino Groundwater Basin and Management Zones





Prepared by: Brown AND Caldwell | WSC Water Systems Consulting, Inc.

Author: AWM Date: 12/8/2020

File Name: CBP_TAKE_MWD Integration Canvas_2020-12-08

N

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project: CBP Chino Basin Program

Preliminary Design Report

Prepared for: Inland Empire Utilities Agency, A Municipal Water District

TAKE Alternative 7

Figure 4-5

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4.3.4 TAKE Alternative 8 – Partial MWD Pump Back and Partial In-Lieu or 100% In-Lieu, Standard Delivery

TAKE Alternative 8 (TAKE-8) involves the delivery of a total of 40.0 TAFY during call years to MWD through pump-back to the Rialto Pipeline, and in-lieu deliveries to CVWD and FWC. TAKE-8 also allows for in-lieu delivery of the full 40 TAFY to CVWD and FWC if MWD elects not to have water pumped back into the Rialto Pipeline.TAKE-8 is based on delivering 40.0 TAFY with the assumption that a credit for the balance of 10.0 TAFY will be given for carriage water not required to be released from Lake Oroville for SWP deliveries, as discussed in Section 4.1.4. Since this alternative is based on standard delivery, no water would be delivered during non-call years under CBP. Table 4-11 provides the deliveries to each Agency in Alternative 8.

Table 4-13. TAKE Alternative 8 Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District[1]	0.0 to 10.0	-
Cucamonga Valley Water District[1]	20.0 to 30.0	-
Fontana Water Company	10.0	-
City of Chino[1]	-	-
City of Chino Hills[1]	-	-
City of Ontario[1]	-	-
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	-	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**40.0**	**-**

Note:
[1]When MWD Pump Back is not used, CVWD will accept delivery of 30.0 TAFY instead of 20.0 TAFY.

TAKE Alternative 8 includes construction or use of the following facilities, shown on Figure 4-4:

- Component A – Groundwater Extraction and Blending
  - 17 extraction wells
  - 12 miles of 12- to 48-inch collector pipelines
  - Storage Tank #1: 5 MG
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir (Storage Tank #1)
  - Potable Water Pump Station #1 – Reservoir to Lloyd Michael clearwell (CVWD Zone III): 5,300 HP, 25,000 gpm firm capacity, 590 ft TDH
  - Potable Water Pump Station #2 – Lloyd Michael clearwell to the Rialto Pipeline: 650 HP, 6,200 gpm firm capacity, 290 ft TDH

  - 6.3 miles of 48-inch potable pipeline from reservoir to Lloyd Michael clearwell
  - 0.8 miles of 24-inch potable pipeline from Lloyd Michael clearwell to the Rialto Pipeline
  - 7.0 miles of 24-inch potable pipeline from Lloyd Michael clearwell to FWC F13 tanks
  - 48-inch turnout to Lloyd Michael clearwell
  - 24-inch turnout to FWC F13 tanks
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 0.7 miles of 24-inch potable pipeline from well field pipe network to FWC F17 tank
  - 2.0 miles of 36-inch potable pipeline from reservoir to proposed JCSD Etiwanda Water Supply pipe network (possible connection to a separate pipeline being constructed to connect the JCSD and CVWD systems). The cost of this pipeline is not included in the cost estimate for this alternative, as it would only be constructed at the direction of JCSD to benefit the Etiwanda Water Supply project.
  - 24-inch turnout to FWC F17 tank
  - 36-inch turnout to proposed JCSD Etiwanda Water Supply pipe network. The cost of this pipeline is not included in the cost estimate for this alternative, as it would only be constructed at the direction of JCSD to benefit the Etiwanda Water Supply project.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - No infrastructure
- Existing Facilities:
  - Rialto Pipeline (HGL 1,936 ft)
  - Lloyd Michael clearwell (HGL 1,658 ft)
  - CB-7 turnout (18-inch)

TAKE Alternative 8 would be operated to deliver 40.0 TAFY to the Rialto Pipeline and member agencies during call years only. Although the facilities would not be operated for Program purposes during non-call years, the infrastructure would be available for local and/or regional uses. The operation of the TAKE-8 components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 40.0 TAFY (about 25,500 gpm) of groundwater during call years in (see Section 4.2.1.1).
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Stations #1.
  - Pump Station #1 would deliver 40.0 TAFY total to the Lloyd Michael clearwell.
  - Pump Station #2 would deliver 10.0 TAFY to the Rialto Pipeline from the Lloyd Michael clearwell.
  - If MWD is receiving 10 TAFY of water into the Rialto Pipeline through Pump Station #2,, CVWD will receive 20.0 TAFY into their distribution system in Zone III at Lloyd Michael. If MWD is not receiving water into the Rialto Pipeline, CVWD will receive 30.0 TAFY into their distribution system.
  - FWC will receive 10.0 TAFY via pipeline from Lloyd Michael to the F13 tanks.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - FWC may elect to receive up to 10.0 TAFY at the F17 tank in the Juniper Zone adjacent to the extraction well field rather than at the F13 tanks in the Highland Zone. In this scenario, a valve would isolate the

easternmost extraction wells (up to 3) and divert up to 10.0 TAFY into the F17 tank. The volume pumped through Pump Station #1 and the pipeline from Lloyd Michael to the FWC F13 tanks would be reduced by the amount delivered to FWC at the F17 tank such that FWC received at total of 10 TAFY combined at the two deliver points.

  - The 36-inch pipe connecting with JCSD's Etiwanda Water Supply project may be used to facilitate exchanges between CVWD and JCSD, but does not have a role in facilitating CBP operations. The costs of this pipeline and turnout are not included in the cost estimate for this alternative, as they would only be constructed at the direction of JCSD to benefit the Etiwanda Water Supply project.

- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - No operations

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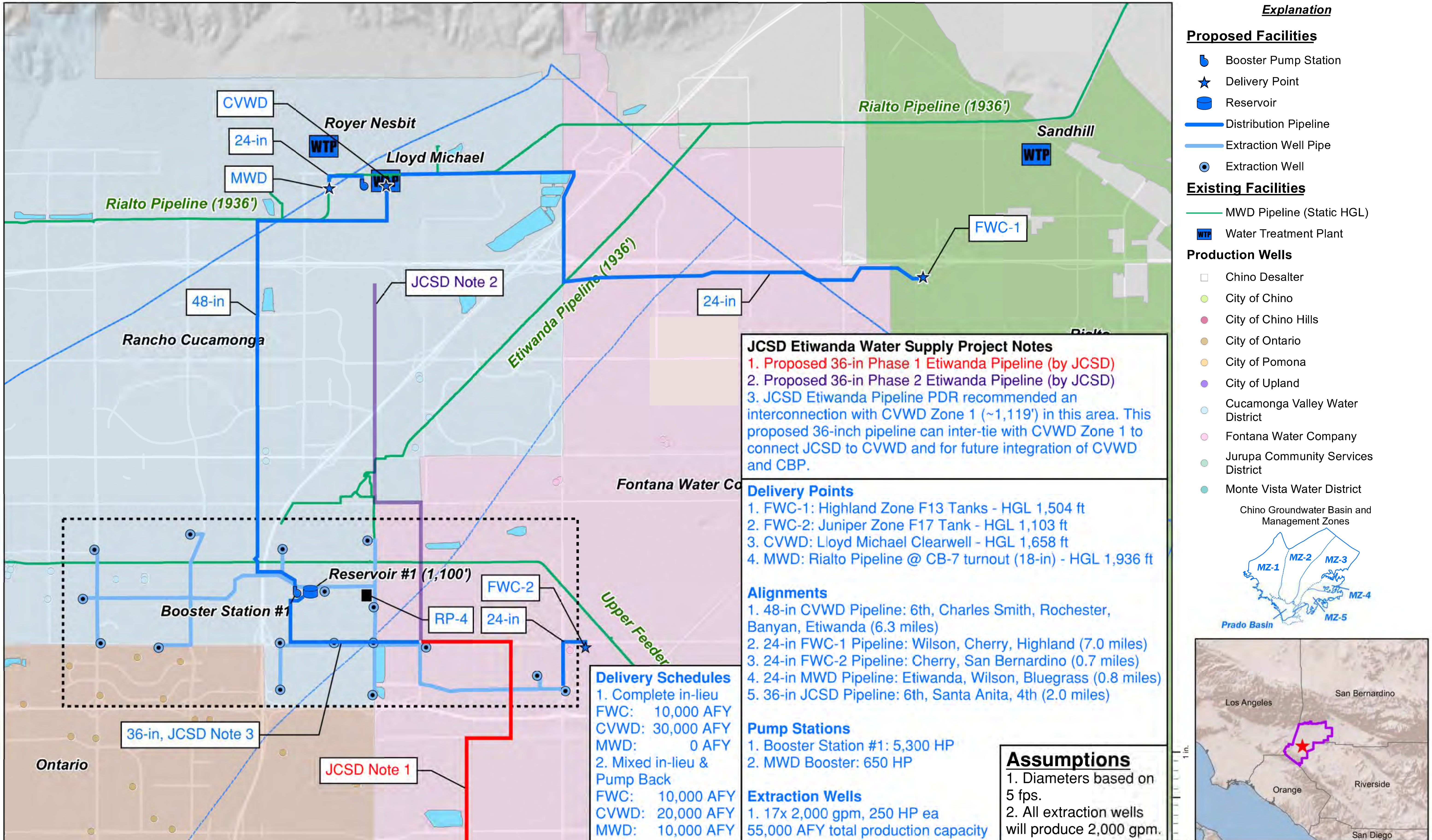

TAKE Alternative 8

Prepared by:

Brown AND Caldwell | WSC Water Systems Consulting, Inc.

Author: AWM

Date: 7/23/2021

File Name: WSIP_TAKE 40TAFY-10PB

N

1 in : 0.9 miles

0 1,450 2,900 Feet

0 0.45 0.9 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP Chino Basin Program

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency A Municipal Water District

Figure 4-6

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4.3.5 TAKE Alternatives Summary and Cost

Major components of each TAKE alternative are summarized in Table 4-14. This table includes the detailed assumptions for each TAKE component for each TAKE Alternative, including extraction wells, wellhead treatment, potable water conveyance, and potable water storage.

The TAKE alternatives conceptual capital cost estimates are summarized in Table 4-15and O&M cost estimates are summarized in Table 4-16. The capital and O&M costs were developed for each major component using a unit cost basis, which is described in detail in TM 1 Section 7. The capital cost estimates are Class 5 estimates based on the AACE International Cost Estimate Classification System criteria, which corresponds to a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate are -20 to -50 percent on the low end and +30 to +100 on the high end. NPV costs were developed for the TAKE alternatives and described in the Draft IEUA's Chino Basin Program Economic Analysis TM (GEI, June 2020).

The capital costs for the TAKE alternatives range from a low of $248.9M (TAKE-1) to a high $326.9M (TAKE-7) (in 2019 dollars) and the annual O&M costs range from a low of $15.0M/year (TAKE-8) to a high of $18.3M/year (TAKE-7).

Note that the costs for the TAKE alternatives do not include any income generated from inline hydropower facilities.

Table 4-14. TAKE Alternatives Summary

TAKE Components	TAKE Alternatives			
	TAKE-1 100% MWD Pump Back, Standard Delivery	TAKE-3 Partial MWD Pump Back and Partial In-Lieu, Standard Delivery	TAKE-7 Partial MWD Pump Back and Partial In-Lieu, Standard Delivery	TAKE-8 Partial MWD Pump Back and Partial In-Lieu or 100% In-Lieu, Standard Delivery
Extraction Wells	*MZ1* •None *MZ2* • 15-2,000 gpm extraction wells • 2-1,500 gpm extraction wells • **17 wells Total** *MZ3* •None	*MZ1* •None *MZ2* • 14-2,000 gpm extraction wells • 1-1,500 gpm extraction well • **15 wells Total** *MZ3* •None	*MZ1* •None *MZ2* • 15-2,000 gpm extraction wells • 2-1,500 gpm extraction wells • **17 wells Total** *MZ3* •None	*MZ1* •None *MZ2* • 17-2,000 gpm extraction wells • **17 wells Total** *MZ3* •None
Wellhead Treatment	•None	*MZ1* • 1-3,000 AFY Biological Treatment • 1-3,000 AFY GAC Treatment	•None	•None
Potable Water Conveyance	*Pump Station #1* •9,300 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* •27,700 ft 54-inch •3,100 ft 42-inch •2,300 ft 36-inch •1,800 ft 30-inch •21,000 ft 24-inch •21,200 ft 12-inch **•77,100 ft Total** **•14.6 miles Total**	*Pump Station #1* •7,100 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* •16,700 ft 48-inch •14,400 ft 42-inch •7,100 ft 36-inch •1,800 ft 30-inch •39,700 ft 24-inch •14,500 ft 16-inch •24,100 ft 12-inch **•118,300 ft Total** **•22.4 miles Total**	*Pump Station #1* •4,800 HP booster pump station near intersection of Baseline and Spruce (land included in Tank #1 site) *Pump Station #2* •220 HP booster pump station near intersection of Baseline and Spruce (land included in Tank #1 site) *Pump Station #3* •830 HP booster pump station near intersection of Baseline and Spruce (land included in Tank #1 site) *Pipelines* •19,400 ft 54-inch •23,500 ft 48-inch •4,600 ft 42-inch •2,300 ft 36-inch •1,800 ft 30-inch •63,300 ft 24-inch •37,000 ft 16-inch •22,200 ft 12-inch	*Pump Station #1* •5,300 HP booster pump station near intersection of 6th and Santa Anita (land included in Tank #1 site) *Pump Station #2* •700 HP booster pump station at Lloyd Michael WTP *Pipelines* •33,500 ft 48-inch •5,300 ft 42-inch •14,000 ft 36-inch •6,100 ft 30-inch •67,100 ft 24-inch •27,100 ft 12-inch **•153,100 ft Total** **•29.0 miles Total**
Potable Water Storage	*Storage Tank #1* •5 MG tank near intersection of Milliken and Jersey •2 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* •5 MG tank near intersection of Milliken and Jersey •2 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* •5 MG tank near intersection of Spruce and Baseline •2 acres of land acquisition (includes land for Booster Station #1, #2, and #3)	*Storage Tank #1* •5 MG tank near intersection of 6th and Santa Anita •2 acres of land acquisition (includes land for Booster Station #1)

Table 4-15. TAKE Alternatives Conceptual-Level Capital Cost Estimates				
	TAKE Alternatives ($M)			
Parameter	**TAKE-1**	**TAKE-3**	**TAKE-7**	**TAKE-8**
Pipelines[1]	$50.9	$67.2	$106.3	$81.8
Turnouts/Connections	$0.5	$2.5	$2.0	$1.5
Pump Stations	$46.5	$35.5	$34.0	$29.9
Extraction Wells	$42.5	$37.5	$47.6	$47.6
Wellhead Treatment	-	$9.2	$0	$0
Water Storage Tank(s)	$6.5	$6.5	$6.5	$6.5
Brine Disposal (NRWS)	-	$0.06	$0	$0
Land	$4.4	$4.1	$4.4	$4.4
Subtotal	$151.4	$162.6	$200.8	$171.7
Contingency (30%)[2]	$44.1	$47.5	$58.9	$50.2
Subtotal	$195.4	$210.1	$259.8	$221.9
Implementation (28%)[2]	$53.5	$57.7	$71.5	$60.9
Total Capital Cost ($M)				
Total Capital Cost ($2019)	**$248.9**	**$267.7**	**$331.3**	**$282.8**
Total Capital Cost ($2024)[3]	$274.8	$295.6	$403.0	$344.1

Notes:

[1]Includes potable water and brine pipelines.

[2]Brine disposal (NRW) and land costs not included in contingency or implementation calculations.

[3]2024 is the estimated mid-point of construction

Table 4-16. TAKE Alternatives Conceptual-Level Annual O&M Cost Estimates				
	TAKE Alternatives ($M/year)			
Parameter	**TAKE-1**	**TAKE-3**	**TAKE-7**	**TAKE-8**
Fixed O&M[1]				
Pipelines	$0.07	$0.1	$0.2	$0.1
Turnouts	$0.005	$0.03	$0.02	$0.02
Extraction Wells	$0.5	$0.5	$0.5	$0.5
EQ Tank	$0.1	$0.1	$0.1	$0.1
Pump Stations	$1.4	$1.1	$1.0	$0.9
NRW	$0	$0.005	$0	$0
Variable O&M[2]				
Extraction Wells	$4.6	$4.0	$8.9	$6.7
Pump Stations	$10.3	$7.8	$7.6	$6.6
Wellhead Treatment	$0	$1.8	$0	$0
NRW	$0	$0.003	$0	$0
Annual O&M Cost ($2019) ($M/year)	**$17.0**	**$15.4**	**$18.3**	**$15.0**

[1]Includes costs for routine annual maintenance.

[2]Includes operations and maintenance costs during call years.

4.4 TAKE Alternatives Evaluation

Initial alternatives (TAKE-1 through TAKE-6) were evaluated with a similar process as the PUT alternatives to compare on a common basis. This multi-criteria evaluation was completed prior to the development of TAKE-7 and TAKE-8. It was later determined that the alternatives with pre-delivery were not feasible. The multi-criteria evaluation of the initial alternatives are included in Appendix B. Since TAKE-7 and TAKE-8 were developed with participating agencies and have their support, these alternatives were not carried through the multi-criteria evaluation.

Section 5: Program Recommendations

This section describes the program alternatives that were developed based on the recommended PUT alternative from Section 3.5 and the recommended TAKE alternatives from Section 4.5.

The PUT and TAKE alternatives were developed and evaluated separately. Based on those evaluations, the following alternatives were recommended to be carried forward into the program alternatives evaluation:

- Recommended PUT alternative (see Section 3.5)
  - PUT-5: AWPF at RP-4 and groundwater recharge in MZ-2
- Recommended TAKE alternatives (see Section 4.4)
  - TAKE-1: 100% pump back with standard delivery
  - TAKE-3: Partial pump back and partial in-lieu with standard delivery
  - TAKE-7: 0 to 100% Pump Back and/or In-Lieu with Expansion Capability with standard delivery
  - TAKE-8: Partial pump back and partial in-lieu or 100% in-lieu with standard delivery

The selection of PUT-5 confirms that the preferred location for the AWPF is at RP-4 with the groundwater recharged focused in MZ-2. Since pre-delivery is not feasible, the recommended TAKE alternatives include TAKE-1, TAKE-3, TAKE-7, and TAKE-8. CVWD and FWC have expressed support for TAKE-8. Due to the participating agency support, TAKE-8 is the preferred TAKE alternative resulting in a recommended program alternative of PUT-5 and TAKE-8. However, all four TAKE alternatives are included in the environmental reports to account for the infrastructure that is not in TAKE-8. This allows IEUA and stakeholders to ultimately select a different TAKE alternative, or combination of infrastructure from multiple alternatives. Thus, though PUT-5 and TAKE-8 comprise the preferred program alternative, all four TAKE alternatives remain as recommendations until the environmental process is complete. Further consideration of the TAKE alternatives was evaluated separately to determine the projected impacts and incorporated into a groundwater modeling TM by West Yost.

The total program costs are summarized in Table 5-1.

Table 5-1. Program Alternatives Conceptual-Level Cost Estimates				
Capital Cost ($M, $2019)				
Component	**PUT-5 & TAKE-1**	**PUT-5 & TAKE-3**	**PUT-5 & TAKE-7**	**PUT-5 & TAKE-8**
PUT	$306	$306	$306	$306
TAKE	$257	$268	$331	$283
Subtotal	***$563***	***$574***	***$637***	***$589***
External supply infrastructure	$79	$79	$79	$79
Total	**$642**	**$671**	**$716**	**$668**
Annual O&M Cost ($M, $2019)				
Component	**PUT-5 & TAKE-1**	**PUT-5 & TAKE-3**	**PUT-5 & TAKE-7**	**PUT-5 & TAKE-8**
PUT	$11.4	$11.4	$11.4	$11.4
TAKE (call year)	$17.0	$15.4	$18.3	$15.0
Subtotal	***$28.4***	***$26.8***	***$29.7***	***$26.4***
External supply infrastructure	$0	$0	$0	$0
Total	**$28.4**	**$26.8**	**$29.7**	**$26.4**

Appendix A: Pre-Delivery TAKE Alternatives

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Section A-1: Introduction

The TAKE alternatives that were initially developed, evaluated, and documented in the Draft TM2 (dated July 6, 2020) are summarized in Table A-1. As discussed in TM2 Section 4, the six initial alternatives were developed based on the delivery mechanism (pump back or in-lieu) and the delivery condition (standard or pre-delivery). The six alternatives include the two bookends for the delivery mechanism with 100 percent pump back (TAKE-1 and TAKE-2) and 100 percent in-lieu (TAKE-5 and TAKE-6) as well as combination alternatives with partial pump back and partial in-lieu (TAKE-3 and TAKE-4). Each of these three delivery mechanisms were the combined with standard delivery and pre-delivery. For this Study, pre-delivery in non-call years was assumed to be 10.0 TAFY.

However, pre-delivery was later determined not to be feasible and is no longer being considered for the CBP. Two additional alternatives (TAKE-7 and TAKE-8) were developed following further discussions with interested, participating agencies and include both partial pump back and partial in-lieu. Also, TAKE-8 could be operated as 100 percent in-lieu.

This section presents the TAKE alternatives descriptions for the pre-delivery alternatives, which include TAKE-2, TAKE-4 (TAKE-4a, 4b, and 4c), and TAKE-6 (TAKE-6a and 6b) and which were originally documented in the Draft TM2 (dated July 6, 2020). Since these alternatives include pre-delivery, these alternatives were eliminated from consideration.

Note that TAKE-5 was envisioned to include in-lieu delivery of 50.0 TAFY of CBP water during call years (i.e., Standard Delivery). TAKE-5 was removed from consideration because the total in-lieu capacity for all member agencies, JCSD, Western, and TVMWD combined was less than 50.0 TAFY when accounting for the required minimum WTP flowrates, and therefore it was impossible to deliver all 50.0 TAFY via in-lieu.

Table A-1. Summary of Initial TAKE Alternatives (Draft TM2 dated July 6. 2020)										
	Description		Non-Call Year Deliveries (Pre-Delivery) (TAFY)	Call Year Deliveries (Includes Pre-Delivery)			Total Delivery over 25 Years		
TAKE Alternative	Pump Back and/or In-Lieu	Standard Delivery or Pre-Delivery		Pump Back (TAFY)	In-Lieu (TAFY)	Total (TAFY)	Pre-Delivery (TAF)	Call Year Deliveries (TAF)	Total (TAF)
TAKE-1	100% Pump Back	Standard	-	50.0	-	50.0	-	375.0	375.0
TAKE-2		Pre-Delivery	10.0	26.7	-	26.7	250.0	125.0	375.0
TAKE-3	Partial Pump Back and Partial In-Lieu	Standard	-	25.5	24.5	50.0	-	375.0	375.0
TAKE-4[1]: TAKE-4a TAKE-4b TAKE-4c		Pre-Delivery	10.0	10.0	16.7	26.7	250.0	125.0	375.0
TAKE-5 Not feasible[2]	100% In-Lieu	Standard	-	-	50.0	50.0	-	375.0	375.0
TAKE-6[3]: TAKE-6a TAKE-6b		Pre-Delivery	10.0	-	26.7	26.7	250.0	125.0	375.0

[1]Three approaches for TAKE-4 were developed: TAKE-4a, TAKE-4b, and TAKE-4c.

[2]TAKE-5 was determined not to be feasible due to in-lieu deliveries exceeding in-lieu capacity.

[3]Two approaches for TAKE-6 were developed: TAKE-6a and TAKE-6b.

A-1.1 TAKE Alternative 2 – 100% MWD Pump Back, Pre-Delivery

TAKE Alternative 2 (TAKE-2) includes delivery of 26.7 TAFY of CBP water to the Rialto Pipeline during call years, 10.0 TAFY pre-delivery of water to the Rialto Pipeline during non-call years, and no delivery of water to member agencies for in-lieu. Table A-2 provides the breakdown of CBP water deliveries during call and non-call years.

Table A-2. TAKE Alternative 2 Deliveries to Each Agency (TAFY)		
Agency	Call Year	Non-Call Year
Metropolitan Water District	26.7	10.0[2]
Cucamonga Valley Water District	-	-
Fontana Water Company	-	-
City of Chino[1]	-	-
City of Chino Hills[1]	-	-
City of Ontario[1]	-	-
City of Upland[1]	-	-

Table A-2. TAKE Alternative 2 Deliveries to Each Agency (TAFY)		
Agency	**Call Year**	**Non-Call Year**
Monte Vista Water District[1]	-	-
Jurupa Community Services District	-	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]Water supplied from the WFA Agua de Lejos WTP.

[2]Could either be MWD Pump Back or In-Lieu CBP. Exact deliveries to agencies during non-call years has not been determined.

TAKE Alternative 2 includes construction or use of the following facilities, shown on Figure A-1:

- Component A – Groundwater Extraction and Blending
  - 10 extraction wells
  - 6 miles of 12- to 30-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 5,000 HP, 16,600 gpm firm capacity, 823 ft TDH
  - 5 miles of 42-inch potable northern pipeline
  - Proposed 42-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - None
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - None
- Existing Facilities:
  - Rialto Pipeline (HGL 1,936 ft)

TAKE Alternative 2 would be operated to delivery 26.7 TAFY to the Rialto Pipeline during call years, and 10.0 TAFY during non-call years. The operation of the TAKE-2 components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 26.7 TAFY (about 16,600 gpm) of groundwater as described in TM 2 Section 4.2.1.1 during call years and 10.0 TAFY (6,200 gpm) during non-call years. Unused extraction capacity during non-call years would be available for other local or regional uses.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir

Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. During call years, Pump Station #1 would deliver 26.7 TAFY of water to the Rialto Pipeline through a proposed 42-inch pipeline and a proposed 42-inch turnout into the Rialto Pipeline. During non-call years, Pump Station #1 would deliver 10.0 TAFY to the Rialto Pipeline.

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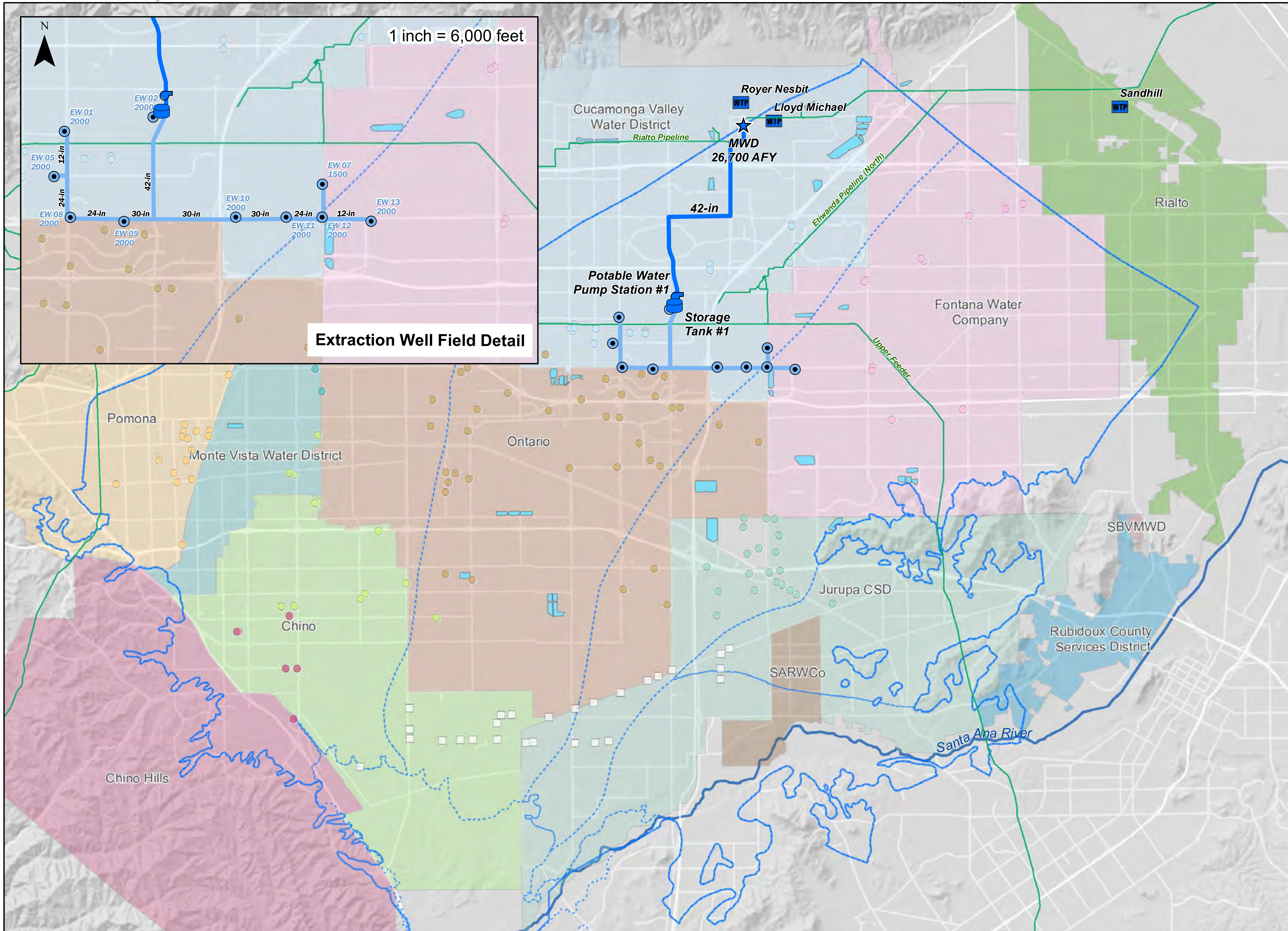


Explanation

TAKE Alternative 2

- Proposed Interconnection (Call Year Delivery)
- Proposed Booster Pump Station
- Proposed Tank
- Proposed Potable Pipelines
- Proposed Extraction Well Collectors
- Proposed Extraction Wells (GPM)

Existing Facilities

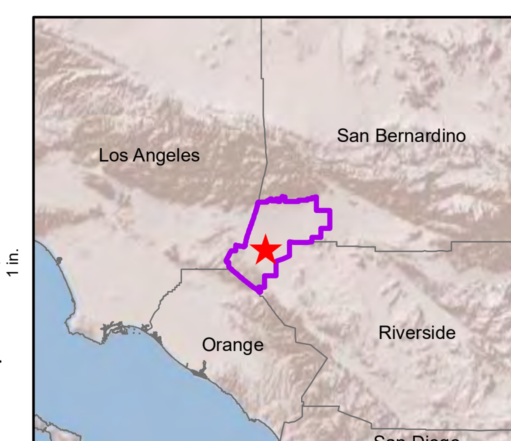
- MWD Mainlines
- Water Treatment Plant
- Recharge Basins

Production Wells

- Chino Desalter
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District

Chino Groundwater Basin and Management Zones

MZ-1 MZ-2 MZ-3 MZ-4 MZ-5 Prado Basin



Prepared by: Brown AND Caldwell | WSC Water Systems Consulting, Inc.

Author: AWM Date: 6/22/2020

File Name: CBP_TAKEAlternative2

N 1 in : 2 miles 0 3,000 6,000 Feet 0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project: CBP Chino Basin Program — *Preliminary Design Report*

Prepared for: Inland Empire Utilities Agency — A Municipal Water District

TAKE Alternative 2

Figure A-1

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A-1.2 TAKE Alternatives 4a, 4b, and 4c – Partial MWD Pump Back and Partial In-Lieu, Pre-Delivery

TAKE Alternative 4 includes partial MWD pump back and partial in-lieu use and pre-delivery. Three variations of TAKE Alternative 4 were developed, TAKE Alternatives 4a, 4b, and 4c, to evaluate different approaches for potable water supply infrastructure. All three alternatives include infrastructure to deliver 26.7 TAFY combined curing call years to the Rialto Pipeline, five to all seven member agencies, and JCSD, and to deliver 10.0 TAFY during non-call years. The three TAKE Alternative 4 variations are as follows:

- TAKE Alternative 4a includes predominantly north-south pipelines and would connect to the Rialto Pipeline near CVWD's Lloyd W. Michael WTP. This alternative includes the least pipeline length, but only delivers in-lieu water to five member agencies and JCSD.
- TAKE Alternative 4b includes predominantly east-west pipelines and would connect to the Rialto Pipeline near the TVMWD's Miramar WTP. This alternative includes more pipeline length than TAKE Alternative 4a, but less than TAKE Alternative 4c, and delivers in-lieu water to seven member agencies and JCSD.
- TAKE Alternative 4c includes north-south and east-west pipelines and would connect to the Rialto pipeline near CVWD's Lloyd W. Michael WTP. This alternative includes the most pipeline length and delivers in-lieu water to seven member agencies and JCSD.

TAKE Alternatives 4a, 4b, and 4c are described in more detail in the following sections.

A-1.2.1 TAKE Alternative 4a – Partial MWD Pump Back and Partial In-Lieu, Pre-Delivery

TAKE Alternative 4a (TAKE-4a) includes the delivery of 26.7 TAFY combined during call years to the Rialto Pipeline, five member agencies, and JCSD. 10.0 TAFY of water would be delivered during non-call years to either MWD or In-Lieu CBP. Table A-3 provides the TAKE Alternative 4a deliveries to each agency.

Table A-3. TAKE Alternative 4a Deliveries (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	10.0	10.0[2]
Cucamonga Valley Water District	2.95	-
Fontana Water Company	2.95	-
City of Chino[1]	2.95	-
City of Chino Hills[1]	2.95	-
City of Ontario[1]	2.95	-
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	1.95	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]*Water supplied from the WFA Agua de Lejos WTP.*

[2]*Could either be MWD Pump Back or In-Lieu CBP. Exact deliveries to agencies during non-call years has not been determined.*

TAKE Alternative 4a includes construction or use of the following facilities, shown on Figure A-2:

- Component A – Groundwater Extraction and Blending
  - 8 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 2,000 HP, 9,900 gpm firm capacity, 552 ft TDH
  - 8 miles of 16- through 30-in potable northern pipeline (includes branches to FWC and CVWD)
  - Proposed 16-inch turnout to FWC Highland Zone (and optional hydropower facility)
  - Proposed 16-inch turnout to CVWD Zone III
  - Potable Water Pump Station #2: 700 HP, 6,200 gpm firm capacity, 282 ft TDH
  - Proposed 24-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 12- and 16-inch potable southern pipeline
  - Proposed 16-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 2.95 TAFY wellhead treatment for Chino Well Nos. 10, 12, and 14
  - 2.95 TAFY wellhead treatment for Chino Hills Well Nos. 1A, 7A, 7B, and 17
- Existing Facilities
  - Rialto Pipeline (HGL 1,936 ft)
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)

All facilities in TAKE Alternative 4a would be operated to deliver 26.7 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to MWD through Pump Station #1 and Pump Station #2. The following sections discuss call year operation.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 20.8 TAFY (about 12,900 gpm) of groundwater as described in TM 2 Section 4.2.1.1.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 15.9 TAFY combined of water to the Rialto Pipeline (via Pump Station #2), CVWD Zone III, and FWC Highland Zone through a proposed 36-inch pipeline, branching pipelines to CVWD and FWC, and turnouts to all three agencies. Potable Water Pump Station #2 would be at a turnout off the northern

pipeline to lift water to the Rialto Pipeline. Based on preliminary calculations, it is more cost effective to construct Pump Station #2 exclusively to lift water to the Rialto Pipeline rather than over-pumping FWC and CVWD deliveries to 1,936 ft and recovering excess energy with hydropower facilities.

- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4.9 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone and JCSD's 1110 Zone along a proposed 12- and 16-inch southern pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not JCSD's turnout.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 5.9 TAFY (of 26.7 TAFY) would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 4a proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 2.95 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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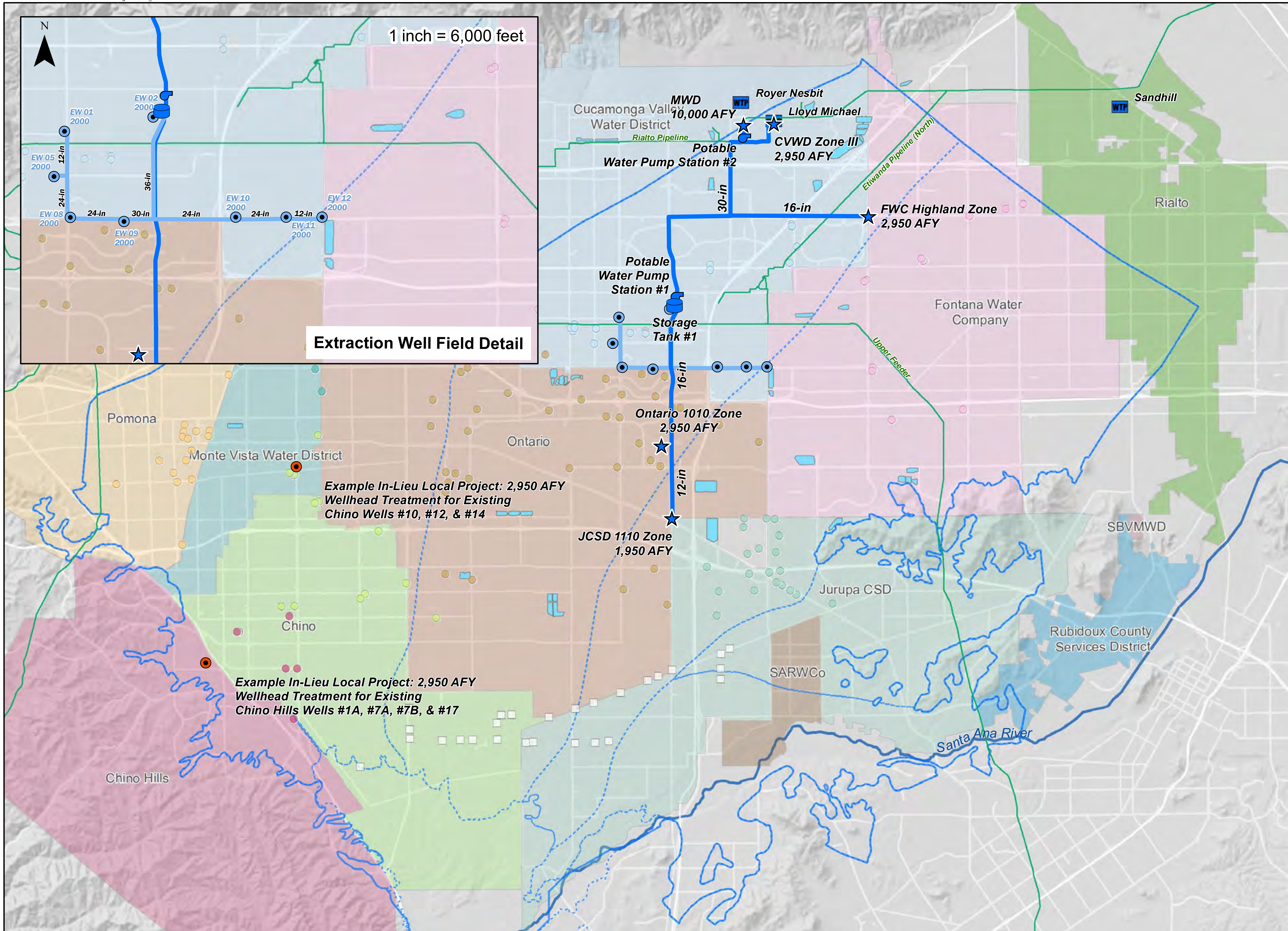


Explanation

TAKE Alternative 4A

- Proposed Interconnection (Call Year Delivery)
- Proposed Booster Pump Station
- Proposed Tank
- Proposed Potable Pipelines
- Proposed Extraction Well Collectors
- Proposed Extraction Wells (GPM)
- Proposed Wellhead Treatment

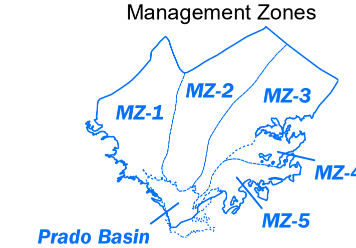
Existing Facilities

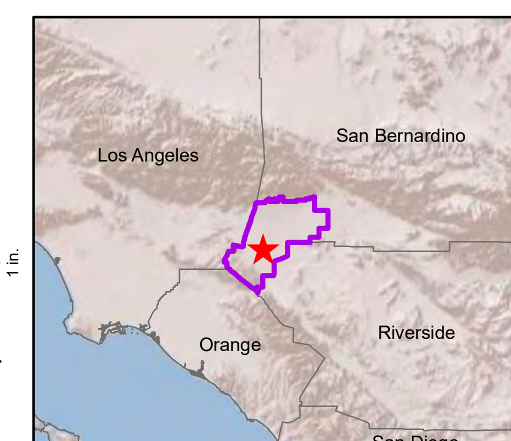
- MWD Mainlines
- Water Treatment Plant
- Recharge Basins

Production Wells

- Chino Desalter
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District

Chino Groundwater Basin and Management Zones





Prepared by:

Brown AND Caldwell
WSC Water Systems Consulting, Inc.

Author: AWM
Date: 6/22/2020
File Name: CBP_TAKEAlternative4A

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References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:
CBP Chino Basin Program
Preliminary Design Report

Prepared for:
Inland Empire Utilities Agency
A Municipal Water District

TAKE Alternative 4A

Figure A-2

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A-1.2.2 TAKE Alternative 4b – Partial MWD Pump Back and Partial In-Lieu, Pre-Delivery

TAKE Alternative 4b (TAKE-4b) involves the delivery of 26.7 TAFY combined during call years to the Rialto Pipeline, all seven member agencies, and Jurupa Community Services District. 10.0 TAFY of water would be delivered during non-call years to either MWD or In-Lieu CBP. TAKE Alternative 4b is different than TAKE-4b in that it includes construction of an east-west pipeline that accommodates delivery of CBP water to member agencies on the west side of the IEUA service area (Upland and MVWD), and also moves the location of MWD pump back to a proposed turnout along the Rialto Pipeline near the TVMWD Miramar WTP in Claremont. Table A-4 provides the deliveries to each agency in TAKE Alternative 4b.

Table A-4. TAKE Alternative 4b Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	10.0	10.0[2]
Cucamonga Valley Water District	2.5	-
Fontana Water Company	2.5	-
City of Chino[1]	1.95	-
City of Chino Hills[1]	1.95	-
City of Ontario[1]	1.95	-
City of Upland[1]	1.95	-
Monte Vista Water District [1]	1.95	-
Jurupa Community Services District	1.95	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]Water supplied from the WFA Agua de Lejos WTP.

[2]Could either be MWD Pump Back or In-Lieu CBP. Exact deliveries to agencies during non-call years has not been determined.

TAKE Alternative 4b includes construction or use of the following facilities, shown on Figure A-3:

- Component A – Groundwater Extraction and Blending
  - 9 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 2,300 HP, 10,200 gpm firm capacity, 599 ft TDH
  - 10 miles of 30-inch east-west pipeline (the first mile of this pipeline in Milliken Avenue from Jersey Street to Foothill Boulevard is part of the northern pipeline in other alternatives. It is considered part of the east-west pipeline in this alternative because the pipeline turns west and does not actually continue to any turnouts in the northern part of the project area).

- Proposed 12-inch turnout to CVWD Zone II
  - Proposed 16-inch turnout to Agua de Lejos clearwell (Upland and MVWD)
  - Potable Water Pump Station #2: 800 HP, 6,200 gpm firm capacity, 314 ft TDH
  - Proposed 24-inch turnout to the Rialto Pipeline
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 6 miles of 12- to 24-inch potable southern pipeline
  - Proposed 12-inch turnout to FWC Juniper Zone (HGL 1,103 ft)
  - Proposed 12-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 1.95 TAFY wellhead treatment for Chino Well Nos. 10, 12, and 14
  - 1.95 TAFY wellhead treatment for Chino Hills Well Nos. 1A, 7A, 7B, and 17
- Existing Facilities
  - Rialto Pipeline (HGL 1,936 ft)
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)
  - Agua de Lejos WTP Clearwell (HGL 1,632 ft)

All facilities in TAKE Alternative 4b would be operated to deliver 26.7 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to MWD through Pump Station #1 and Pump Station #2. The following sections discuss call year operation.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 22.8 TAFY (14,200 gpm) of groundwater as described in TM 2 Section 4.2.1.1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 16.4 TAFY combined of water to the Rialto Pipeline, CVWD Zone II (HGL 1,420 ft), and Upland and MVWD via the WFA Agua de Lejos WTP clearwell (HGL 1,632 ft) through a proposed 10-mile 30-inch east-west pipeline and three turnouts.
  - Pump Station #2 would be at the final turnout on the East-West pipeline would be to lift water to the Rialto Pipeline. In TAKE Alternative 4b and based on preliminary calculations, it is more cost effective to construct Pump Station #2 exclusively to lift water to the Rialto Pipeline rather than over-pumping CVWD and Agua de Lejos deliveries to 1,936 ft and recovering excess energy with hydropower facilities.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 6.4 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone, FWC's Juniper Zone (HGL 1,103 ft), and JCSD's 1110 Zone along a proposed 12- to 24-inch Southern Pipeline (in TAKE Alternative 4b, the southern pipeline also includes a branching pipeline to deliver water to FWC's Juniper Zone through a 12-inch turnout). Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout. Pressure reducing valve stations without energy recapture ability are not appropriate for JCSD and FWC's turnouts due to the small difference in head between their HGLs and Storage Tank #1.

- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 3.9 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 4b proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 1.95 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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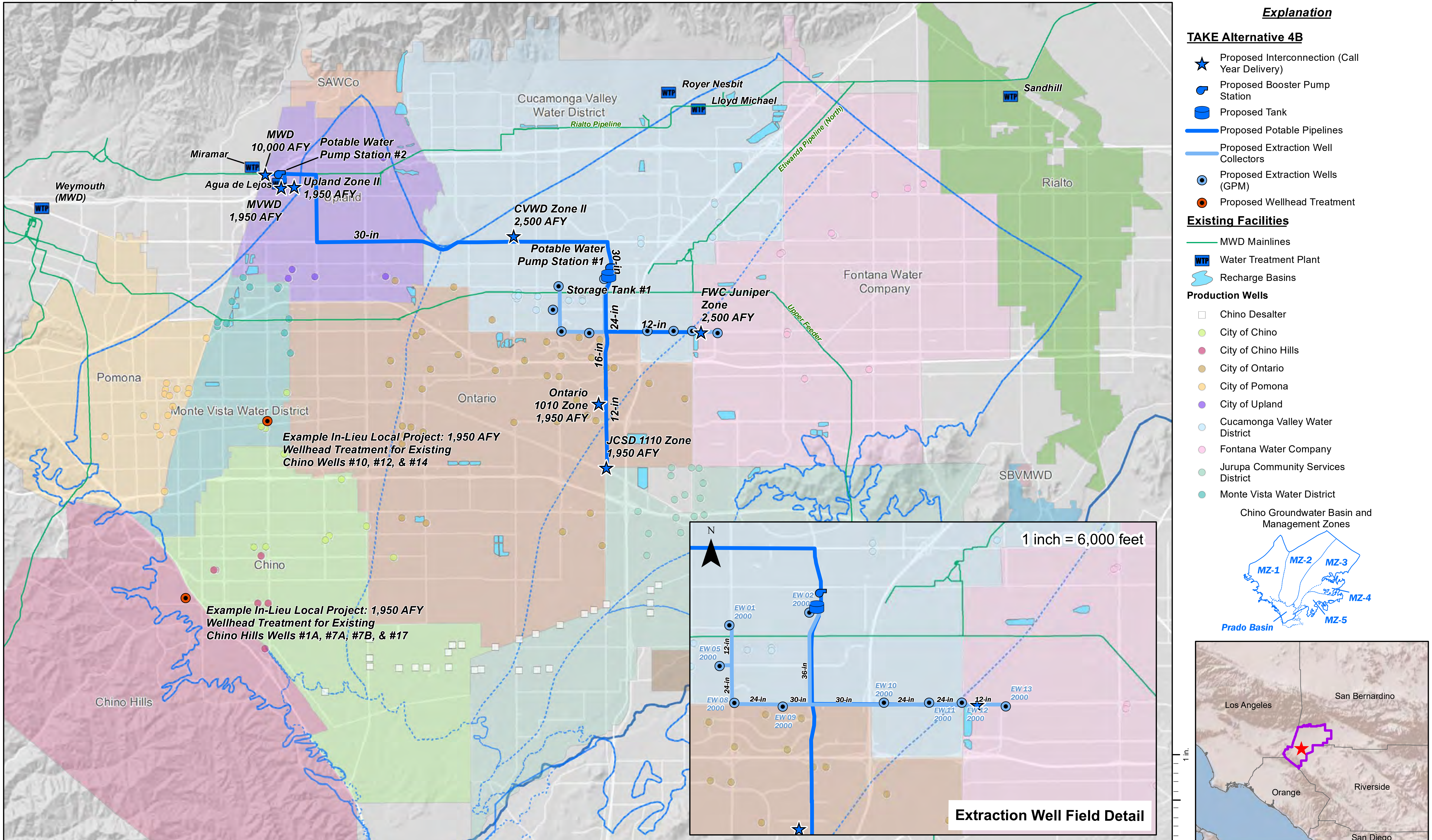

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative4B

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0 0.75 1.5 Miles

References/Notes:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency A MUNICIPAL WATER DISTRICT

TAKE Alternative 4B

Figure A-3

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A-1.2.3 TAKE Alternative 4c – Partial MWD Pump Back and Partial In-Lieu, Pre-Delivery

TAKE Alternative 4c (TAKE-4c) involves the delivery of 26.7 TAFY combined during call years to the Rialto Pipeline, all seven member agencies, and Jurupa Community Services District. 10.0 TAFY of water would be delivered during non-call years to either MWD or In-Lieu CBP. TAKE Alternative 4c is nearly identical to TAKE Alternative 4b, with the only changes being MWD's proposed turnout being located near CVWD's Lloyd W. Michael WTP, and CVWD and FWC's turnouts being moved to higher pressure zones to provide them with more operational flexibility. TAKE Alternative 4c is different from TAKE-4a in that it also includes the east-west pipeline to deliver water to Upland and MVWD. Table A-5 provides the deliveries to each agency for TAKE Alternative 4c.

Table A-5. TAKE Alternative 4c Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	10.0	10.0[2]
Cucamonga Valley Water District	2.5	-
Fontana Water Company	2.5	-
City of Chino[1]	1.95	-
City of Chino Hills[1]	1.95	-
City of Ontario[1]	1.95	-
City of Upland[1]	1.95	-
Monte Vista Water District[1]	1.95	-
Jurupa Community Services District	1.95	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]*Water supplied from the WFA Agua de Lejos WTP.*

[2]*Could either be MWD Pump Back or In-Lieu CBP. Exact deliveries to agencies during non-call years has not been determined.*

TAKE Alternative 4c includes construction or use of the following facilities, shown on Figure A-4:

- Component A – Groundwater Extraction and Blending
  - 9 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 2,600 HP, 11,700 gpm firm capacity, 599 ft TDH
  - 8 miles of 12- to 36-inch northern pipeline
  - Proposed 12-inch turnout to FWC Highland Zone

  - Proposed 12-inch turnout to CVWD Zone III
  - Potable Water Pump Station #2: 700 HP, 6,200 gpm firm capacity, 281 ft TDH
  - Proposed 24-inch turnout to the Rialto Pipeline
  - 9 miles of 16-inch east-west pipeline
  - Proposed 16-inch turnout to Agua de Lejos clearwell (Upland and MVWD)
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 12- and 16-inch potable southern pipeline
  - Proposed 12-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 1.95-TAFY biological wellhead treatment at Chino Well 14
  - 1.95-TAFY biological wellhead treatment at Chino Hills Well TBD
- Existing Facilities
  - Rialto Pipeline (HGL 1,936 ft)
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)
  - Agua de Lejos WTP Clearwell (HGL 1,632 ft)

All facilities in TAKE Alternative 4c would be operated to deliver 26.7 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to MWD through Pump Station #1 and Pump Station #2. The following sections discuss call year operation.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 22.8 TAFY (about 14,200 gpm) of groundwater as described in TM 2 Section 4.2.1.1.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 18.9 TAFY combined of water to the Rialto Pipeline, CVWD Zone III (HGL 1,658 ft), FWC Highland Zone (HGL 1,504), and Upland and MVWD via the WFA Agua de Lejos clearwell (HGL 1,632 ft) through the proposed northern and east-west pipelines network, and four turnouts.
  - Potable Water Pump Station #2 would be at a turnout off the northern pipeline to lift water to the Rialto Pipeline. In TAKE Alternative 4c and based on preliminary calculations, it is more cost effective to construct Pump Station #2 exclusively to lift water to the Rialto Pipeline rather than over-pumping FWC and CVWD deliveries to 1,936 ft and recovering excess energy with hydropower facilities.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4.9 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone, FWC's Juniper Zone (HGL 1,103 ft), and JCSD's 1110 Zone along a proposed 16-inch southern pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not JCSD's turnout.

- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)

The remaining 3.9 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 4c proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 1.95 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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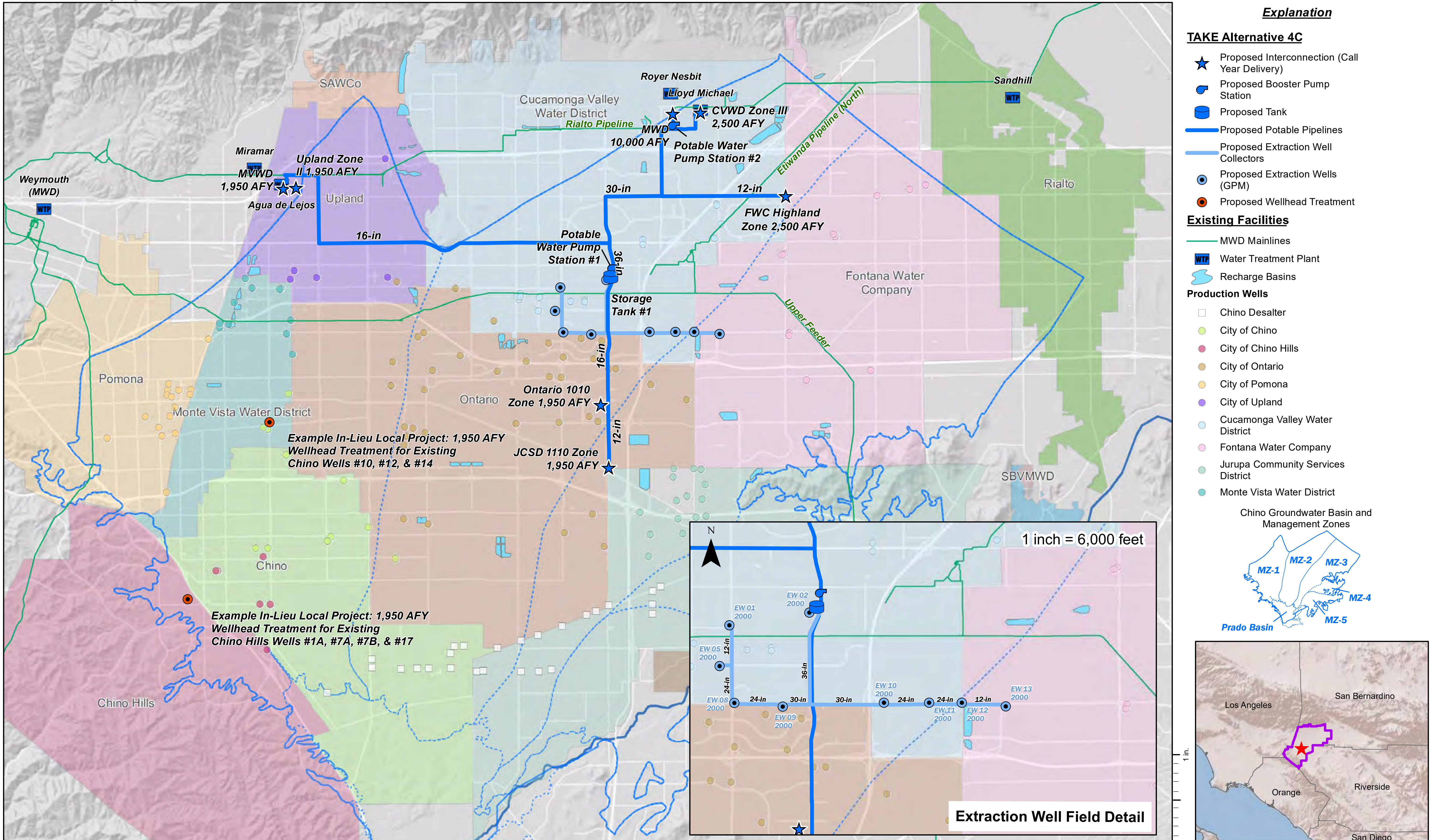

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative4C

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

TAKE Alternative 4C

Figure A-4

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A-1.3 TAKE Alternatives 6a and 6b – 100% In-Lieu, Pre-Delivery

TAKE Alternative 6 includes 100% in-lieu use and pre-delivery. Two variations of TAKE Alternative 6 were developed, TAKE Alternatives 6a and 6b, to evaluate different approaches for potable water supply infrastructure. Both alternatives include infrastructure to deliver 26.7 TAFY combined curing call years and 10.0 TAFY during non-call years to member agencies and outside agencies, including JCSD, Western, and/or TVMWD. TAKE Alternatives 6a and 6b do not have MWD pump back to the Rialto Pipeline. The two TAKE Alternative 6 variations are as follows:

- TAKE Alternative 6a includes predominantly north-south pipelines and delivers in-lieu water to five agencies, JCSD, and Western.
- TAKE Alternative 6b includes predominantly east-west pipelines and delivers in-lieu water to all seven member agencies, JCSD, and TVMWD.

TAKE Alternatives 6a and 6b are described in more detail in the following sections.

A-1.3.1 TAKE Alternative 6a – 100% In-Lieu, Pre-Delivery

TAKE Alternative 6a (TAKE-6a) involves the delivery of 26.7 TAFY of CBP water to five member agencies, JCSD, and Western during call years and 10.0 TAFY in non-call years. Table A-6 provides the deliveries to each agency for TAKE Alternative 6a.

Table A-6. TAKE Alternative 6a Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	-	-
Cucamonga Valley Water District	7.7	2.0
Fontana Water Company	4.0	1.0
City of Chino[1]	3.0	3.0
City of Chino Hills[1]	3.0	3.0
City of Ontario[1]	4.0	1.0
City of Upland[1]	-	-
Monte Vista Water District[1]	-	-
Jurupa Community Services District	2.5	-
Western Municipal Water District	2.5	-
Three Valleys Municipal Water District	-	-
TOTAL	**26.7**	**10.0**

[1]*Water supplied from the WFA Agua de Lejos WTP.*

TAKE Alternative 6a includes construction or use of the following facilities, shown on Figure A-5:

- Component A – Groundwater Extraction and Blending
  - 8 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1

- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 1,500 HP, 7,300 gpm firm capacity, 552 ft TDH
  - 8 miles of 16- to 30-inch northern pipeline
  - Proposed 16-inch turnout to FWC Highland Zone
  - Proposed 24-inch turnout to CVWD Zone III
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 24-inch potable southern pipeline
  - Proposed 16-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 24-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 3.0-TAFY biological wellhead treatment at Chino Well 14
  - 3.0-TAFY biological wellhead treatment at Chino Hills Well TBD
- Existing Facilities
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)

All facilities in TAKE Alternative 6a would be operated to deliver 26.7 TAFY to member agencies, JCSD, and Western during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to member agencies. The following sections discuss call year operation.

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 20.7 TAFY (about 12,900 gpm) of groundwater as described in TM 2 Section 4.2.1.1.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 11.7 TAFY combined of water to CVWD Zone III and FWC Highland Zone through a proposed 30- and 24-inch pipeline, with a branch to FWC and turnouts to both agencies.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 9.0 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone and JCSD's 1110 Zone along a proposed 16- to 24-inch Southern Pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not JCSD's turnout. Western would receive its 2.5 TAFY delivery through JCSD's 1110 Zone, making the delivery to JCSD's 1110 Zone 5.0 TAFY.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 6.0 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 6a proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 3.0 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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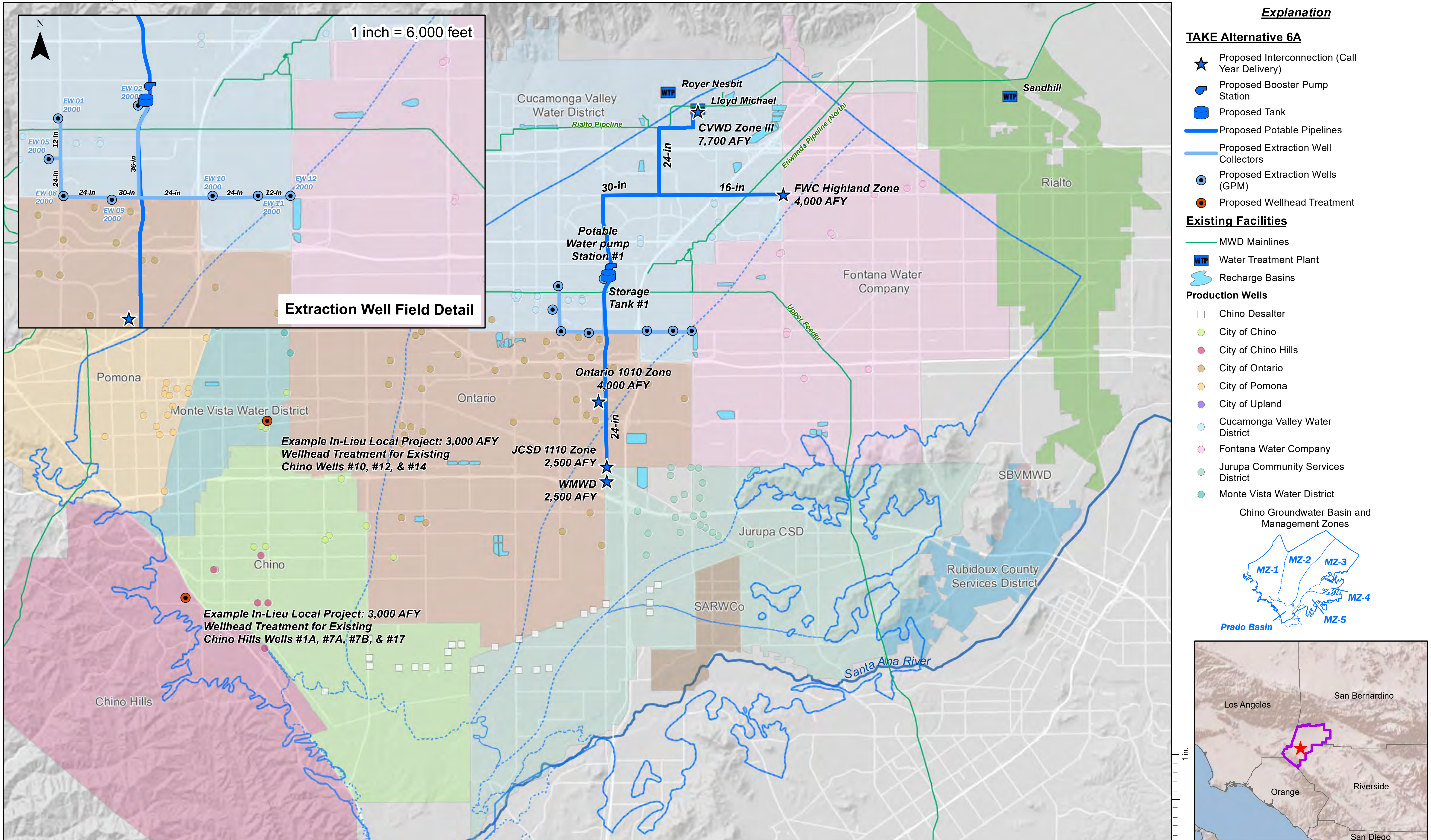

Prepared by:

Brown AND Caldwell

WSC Water Systems Consulting, Inc.

Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative6A

N

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project:

CBP CHINO BASIN PROGRAM

Preliminary Design Report

Prepared for:

Inland Empire Utilities Agency A MUNICIPAL WATER DISTRICT

TAKE Alternative 6A

Figure A-5

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A-1.3.2 TAKE Alternative 6b – 100% In-Lieu, Pre-Delivery

TAKE Alternative 6b (TAKE-6b) involves the delivery of 26.7 TAFY of CBP water to all seven member agencies, JCSD, and TVMWD during call years and 10.0 TAFY during non-call years. Table A-7 provides the deliveries to each agency for TAKE Alternative 6b.

Table A-7. TAKE Alternative 6b Deliveries to Each Agency (TAFY)

Agency	Call Year	Non-Call Year
Metropolitan Water District	-	-
Cucamonga Valley Water District	7.7	2.0
Fontana Water Company	2.0	1.0
City of Chino[1]	2.0	2.0
City of Chino Hills[1]	2.0	2.0
City of Ontario[1]	2.0	1.0
City of Upland[1]	2.0	1.0
Monte Vista Water District[1]	2.0	1.0
Jurupa Community Services District	2.5	-
Western Municipal Water District	-	-
Three Valleys Municipal Water District	2.5	-
TOTAL	**26.7**	**10.0**

[1]*Water supplied from the WFA Agua de Lejos WTP.*

TAKE Alternative 6b includes construction or use of the following facilities, shown on Figure A-6:

- Component A – Groundwater Extraction and Blending
  - 9 extraction wells
  - 6 miles of 12- to 36-inch collector pipelines
  - 2.5 MG Storage Tank #1
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Potable Water Pump Station #1: 2,500 HP, 11,300 gpm firm capacity, 599 ft TDH
  - 8 miles of 16- to 36-inch northern pipeline
  - Proposed 16-inch turnout to FWC Highland Zone
  - Proposed 24-inch turnout to CVWD Zone III
  - 9 miles of 24-inch east-west pipeline
  - Proposed 16-inch turnout to Agua de Lejos clearwell (Upland and MVWD)
  - Proposed 12-inch turnout to TVMWD Miramar WTP clearwell (HGL 1,630ft)

- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4 miles of 12- and 16-inch potable southern pipeline
  - Proposed 12-inch turnout to Ontario 1010 Zone (and optional hydropower facility)
  - Proposed 12-inch turnout to JCSD 1110 Zone
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - 2.0-TAFY biological wellhead treatment at Chino Well 14
  - 2.0-TAFY biological wellhead treatment at Chino Hills Well TBD
- Existing Facilities
  - Chino Well Nos. 10, 12, and 14 (currently offline due to water quality)
  - Chino Hills Well Nos. 1A, 7A, 7B, and 17 (currently offline due to water quality)

All facilities in TAKE Alternative 6b would be operated to deliver 26.7 TAFY to the Rialto Pipeline, member agencies, and JCSD during call years. The facilities would operate during non-call years to pre-deliver 10.0 TAFY to member agencies. The following sections discuss call year operation. The operation of the TAKE-6b components would be as follows:

- Component A – Groundwater Extraction and Blending
  - The extraction wells, collector pipes, and Storage Tank #1 would extract and blend 22.7 TAFY (about 14,100 gpm) of groundwater as described in TM 2 Section 4.2.1.1.
- Component B – Delivery to Hydraulic Elevations Above the Blending Reservoir
  - Storage Tank #1 would serve as a forebay for Potable Water Pump Station #1. Pump Station #1 would deliver 18.2 TAFY combined of water to CVWD Zone III, FWC Highland Zone, Upland Zone II, MVWD, and TVMWD through a proposed network of 16- to 36-inch pipelines.
- Component C – Delivery to Hydraulic Elevations Below the Blending Reservoir
  - 4.5 TAFY of water would flow by gravity from Storage Tank #1 South to turnouts to Ontario's 1010 Zone and JCSD's 1110 Zone along a proposed 16-inch southern pipeline. Coming from an HGL of 1,180 in Storage Tank #1, an in-conduit hydropower facility may be appropriate at Ontario's turnout, but not JCSD's.
- Component D – Delivery to Chino and Chino Hills via In-Lieu Local (Example Projects)
  - The remaining 4.0 TAFY would be delivered to Chino and Chino Hills via In-Lieu Local and groundwater treatment. TAKE Alternative 6b proposes two new groundwater treatment facilities for Chino and Chino Hills that would enable reactivation of local wells currently offline due to water quality. The Chino facility would treat impaired groundwater from existing wells 10, 12 and 14. The Chino Hills facility would treat impaired groundwater from existing wells 1A, 7A, 7B and 17. Both facilities would produce 2.0 TAFY of potable supply which they would use in-lieu of MWD Rialto Pipeline Water. Chino and Chino Hills would use existing infrastructure to convey treated groundwater throughout their distribution systems to their customers. The Program would help fund these facilities in exchange for in-lieu participation.

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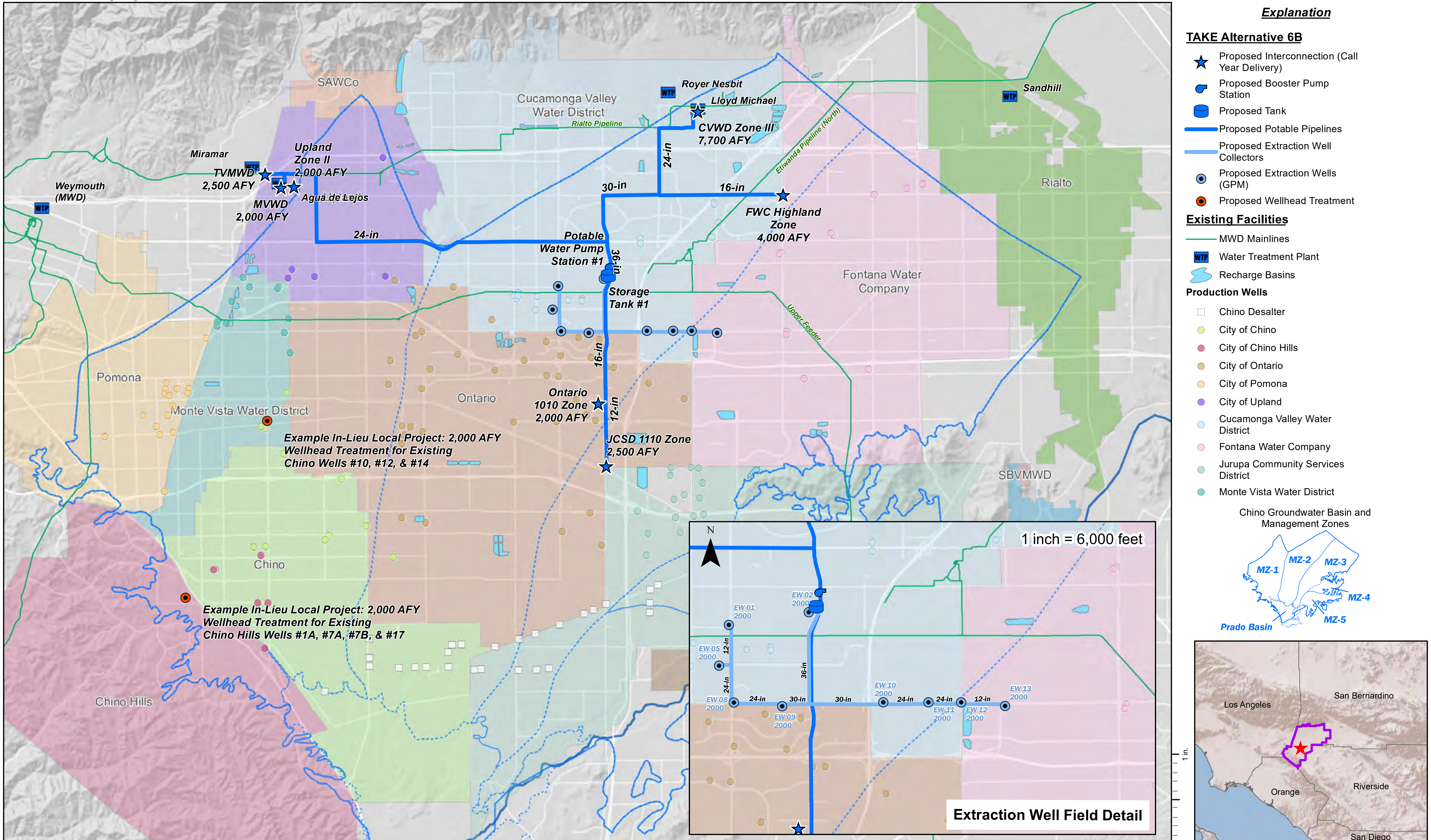

Prepared by: Brown and Caldwell | WSC Water Systems Consulting, Inc.

Author: AWM

Date: 6/22/2020

File Name: CBP_TAKEAlternative6B

1 in : 2 miles

0 3,000 6,000 Feet

0 0.75 1.5 Miles

References/Notes:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Project: CBP Chino Basin Program

Preliminary Design Report

Prepared for: Inland Empire Utilities Agency, A Municipal Water District

TAKE Alternative 6B

Figure A-6

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A-1.4 Initial TAKE Alternatives Summary and Cost

Major components of each initial TAKE alternative (TAKE-1 through TAKE-6) are summarized in Table A-9. This table includes the detailed assumptions for each TAKE component for each TAKE Alternative initially developed, including extraction wells, wellhead treatment, potable water conveyance, and potable water storage.

The initial TAKE alternatives conceptual capital and O&M cost estimates are summarized in Table A-8. The capital and O&M costs were developed for each major component using a unit cost basis, which is described in detail in TM 1 Section 7. The capital cost estimates are Class 5 estimates based on the AACE International Cost Estimate Classification System criteria, which corresponds to a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate are -20 to -50 percent on the low end and +30 to +100 on the high end. NPV costs were developed for the TAKE alternatives and described in the Draft IEUA's Chino Basin Program Economic Analysis TM (GEI, June 2020). Note that the costs for the TAKE alternatives do not include any income generated from inline hydropower facilities.

Since the initial TAKE alternatives were developed prior to TAKE-7 and TAKE-8, Tables A-8 and A-9 do not include TAKE-7 and TAKE-8, which are included in TM 2.

Table A-8. Initial TAKE Alternatives Conceptual-Level Cost Estimates (Draft TM2 dated July 6, 2020)

Parameter	TAKE Alternatives ($M)							
	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Pipelines[1]	$50.9	$40.7	$67.2	$47.6	$60.7	$66.0	$49.5	$71.1
Turnouts/Connections	$0.5	$0.5	$2.5	$2.5	$3.5	$3.5	$2.0	$3.5
Pump Stations	$46.5	$25.0	$35.5	$13.5	$15.5	$16.5	$7.5	$12.5
Extraction Wells	$42.5	$25.0	$37.5	$20.0	$22.5	$22.5	$20.0	$22.5
Wellhead Treatment	-	-	$9.2	$9.2	$6.1	$6.1	$9.2	$6.1
Water Storage Tank(s)	$6.5	$3.3	$6.5	$3.3	$3.3	$3.3	$3.3	$3.3
Brine Disposal (NRWS)	-	-	$0.06	$0.06	$0.04	$0.04	$0.06	$0.04
Land	$4.4	$2.8	$4.1	$2.9	$2.7	$2.7	$2.5	$2.7
Subtotal	$151.4	$97.3	$162.6	$99.0	$114.3	$120.6	$94.0	$121.7
Contingency (30%)[2]	$44.1	$28.3	$47.5	$28.8	$33.5	$35.4	$27.4	$35.7
Subtotal	$195.4	$125.6	$210.1	$127.8	$147.8	$155.9	$121.5	$157.4
Implementation (28%)[2]	$53.5	$34.4	$57.7	$35.0	$40.6	$42.9	$33.3	$43.3
Total Capital Cost ($M)								
Total Capital Cost ($2015)	$227.1	$145.9	$244.3	$148.5	$171.9	$181.4	$141.2	$183.1
Total Capital Cost ($2019)	**$248.9**	**$160.0**	**$267.7**	**$162.7**	**$188.5**	**$198.8**	**$154.8**	**$200.7**
Total Capital Cost ($2024)[3]	$274.8	$176.6	$295.6	$179.7	$208.1	$219.5	$170.9	$221.6

Table A-8. Initial TAKE Alternatives Conceptual-Level Cost Estimates (Draft TM2 dated July 6, 2020)

Parameter	TAKE Alternatives ($M)							
	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Annual O&M Cost ($2019) ($M/year)								
Fixed O&M[4]	$2.1	$5.3	$1.8	$4.9	$5.1	$5.1	$4.8	$5.0
Variable O&M[5]	$14.9	$8.3	$13.7	$6.9	$7.1	$7.3	$5.6	$6.4
Annual O&M Cost	**$17.0**	**$13.6**	**$15.4**	**$11.8**	**$12.1**	**$12.4**	**$10.3**	**$11.4**
NPV Cost[6] ($2019) ($M)	**$463**	**$367**	**$429**	**$303**	**$328**	**$343**	**$249**	**$311**

[1]Includes potable water and brine pipelines.

[2]Brine disposal (NRW) and land costs not included in contingency or implementation calculations.

[3]2024 is the estimated mid-point of construction

[4]Includes costs for routine annual maintenance.

[5]Includes operations and maintenance costs during call years.

[6]From the economic analysis tool, Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The TAKE NPV costs were estimated on a program basis assuming PUT-5 for the PUT alternative.

Table A-9. Initial TAKE Alternatives Summary

		TAKE Alternatives							
TAKE Components	**Parameters**	**TAKE-1 100% MWD Pump Back with Standard Delivery**	**TAKE-2 100% MWD Pump Back with Pre-Delivery**	**TAKE-3 Mixed Pump Back and In-Lieu Use with Standard Delivery**	**TAKE-4a Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-4b Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-4c Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-6a 100% In-Lieu Use with Pre-Delivery**	**TAKE-6b 100% In-Lieu Use with Pre-Delivery**
Extraction Wells	Description	*MZ1* • None *MZ2* • 15-2,000 gpm extraction wells • 2-1,500 gpm extraction wells • **17 wells Total** *MZ3* • None	*MZ1* • None • *MZ2* 9-2,000 gpm extraction wells • 1-1,500 gpm extraction well • **10 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 14-2,000 gpm extraction wells • 1-1,500 gpm extraction well • **15 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 8-2,000 gpm extraction wells • 8 wells Total *MZ3* • None	*MZ1* • None *MZ2* • 9-2,000 gpm extraction wells • **9 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 9-2,000 gpm extraction wells • **9 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 8-2,000 gpm extraction wells • **8 wells Total** *MZ3* • None	*MZ1* • None *MZ2* • 9-2,000 gpm extraction wells • **9 wells Total** *MZ3* • None
Wellhead Treatment	Description	• None	• None	*MZ1* • 1-3,000 AFY Biological Treatment • 1-3,000 AFY GAC Treatment	*MZ1* • 1-2,950 AFY Biological Treatment • 1-2,950 AFY GAC Treatment	*MZ1* • 1-1,950 AFY Biological Treatment • 1-1,950 AFY GAC Treatment	*MZ1* • 1-1,950 AFY Biological Treatment • 1-1,950 AFY GAC Treatment	*MZ1* • 1-3,000 AFY Biological Treatment • 1-3,000 AFY GAC Treatment	*MZ1* • 1-2,000 AFY Biological Treatment • 1-2,000 AFY GAC Treatment
Potable Water Conveyance	Description	*Pump Station #1* • 9,300 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipeline* • 27,700 ft 54-inch • 3,100 ft 42-inch • 2,300 ft 36-inch • 1,800 ft 30-inch • 21,000 ft 24-inch • 21,200 ft 12-inch • **77,100 ft Total** • **14.6 miles Total**	*Pump Station #1* • 5,000 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* • 34,300 ft 42-inch • 9,900 ft 30-inch • 8,400 ft 24-inch • 9,000 ft 12-inch • **61,600 ft Total** • **11.7 miles Total**	*Pump Station #1* • 7,100 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* • 16,700 ft 48-inch • 14,400 ft 42-inch • 7,100 ft 36-inch • 1,800 ft 30-inch • 39,700 ft 24-inch • 14,500 ft 16-inch • 24,100 ft 12-inch • **118,300 ft Total** • **22.4 miles Total**	*Pump Station #1* • 2,000 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pump Station #2* • 700 HP booster pump station near intersection of Bluegrass and Banyan • 0.5 acres of land acquisition *Pipelines* • 6,600 ft 36-inch • 27,800 of 30-inch • 15,900 ft 24-inch • 35,300 ft 16-inch • 14,100 ft 12-inch • **99,700 ft Total** • **18.9 miles Total**	*Pump Station #1* • 2,300 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pump Station #2* • 800 HP booster pump station near Miramar Water Treatment Plant • 0.5 acres of land acquisition *Pipelines* • 6,600 ft 36-inch • 58,000 of 30-inch • 20,200 ft 24-inch • 8,700 ft 16-inch • 26,300 ft 12-inch • **119,800 ft Total** • **22.7 miles Total**	*Pump Station #1* • 2,600 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pump Station #2* • 700 HP booster pump station near intersection of Bluegrass and Banyan • 0.5 acres of land acquisition *Pipelines* • 12,200 ft 36-inch • 29,100 of 30-inch • 11,400 ft 24-inch • 62,700 ft 16-inch • 34,800 ft 12-inch • **150,200 ft Total** • **28.4 miles Total**	*Pump Station #1* • 1,500 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* • 6,600 ft 36-inch • 18,500 ft 30-inch • 51,600 ft 24-inch • 14,500 ft 16-inch • 6,500 ft 12-inch • **97,700 ft Total** • **18.5 miles Total**	*Pump Station #1* • 2,500 HP booster pump station near intersection of Milliken and Jersey (land included in Tank #1 site) *Pipelines* • 10,400 ft 36-inch • 19,700 ft 30-inch • 73,200 ft 24-inch • 29,900 ft 16-inch • 17,200 ft 12-inch • **150,400 ft Total** • **28.5 miles Total**

Table A-9. Initial TAKE Alternatives Summary

TAKE Components	Parameters	TAKE Alternatives							
		TAKE-1 **100% MWD Pump Back with Standard Delivery**	**TAKE-2** **100% MWD Pump Back with Pre-Delivery**	**TAKE-3** **Mixed Pump Back and In-Lieu Use with Standard Delivery**	**TAKE-4a** **Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-4b** **Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-4c** **Mixed Pump Back and In-Lieu Use with Pre-Delivery**	**TAKE-6a** **100% In-Lieu Use with Pre-Delivery**	**TAKE-6b** **100% In-Lieu Use with Pre-Delivery**
Potable Water Storage	Description	*Storage Tank #1* • 5 MG tank near intersection of Milliken and Jersey • 2 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 5 MG tank near intersection of Milliken and Jersey • 2 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)	*Storage Tank #1* • 2.5 MG tank near intersection of Milliken and Jersey • 1.5 acres of land acquisition (includes land for Booster Station #1)

Appendix B: Initial TAKE Alternatives Evaluation

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Section B-1: Introduction

Initial alternatives including pre-delivery were evaluated using a similar multi-criteria evaluation process as the PUT alternatives. The initial TAKE alternatives evaluation was completed prior to the development of TAKE-7 and TAKE-8 and the results of the evaluation were documented in the Draft TM2 (dated July 6, 2020). This section describes the process used to evaluate the initial alternatives (TAKE-1 through TAKE-6). As discussed in TM2, pre-delivery was later determined to be infeasible based on discussions with MWD and TAKE-2, TAKE-4 (TAKE-4a, 4b, and 4c), and TAKE-6 (TAKE-6a and 6b) were eliminated from consideration. Please refer to TM2 Section 4 for descriptions of TAKE-1 and TAKE-3 and to TM2 Attachment A for descriptions of TAKE-2, TAKE-4 (TAKE-4a, 4b, and 4c), and TAKE-6 (TAKE-6a and 6b). Note that TAKE-5 was determined to be infeasible before the initial TAKE alternatives evaluation was completed and was not compared in this analysis.

The initial alternatives were evaluated using a multi-criteria approach, which allows for the quantification and visualization of the relative performance of each individual alternative so they can be compared with one another on a common basis. This approach is organized with five overarching program objectives that encompass the CBP goals, each with associated evaluation criteria to measure how well each alternative meets the objectives. All TAKE alternatives were developed to meet the two minimum requirements for alternatives, which include (1) meet Basin-wide objectives and regulatory requirements and (2) provide water exchange for the benefit of the Delta Ecosystem. The minimum requirements are described in more detail in TM1 Section 8.

Table B-1 summarizes the TAKE alternatives evaluation for TAKE-1 through TAKE-6b with scores assigned for each alternative for each criterion. The following Sections B-1.1 through B-1.5 describe the scoring for all evaluation criteria, organized by the five project objectives. The scores were assigned as follows:

- Each alternative was analyzed for each criterion and assigned a score of 1 through 5, with 5 being most advantageous and 1 being the least advantageous.
- The evaluation criteria are scored either quantitatively or qualitatively. Quantitative criteria are those criteria that are scored based on attributes that can be measured, such as pipeline length. Qualitative criteria are scored based on an opinion of how well that alternative supports the evaluation criterion, such as the ability to meet future direct potable reuse (DPR) needs. Criteria that require qualitative scored with whole numbers, while criteria that are scored qualitatively have rational numbers as scores.

Note that the evaluation criteria were defined for the program alternatives and some individual criteria do not apply to the TAKE alternatives. In addition, some of the criteria are non-differentiators when applied to the CBP alternatives alone but would show differentiation if used to compare CBP and non-CBP alternatives. These non-differentiating criteria were included in this evaluation and are described in the following sections. The scoring approach for all criteria is further detailed in TM1 Section 8.

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Table B-1. TAKE Alternatives Evaluation

Objectives			Evaluation Criteria			Alternatives							
No.	Name	Baseline Weighting (%)	No.	Description	Baseline Weighting (%)	TAKE - 1	TAKE - 2	TAKE - 3	TAKE - 4a	TAKE - 4b	TAKE - 4c	TAKE - 6a	TAKE - 6b
					Pump Back vs. In Lieu	*100% PB*	*100% PB*	*PB & IL*	*PB & IL*	*PB & IL*	*PB & IL*	*100% IL*	*100% IL*
					Pre-Delivery	*Standard Delivery*	*Pre-Delivery*	*Standard Delivery*	*Pre-Delivery*	*Pre-Delivery*	*Pre-Delivery*	*Pre-Delivery*	*Pre-Delivery*
					E-W Pipeline	-	-	-	-	X	X	-	X
					Northern part of N-S pipeline to Rialto Pipeline	X	X	X	X	-	X	X	X
					Southern part of N-S pipeline to JCSD	-	-	X	X	X	X	X	X
1	Develop Basin-wide water supply infrastructure	25%	1a	Create exchange opportunities within Chino Basin	30%	1.0	1.0	3.7	3.7	5.0	5.0	3.7	5.0
			1b	Provide synergy with region's planned projects	20%	1.0	1.0	3.0	3.0	5.0	5.0	3.0	5.0
			1c	Ability to meet future Direct Potable Reuse conveyance needs (raw water augmentation)	0%	-	-	-	-	-	-	-	-
			1d	Enhance MWD Rialto Pipeline reliability	30%	1.0	1.0	1.0	1.0	3.0	4.5	1.0	5.0
			1e	Integrate with other storage programs	20%	5.0	4.0	4.0	2.0	2.0	2.0	1.0	1.0
			Total - 1a through 1e (Must equal 100%)		100%	1.8	1.6	2.8	2.4	3.8	4.3	2.2	4.2
2	Increase water supply reliability	15%	2a	Insurance water (critically dry year access to treatment and unused water) (access to emergency supply)	40%	5.0	1.7	5.0	1.7	1.7	1.7	1.7	1.7
			2b	Address CECs on the horizon (such as PFAS)	20%	4.0	3.0	5.0	4.0	4.0	4.0	4.0	4.0
			2c	Increased potable water supply (beyond 25-year CBP)	40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
			Total - 2a through 2c (Must equal 100%)		100%	**4.8**	**3.3**	**5.0**	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**
3	Streamline operations and maintenance	15%	3a	Minimize operational complexity	40%	3.0	4.0	2.7	3.0	2.8	2.8	3.7	3.5
			3b	Minimize impacts to water levels in existing wells	25%	3.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0
			3c	Optimize energy use	35%	1.0	1.0	2.5	2.5	1.5	1.5	5.0	4.0
			Total - 3a through 3c (Must equal 100%)		100%	2.3	3.2	2.7	3.3	2.9	2.9	4.5	4.1
4	Minimize program complexity	20%	4a	Minimize institutional complexity	30%	5.0	4.0	2.0	2.0	1.0	1.0	2.0	1.0
			4b	Minimize implementation complexity	30%	4.1	4.5	2.8	2.7	2.4	1.5	3.2	2.0
			4c	Leverage existing available land to minimize land acquisition	40%	1.5	4.0	2.3	4.0	4.3	4.3	4.5	4.3
			Total - 4a through 4c (Must equal 100%)		100%	3.3	4.2	2.3	3.0	2.7	2.5	3.4	2.6
5	Support cost effectiveness	25%	5a	Minimize NPV costs (includes $206.9 M funding for CBP alternatives) (with pre-delivery charge)	40%	1.0	2.8	1.6	4.0	3.5	3.2	5.0	3.8
			5b	Minimize capital costs	30%	1.7	4.8	1.0	4.7	3.8	3.4	5.0	3.4
			5c	Minimize annual O&M costs (with pre-delivery charge)	30%	1.0	3.0	2.0	4.1	3.9	3.7	5.0	4.3
			Total - 5a through 5b (Must equal 100%)		100%	1.2	3.5	1.5	4.2	3.7	3.5	5.0	3.9
Total Objectives 1 through 5 (Must equal 100%)		100%			**Total Score:**	**2.5**	**3.1**	**2.7**	**3.3**	**3.4**	**3.4**	**3.7**	**3.7**

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B-1.1 Objective 1 – Develop Basin-Wide Water Supply Infrastructure

TAKE alternatives require new infrastructure and facilities, so it was important to have the first objective analyze Basin-wide water supply infrastructure to be inclusive of IEUA's and stakeholders' goals. The evaluation criteria for the TAKE alternatives are as follows:

- 1a – Create Exchange Opportunities within Chino Basin,
- 1b – Provide Synergy with Region's Planned Projects,
- 1d – Enhance MWD Rialto Pipeline Reliability, and
- 1e – Integrate with Other Storage Programs.

Note that Criterion 1c – Ability to Meet Future Direct Potable Reuse Conveyance Needs does not apply to TAKE alternatives and is not discussed. The following sections discuss the applicable criteria, their performance measures, and the scores for each TAKE alternative.

B-1.1.1 Create Exchange Opportunities within Chino Basin (Criterion 1a)

This criterion analyzes new TAKE connections that are developed basin wide. The performance is measured by the ability to have access to new potable water infrastructure via number of new interconnections added to existing infrastructure. TAKE alternatives that provide more interconnections score better than those that provide fewer interconnections. Table B-2 shows the number of new interconnections for each TAKE alternative and the scores.

Table B-2. TAKE Alternatives – Scoring for Create Exchange Opportunities within Chino Basin (Criterion 1a)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Number of Interconnections	1	1	5	5	7	7	5	7
Criterion 1a Score	1.0	1.0	3.7	3.7	5.0	5.0	3.7	5.0

B-1.1.2 Provide Synergy with Region's Planned Projects (Criterion 1b)

The ability to combine stakeholders' planned projects with the alternatives is a significant component in developing the basin-wide water supply infrastructure for the CBP since it would enable the stakeholders to achieve more from the program. The performance measure is based on the number of planned projects incorporated in the alternative. Alternatives that provide more synergies with stakeholders' planned projects scored higher than alternatives that provide fewer synergies. The scoring criterion is based on current understanding of stakeholders' planned projects. The current planned projects include the following:

- Wellhead treatment: treatment projects for existing wells at Chino and Chino Hills (example In-Lieu Local projects)
- North-south (or northern) pipeline: Projects to include north-south pipeline to JCSD that can provide dual benefit for the program in-lieu as well as CVWD imported water to JCSD.
- East-west pipeline: Project to extend east-west pipeline.

Table B-3 summarizes the planned projects for each TAKE alternative and the scores. Note that TAKE Alternative 6b can further extend to TVMWD which can provide dual benefit for CBP in-lieu and meet TVMWD's goal to access Chino Basin groundwater storage, but it does not hold more weight than other TAKE alternatives that also extend the east-west pipeline.

Table B-3. TAKE Alternatives – Scoring for Provide Synergy with Region's Planned Projects (Criterion 1b)								
Planned Projects	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Wellhead Treatment	-	-	X	X	X	X	X	X
North-South Pipeline	-	-	X	X	X	X	X	X
East-West Pipeline	-	-	-	-	X	X	-	X
Criterion 1b Score	1.0	1.0	3.0	3.0	5.0	5.0	3.0	5.0

B-1.1.3 Enhance MWD Rialto Pipeline Reliability (Criterion 1d)

The ability to increase the reliability of imported water deliveries during a shutdown of the MWD Rialto Pipeline is important in planning and developing Basin-wide water supply infrastructure. TAKE alternatives that enhance the reliability of the MWD Rialto Pipeline by providing parallel east-west conveyance for imported water during Rialto Pipeline shutdowns, thus supplementing the Rialto Pipeline, are scored higher than alternatives that do not enhance reliability. Table B-4 summarizes the east-west pipelines for each TAKE alternative and the scores.

Table B-4. TAKE Alternatives – Scoring for Enhance MWD Rialto Pipeline Reliability (Criterion 1d)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
East-West Pipeline	-	-	-	-	X	X	-	X
FWC Highland Zone Pipeline	-	-	-	-	-	X	-	X
Diameter (inches)	-	-	-	-	30	12 - 16	-	16 - 24
Criterion 1d Score	1.0	1.0	1.0	1.0	3.0	4.5	1.0	5.0

B-1.1.4 Integrate with Other Storage Programs (Criterion 1e)

The ability to transport more water to storage programs outside of Chino Basin is significant in evaluating pump back to MWD. The performance measure is standard delivery (e.g., no pre-delivery) alternatives and non in-lieu alternatives score higher since standard delivery alternatives move more water and MWD pump back alternatives convey water to MWD. This movement of water allows for other programs outside of Chino Basin to capture the water and use it in their storage programs. The most advantageous score would require 100% pump back and no pre-delivery while the least advantageous would score would require 100 percent in-lieu with pre-delivery. Table B-5 summarizes the delivery mechanisms for each TAKE alternative and the scores.

Table B-5. TAKE Alternatives – Scoring for Integrate with Other Storage Programs (Criterion 1e)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Pump Back vs. In-Lieu	100% Pump Back	100% Pump Back	Pump Back and In-Lieu	Pump Back and In-Lieu	Pump Back and In-Lieu	Pump Back and In-Lieu	100% In-Lieu	100% In-Lieu
Delivery Type: Standard or Pre-Delivery	Standard	Pre-Delivery	Standard	Pre-Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery
Criterion 1e Score	5.0	4.0	4.0	2.0	2.0	2.0	1.0	1.0

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B-1.2 Objective 2 – Increase Water Supply Reliability

The Program has the ability to diversify and increase the regional water supply portfolio for IEUA and stakeholders. This second objective analyzes alternatives on the basis that it would increase the region's water supply and water quality. The evaluation criteria for the TAKE alternatives are as follows:

- 2a – Insurance Water,
- 2b – Address Contaminants of Emerging Concern (CECs) on the Horizon, and
- 2c – Increased Potable Water Supply.

The following sections discuss these criteria, their performance measures, and the scores for each TAKE alternative.

B-1.2.1 Insurance Water (Criterion 2a)

The ability to provide insurance water allows for the region to access unused water during critically dry years or during times of emergency. TAKE alternatives that provide more water to the Chino Basin score better than those that divert more water to MWD. Scores are based on Year 7 storage amounts for each TAKE alternative assuming that the first call year is Year 8. The TAKE alternative that has the largest storage volume score a 5 and the other alternatives were scaled proportional from the largest storage volume to their respective storage volumes. Table B-6 summarizes the storage amount at the end of Year 7 for each TAKE alternative and the scores.

Table B-6. TAKE Alternatives – Scoring for Insurance Water (Criterion 2a)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Storage at end of Year 7	105 TAF	35 TAF	105 TAF	35 TAF	35 TAF	35 TAF	35 TAF	35 TAF
Criterion 2a Score	5.0	1.7	5.0	1.7	1.7	1.7	1.7	1.7

B-1.2.2 Address CECs on the Horizon (Criterion 2b)

It is important to have the ability to address CECs that are on the horizon by analyzing different elements that would provide more treatment to improve water quality. An example of a forthcoming CEC limit is for PFAS. TAKE alternatives that have standard delivery alternatives score better because more extraction occurs in better water quality areas. Similarly, alternatives with groundwater treatment (e.g., Chino and Chino Hills example In-Lieu Local projects) score better. All TAKE alternatives provide extraction wells in better water quality areas, however alternatives with standard delivery provide more wells and provide more access to better quality water than those that have pre-delivery. Wells that have fewer extraction wells score lower since not as much higher-quality potable water can be extracted. Table B-7 summarizes the TAKE alternatives delivery type, applicable wellhead treatment, and scores.

Table B-7. TAKE Alternatives – Scoring for Address CECs on the Horizon (Criterion 2b)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Delivery Type	Standard Delivery	Pre-Delivery	Standard Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery	Pre-Delivery
Wellhead Treatment	-	-	X	X	X	X	X	X
Criterion 2b Score	4.0	3.0	5.0	4.0	4.0	4.0	4.0	4.0

B-1.2.3 Increased Potable Water Supply (Criterion 2c)

The ability to increase potable water supply for the region beyond the 25-year Program is based on IEUA and stakeholders capitalizing the existing assets developed from the program. The performance measure is the amount of new potable water generated in the Chino Basin Area. TAKE alternatives that provide infrastructure that allows for the largest amount of new potable water to be generated in the Chino Basin area score better than those that limit water production. Because all TAKE alternatives generate 375.0 TAF beyond the 25-year program, they all score a 5.0. The TAKE is analyzed in this criterion to provide better assessment between CBP and non-CBP alternatives during the program alternatives evaluation. The TAKE alternatives scores are shown in Table B-8.

Table B-8. TAKE Alternatives – Scoring for Increased Potable Water Supply (Criterion 2c)								
Alternative	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Criterion 2c Score	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

B-1.3 Objective 3 – Streamline Operations and Maintenance

The CBP would introduce new treatment processes and multiple wells that would need to be operated and maintained, thus the ability to streamline O&M is an important third objective. Streamlining these efforts provides efficiency and a smoother transition to these new services amongst stakeholders. The evaluation criteria used for the TAKE alternatives are as follows:

- 3a – Minimize Operational Complexity,
- 3b – Minimize Impacts to Water Levels in Existing Wells, and
- 3c – Optimize Energy Use.

The following sections discuss these criteria, their performance measures, and the scores for each TAKE alternative.

B-1.3.1 Minimize Operational Complexity (Criterion 3a)

The ability to minimize operational complexity is important for a region-wide program. The TAKE alternative's performance measures are based on the complexity of operations measured in number of extraction wells and booster pump stations, and wellhead treatment. Table B-9 summarizes the performance measure elements and scores for each TAKE alternative.

Table B-9. TAKE Alternatives – Scoring for Minimize Operational Complexity (Criterion 3a)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Extraction Wells	17	10	15	8	9	9	8	9
Wellhead Treatment	-	-	X	X	X	X	X	X
Pump Stations	1	1	1	2	2	2	1	1
Criterion 3a Score	3.0	4.0	2.7	3.0	2.8	2.8	3.7	3.5

B-1.3.2 Minimize Impacts to Water Levels in Existing Wells (Criterion 3b)

The new TAKE extraction wells may negatively affect the groundwater basin by overdrawing and reducing water levels in nearby existing wells. This criterion is evaluated by reviewing well hydrographs and analyzing the water levels at nearby existing wells. Table B-10 summarizes the wellhead impacts for each alternative and their scoring. Note that the initial groundwater modeling has only been done for the standard delivery options which show minimal drawdown. The remaining TAKE alternatives have yet to be modeled, but it is anticipated they would have less drawdown on neighboring wells due to their lower pumping rate, therefore were scored a 5.0.

Table B-10. TAKE Alternatives – Scoring for Minimize Impacts to Water Levels in Existing Wells (Criterion 3b)								
Parameter	**TAKE-1**	**TAKE-2**	**TAKE-3**	**TAKE-4a**	**TAKE-4b**	**TAKE-4c**	**TAKE-6a**	**TAKE-6b**
Groundwater Level Impacts at Nearby Wells	Minimal Drawdown	N/A	Minimal Drawdown	N/A	N/A	N/A	N/A	N/A
Criterion 3b Score	3.0	5.0	3.0	5.0	5.0	5.0	5.0	5.0

B-1.3.3 Optimize Energy Use (Criterion 3c)

The criterion to optimize energy use is based on the energy demand in 1,000 kWh for project components. The TAKE alternatives are evaluated by the energy demand for the extraction wells, wellhead treatment, and pump stations. Because each TAKE alterative has differing energy demands between normal (non-call) years and call years, the energy use for the alternatives were evaluated across the lifetime of the program. Across the entirety of the program, there are 7.5 call years and 17.5 normal (non-call) years. A lower energy demand scores higher in the evaluation. Table B-11 summarizes the scores and power consumption of the call years and normal years throughout the program as well as applicable wellhead treatment that slightly impacts energy use. Note that the wellhead treatment only operates during call years for standard delivery options while pre-delivery options would operate during both normal years and call years.

Table B-11. TAKE Alternatives – Scoring for Optimize Energy Use (Criterion 3c)								
Parameter	Power Consumption (1,000 kWH)							
	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Call Years	637,100	340,600	538,700	215,200	237,400	247,200	161,300	224,800
Non-Call Years (Normal Years)	-	297,300	-	309,900	337,600	323,400	117,900	145,100
Wellhead Treatment	-	-	7,000	23,200	15,500	15,500	23,200	15,500
Total	637,100,	637,900	545,700	548,300	590,500	586,100	302,400	385,400
Criterion 3c Score	1.0	1.0	2.5	2.5	1.5	1.5	5.0	4.0

B-1.4 Objective 4 – Minimize Program Complexity

Each alternative includes many shared components amongst stakeholders, so a significant fourth objective is to minimize program complexities. The evaluation criteria used for the TAKE alternatives are as follows:

- 4a – Minimize Institutional Complexity,
- 4b – Minimize Implementation Complexity, and
- 4c – Leverage Existing Available Land to Minimize Land Acquisition.

The following sections discuss these criteria, their performance measures, and the scores for each TAKE alternative.

B-1.4.1 Minimize Institutional Complexity (Criterion 4a)

The performance measure for the ability to minimize institutional complexity is based on the numbers of contracts/agreements needed with stakeholders. The fewer the agreements with stakeholders the better the score. This criterion evaluates the delivery contracts between all applicable agencies. Since all TAKE alternatives would require agreements with IEUA member agencies, Chino Basin parties, and MWD, they are not included as a contract in the scoring. Table B-12 summarizes the number of contracts needed for each TAKE alternative and the scores. The agency names are detailed in TM 2 Sections 4.3.1 through 4.3.2 and Appendix A Sections A-1.2.1 through A-1.2.3. Note that despite TAKE-1 and TAKE-2 only requiring one contract, the contract for TAKE-1 is less complex with standard delivery.

Table B-12. TAKE Alternatives – Scoring for Minimize Institutional Complexity (Criterion 4a)								
Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Number of Contracts	1	1	7	7	9	9	7	9
Criterion 4a Score	5.0	4.0	2.0	2.0	1.0	1.0	2.0	1.0

B-1.4.2 Minimize Implementation Complexity (Criterion 4b)

The ability to minimize implementation complexity is scored based on the numbers of project elements and permits for each alternative. The fewer the projects and permits, the better the score. The TAKE alternatives were evaluated using the number of projects based on pump stations, miles of pipelines, pipeline crossings, and wellhead treatment. All TAKE alternatives are assumed to require the same number of permits, so it is not a differentiator. Table B-13 summarizes the number of pump station and pipeline crossings, miles of pipelines, wellhead treatment example projects for Chino and Chino Hills, and the score for this criterion.

Table B-13. TAKE Alternatives – Scoring for Minimize Implementation Complexity (Criterion 4b)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Number of Pump Stations	1	1	1	2	2	2	1	1
Number of Crossings	9	7	12	10	11	15	10	15
Miles of Pipelines	14.6	11.7	22.4	18.9	22.7	28.4	18.5	28.5
Wellhead Treatment	-	-	X	X	X	X	X	X
Criterion 4b Score	4.1	4.5	2.8	2.7	2.4	1.5	3.2	2.0

B-1.4.3 Leverage Existing Available Land to Minimize Land Acquisition (Criterion 4c)

Since the CBP needs to be implemented by 2026, using existing available land for CBP facilities was identified as a critical element to keep the project on schedule by avoiding complications with land purchases and rezoning or permitting new parcels. Using existing land also helps reduce program costs. Alternatives that require less land acquisition score better than alternatives that require more land acquisition. The scores were calculated by evaluating the total acreage required for extraction wells, storage tanks, and pump stations. Table B-14 summarizes the score and total acreage including extraction wells, storage tanks, and pump stations acreage.

Table B-14. TAKE Alternatives – Scoring for Leverage Existing Available Land to Minimize Land Acquisition (Criterion 4c)

Acreage	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Extraction Wells	3.9	2.3	3.4	1.8	2.1	2.1	1.8	2.1
Storage Tanks	2	1.5	2	1.5	1.5	1.5	1.5	1.5
Pump Stations	-	-	-	0.5	-	-	-	-
Total	5.9	3.8	5.4	3.8	3.6	3.6	3.3	3.6
Criterion 4c Score	1.5	4.0	2.3	4.0	4.3	4.3	4.5	4.3

B-1.5 Objective 5 – Support Cost Effectiveness

The ability to support cost effectiveness is part of the BCE and an important factor in the multicriteria evaluation to ensure costs are accounted for. The cost estimates are summarized in Section 4.3.7 of this TM with the cost estimating approach presented in TM1 Section 7. Cost scores were calculated based on the highest cost was the lowest score of 1 and the lowest cost was the highest score of 5. The evaluation criteria used for the TAKE alternatives are as follows:

- 5a – Minimize NPV Costs,
- 5b – Minimize Capital Costs, and
- 5c – Minimize Annual O&M Costs.

The following sections discuss these criteria, their performance measures, and the scores for each PUT alternative.

B-1.5.1 Minimize NPV Costs (Criterion 5a)

NPV costs were developed over a project lifecycle of 50 years using the economic analysis tool that is described in the Draft Economic Analysis of Master Plan and CBP Alternatives TM (GEI, June 2020). The NPV costs represent the present value of cash flow over the 25-year CBP and the 25 years following the CBP. The NPV costs include capital costs, replacement costs, annual O&M costs, non-recoverable wastewater disposal costs, and supplemental external source water cost (i.e., recycled water supplies from JCSD and City of Rialto). For the CBP alternatives, the NPV costs take into account the Proposition 1 Water Storage Investment Program (WSIP) funding of $206.9M. The NPV costs are in 2019 dollars.

The economic analysis tool was developed to calculate the NPV costs for overall CBP costs. Therefore, the program costs were estimated for the eight TAKE alternatives assuming that the PUT portion was PUT-5, and then the TAKE portion of the NPV cost was separated out. Table B-15 summarizes the NPV costs and scores.

Table B-15. TAKE Alternatives – Scoring for Minimize NPV Costs (Criterion 5a)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
NPV ($M 2019)	$463	$367	$429	$303	$328	$343	$249	$311
Criterion 5a Score	1.0	2.8	1.6	4.0	3.5	3.2	5.0	3.8

B-1.5.2 Minimize Capital Costs (Criterion 5b)

Capital costs include the cost of equipment and construction costs including direct and indirect costs of all elements. The capital costs for the TAKE alternatives include all TAKE components as summarized in TM 2 Table 4-14 and Appendix A Table A-9 TAKE Alternatives Summary, which includes extraction wells, wellhead treatment, potable water conveyance, and potable water storage. The capital costs include contingency and project implementation costs for engineering services, client administration, and construction management. The capital costs are in 2019 dollars. Table B-16 summarizes the capital costs and scores.

Table B-16. TAKE Alternatives – Scoring for Minimize Capital Costs (Criterion 5b)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
Capital Cost ($M 2019)	$248.9	$160.0	$267.7	$162.7	$188.5	$198.8	$154.8	$200.7
Criterion 5b Score	1.7	4.8	1.0	4.7	3.8	3.4	5.0	3.4

B-1.5.3 Minimize Annual O&M Costs (Criterion 5c)

The O&M costs describe the annual costs to manage and maintain the equipment and infrastructure for the alternative of interest. The annual O&M costs for the TAKE alternatives include annual O&M costs for extraction wells, wellhead treatment, potable water conveyance, and potable water storage. The annual O&M costs for the TAKE alternatives are split between fixed and variable O&M costs and summed for the total annual O&M cost, which was used for the alternatives evaluation. The lower the O&M cost, the higher the score. The O&M costs were evaluated with the pre-delivery charge to MWD for all alternatives that include pre-delivery. Table B-17 summarizes the O&M costs and scores.

Table B-17. TAKE Alternatives – Scoring for Minimize Annual O&M Costs (Criterion 5c)

Parameter	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
O&M Cost ($M 2019)	$17.0	$13.6	$15.4	$11.8	$12.1	$12.4	$10.3	$11.4
Criterion 5c Score	1.2	3.5	1.5	4.2	3.7	3.5	5.0	3.9

B-1.6 TAKE Alternatives Recommendations

Based on the results of the TAKE alternatives evaluation, and as shown in Table B-1 TAKE Alternatives Evaluation, TAKE-6a and TAKE-6b were the highest ranked alternatives with scores of 3.7; followed by TAKE-2, TAKE-4a, TAKE-4b, and TAKE-4c with a range of scores between 3.1 and 3.4; and TAKE-1 and TAKE-3 with the lowest scores of 2.5 to 2.7.

Overall, the six alternatives with pre-delivery scored better than two alternatives with standard delivery (i.e., no pre-delivery): TAKE-2, TAKE-4a, TAKE-4b, TAKE-4c, TAKE-6a, and TAKE-6b (with pre-delivery) all scored in the range of 3.1 to 3.7, whereas TAKE-1 and TAKE-3 (with standard delivery) scored 2.5 and 2.7, respectively. Some of the scoring trends for the pre-delivery alternatives and standard delivery alternatives include:

- Pre-delivery alternatives
  - The six pre-delivery alternatives scored better than the standard delivery alternatives in terms of Objective 5 Support Cost Effectiveness because the pre-delivery alternatives all had lower capital, annual O&M, and NPV costs than the standard delivery alternatives.
  - In general, the pre-delivery alternatives also scored better in terms of Objective 1 Develop Basin-Wide Water Supply Infrastructure (with the exception of TAKE-2, which scored similarly to TAKE-1) because they each include more regional infrastructure than TAKE-1 and TAKE-3; and Objective 3 Streamline O&M (with the exception of TAKE-4b and TAKE-4c, which scored similarly to TAKE-3) because the pre-delivery alternatives pump groundwater at a more constant rate than standard delivery and are expected to minimize impacts to water levels in existing wells.
  - The pre-delivery alternatives scored worse in terms of Objective 2 Increase Water Supply Reliability because not as much water would be stored in the Chino Basin and available as an emergency supply.
- Standard delivery alternatives
  - The two alternatives with standard delivery both scored the best of all alternatives on Objective 2 Increased Water Supply Reliability because more water would be stored in the Chino Basin with standard delivery.

  - The standard delivery alternatives scored the lowest on Objective 5 Support Cost Effectiveness because of the extensive infrastructure required to delivery 50.0 TAFY during call years. The standard delivery alternatives also scored low on the other three objectives, Objectives 1, 3, and 4.

But, even though the pre-delivery alternatives scored better overall than the standard delivery alternatives, because the original CBP concept was based on standard delivery, the CBP team recommended that the TAKE alternatives selected to move forward into the program alternatives evaluation needed to include both standard and pre-delivery alternatives. In addition, since a single PUT alternative was selected to move forward into the program alternatives (PUT-5), four TAKE alternatives were carried forward to create four program alternatives. It was decided to carry forward two standard delivery alternatives and two pre-delivery alternatives to be able to compare a range of CBP alternatives that cover 100% MWD pump back, partial MWD pump back and partial in-lieu, and 100% in-lieu with both standard delivery and pre-delivery.

Based on this reasoning, the following TAKE alternatives were selected to move forward:

- Standard delivery: TAKE-1 and TAKE-3, which are the only standard delivery alternatives.
- Pre-delivery: TAKE-4c and TAKE-6b, which were two of the six pre-delivery alternatives. These alternatives were selected for the following reasons:
  - TAKE-6a and TAKE-6b scored the best overall and scored equivalently, but it was recommended to carry forward only one 100% in-lieu alternative. TAKE-6b includes more regional infrastructure and scored better on Objective 1 Develop Basin-Wide Water Supply Infrastructure because the alternative creates more exchange opportunities within the Chino Basin, provides synergy with the region's planned projects, and enhances the reliability of the MWD Rialto Pipeline with the inclusion of the east-west pipeline.
  - TAKE-2 was not selected because (1) it includes 100% MWD pump back, which is included in the program alternatives as part of TAKE-1, and (2) it was the lowest performing pre-delivery alternative.
  - Of the three alternatives developed for TAKE-4, TAKE-4c was selected to for similar reasons as TAKE-6b: it scored highest on Objective 1 Develop Basin-Wide Water Supply infrastructure because it includes more regional infrastructure that would benefit the agencies in the Chino Basin.

APPENDIX 3

Brine Disposal System
Technical Memorandum #3

IN ASSOCIATION WITH

DRAFT

Brine Disposal System

Technical Memorandum No. 3

July 31, 2020

Prepared for

18500 Von Karman Avenue, Suite 1100
Irvine, CA 92612
T: 714.730.7600

Technical Memorandum

Prepared for: Inland Empire Utilities Agency

Project Title: Chino Basin Program PDR

Project No.: 153489.075

Technical Memorandum No. 3

Subject: Brine Disposal System

Date: July 31, 2020

To: Sylvie Lee, P.E., Manager of Planning & Environmental Resources
Liza Munoz, P.E., Project Manager

From: Andrew Lazenby, P.E., Director/Sr. Project Manager, Brown and Caldwell

Prepared by: ______________________________
Marcus Maltby, Civil Engineer, Brown and Caldwell
License No. C87226, Expiration 9/30/21

Windsor Lee, Brown and Caldwell

Reviewed by: ______________________________
Jennifer K. Thompson, P.E., Sr. Project Manager, Brown and Caldwell

Adam Zacheis, P.E., Director/Client Services, Brown and Caldwell

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List of Abbreviations

AC	asbestos cement
AF	acre-feet
AWPF	advanced water purification facility
CBP	Chino Basin Program
cfs	cubic feet per second
CU	capacity unit
EWL	Etiwanda Wastewater Line
EWLCU	Etiwanda Wastewater Line Capacity Unit
FOG	fats, oil, and grease
fps	feet per second
ft	feet
gpd	gallons per day
gpm	gallons per minute
HDPE	high-density polyethylene
IEBL	Inland Empire Brine Line
IEUA	Inland Empire Utilities Agency
in	inches
IX	ion exchange
JOS	Joint Outfall System
LACSD	Los Angeles County Sanitation District
mgd	million gallons per day
MVWD	Monte Vista Water District
NPDES	National Pollution Discharge Elimination System
NRWS	Non-Reclaimable Wastewater System
NRWSCU	Non-Reclaimable Wastewater System Capacity Unit
OCSD	Orange County Sanitation District
ppd	pounds per day
Program	Chino Basin Program
psi	pounds per square inch
‘RCP	reinforced concrete pipe
RO	reverse osmosis
RP-1	Regional Water Recycling Plant No. 1
RP-4	Regional Water Recycling Plant No. 4
SAWPA	Santa Ana Watershed Project Authority
Study	CBP Technical Feasibility Study
TAFY	thousand acre-feet per year
TM	technical memorandum
TM3	Technical Memorandum 3
TSS	total suspended solids
VCP	vitrified clay pipe
WDR	Waste Discharge Requirements

Section 1: Introduction

The Inland Empire Utilities Agency (IEUA) operates the Non-Reclaimable Wastewater System (NRWS), which is infrastructure for disposal of high-salinity wastewater (brine) and other non-reclaimable high-strength wastewater. The NRWS is comprised of three pipelines: the NRWS pipeline, the Etiwanda Wastewater Line (EWL), and the Inland Empire Brine Line (IEBL). The NRWS is split into two service areas within IEUA's jurisdiction. The North NRWS is comprised of the NRWS pipeline and EWL, while the South NRWS is comprised of the IEBL (and is referred to as IEBL in this technical memorandum [TM]). The NRWS pipeline and the EWL ultimately convey flow to the Los Angeles County Sanitation Districts (LACSD) through the Joint Outfall System (JOS). The IEBL directly conveys flow to the Orange County Sanitation District (OCSD) by gravity. The NRWS is shown graphically in Figures 1-1 and 1-2.

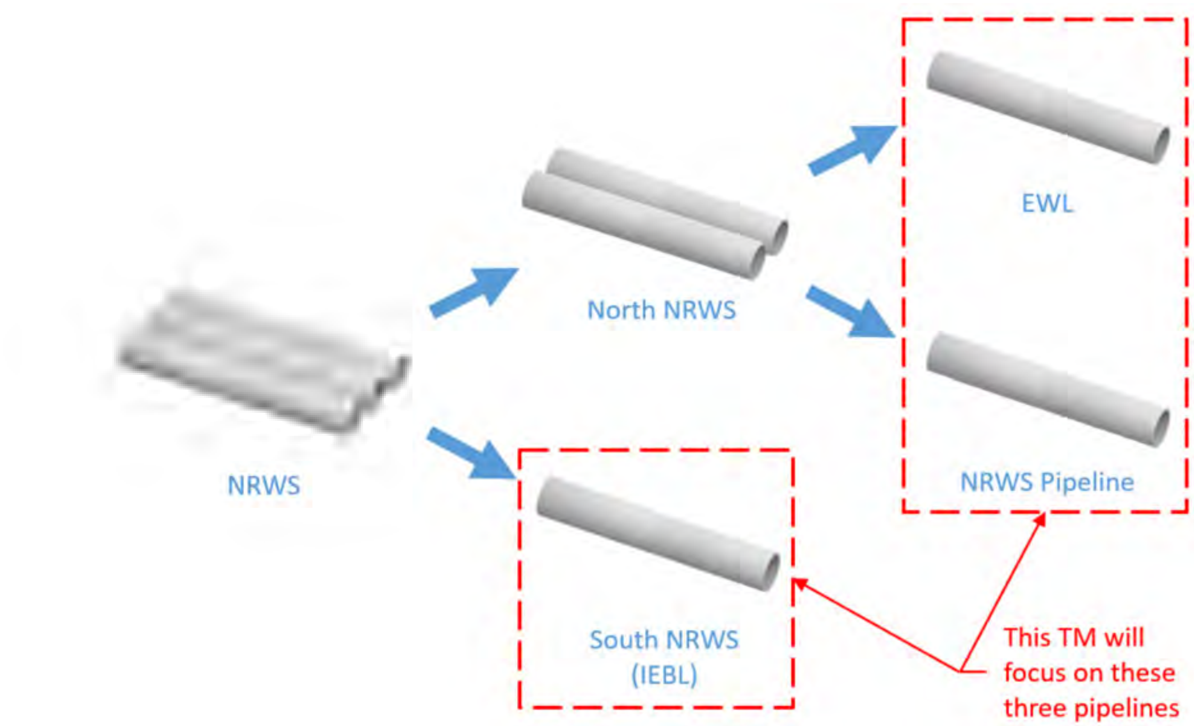

Figure 1-1. NRWS Nomenclature

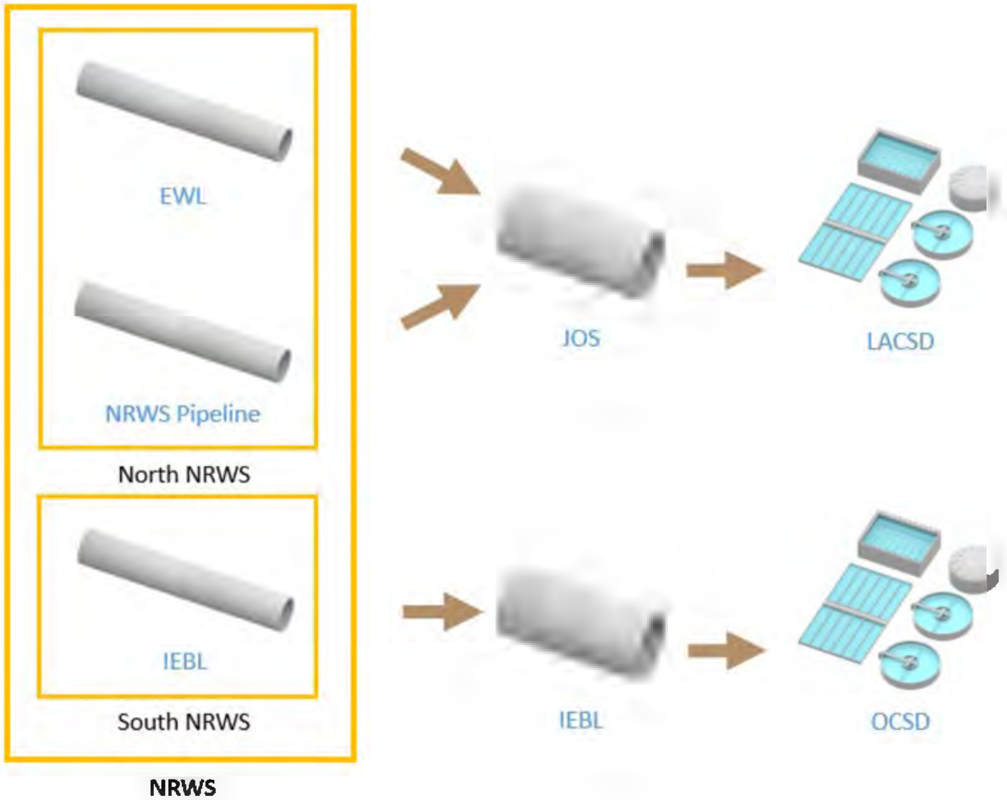

Figure 1-2. Overall System Schematic

The Chino Basin Program (CBP or Program) will purify recycled water for groundwater replenishment and treat extracted groundwater for potable water use. The proposed treatment processes will create brine streams that must be managed and disposed. Technical Memorandum 3 (TM3) presents a summary of NRWS infrastructure, available capacity in each system, requirements for new connections and tie-ins, a summary of system costs for connection capacity and operations, and future considerations for brine conveyance and scaling mitigation. New connections to the NRWS consider the existing hydraulics, requirements for physical connection, and operations and maintenance.

TM3 was developed as part of the CBP Technical Feasibility Study (Study), which is being completed to advance the projects that comprise the CBP. The CBP includes both PUT facilities, the components to recharge purified water to the Chino Basin, and TAKE facilities, the components to extract groundwater and convey potable water supply. The Study will be the primary deliverable for the overall project and will present the overall findings of the project, including the conceptual design for elements of the recommended program. Several background TMs document the assumptions, identification, and selection of the recommended CBP projects, which include:

- **TM1 – Chino Basin Program Assumptions:** Documents the assumptions used to develop the PUT and TAKE alternatives and presents the alternatives evaluation approach used to evaluate the PUT, TAKE, and program alternatives.
- **TM2 – Chino Basin Program – PUT, TAKE, and Program Alternatives Evaluation:** Presents the development and formation of the PUT and TAKE alternatives and evaluation, the development of the program alternatives (based on the results of the PUT and TAKE alternatives evaluation), and the selected program alternative for the overall CBP.

- **TM3 – Brine Disposal System (this TM):** Presents a summary of the brine disposal systems in IEUA's service area and how the CBP facilities would connect to the systems.

1.1 Program Objectives

The objective of the CBP is to produce 15.0 thousand acre-feet per year (TAFY) of purified water for groundwater recharge (PUT) and extract up to 50.0 TAFY of potable water to supplement the drinking water system during call years (TAKE). Refer to TMs 1 and 2 for more information about the CBP assumptions and alternatives.

To produce 15.0 TAFY, the CBP alternatives include potential advanced water purification facilities (AWPFs) at IEUA Regional Water Recycling Plant No. 1 (RP-1) or IEUA Regional Water Recycling Plant No. 4 (RP-4), with a potential smaller AWPF at the Monte Vista Water District (MVWD) Plant 28. The CBP may also include wellhead treatment facilities for In-Lieu Local projects. As described in TMs 1 and 2, example In-Lieu Local projects were included for the City of Chino and City of Chino Hills, which would contribute up to six TAFY, depending on the selected CBP alternative, to the groundwater extraction goals. The proposed AWPF(s) includes reverse osmosis (RO) and one of the example In-Lieu Local projects (the City of Chino Hills wellhead treatment facility) includes ion exchange (IX). Both of these processes generate brine that requires disposal in the NRWS. The potential AWPF locations are within the service area of the North NRWS and the example In-Lieu Local project for the City of Chino Hills is within the service area of the IEBL.

1.2 Background Information

An overall site map of the NRWS within the IEUA limits of jurisdiction is provided Figure 1-3.

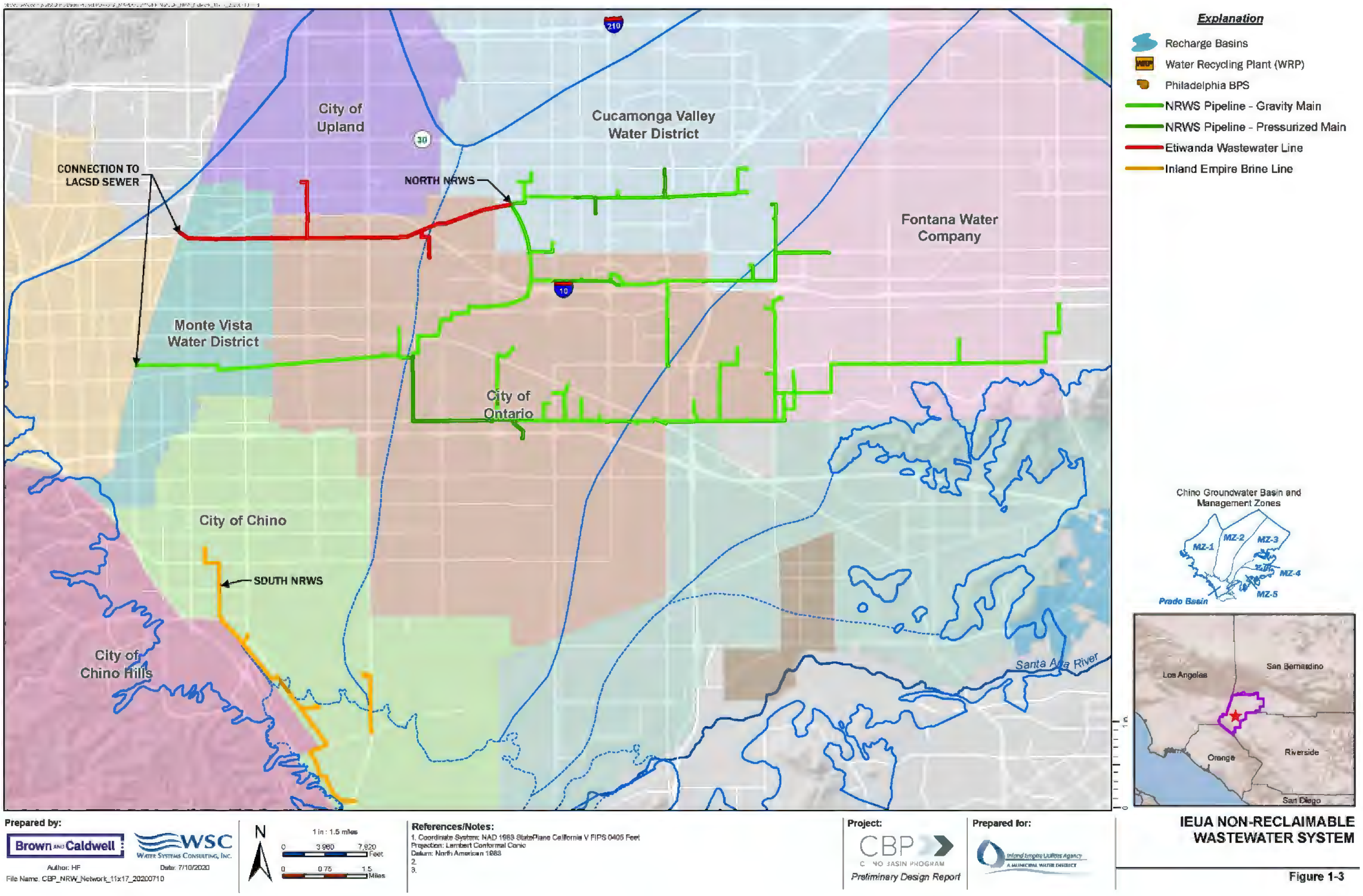

Figure 1-3. NRWS Overall Map

IEUA owns and maintains the North NRWS, which is within their jurisdiction. The North NRWS flows by gravity, except for approximately 2.5 miles of force main leaving the Philadelphia Pump Station. There is available capacity in the North NRWS. IEUA owns capacity units in the NRWS pipeline but does not currently own capacity units in the EWL.

The Santa Ana Watershed Project Authority (SAWPA) is a Joint Powers Authority that serves as an administrator for the Santa Ana River Watershed. SAWPA owns the IEBL and IEUA maintains the reach that is within their jurisdiction. IEUA owns and maintains the laterals connecting to the IEBL within their jurisdiction. There is available capacity in the portion of the IEBL within IEUA's jurisdiction and IEUA currently owns capacity units in the system.

Table 1-1 lists and summarizes the reference information utilized for the development of this TM.

Table 1-1. Reference Information

Source No.	Source Name	Description
1	NRWS Capacity Map	Excel file listing the pipeline capacity, purchased capacity, and actual flows for each pipe segment within the NRWS.
2	NRWS GIS File	GIS file mapping the NRWS. Information for each pipe segment is listed, including pipe diameter, slope, and material.
3	IEUA Resolution No. 2019-6-2	Resolution establishing the rate structure for brine disposal using the EWL, effective July 1, 2019.
4	IEUA Resolution No. 2019-6-3	Resolution establishing the rate structure for brine disposal using the NRWS pipeline, effective July 1, 2019.
5	IEUA Resolution No. 2019-6-4	Resolution establishing the rate structure for brine disposal using the IEBL, effective July 1, 2019.
6	IEUA Ordinance No. 99	Ordinance providing the terms for brine disposal using the NRWS pipeline and EWL, effective June 18, 2014.
7	IEUA Ordinance No. 106	Ordinance providing the terms for brine disposal using the IEBL, effective February 21, 2018.
8	LACSD Discharge Limits	Provides discharge limits for all wastewater within LACSD's service area. Available on LACSD's website.
9	Amended and Restated Wastewater Capacity Agreement	Provides the terms and discharge limits for brine disposal using the EWL, dated May 26, 2010 and effective May 23, 2012. The discharge limits listed in this document are additional to LACSD's discharge limits.
10	SAWPA Resolution No. 2017-11	Provides discharge limits for wastewater discharged to the IEBL, effective September 19, 2017.

1.3 Evaluation Assumptions

The following assumptions were made for the brine disposal system evaluation in TM3:

- The NRWS capacity, actual flow, and purchased capacity were provided by IEUA and verified with hydraulic calculations.
  - The capacity of the existing NRWS was calculated assuming full pipe flow, or a d/D of 1, and does not account for reduced open area due to scaling.
- The fees for CUs do not take into account any available purchased CUs that could be used. The CU fees are based on purchasing the entire volume of brine discharged. The brine disposal fees could be refined as the Study progresses to take into account IEUA's available purchased CUs.
- The brine system capacities evaluated in this TM are for the segments of the North NRWS and IEBL within IEUA's jurisdiction. The available capacity in the downstream segments of the NRWS North and IEBL needs to be confirmed.
- Determine if additional downstream treatment costs for discharge into the IEBL would be assessed. Per IEUA Ordinance No. 99, the NRWS North fees are assumed to be inclusive of LACSD treatment charges.

Section 2: New Connections to the NRWS

This section presents information about the potential new connections to the NWRS for CBP alternatives. The following information is presented in this section:

- Connection requirements for the NRWS.
- New North NRWS connections for the potential AWPF(s) at RP-1, RP-4, and MVWD Plant No. 28.
- New IEBL connection for the example In-Lieu Local project for the City of Chino Hills.
- Disposal fees and estimated annual disposal cost estimates.

2.1 Connection Requirements

To discharge to the NRWS, the user must obtain a Wastewater Discharge Permit and purchase capacity units (CU) for the respective pipeline. The typical terms for the permit are five years for the NRWS pipeline and EWL and two years for the IEBL. Permit application and renewal fees vary by industry and are listed in the Resolutions for each pipeline. Figure 2-1 summarizes the steps to obtain a permit.

Figure 2-1. Typical Process for Wastewater Discharge Permit

Plans detailing the facility layout, points of connection to the NRWS, and monitoring station must be submitted with the Wastewater Discharge Permit Application. As stated on IEUA's website, the following must be submitted with the Wastewater Discharge Permit Application:

- Six sets of plans, including:
  - Facility layouts and spill containment systems for storage tanks and containers.
  - Industrial and sanitary waste lines located within the facility and points of connections to the NRWS or domestic sewers.

- – Schematic diagrams of wastewater treatment equipment and process, if any.
- – Proposed plans for connection to the NRWS.
- – Proposed monitoring station with flow meter (and data logger where applicable) for the discharge (upstream of connection to the NRWS).

- A schematic diagram for the water mass balance with average flow rates for water usage and discharge for the facility.
- Descriptions of manufacturing processes, wastewater generation processes, and wastewater treatment practices, if any.
- Lists of primary raw materials and end products.
- If possible, a wastewater characteristic report of wastewater from a similar facility that the user affiliates with.
- Other items that are required by the Agency's staff to properly determine industry's category and discharge limits.

The capacity units for the three pipelines are summarized in Table 2-1.

Table 2-1. Capacity Units Summary

Parameter	Description
Pipeline	NRWS Pipeline[1]
Capacity Units	Non-Reclaimable Wastewater System Capacity Unit (NRWSCU)
Capacity Unit Equivalent	$\left(0.6513 * \frac{Flow_{gpd}}{260}\right) + \left(0.1325 * \frac{COD_{ppd,dry}}{1.22}\right) + \left(0.2162 * \frac{TSS_{ppd,dry}}{0.59}\right)$
Minimum Capacity Units Acquisition[2]	25 NRWSCU
Pipeline	EWL[3]
Capacity Units	Etiwanda Wastewater Line Capacity Unit (EWLCU)
Capacity Unit Equivalent	15 gpm
Minimum Capacity Units Acquisition	No minimum
Pipeline	IEBL[4]
Capacity Units	Agency CU
Capacity Unit Equivalent	15 gpm
Minimum Capacity Units Acquisition	1 Agency CU

1. Per IEUA Resolution No. 2019-6-3 (see Source No. 4 in Table 1-1).

2. Optionally, NRWSCU can be leased on an annual basis for 5 percent of the purchase rate per year.

3. Per IEUA Resolution No. 2019-6-2 (see Source No. 3 in Table 1-1).

4. Per IEUA Resolution No. 2019-6-4 (see Source No. 5 in Table 1-1).

2.1.1 Water Quality Requirements

Non-reclaimable wastewater is conveyed through the NRWS to either LACSD or OCSD for eventual discharge to the Pacific Ocean. LACSD's ocean discharge is regulated under the existing National Pollution Discharge Elimination System (NPDES) Permit No. CA0053813 and Waste Discharge Requirements (WDR) Order No. R4-2017-0180. OCSD's ocean discharge is regulated under the existing NPDES Permit No. CA0110604 and WDR Order No. R8-2012-0035. Discharge limits are set for each pipeline in the NRWS to allow the wastewater treatment plants to generate a final effluent that meets their NPDES and WDR requirements. It is assumed that brine streams produced by the proposed AWPFs and wellhead treatment facility will not exceed the discharge limits.

As the control authority, LACSD establishes the discharge limits for the North NRWS. The North NRWS is subject to the same limits set for wastewater discharged within LACSD's service area, which are available on LACSD's website (see Source No. 8, Table 1-1) and summarized in Table 2-2.

Table 2-2. North NRWS Discharge Limits

Contaminant	Unit	Maximum Daily Limit
Cyanide (Total)	mg/L	10
Arsenic	mg/L	3
Cadmium	mg/L	15
Chromium	mg/L	10
Copper	mg/L	15
Lead	mg/L	40
Mercury	mg/L	2
Nickel	mg/L	12
Silver	mg/L	5
Zinc	mg/L	25
TICH	mg/L	Essentially none
pH	s.u.	Above 6
Dissolved Sulfide	mg/L	0.1
Temperature	°F	Below 140
Flash Point	°F	Above 140

LACSD set additional discharge limits for the EWL in the Amended and Restated Wastewater Capacity Agreement (see Source No. 9, Table 1-1), summarized in Table 2-3. The EWL is subject to the discharge limits listed in Tables 2-2 and 2-3.

Table 2-3. EWL Discharge Limits		
Contaminant	**Unit**	**Maximum Daily Limit**
Dissolved Sulfide	mg/L	0.1
Settleable Solids	mL/L	2
Fats, Oil and Grease (FOG)	mg/L	30
Carbonaceous Biological Oxygen Demand (CBOD)	mg/L	30

OCSD, as the control authority for the IEBL, establishes the discharge limits for the IEBL. SAWPA adopted these discharge limits under SAWPA Resolution No. 2017-11 (see Source No. 10, Table 1-1), summarized in Table 2-4.

Table 2-4. IEBL Discharge Limits		
Contaminant	**Unit**	**Maximum Daily Limit**
1,4-dioxane	mg/L	1.0
Arsenic	mg/L	2.0
Cadmium	mg/L	1.0
Chromium (Total)	mg/L	20.0
Copper	mg/L	3.0
Lead	mg/L	2.0
Mercury	mg/L	0.03
Nickel	mg/L	10.0
Selenium	mg/L	3.9
Silver	mg/L	15.0
Zinc	mg/L	10.0
Cyanide (Total)	mg/L	5.0
Molybdenum	mg/L	2.3
Polychlorinated biphenyls (PCB)	mg/L	0.01
Pesticides	mg/L	0.01
Sulfide (Total)	mg/L	5.0
Sulfide (Dissolved)	mg/L	0.5

Table 2-4. IEBL Discharge Limits		
Contaminant	**Unit**	**Maximum Daily Limit**
Oil and Grease (Mineral/Petroleum Oil Origin)	mg/L	100.0
Fats, Oil and Grease (FOG)	mg/L	500.0
Biochemical Oxygen Demand	mg/L	12,000
pH	s.u.	6.0 – 12

2.1.2 Connection Points

For this TM, it is assumed that new connections to the NRWS will utilize existing manholes. The user is required to provide and maintain monitoring stations upstream of the connections to the NRWS. At a minimum, the station must be equipped with a flow meter and, in some cases, equipment to measure pH or electrical conductivity. The station must be directly accessible to IEUA or SAWPA personnel for inspection at any given time. Isolation, metering, and sampling provisions will require coordination with IEUA or SAWPA.

2.1.3 Recommended Design Criteria

The following design criteria are recommended for the brine pipelines:

- Velocity: A maximum velocity of approximately 5 feet per second (fps) and a minimum velocity of approximately 2 fps to minimize scaling within the pipeline.
  - Note that IEUA requires a minimum diameter for new brine pipelines of 8 inches. If an 8-inch diameter pipeline exceeded the maximum recommended velocity or was less than the minimum recommended velocity, then an exception was proposed for IEUA's consideration to minimize scaling.
- Pipeline: High-density polyethylene (HDPE) pipe designed for full-pipe flow.

See Section 3 for additional discussion of scaling prevention and recommendations to minimize scaling. Refer to TM1 for additional brine pipeline design criteria and planning assumptions.

2.2 New North NRWS Connections

Each AWPF would require a new connection to the North NRWS. Table 2-5 provides a summary of the proposed AWPFs and the corresponding product water capacity for each PUT alternative, as described further in TM2.

Table 2-5. CBP PUT Alternatives AWPF Capacities						
AWPF Location	**PUT-1**	**PUT-2**	**PUT-3**	**PUT-4**	**PUT-5**	**PUT-6**
RP-1	15 TAFY	15 TAFY	12 TAFY	-	-	-
RP-4	-	-	-	15 TAFY	15 TAFY	12 TAFY
MVWD Plant 28	-	-	3 TAFY	-	-	3 TAFY

The following sections provide additional detail for each new connection to the North NRWS.

2.2.1 AWPF at RP-1

PUT Alternatives 1, 2, and 3 assume that the AWPF is located at RP-1. For a product water capacity of 15 TAFY (PUT Alternatives 1 and 2), approximately 1.03 million gallons per day (mgd) of brine concentrate will require disposal; for a product water capacity of 12 TAFY (PUT Alternative 3), approximately 0.8 mgd of brine concentrate will require disposal. The size and alignment for the proposed brine line is the same for PUT Alternatives 1, 2, and 3. The elements of the proposed connection are as follows:

- Connection
  - Brine concentrate would be conveyed through a 3,900-foot 8-inch HDPE brine line using the residual pressure from the RO system. The residual pressure is projected to be a maximum of 80 pounds per square inch (psi) and would be reduced using a control valve. It is assumed that the brine concentrate would be discharged from an RO concentrate air gap.
  - The new brine line would exit the northeast corner of the AWPF, parallel to the new recycled water conveyance line, and connect to existing manhole NSST-149 on the NRWS pipeline. The connection point is located on Philadelphia Street between Proforma Avenue and Hellman Avenue.
  - To cross Highway 60, approximately 400 feet of the brine line would be installed using jack and bore.
- Capacity
  - At the proposed connection, the existing NRWS pipeline is a 27-inch asbestos-cement (AC) pipe with a capacity of 9.3 cubic feet per second (cfs) (6.0 mgd).
  - The current flow at this location is 2.3 mgd and the purchased capacity is 4.6 mgd.
  - The existing NRWS infrastructure is able to accommodate the additional brine stream at the point of connection and downstream.
  - 2,603 NRWSCUs (NRWSCUs) would need to be purchased for PUT Alternatives 1 and 2, and 2,088 NRWSCUs would need to be purchased for PUT Alternative 3.
- Hydraulics
  - At the proposed connection, flow would transition from pressurized to gravity.

The brine disposal for the AWPF at RP-1 is summarized in Table 2-6 and shown in Figure 2-2.

Table 2-6. RP-1 AWPF Brine Disposal

Parameter	Description
Brine Stream Characteristics	
Flow	1,027,300 gallons per day (gpd)
COD[1]	262 pounds per day (ppd), dry
TSS[1]	1 ppd, dry
Connection	
Disposal System	NRWS Pipeline
Pipeline	3,900 ft (8-inch)
No. of Crossings	1 (jack and bore 400 feet beneath 60 Highway)

Table 2-6. RP-1 AWPF Brine Disposal	
Parameter	**Description**
NRWSCUs Required	2,603 (PUT-1 and PUT-2) 2,088 (PUT-3)
Capacity	
NRWS Pipeline Capacity	6.0 mgd (27-inch)
Current Flow	2.3 mgd
Purchased Capacity	4.6 mgd
Hydraulics	
Design Velocity	5 fps

1. Values are estimated

Figure 2-2. RP-1 AWPF Brine Line

2.2.2 AWPF at RP-4

PUT Alternatives 4, 5, and 6 assume that the AWPF is located at RP-4. For a product water capacity of 15 TAFY, approximately 1.03 mgd of brine concentrate will require disposal; for a product water capacity of 12 TAFY, approximately 0.8 mgd of brine concentrate will require disposal. The size and alignment for the proposed brine line is the same for PUT Alternatives 4, 5, and 6. The elements of the proposed connection are as follows:

- Connection
  - Brine concentrate will be conveyed through a 1,400-foot 8-inch HDPE brine line using residual pressure from the RO system. The residual pressure is projected to be a maximum of 80 psi and would be reduced using a control valve. It is assumed that the brine concentrate would be discharged from an RO concentrate air gap.
  - The new brine line would exit the southeast side of the AWPF and connect to existing manhole EINL-008 on the NRWS pipeline, located on Etiwanda Avenue between Wells Street and 6th Street.
  - No trenchless crossings would be required for this brine line.
- Capacity
  - At the proposed connection, the existing NRWS pipeline is a 15-inch vitrified clay pipe (VCP) with a capacity of 7.1 cfs (4.6 mgd).
  - The current flow at this location is 20,000 gallons per day (gpd) and the purchased capacity is 21,600 gpd.
  - It has been verified that the existing NRWS infrastructure would be able to accommodate the brine stream at the point of connection and downstream.
  - 2,603 NRWSCUs would need to be purchased for PUT Alternatives 4 and 5, and 2,088 NRWSCUs would need to be purchased for PUT Alternative 6.
- Hydraulics
  - At the proposed connection, flow would transition from pressurized to gravity.

The brine disposal for the AWPF at RP-4 is summarized in Table 2-7 and shown in Figure 2-3.

Table 2-7. RP-4 AWPF Brine Disposal

Parameter	Description
Brine Stream Characteristics	
Flow	1,027,300 gpd
COD[1]	262 ppd, dry
TSS[1]	1 ppd, dry
Connection	
Disposal System	NRWS Pipeline
Pipeline	1,400 ft (8-inch)
No. of Crossings	None
NRWSCUs Required	2,603 (PUT Alt 4, 5)

Table 2-7. RP-4 AWPF Brine Disposal	
Parameter	**Description**
	2,088 (PUT Alt 6)
Capacity	
NRWS Pipeline Capacity	4.6 mgd (15-inch)
Current Flow	20,000 gpd
Purchased Capacity	21,600 gpd
Hydraulics	
Design Velocity	5 fps

1. Values are estimated

Figure 2-3. RP-4 AWPF Brine Line

2.2.3 MVWD Plant 28

PUT Alternatives 3 and 6 assume that a smaller 3-TAFY AWPF would be located at MVWD Plant 28 in addition to a larger AWPF at either RP-1 or RP-4, respectively. For a product water capacity of 3 TAFY, approximately 0.2 mgd of brine concentrate will require disposal. The size and alignment for the proposed brine line is the same for PUT Alternatives 3 and 6. The elements of the proposed connection are as follows:

- Connection
  - Brine concentrate will be conveyed through a 900-foot 4-inch HDPE brine line using residual pressure from the RO system. The residual pressure is projected to be a maximum of 80 psi and would be reduced using a control valve. It is assumed that the brine concentrate would be discharged from an RO concentrate air gap.
  - The new brine line would exit the north side of the AWPF, parallel to the new recycled water conveyance line, and connect to existing manhole EWL-036 on the EWL, located on Palo Verde Street near Ramona Avenue.
  - No trenchless crossings would be required for this brine line.
- Capacity
  - At the proposed connection, the existing EWL pipeline is a 21-inch reinforced concrete pipe (RCP) with a capacity of 5.0 cfs (3.2 mgd).
  - The current flow at this location is unknown and the purchased capacity is 26,000 gpd.
  - It has been verified that the existing EWL infrastructure would be able to accommodate the brine stream at the point of connection and downstream.
  - 10 EWLCUs would need to be purchased for PUT Alternatives 3 and 6.
- Hydraulics
  - Although IEUA has stated that the minimum diameter for brine lines is 8-inches, it is recommended that a 4-inch diameter brine line is installed to prevent scaling due to low velocity in an 8-inch pipeline.
  - At the proposed connection, flow would transition from pressurized to gravity.

The brine disposal for the AWPF at MVWD Plant 28 is summarized in Table 2-8 and shown in Figure 2-4.

Table 2-8. MVWD Plant 28 AWPF Brine Disposal	
Parameter	**Description**
Brine Stream Characteristics	
Flow	205,460 gpd
COD[1]	53 ppd, dry
TSS[1]	0.2 ppd, dry
Connection	
Disposal System	EWL
Pipeline	900 ft (4-inch)
No. of Crossings	None
EWLCUs Required	10 (PUT Alt 3, 6)
Capacity	
EWL Capacity	3.2 mgd (21-inch)
Current Flow	Unknown
Purchased Capacity	26,000 gpd
Hydraulics	
Design Velocity	5 fps

1. Values are estimated

Figure 2-4. MVWD Plant 28 AWPF Brine Line

2.3 New IEBL Connection

The CBP may include groundwater wellhead treatment facilities that could generate brine. Two example In-Lieu Local projects were included in the TAKE alternatives for the City of Chino Hills and the City of Chino. The City of Chino Hills wellhead treatment facility would require a new connection to the IEBL. Table 2-9 provides a summary of the proposed example In-Lieu Local project for the City of Chino Hills and the corresponding product water capacity for each TAKE alternative (see TM2 for more information).

Table 2-9. CBP TAKE Alternative Wellhead Treatment Facility Capacity

Wellhead Treatment Facility Location	TAKE-1	TAKE-2	TAKE-3	TAKE-4a	TAKE-4b	TAKE-4c	TAKE-6a	TAKE-6b
City of Chino Hills	-	-	3 TAFY	2.95 TAFY	1.95 TAFY	1.95 TAFY	3 TAFY	2 TAFY

CBP TAKE Alternatives 3, 4a, 4b, 4c, 6a, and 6b assume that one of the wellhead treatment facilities is located at the City of Chino Hills Booster 9. For a product water capacity of 3 TAFY, approximately 4,900 gpd of brine concentrate will require disposal. The size and alignment for the proposed brine line is the same for TAKE Alternatives 3, 4a, 4b, 4c, 6a, and 6b. The elements of the proposed connection are as follows:

- Connection
  - Brine concentrate would be conveyed through a 6,800-foot 8-inch HDPE brine line.
  - The new brine line would exit the south side of the facility and connect to existing manhole SST-018 on the IEBL, located at the intersection of Eucalyptus Avenue and Monte Vista Avenue.
  - To cross the 71 Highway and Chino Creek, approximately 300 feet of the brine line would need to be installed using jack and bore.
- Capacity
  - At the proposed connection, the existing IEBL pipeline is a 12-inch VCP with a capacity of 3.5 CFS (2.3 mgd).
  - The current flow at this location is 22,000 gpd and the purchased capacity is 43,000 gpd.
  - It has been verified that the existing IEBL infrastructure would be able to accommodate the brine stream at the point of connection and downstream.
  - One Agency CU would need to be purchased for TAKE Alternatives 3, 4a, 4b, 4c, 6a, and 6b.
- Hydraulics
  - Constant flow through the brine line is not feasible since a very small pipe diameter is needed to meet the velocity design criteria. To promote full pipe flow, a pressure sustaining valve is recommended at the connection to the IEBL.
  - At the proposed connection, flow will transition from pressurized to gravity.

The brine disposal for the City of Chino Hills wellhead example In-Lieu Local project is summarized in Table 2-10 and shown in Figure 2-5.

Table 2-10. Example In-Lieu Local Project (City of Chino Hills Wellhead Treatment Facility) Brine Disposal

Parameter	Description
Brine Stream Characteristics	
Flow	4,900 gpd
COD[1]	10 ppd, dry
TSS[1]	1 ppd, dry
Connection	
Disposal System	IEBL
Pipeline	6,800 ft (8-inch)
No. of Crossings	1 (jack and bore 300 ft beneath 71 Highway and Chino Creek)
Agency CU Required	1 (TAKE Alt 3, 4a, 4b, 4c, 6a, 6b)
Capacity	
IEBL Capacity	1.9 mgd (12-inch)
Current Flow	22,000 gpd
Purchased Capacity	43,000 gpd
Hydraulics	
Design Velocity	5 fps

1. Values are estimated

Figure 2-5. City of Chino Hills Wellhead Treatment Facility Brine Line

2.4 Disposal Fees and Estimated Disposal Costs

This section presents the NRWS, EWL, and IEBL disposal fees and the estimated initial and annual disposal fees for the potential new North NRWS connections and the potential new IEBL connection.

2.4.1 NRWS, EWL, and IEBL Disposal Fees

Disposal fees for the NRWS are outlined in the corresponding IEUA resolutions. The resolutions are updated annually. Disposal fees for the NRWS pipeline are summarized in Table 2-11, for the EWL are summarized in Table 2-12, and for the IEBL are summarized in Table 2-13.

Table 2-11. NRWS Disposal Fees

Description	Cost	Unit
NRWSCU Acquisition (initial)[1]	$4,172	Per NRWSCU
Volumetric Charges	$940	Per million gallons
Peak Flow Charges	$357	Per million gallons
Strength Charges, COD	$166	Per 1,000 lb (dry)
Strength Charges, TSS	$470	Per 1,000 lb (dry)
Agency Operations and Maintenance (O&M) Charges (monthly)	$20.25	Per NRWSCU
Agency Capital Improvement Program (CIP) Charges (monthly)	$8	Per NRWSCU

1. Optionally, NRWSCU can be leased on an annual basis for 5 percent of the purchase rate per year.

2. NRWS pipeline disposal fees are per IEUA Resolution No. 2019-6-3 (see Source No.4 in Table 1-1).

Table 2-12. EWL Disposal Fees

Description	Cost	Unit
EWLCU Acquisition (initial)	$215,000	Per EWLCU
Capacity Charges (monthly)[1]	$80	Per EWLCU
Capital Improvements Program Charges (monthly)	$90	Per EWLCU
Volumetric Charges[1,2]	$760	Per million gallons
Strength Charges, COD[1]	$135	Per 1,000 lb (dry)
Strength Charges, TSS[1]	$380	Per 1,000 lb (dry)

1. Agency CIP and O&M Charges of 50% will be added to the cost shown.

2. The minimum Volumetric Charge for discharge of 100,000 gallons or less per EWLCU per month is $97.90 per EWLCU per month.

3. EWL disposal fees are per IEUA Resolution No. 2019-6-2 (see Source No. 3 in Table 1-1).

Table 2-13. IEBL Disposal Fees		
Description	**Cost**	**Unit**
Agency CU Acquisition (initial)	$215,000	Per Agency CU
Capacity Charges (monthly)[1]	$418.67	Per Agency CU
Capital Improvements Program Charges (monthly)	$90	Per Agency CU
Volumetric Charges[1,2]	$979	Per million gallons
Strength Charges, BOD[1]	$316	Per 1,000 lb (dry)
Strength Charges, TSS[1]	$442	Per 1,000 lb (dry)

1. Agency Administrative Charges of 50% will be added to the cost shown.

2. The minimum Volumetric Charge for discharge of 100,000 gallons or less per CU per month is $97.90 per CU per month.

3. EWL disposal fees are per IEUA Resolution No. 2019-6-4 (see Source No. 5 in Table 1-1).

2.4.2 Estimated Initial and Annual Disposal Costs

The initial and annual costs were calculated assuming the maximum CUs listed in Sections 2.2 and 2.3.

2.4.3 AWPF at RP-1

The following tables summarize the initial and annual costs for the potential connections to the North NRWS and IEBL. The information is presented in the following tables:

- Table 2-14 summarizes the annual costs to dispose of approximately 1.03 mgd of brine concentrate from the 15-TAFY AWPF at RP-1.
- Table 2-15 summarizes the annual costs to dispose of approximately 1.03 mgd of brine concentrate from the 15-TAFY AWPF at RP-4.
- Table 2-16 summarizes the annual costs to dispose of approximately 0.2 mgd of brine concentrate from the 3-TAFY AWPF at MVWD Plant 28.
- Table 2-17 summarizes the annual costs to dispose of approximately 4,900 gpd of brine concentrate from the 3-TAFY wellhead treatment facility (example In-Lieu Local project).

Table 2-14. RP-1 AWPF Annual Disposal Cost	
Description	**Cost**
NRWSCU Acquisition	$10,860,000
Volumetric Charges	$352,000
Peak Flow Charges	$134,000
Strength Charges, COD[1]	$16,000
Strength Charges, TSS[1]	$170
Agency O&M Charges	$633,000
Agency CIP Charges	$250,000

Table 2-14. RP-1 AWPF Annual Disposal Cost	
Description	**Cost**
TOTAL COST (INITIAL)	**$10,860,000**
TOTAL COST (ANNUAL)	**$1,385,000**

1. Values are estimated

Table 2-15. RP-4 AWPF Annual Disposal Cost	
Description	**Cost**
NRWSCU Acquisition	$10,860,000
Volumetric Charges	$352,000
Peak Flow Charges	$134,000
Strength Charges, COD[1]	$16,000
Strength Charges, TSS[1]	$170
Agency O&M Charges	$633,000
Agency CIP Charges	$250,000
TOTAL COST (INITIAL)	**$10,860,000**
TOTAL COST (ANNUAL)	**$1,385,000**

1. Values are estimated

Table 2-16. MVWD Plant 28 AWPF Annual Disposal Cost	
Description	**Cost**
EWLCU Acquisition	$2,150,000
Capacity Charges	$10,000
Capital Improvements Program Charges	$11,000
Volumetric Charges	$57,000
Strength Charges, COD[1]	$3,000
Strength Charges, TSS[1]	$30
Agency CIP and O&M Charges	$35,000
TOTAL COST (INITIAL)	**$2,150,000**
TOTAL COST (ANNUAL)	**$116,000**

1. Values are estimated

Table 2-17. City of Chino Hills Wellhead Treatment Facility Annual Disposal Cost	
Description	**Cost**
Agency CU Acquisition	$215,000
Capacity Charges	$5,000
Capital Improvements Program Charges	$1,000
Volumetric Charges	$2,000
Strength Charges, BOD[1]	$1,000
Strength Charges, TSS[1]	$200
Agency Administrative Charges	$4,000
TOTAL COST (INITIAL)	**$215,000**
TOTAL COST (ANNUAL)	**$13,000**

1. Values are estimated

2.5 Summary

Table 2-18 summarizes the new potential connections to the NRWS (diameter and length), the disposal system, and the CUs required.

Table 2-18. Summary of New Connections

Brine Line	Diameter (in)	Approximate Length (ft)	Disposal System	CUs Required
RP-1 Brine Line	8	3,900	NRWS Pipeline	2,603 (PUT Alt 1, 2) 2,088 (PUT Alt 3)
RP-4 Brine Line	8	1,400	NRWS Pipeline	2,603 (PUT Alt 4, 5) 2,088 (PUT Alt 6)
MVWD Plant 28 Brine Line	4	900	EWL	10 (PUT Alt 3, 6)
City of Chino Hills Brine Line	8	6,800	IEBL	1 (TAKE Alt 3, 4a, 4b, 4c, 6a, 6b)

Section 3: Scaling Prevention and Mitigation Strategies

Scaling occurs when minerals precipitate out of a liquid stream and form deposits on surfaces within treatment processes or downstream distribution systems. Calcium carbonate and sulfate scales are the most common types of scale resulting from RO and IX systems. If not properly managed, scale can reduce capacity, cause water quality fluctuations, diminish treatment results, or lead to failure of piping and equipment. For applications susceptible to scaling, a water quality analysis should be performed, and an action plan implemented to minimize the effects of scaling on the system. This TM will discuss scaling prevention and mitigation strategies for brine conveyance pipelines.

3.1 Scaling Potential

The scaling process starts with nucleation, which is the early stages of crystal formation. Subsequent crystal formation will quicken once nucleation has started. Nucleation can only occur in saturated or supersaturated solutions. There are two types of nucleation:

- Homogenous nucleation
  - Crystal growth within a solution. Clusters of ions, known as seed crystals, can form and grow until they are large enough to precipitate out of the solution, forming scale deposits.
  - More likely to occur as the degree of supersaturation increases.
  - Typically prevented by adding scale inhibitors (inhibits nucleation), distorting agents (alters and weakens crystal structure), and dispersants (cause crystals to repel each other).
- Heterogenous nucleation
  - Crystal growth on an existing surface. The interaction between the solution and the existing surface will form seed crystals and lead to scale deposits.
  - More likely to occur at irregularities on the existing surface such as pipe joints, defects, valves, and meters.
  - Typically prevented by altering the physical properties of the piping or equipment. Minimizing homogenous nucleation will also reduce heterogenous nucleation by maintaining a smoother pipe free of scale deposits.

RO systems typically inject scale inhibitors upstream of the treatment process to facilitate a higher recovery rate; thus, it is expected that the brine concentrate from the proposed AWPF(s) would be supersaturated. Brine concentrate from the IX system at the City of Chino Hills wellhead treatment facility is expected to be saturated since scale inhibitors are typically not injected upstream of the treatment process.

3.2 Mitigation Strategies

Scale inhibitors are a viable strategy to prevent scaling within treatment processes; however, since the effects are temporary, additional strategies are recommended to prevent scaling within downstream distribution systems. The treatment recovery rate, pH, alkalinity, physical properties of interacting surfaces, and flow regime largely influence the tendency of brine to form scale. Table 3-1 summarizes the factors affecting scaling potential and lists applicable mitigation strategies.

Table 3-1. Factors Affecting Scaling Potential

Parameter	Description	Mitigation Strategy
Treatment Recovery Rate	For RO systems, higher recovery rates will lead to brine with higher salt concentrations since less water is wasted.	Confirm that anti-scalant residuals are present in RO system brines.
Degree of Saturation	Higher degrees of saturation will increase the rate of homogenous and heterogenous nucleation.	Inject scale inhibitors or dispersants to prevent crystal growth, or inject distorting agents so that scale is easier to clean.
pH	The solubility of carbonate increases with acidity.	Lower the pH to reduce the scaling potential in the brine line (through chemical injection)
Alkalinity	Results from the presence of hydroxides, carbonates, and bicarbonates.	Reduce the alkalinity to directly reduce the scaling potential (acid addition).
Physical Properties of Interacting Surfaces	Roughness, shape, and material of the piping or equipment can catalyze heterogenous nucleation.	Select materials resistant to scale, minimize irregularities, and frequently perform maintenance.
Flow Regime	Free water surfaces will lead to scaling at the interacting surface. Free water surfaces will also experience evaporation, causing the salt concentration to increase.	Brine conveyance pipelines should be designed to promote full pipe flow.

3.3 Recommendations

Heterogenous nucleation is more likely to occur than homogenous nucleation in brine conveyance pipelines. The most economical strategies for preventing scale are physical properties and flow regime. The following should be considered:

- HDPE is recommended because the pipe interior is smooth.
- The fusion-weld beads resulting from HDPE installation should be removed from the interior using a mandrel.
- The pipeline design should promote full-pipe flow. Air release valves are likely needed and should be easily accessible and resistant to scale. To promote full-pipe flow, a pressure sustaining valve could be used at the connection to the North NRWS or IEBL.
- The velocity should not exceed 5 fps because turbulent flow will induce scaling.

Chemical treatment and pH adjustment should also be considered. Since RO systems utilize scale inhibitor upstream of the process, it is a feasible option to inject additional scale inhibitor into the brine concentrate leaving the system. Since IX systems do not utilize scale inhibitors, it would be more economical to inject sulfuric acid into the brine concentrate to dissolve calcium carbonate by suppressing the pH. A water quality analysis for the brine concentrate is recommended to determine the optimal strategy to prevent scaling.

It is recommended that the brine lines are inspected regularly as a preventive measure. If scale formation is detected, then cleaning through chemical treatment (acid) should be undertaken before scaling becomes extensive. Long radius bends should be installed to facilitate pipe pigging in the future, if required. Additionally, installing parallel brine lines at each facility is recommended to allow for continuous operation during maintenance. The second brine line would be drained and flushed when not in use.

References

IEUA, *Ordinance No. 99*, June 18, 2014.

IEUA, *Ordinance No. 106*, September 19, 2017.

IEUA, *Resolution No. 2019-6-2*, June 19, 2019.

IEUA, *Resolution No. 2019-6-3*, June 19, 2019.

IEUA, *Resolution No. 2019-6-4*, June 19, 2019.

LACSD, *Amended and Restated Wastewater Capacity Agreement*, May 26, 2010.

LACSD, *Discharge Limits*.

SAWPA, *Resolution No. 2017-11*, September 19, 2017

APPENDIX 4

Evaluation of the CBP / Water Storage Investment Program Technical Memorandum

WEST YOST
Water. Engineered.

23692 Birtcher Drive
Lake Forest, CA 92630

949.420.3030 phone
530.756.5991 fax
westyost.com

TECHNICAL MEMORANDUM

DATE: October 15, 2021

Project No.: 941-80-21-69
SENT VIA: EMAIL

TO: Liza Muñoz, PE

CC: Sylvie Lee, PE

FROM: Garrett Rapp, PE, RCE #86007
Lauren Sather, PhD

REVIEWED BY: Andy Malone, PG

SUBJECT: Evaluation of the Chino Basin Program/Water Storage Investment Program

INTRODUCTION

Groundwater pumping rights in the Chino Basin were adjudicated in the 1970s and settled in the 1978 stipulated agreement (Judgment).[1] Figure 1 shows the location of the Chino Basin, the Chino Basin Optimum Basin Management Program (OBMP) defined groundwater management zones, and the Areas of Subsidence Concern.

The Inland Empire Utilities Agency (IEUA) is investigating the feasibility of conducting a Storage and Recovery Program in the Chino Basin called the Chino Basin Program (CBP). They have submitted the CBP for the Proposition 1 Water Storage Investment Program (WSIP) funding. The CBP would produce a total exchange of up to 375,000 acre-feet (af) of water over 25 years for the California Department of Fish and Wildlife to use to improve the habitat for native fish populations in the Bay-Delta watershed.

The IEUA retained Brown and Caldwell to conduct an engineering feasibility analysis of the CBP. The IEUA retained West Yost to use the Chino Basin Watermaster (Watermaster) 2020 Chino Valley Model (CVM) to evaluate the potential hydrologic impacts from various CBP alternatives within the Chino Basin. Impacts of the CBP project were evaluated based on methods and metrics that Watermaster traditionally uses to evaluate Storage and Recovery Programs, which are required by the Peace Agreement and documented in Watermaster's Storage Management Plan (WEI, 2020a).

[1] Original Judgment in Chino Basin Municipal Water District vs. City of Chino, et al., signed by Judge Howard B. Weiner, Case No. 164327. File transferred August 1989, by order of the Court, and assigned new case number RCV51010. The Restated Judgment can be found here: Link

Since the CBP alternatives investigated the injection of recycled water into the basin, the CBP alternatives must also be evaluated to determine compliance with the Title 22 Regulations for Groundwater Replenishment Reuse Project (Title 22). Brown and Caldwell (2020) summarized Title 22 requirements in their siting criteria for the planned injection wells in the CBP:

> *"Injection well locations need to consider nearby groundwater extraction well locations to confirm that there is sufficient travel time between the injection well and groundwater extraction well to meet regulatory requirements. Under the Title 22 Regulations for Groundwater Replenishment Using Recycled Water, purified recycled water must have a minimum response retention time (i.e., minimum period of time recycled water is retained underground, or travel time) of at least two months as demonstrated with tracer study after construction (see TM1 Appendix A, Summary of Title 22 Regulations for Groundwater Replenishment Using Recycled Water). Also in accordance with the Title 22 regulations, numerical modeling is granted 50% credit of a tracer test and must demonstrate four months of travel time between injection and extraction wells."*

This Technical Memorandum (TM) documents the West Yost application of the CVM to evaluate impacts to the Chino Basin, including impacts related to Title 22 compliance, that could be attributable to the implementation of one of the six CBP alternatives that the IEUA developed based on the two identified in Brown and Caldwell's feasibility study (2020). West Yost modeled these six scenarios to evaluate their impacts on the Chino Basin relative to a baseline scenario. The baseline scenario is based on the project scenario documented in the *Evaluation of the Local Storage Limitation Solution* (WY, 2021a) with updated locations of three planned wells owned by the Cucamonga Valley Water District (CVWD). West Yost used the CVM to estimate the travel time between water recharged at proposed injection wells and water extracted at CBP extraction wells and other nearby wells to evaluate Title 22 compliance. The results of this work will be used by the IEUA to assess the feasibility of the CBP and as a resource in the subsequent environmental review prepared by the IEUA pursuant to the California Environmental Quality Act.

DESCRIPTION OF THE CHINO BASIN PROGRAM PLANNING SCENARIOS

Brown and Caldwell (2020) documented four potential CBP alternatives in their feasibility study. The IEUA chose two alternatives for further review and refinement. Based on these alternatives and subsequent discussions with IEUA stakeholders, six potential CBP scenarios were developed and chosen for analysis. This TM documents the projected impacts of these scenarios on the Chino Basin using the CVM. The impacts of the six CBP scenarios are evaluated relative to a baseline scenario, which is the planning scenario simulated in the *Evaluation of the Local Storage Limitation Solution* (WY, 2021a) with updated locations of three planned wells operated by the Cucamonga Valley Water District (CVWD).

Climate Projections

For use in SGMA-related water budget development and groundwater modeling, the California Department of Water Resources (DWR, 2018) provides climate change datasets in the form of change factors of precipitation, ET0, and surface runoff for the years 2030 and 2070. To account for climate change, the future climate and hydrology simulated in the baseline scenario were adjusted using these change factors. The specific methodology is described in the 2020 Safe Yield Recalculation Report (WEI, 2020b).

Put/Take Cycles

The CBP is assumed to operate from January 1, 2029 through December 31, 2053 (referenced herein as the program period). Table 1 shows the schedule of the operational cycles of injection (put) and extraction (take) volumes through the planned CBP facilities for the six CBP scenarios.

Scenarios 1 through 4 are characterized by continuous 15,000 acre-feet per year (afy) puts during the program period, for a total injection of 375,000 af. Scenarios 5 and 6 are characterized by continuous 12,000 afy puts during the program period, for a total injection of 300,000 af.

The take cycles for each of the scenarios follow a late or early call schedule. The late call takes occur during the following years:

- Cycle 1: January 1, 2036 to January 1, 2039
- Cycle 2: January 1, 2046 to January 1, 2049
- Cycle 3: January 1, 2052 to January 1, 2054

The early call takes occur during the following years:

- Cycle 1: January 1, 2029 to January 1, 2032
- Cycle 2: January 1, 2039 to January 1, 2042
- Cycle 3: January 1, 2049 to January 1, 2052

Scenarios 1 and 2 follow late and early call schedules, respectively. Take cycles consist of pumping 50,000 afy, except for the final year of Cycle 3 where the take is 25,000 af. The total take volume is 375,000 af over the program period.

Scenarios 3 and 4 follow late and early call schedules, respectively. Take cycles consist of pumping 40,000 afy, except for the final year of Cycle 3 where the take is 20,000 af. The total take volume during the eight call years is 300,000 af. During the 17 non-call years, pumping occurs at a constant rate of about 4,400 afy in Scenario 4 to increase the total take volume to equal the total injection of 375,000 af. The late call in Scenario 3 causes an increase in storage and a reduction in net recharge. To address this, the non-call year pumping was reduced by an amount approximately equal to the total reduction in net recharge over the program period. Since pumping affects net recharge, West Yost conducted multiple iterations of Scenario 3 until the discrepancy between total reduction in the non-call year pumping and the total reduction in net recharge was less than 0.1 percent of the total injection over the program period. The non-call year pumping in the final iteration was reduced by about 420 afy, which leaves a net balance of +7,140 af in the Chino Basin at the end of the program period. As a result, the total take volume in Scenario 3 is 367,860 af. The non-call year pumping in Scenario 4 was not reduced since the early call results in an increase in net recharge over the program period compared to the baseline.

The takes in Scenario 5 and 6 are identical to the takes in Scenarios 3 and 4, respectively, except there is no additional pumping in non-call years, reducing the total take volume to 300,000 af. The total injection and extraction over the program period for Scenarios 5 and 6 is 300,000 af.

Table 1. Summary of Put/Take Cycles for the CBP Scenarios

values in 1,000 afy

Calendar Year	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6	
	Put	Take	Put	Take	Put	Take	Put	Take	Put	Take	Put	Take
2029	15	-	15	50	15	4.0	15	40	12	-	12	40
2030	15	-	15	50	15	4.0	15	40	12	-	12	40
2031	15	-	15	50	15	4.0	15	40	12	-	12	40
2032	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2033	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2034	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2035	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2036	15	50	15	-	15	40	15	4.4	12	40	12	-
2037	15	50	15	-	15	40	15	4.4	12	40	12	-
2038	15	50	15	-	15	40	15	4.4	12	40	12	-
2039	15	-	15	50	15	4.0	15	40	12	-	12	40
2040	15	-	15	50	15	4.0	15	40	12	-	12	40
2041	15	-	15	50	15	4.0	15	40	12	-	12	40
2042	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2043	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2044	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2045	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2046	15	50	15	-	15	40	15	4.4	12	40	12	-
2047	15	50	15	-	15	40	15	4.4	12	40	12	-
2048	15	50	15	-	15	40	15	4.4	12	40	12	-
2049	15	-	15	50	15	4.0	15	40	12	-	12	40
2050	15	-	15	25	15	4.0	15	20	12	-	12	20
2051	15	-	15	-	15	4.0	15	4.4	12	-	12	-
2052	15	50	15	-	15	40	15	4.4	12	40	12	-
2053	15	25	15	-	15	20	15	4.4	12	20	12	-
Total	**375**	**375**	**375**	**375**	**375**	**367.8**	**375**	**375**	**300**	**300**	**300**	**300**

Figure 2 is a map of the Chino Basin that shows the assumed locations of the injection and extraction wells that will facilitate the puts and the takes in the CBP scenarios.[2] Each of the injection wells is assumed to have an injection capacity of 1,250 afy, exercised every year of the program. Each of the extraction wells is assumed to have a pumping rate ranging from 2,400 to 3,200 afy fully exercised during the years of 50,000 afy takes in Scenarios 1 and 2.

Managed Storage

The term managed storage as used herein refers to water stored by the Parties to the Judgment and other entities and includes Carryover, Local Storage, and Supplemental Water held in storage accounts by the Parties and Storage and Recovery Programs. The water injected and extracted from the Chino Basin in the CBP is assumed to be a credit and a debit to the managed storage accounts, respectively. Figure 3 shows the planned end-of-year managed storage account balances for the baseline scenario and the six CBP scenarios from fiscal year (FY) 2019 through 2054. The program period spans FY 2029 through FY 2054. The current Safe Storage Capacity (SSC) for the Chino Basin[3] is superimposed on Figure 3 in the blue dotted line. The late call scenarios (Scenarios 1, 3, and 5) result in managed storage that exceeds the SSC after 2030. The CBP proposes an increase in SSC up to 700,000 af through June 30, 2039, and to 580,000 af from July 1, 2039 through June 30, 2048, with the SSC decreasing to 500,000 af thereafter (shown in the red dotted line).

The projected managed storage in the early call scenarios (Scenarios 2, 4, and 6) is less than in the baseline scenario over the program period. Conversely, the projected managed storage in the late call scenarios (Scenarios 1, 3, and 5) is greater than in the baseline scenario over the program period. Scenario 1 results in the greatest increase in managed storage compared to the baseline scenario, reaching 690,000 af at the end of FY2035, about 100,000 af greater than in the baseline scenario. The projected managed storage at the end of the program period in Scenario 3 is 7,140 af greater than in the baseline scenario, which is the leftover balance at the end of the program to offset the reduction in net recharge.

PROJECTED BASIN RESPONSE TO THE CBP PLANNING SCENARIOS

This section describes the hydrologic impacts to the basin and the Parties from the implementation of the CBP planning scenarios. Evaluated impacts include changes in net recharge, groundwater levels, pumping sustainability, new land subsidence, state of Hydraulic Control, the speed and direction of significant contaminant plumes. Transit time of the injected water to the nearest extraction well(s) was also evaluated for Title 22 compliance.

Net Recharge

Net recharge, as used herein, is the exploitable inflow to a groundwater basin over a specified period, either under historical conditions or in a future projection under prescribed operating conditions. Net recharge is influenced by the hydrology, cultural conditions, and water management practices of the period. Net recharge is equal to recharge minus uncontrolled discharge and excludes the recharge of supplemental water. Algebraically:

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[2] Several additional wells are planned to be constructed for the CBP to provide redundant capacity. In this evaluation, these wells are assumed to be inactive and are not shown on Figure 2.

[3] See the Notice of Order Re: Motion Regarding Implementation of the Local Storage Limitation Solution here: link

$$Net\ recharge = \Delta S/\Delta t + O_p - I_{ar}$$

Where ΔS is change in storage over a base period, Δt is the duration of a base period, and O_p and I_{ar} are the average groundwater pumping and average supplemental water recharge over the base period, respectively.

Figure 4 shows the time series of net recharge for the baseline scenario and the CBP planning scenarios for the period of fiscal year (FY) 2029 through 2054. The scenarios with late calls (Scenarios 1, 3, and 5) result in a decrease of net recharge compared to the baseline scenario. The scenarios with early calls (Scenarios 2, 4, and 6) result in an increase in net recharge compared to the baseline scenario. The projected net recharge in Scenario 1 averages about 410 afy less than the projected net recharge in the baseline scenario—the greatest negative difference of all six scenarios. The projected net recharge in Scenario 2 averages about 840 afy greater than the projected net recharge in the baseline scenario—the greatest positive difference of all six scenarios. The projected net recharge in Scenario 3 averages about 260 afy less than the projected net recharge in the baseline scenario, totaling -6,760 af over the program period, which is 380 af less than the leftover balance at the end of the program.

Groundwater Elevations

To evaluate the impacts of the CBP operations on groundwater levels, we show maps of the difference in groundwater levels between each of the six CBP scenarios and the baseline scenario for three different years:

1. The year with the greatest positive difference in average groundwater levels (i.e., CBP groundwater levels are higher than in the baseline scenario).
2. The year with the greatest negative difference in average groundwater levels (i.e., CBP groundwater levels are lower than in the baseline scenario).
3. The final year of the program period (January 1, 2054).

Table 2 summarizes, for each of the six CBP scenarios, the groundwater level differences compared to the baseline scenario for the three years specified above. For each of the three years, Table 2 shows the greatest groundwater-level difference at any point in the Chino Basin and the average groundwater-level difference across the Chino Basin. Figures 5 through 22 are maps that show the differences in groundwater levels for each of the combinations of scenarios and years as indicated in Table 2. A review of Table 2 and the groundwater-level difference maps shows the following:

- Scenario 1 results in the greatest positive difference in average groundwater levels compared to the baseline scenario (+5.0 ft on January 1, 2036). Figure 5 shows that positive differences of almost +30 feet occur near the injection wells where the puts are assumed to occur.
- Scenario 2 results in the greatest negative difference in average groundwater levels compared to the baseline scenario (-4.5 ft on January 1, 2049). Figure 9 shows that negative differences of over -35 feet occur near the extraction wells where the takes are assumed to occur.

- For Scenarios 3 through 6 (Figures 11 through 22), the differences in groundwater levels compared to the baseline scenario are less than the differences in Scenarios 1 and 2 due to the lower magnitude of the takes in Scenarios 3 through 6.
- By the end of the program period in all six scenarios, the average differences in groundwater levels compared to the baseline scenario range from -0.5 to +1.2 feet.

Table 2. Summary of Differences in Groundwater Levels between the CBP Scenarios and the Baseline Scenario [a]									
	Maximum Positive Difference in Groundwater Levels over the Program Period			Maximum Negative Difference in Groundwater Levels over the Program Period			Difference in Groundwater Levels at the End of the Program Period		
Scenario	Figure	Year	Average Difference in Groundwater Levels Compared to the Baseline Scenario (ft)	Figure	Year	Average Difference in Groundwater Levels Compared to the Baseline Scenario (ft)	Figure	Year	Average Difference in Groundwater Levels Compared to the Baseline Scenario (ft)
1	5	2036	5.0	6	2049	-0.5	7	2054	-0.5
2	8	2049	1.1	9	2042	-4.5	10	2054	1.2
3	11	2046	3.6	12	2049	-0.1	13	2054	0.1
4	14	2049	0.8	15	2042	-3.2	16	2054	1.0
5	17	2036	4.0	18	2049	-0.4	19	2054	-0.4
6	20	2049	0.9	21	2042	-3.6	22	2054	1.0

(a) Groundwater level changes are calculated as the difference from the baseline groundwater level on January 1st of each year during the program period.

Pumping Sustainability

The term *pumping sustainability*, as used herein, refers to the ability to produce water from a specific well at a desired production rate, given the groundwater level at that well and its well construction and current pumping equipment details. The projected groundwater-elevation time-series charts at individual wells (Attachment A) includes a pumping sustainability metric if provided by the Appropriator. Pumping sustainability metrics are defined by each well owner. Groundwater pumping at a well is assumed to be sustainable if the groundwater elevation at that well remains above the pumping sustainability metric. If the projected groundwater elevation declines below the sustainability metric, the owner will either lower the pumping equipment in their well, reduce pumping, or a combination of the two.

Figure 23 shows the wells that have pumping sustainability metrics. Table 3 shows a subset of these wells with projected groundwater levels that decline below the sustainability metric under the baseline scenario or any CBP scenario during the program period. These wells are labeled in red on Figure 23. The wells in Table 3 are sorted in order of magnitude of groundwater-level impact of the CBP scenarios. As shown in Table 3, there are 17 wells that are projected to experience pumping sustainability challenges in the baseline scenario. One or more CBP scenarios cause two additional wells (City of Ontario Well 39 and Jurupa Community Services District Well 16) to experience pumping sustainability challenges. One or more CBP scenarios are projected to exacerbate existing pumping sustainability challenges by 10 feet or more at the City of Ontario Wells 38, 37, and 31, and CVWD Well CB-5.

These projected effects on pumping sustainability are localized and temporary. As shown in the hydrographs in Attachment A, the minimum groundwater levels occur at the end of a take cycle and generally recover to near the baseline groundwater level three to four years after the take cycle ends. Potential actions to mitigate these pumping sustainability challenges include, but are not limited to: (1) modifying the put and take cycles, (2) strategically increasing supplemental water recharge near the affected wells, (3) modifying a party’s affected well (lowering pump bowls), (4) providing an alternate supply to the affected party to ensure it can meet its demands, (5) a combination of (1) through (4), and (6) the implementation of a monitoring program to verify the effectiveness of the mitigation actions.

New Land Subsidence

To evaluate the risk of the occurrence of new land subsidence across MZ1 in the *Evaluation of the Local Storage Limitation Solution* (WY, 2021a), minimum historical groundwater elevations at wells were used to develop a groundwater elevation control surface (new land subsidence metric) across MZ1 that defined the likelihood of initiating new subsidence: if groundwater levels are higher than the new land subsidence metric, then new land subsidence should not occur; if groundwater levels decline below the new land subsidence metric, then new land subsidence could occur.

The *Evaluation of the Local Storage Limitation Solution*, which used a planning scenario identical to the baseline scenario except for the updated locations of the planned CVWD wells in MZ2, indicated that groundwater levels were projected to remain higher than the new land subsidence metric “except for two small areas centered on wells where groundwater pumping can be modified to ensure no new land subsidence.” Hence, the same conclusion can be assumed for the baseline scenario in this investigation.

Table 3. Projected Pumping Sustainability Challenges at Wells in the Chino Basin[a]												
			Minimum Water Level Minus Pumping Sustainability Metric (ft)[b]							Greatest negative difference in water levels compared to baseline	Smallest negative difference in water levels compared to baseline	New pumping sustainability challenges due to one or more CBP scenarios
Well Owner	Well Name	Pumping Sustainability Metric (ft-amsl)	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6			
City of Ontario	38	589	-3	-23	-24	-17	-17	-18	-18	-21	-14	
City of Ontario	39	609	2	-17	-19	-11	-11	-13	-13	-20	-13	x
City of Ontario	37	609	-1	-20	-21	-14	-14	-15	-15	-20	-13	
Cucamonga Valley Water District	CB-5	613	-17	-33	-35	-28	-29	-30	-30	-18	-11	
City of Ontario	31	635	-5	-19	-20	-14	-14	-15	-15	-16	-9	
Jurupa Community Services District	13	627	-41	-46	-46	-44	-43	-45	-43	-5	-2	
Jurupa Community Services District	20	580	-2	-7	-6	-6	-4	-6	-4	-5	-2	
Jurupa Community Services District	18	580	-5	-9	-8	-8	-7	-8	-7	-4	-2	
Fontana Water Company	F26A	765	-73	-70	-72	-70	-70	-71	-71	-	-	
Fontana Water Company	F24A	769	-57	-55	-56	-54	-55	-55	-56	-	-	
Fontana Water Company	F44B	703	-14	-13	-13	-12	-11	-13	-12	-	-	
Jurupa Community Services District	14	560	-6	-9	-8	-8	-7	-8	-7	-3	-1	
City of Pomona	21	613	-32	-31	-35	-31	-34	-31	-34	-2	-2	
Jurupa Community Services District	16	552	2	-1	0	0	0	0	1	-2	-1	x
Fontana Water Company	F23A	723	-17	-18	-18	-17	-16	-18	-16	-0.5	-0.5	
Jurupa Community Services District	8	581	-2	-3	-3	-3	-3	-3	-3	-1	-1	
Chino Basin Desalter Authority	II-1	574	-64	-64	-65	-64	-65	-64	-65	-1	-0.4	
Chino Basin Desalter Authority	I-14	533	-26	-26	-27	-26	-27	-26	-27	-1	-0.2	
Chino Basin Desalter Authority	I-15	528	-18	-18	-19	-18	-19	-18	-19	-1	-0.2	

(a) Wells are sorted in order of magnitude of groundwater-level impact of the CBP scenarios.

(b) Determined over the program period.

To determine the risk of new land subsidence, projected minimum groundwater levels for the CBP scenarios and the baseline scenario were compared at each of the locations in MZ1 that were used to develop the new land subsidence metric in the *Evaluation of the Local Storage Limitation Solution*. The CBP scenarios are not projected to initiate new land subsidence in any location in MZ1 that was not already projected to initiate new land subsidence in the baseline scenario. Scenario 2 results in the greatest negative difference in minimum groundwater levels compared to the baseline scenario (about -2.5 feet). The location of the greatest negative difference is an area where new subsidence was already projected to occur in the *Evaluation of the Local Storage Limitation Solution*. These projected additional declines in groundwater levels (by up to -2.5 ft) have the potential to exacerbate the occurrence of new subsidence in these areas. The minimum groundwater levels in MZ1 in Scenarios 3 and 5 are always greater than or equal to the groundwater levels in MZ1 in the baseline scenario; therefore, there is no increased risk of new land subsidence in these scenarios.

Watermaster regularly monitors pumping, groundwater levels, and ground motion in the Areas of Subsidence Concern pursuant to its adaptive Subsidence Management Plan under the guidance and supervision of the Ground Level Monitoring Committee (GLMC). Participation in the GLMC process could be an appropriate monitoring and mitigation measure to ensure that the CBP does not result in MPI related to land subsidence in the Chino Basin.

State of Hydraulic Control

The projected state of Hydraulic Control was estimated with the CVM by simulating the Chino Basin response to the baseline and CBP scenarios. The attainment of Hydraulic Control is measured by demonstrating, from groundwater elevation data, either that all groundwater north of the Chino Desalter Authority (CDA) well field cannot pass through the CDA well field (total hydraulic containment standard) or that groundwater discharge through the CDA well field is, in aggregate, less than 1,000 afy (the de minimus discharge standard). The Regional Board has agreed that compliance with the de minimus discharge standard will be determined from groundwater monitoring data and the results of periodic calibration of the Watermaster groundwater model (currently the CVM) and interpretations of the calibration results. The modeling results indicate that the CDA well field is a complete barrier to all groundwater flow towards the Santa Ana River except in the Chino Creek Well Field (CCWF) where some discharge past the CCWF is projected to occur.

Figure 24 shows the time series of groundwater discharge through the CCWF for the baseline and the CBP scenarios and compares them to the de minimus discharge standard of 1,000 afy. The discharge through the CCWF in the baseline scenario and all CBP scenarios declines over time, never exceeds more than about 450 afy, and is always less than the de minimus discharge standard. Discharge past the CCWF is greatest under Scenario 1, where the discharge averages 10 afy more than the baseline scenario over the program period.

Movement of Water Quality Anomalies

The Chino Basin has seven major volatile organic compound (VOC) plumes which have been documented in recent Watermaster reports (WY, 2021b). To assess the impact of the CBP planning scenarios on the movement of these plumes, we used MT3D-USGS (Bedekar, 2016) to simulate their movement over time compared to the baseline. Figures 25 through 27 show the projected locations of the plumes at the end of the program period for the baseline scenario compared to Scenarios 1 and 2, 3 and 4, and 5 and 6, respectively. A review of Figures 25 through 27 show that none of the CBP scenarios are projected to accelerate the southern (downgradient) boundaries of the plumes compared to the baseline scenario. The plume displacements due to the CBP scenarios are minor compared to the magnitude of the projected movement of the plumes in the baseline scenario. None of the CBP scenarios are projected to result in any plume impacting a well operated by an Appropriative Pool party that is not already projected to be impacted under the baseline scenario.

Travel Time of Injected Water

Methodology

The particle-tracking model MODPATH (Pollock, 2016) was used to calculate travel time between the injection wells and extraction wells. In a particle-tracking simulation, tracer particles are inserted into the groundwater model around injection wells at specific times, then MODPATH calculates the flow paths and travel times of the inserted particles based on the simulated flow fields of the groundwater-flow model.

To estimate the residence time of the treated recycled water injected at the CBP injection wells, a cluster of 21 particles were inserted at each of the model grid cells corresponding to the planned injection wells. New clusters of particles were inserted each quarter during the program period to capture the changes in the groundwater flow field over time. The travel time of particles that reach CBP extraction wells or the Parties' extraction wells can be used as a metric to evaluate compliance with Title 22 regulations.

As mentioned in the introduction and Brown and Caldwell (2020), numerical modeling methods must demonstrate four months of travel time between injection and extraction wells. Brown and Caldwell (2020) use the conservative estimate of six months of travel time as a threshold for determining compliance with Title 22 regulations.

Results

Figure 28 shows the locations of particles at six months (light blue) and two years (dark blue) after their release from the injection wells during the program period for Scenario 1. Six months after particles are released, all particles are located within 0.2 miles of their original location. Two years after particles are released, all particles are still within one mile of their initial locations. Scenarios 2 through 6 show similar patterns of particle migration.

Table 4 lists the five extraction wells that are projected to extract particles with travel times of less than three years in one or more CBP scenarios. For each of these extraction wells, Table 4 shows the shortest travel time of a particle to the well under each of the CBP scenarios and lists the injection wells from where the particles originated. The minimum travel time from an injection well to an extraction well occurs at CBP well EW-04 in Scenarios 1 and 2, where the minimum travel times are 8.3 months and 8.4 months, respectively. No Appropriator wells are projected to extract particles within one year of release from an injection well. All CBP scenarios meet the Brown and Caldwell six-month threshold for travel time of injected water.

Table 4. Summary of Extraction Wells Projected to Extract Particles with Travel Times of Less Than Three Years

Well Name	Well Owner	Existing/ Planned Well	Shortest Travel Time to Extraction Well (months)						CBP Injection Well Source(s)
			Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	
CB-43	CVWD	Existing	19.4	19.3	20.5	20.6	23.5	23.5	CBP-IW-15
CB-50	CVWD	Planned	13.8	13.7	14.7	14.8	15.5	15.7	CBP-IW-10[(a)], CBP-IW-6, CBP-IW-7, CBP-IW-9
EW-02	CBP	Planned	14.8	14.7	16.4	16.4	17.0	17.1	CBP-IW-4, CBP-IW-3, CBP-IW-2,
EW-03	CBP	Planned	9.1	9.1	10.2	10.3	10.8	10.9	CBP-IW-12[(b)], CBP-IW-7
EW-04	CBP	Planned	8.3	8.4	10.0	10.1	13.2	13.2	CBP-IW-15, CBP-IW-16, CBP-IW-11

(a) Only a source in Scenarios 1,3,5, and 6.

(b) Only a source in Scenario 2.

SUMMARY OF POTENTIAL IMPACTS AND TITLE 22 COMPLIANCE

Table 5 below summarizes the potential impacts to the Chino Basin and the Parties from implementation of the CBP scenarios.

Table 5. Summary of Potential MPI and Adverse Impacts

Potential Impact Category	Projected Impacts of the CBP Scenarios
Net recharge and Safe Yield	Net recharge is projected to decrease in the late call scenarios (Scenarios 1, 3, and 5) by an average of 260 to 410 afy during the program period. Net recharge is projected to increase in the early call scenarios (Scenarios 2, 4, and 6) by an average of 680 to 840 afy during the program period.
Pumping sustainability	Under the baseline scenario, 17 wells are projected to experience pumping sustainability challenges. One or more of the CBP scenarios are expected to cause pumping sustainability challenges at two additional wells and exacerbate the existing pumping sustainability challenges at several wells identified under the baseline scenario.
New land subsidence	New land subsidence is projected to be minor and only occur in areas already identified under the baseline scenario.
State of Hydraulic Control	Hydraulic Control is projected to be maintained through 2053.
Direction and speed of known plumes	Plume displacement is projected to be minor and is not projected to impact any previously unimpacted Appropriator wells through 2053.
Title 22 Compliance	No compliance challenges with minimum travel times are expected to occur with currently active wells and assumed locations for future wells.

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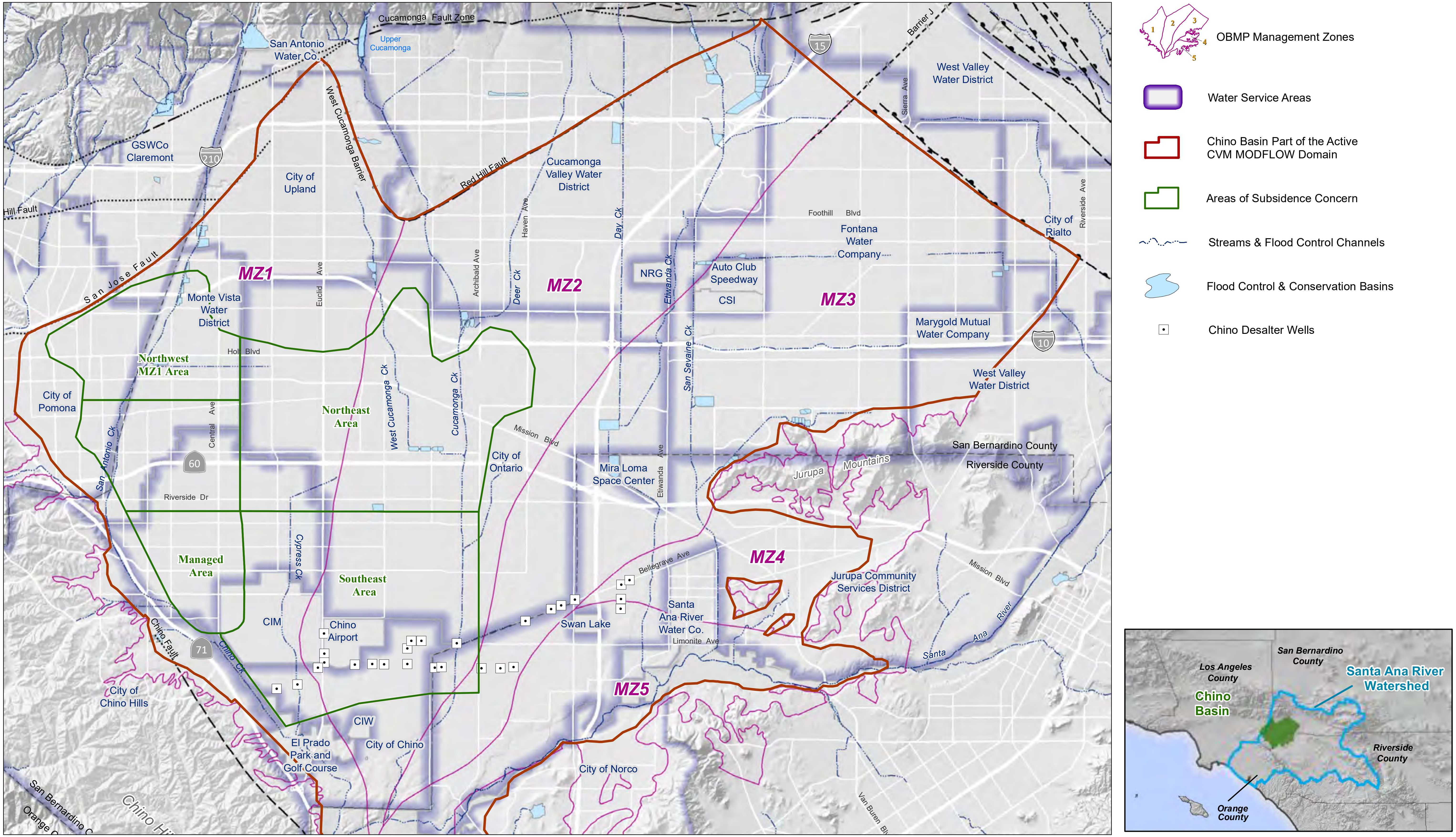


Prepared by:

WEST YOST

Author: TA
Date: 10/4/2021
File: Figure 1 Chino Basin.mxd

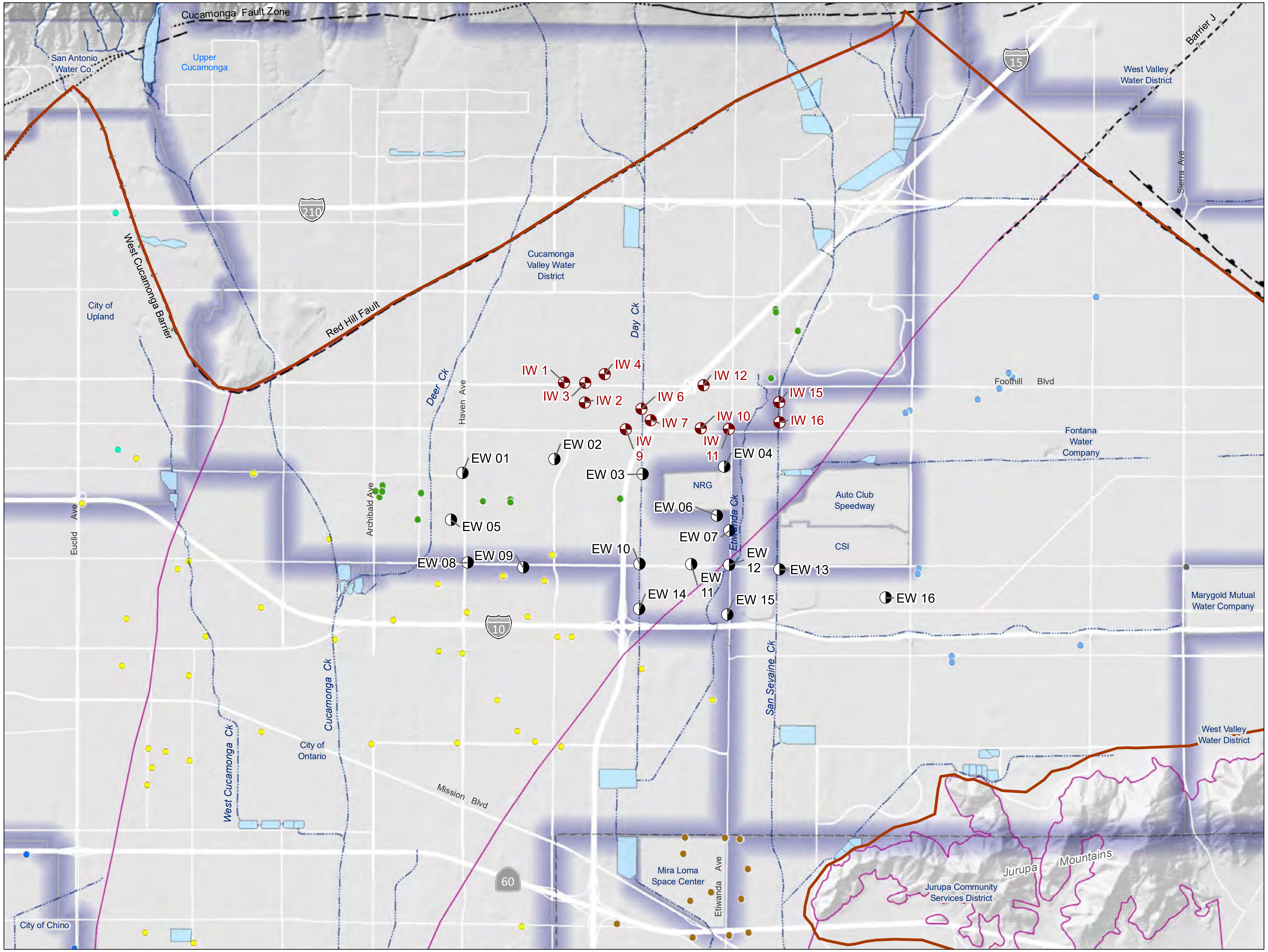
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Chino Groundwater Basin

Figure 1



Facilities for Conducting Puts and Takes in CBP Scenarios

- Injection Well
- Extraction Well

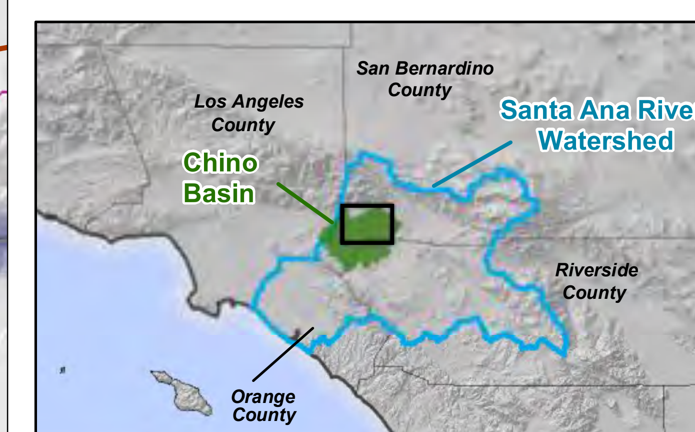
Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

- Chino Desalter Wells
- Streams & Flood Control Channels
- Chino Basin Part of the Active CVM MODFLOW Domain
- OBMP Management Zones
- Water Service Areas
- Flood Control & Conservation Basins

Faults

- Location Certain
- Location Concealed
- Location Approximate
- Location Uncertain
- Approximate Location of Groundwater Barrier



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0 1 2 Miles
0 2 4 Km

Evaluation of the Chino Basin Program

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Chino Basin and Facilities used in CBP Scenarios

Figure 2

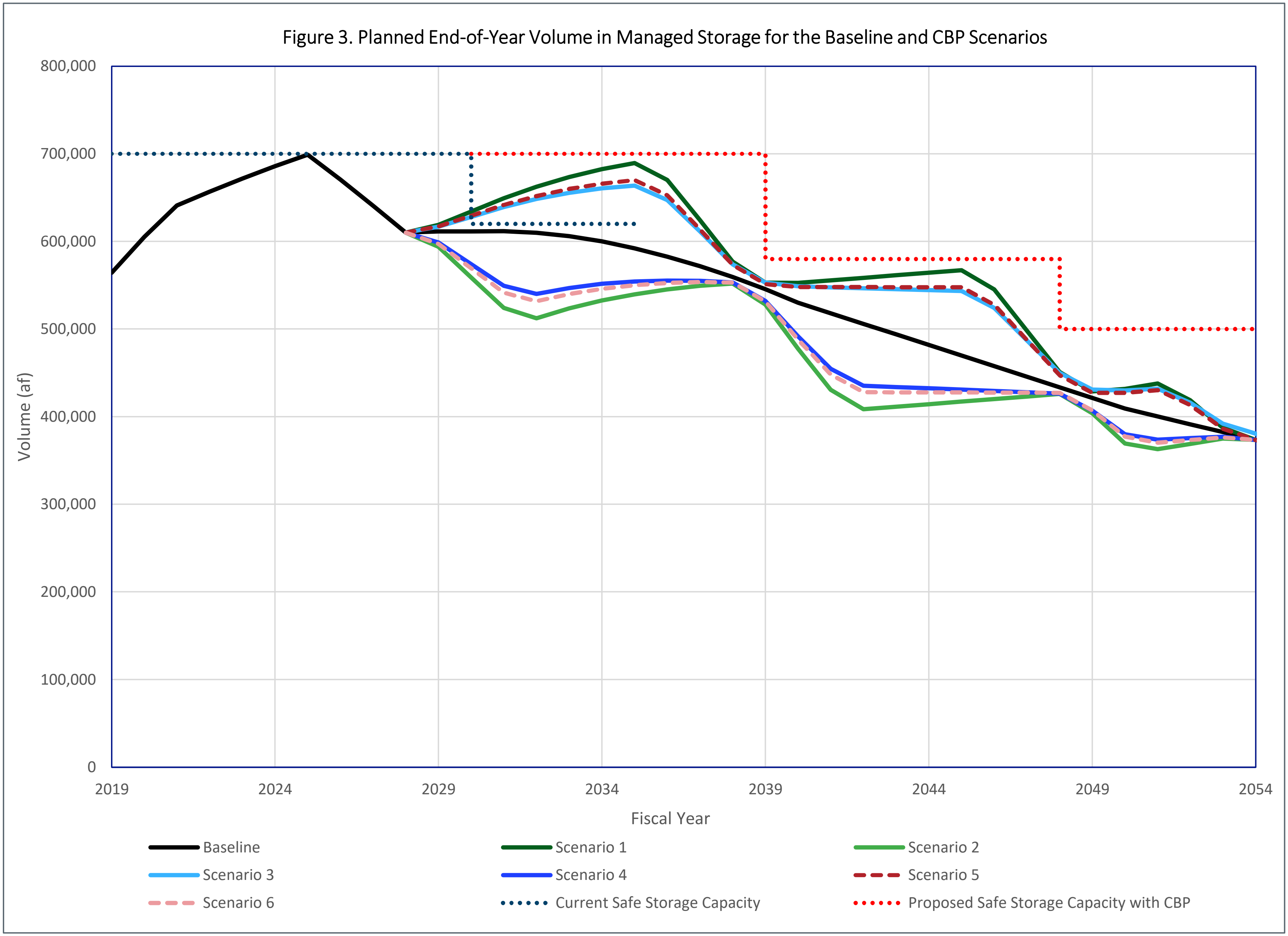
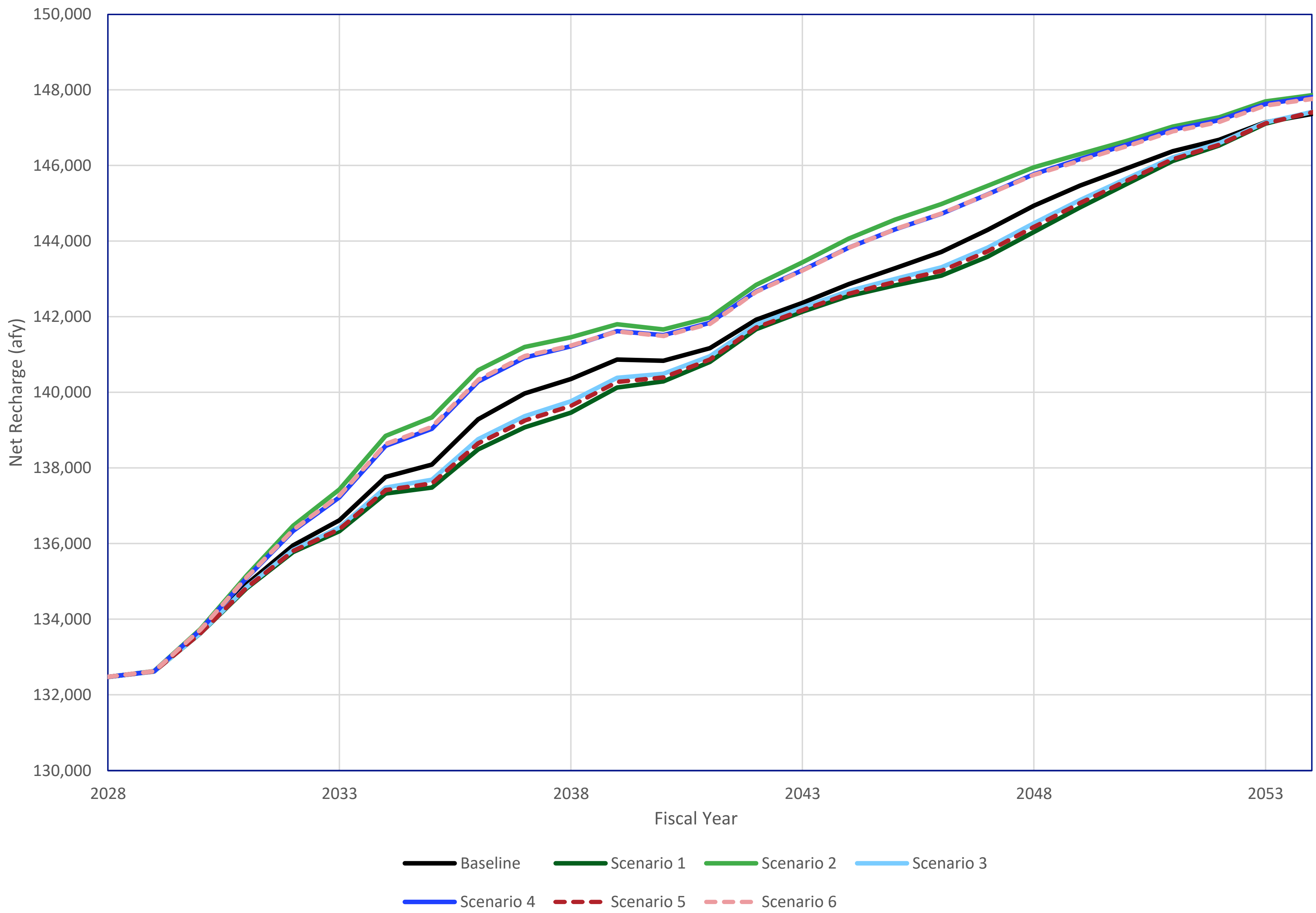
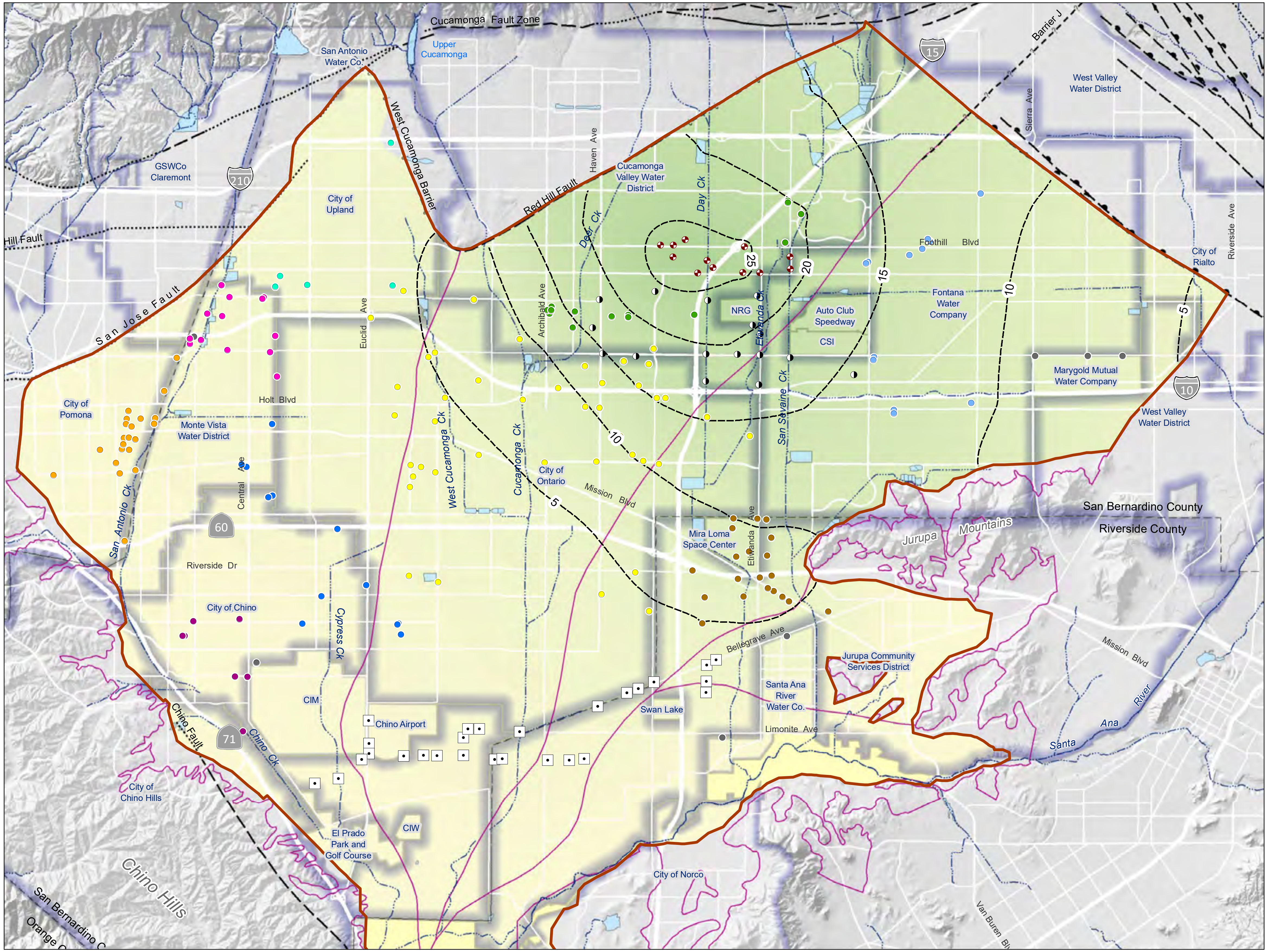


Figure 3. Planned End-of-Year Volume in Managed Storage for the Baseline and CBP Scenarios
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Volume (af)
2019
2024
2029
2034
2039
2044
2049
2054
Fiscal Year
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Current Safe Storage Capacity
Proposed Safe Storage Capacity with CBP

Figure 4. Projected Net Recharge for the Baseline and CBP Scenarios





Contour of Difference in Groundwater Level (ft)
Positive Difference *Scenario 1 minus Baseline (Jan. 2036)*

Contour of Difference in Groundwater Level (ft)
Negative Difference *Scenario 1 minus Baseline (Jan. 2036)*

Difference in Groundwater Level (ft)
January 2036 - Scenario 1 minus Baseline

50 — Areas where Scenario will result in higher groundwater levels than the Baseline
0
-50 — Areas where Scenario will result in lower groundwater levels than the Baseline

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Chino Desalter Wells

Active CBP Injection Well

Active CBP Extraction Well

Streams & Flood Control Channels

Flood Control & Conservation Basins

Water Service Area

Chino Basin Part of the Active CVM MODFLOW Domain

OBMP Management Zones

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0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

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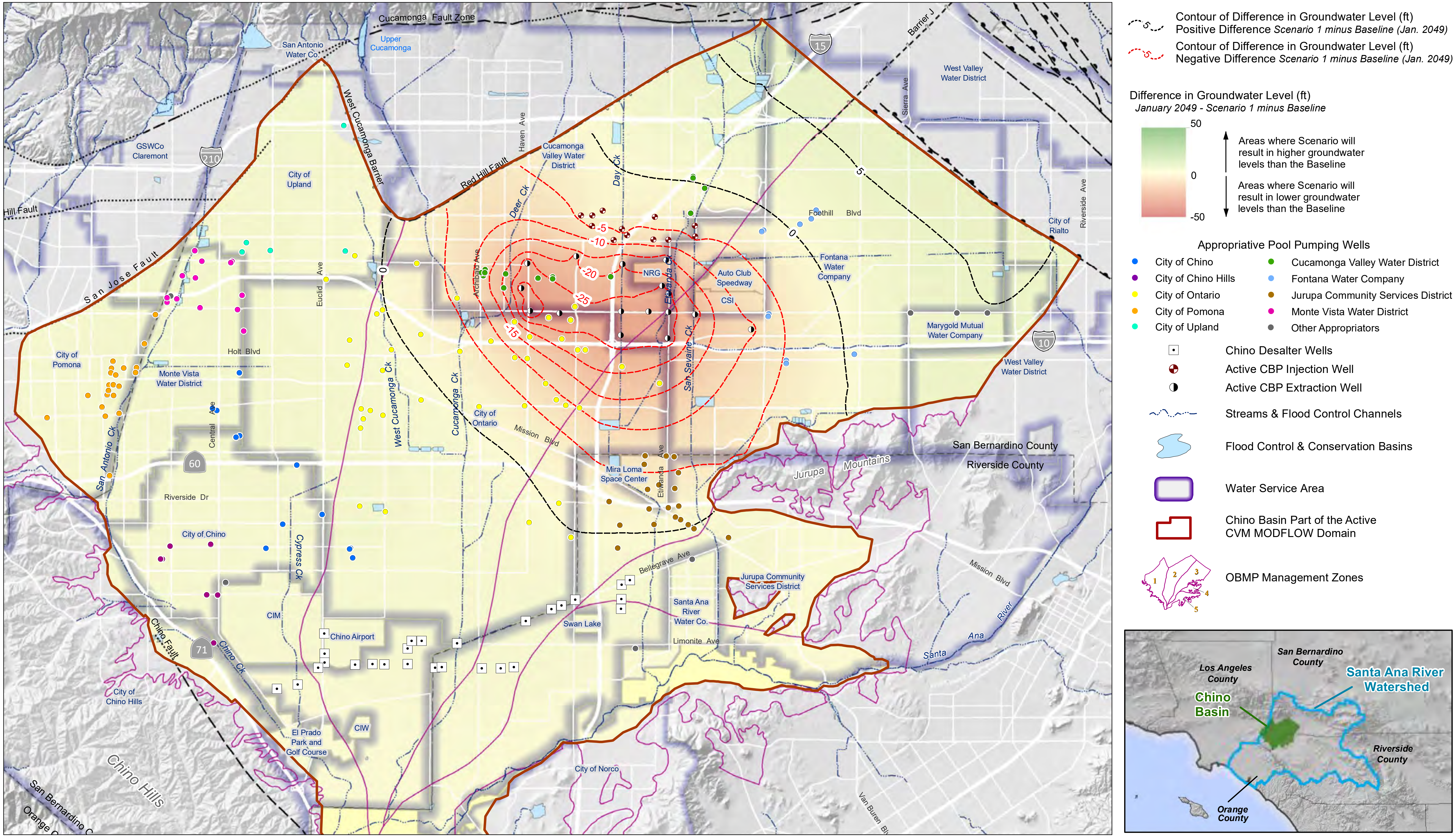
Projected Difference in Groundwater Levels for Layer 1
Scenario 1 minus Baseline (January 2036)

Figure 5



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WEST YOST

Author: GR
Date: 10/4/2021
File: Fig6 GWLch S1-BL 2049.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

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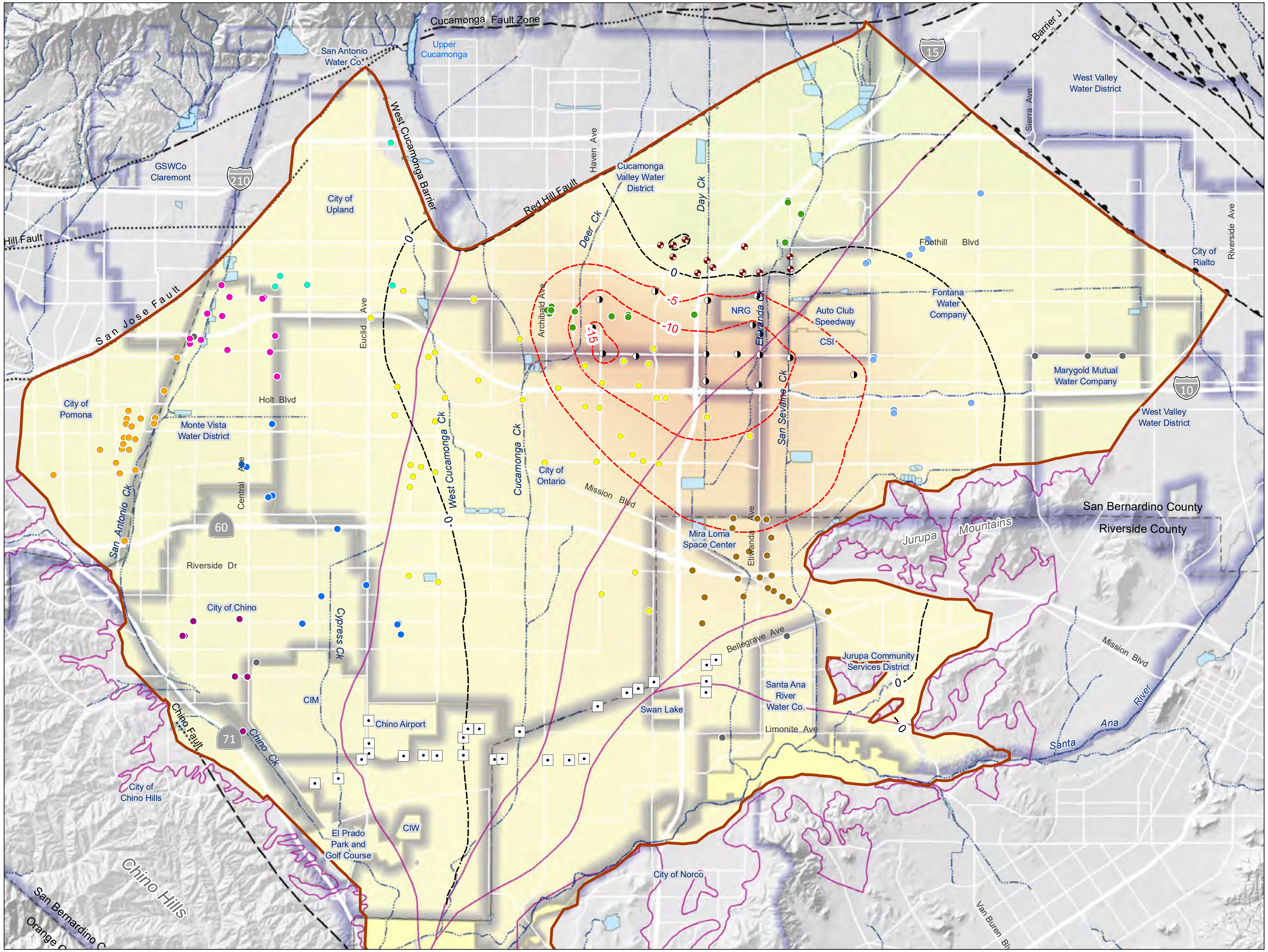
Projected Difference in Groundwater Levels for Layer 1
Scenario 1 minus Baseline (January 2049)

Figure 6



Contour of Difference in Groundwater Level (ft)
Positive Difference *Scenario 1 minus Baseline (Jan. 2054)*

Contour of Difference in Groundwater Level (ft)
Negative Difference *Scenario 1 minus Baseline (Jan. 2054)*

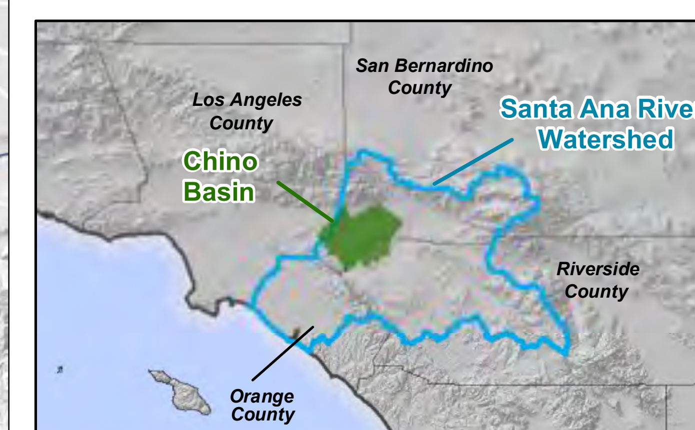
Difference in Groundwater Level (ft)
January 2054 - Scenario 1 minus Baseline

50 — Areas where Scenario will result in higher groundwater levels than the Baseline
0
-50 — Areas where Scenario will result in lower groundwater levels than the Baseline

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

- Chino Desalter Wells
- Active CBP Injection Well
- Active CBP Extraction Well
- Streams & Flood Control Channels
- Flood Control & Conservation Basins
- Water Service Area
- Chino Basin Part of the Active CVM MODFLOW Domain
- OBMP Management Zones



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig7 GWLch S1-BL 2054.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

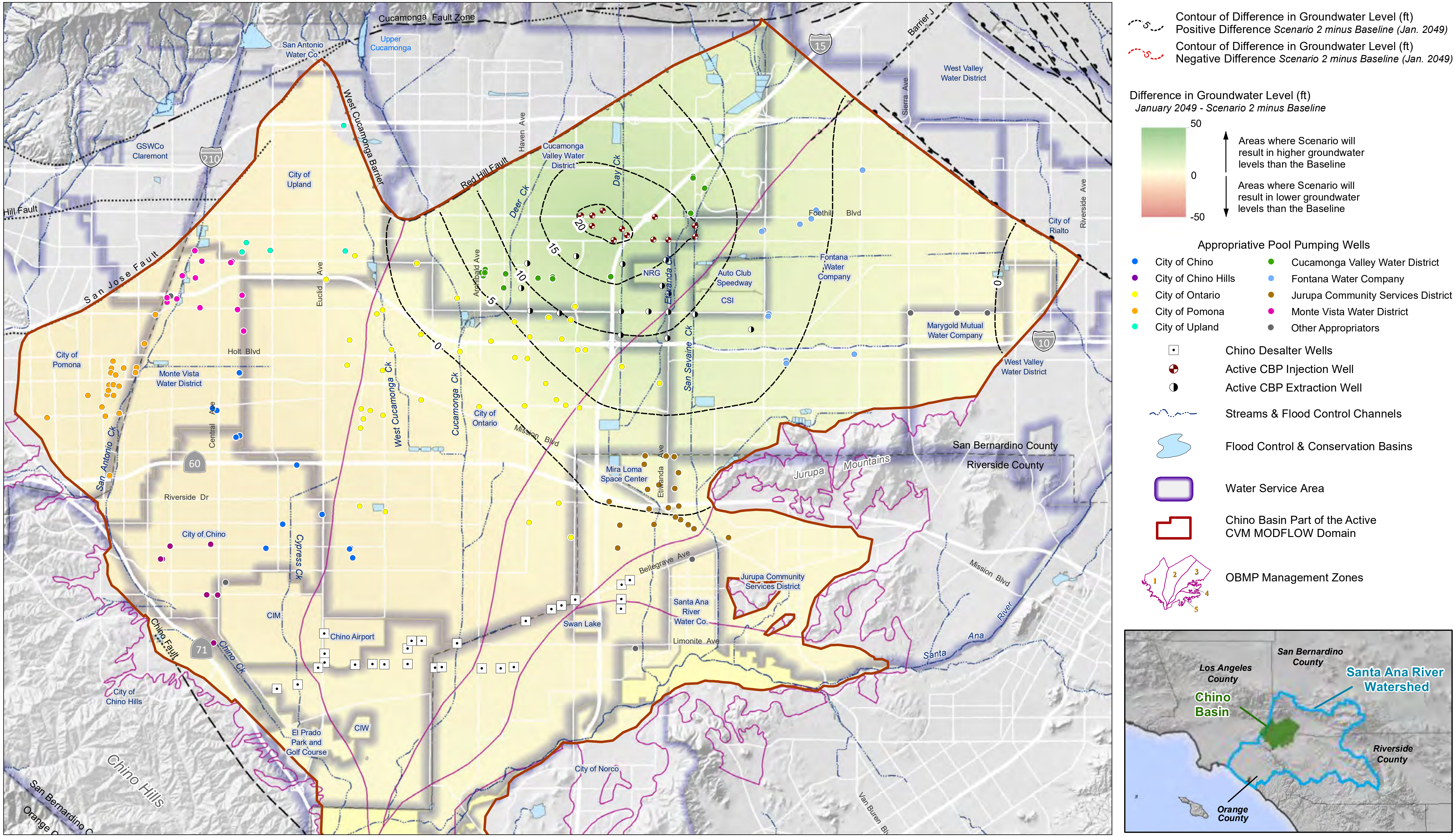
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 1 minus Baseline (January 2054)

Figure 7



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig8 GWLch S2-BL 2049.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

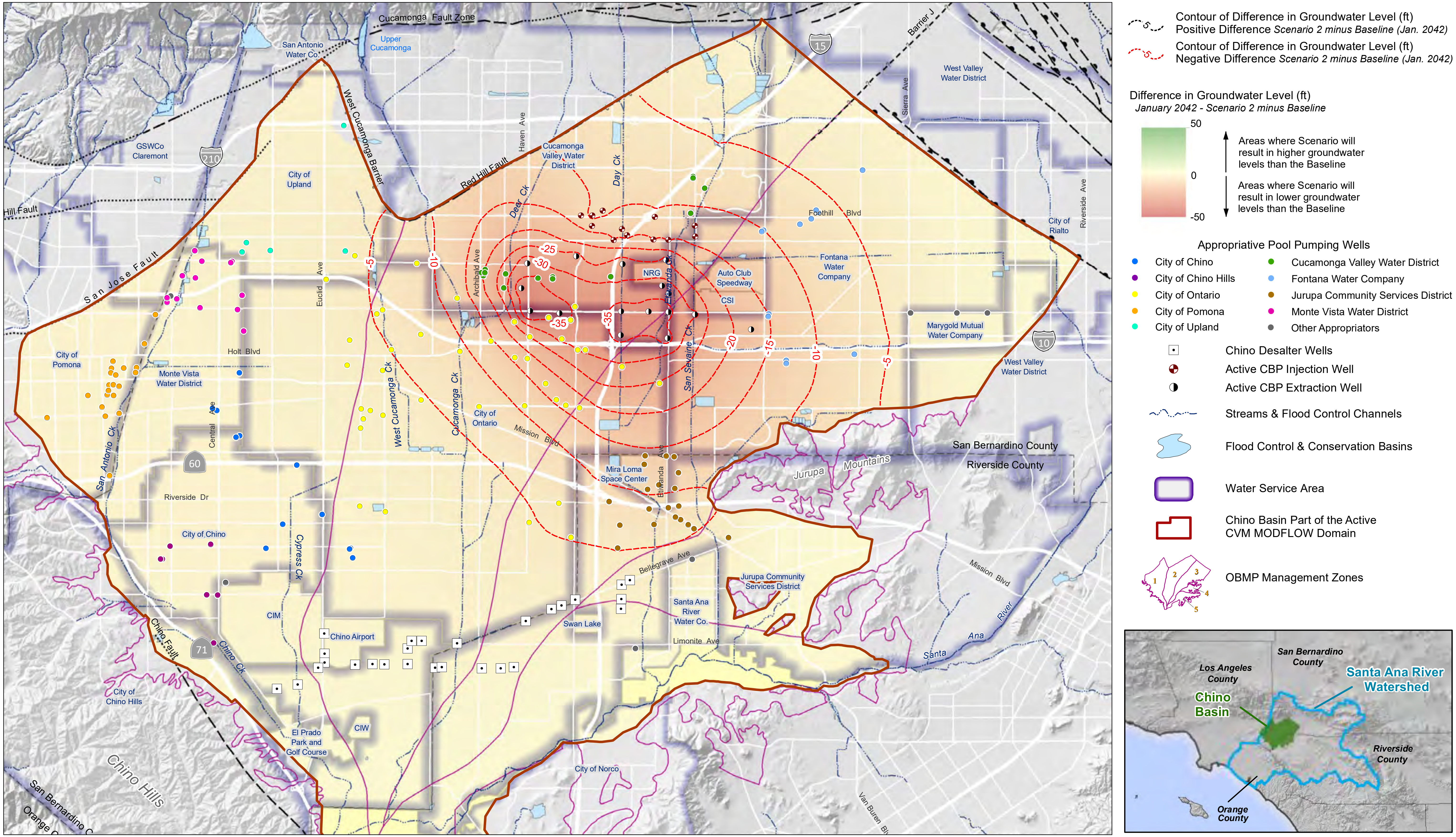
Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1

Scenario 2 minus Baseline (January 2049)

Figure 8



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig9 GWLch S2-BL 2042.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

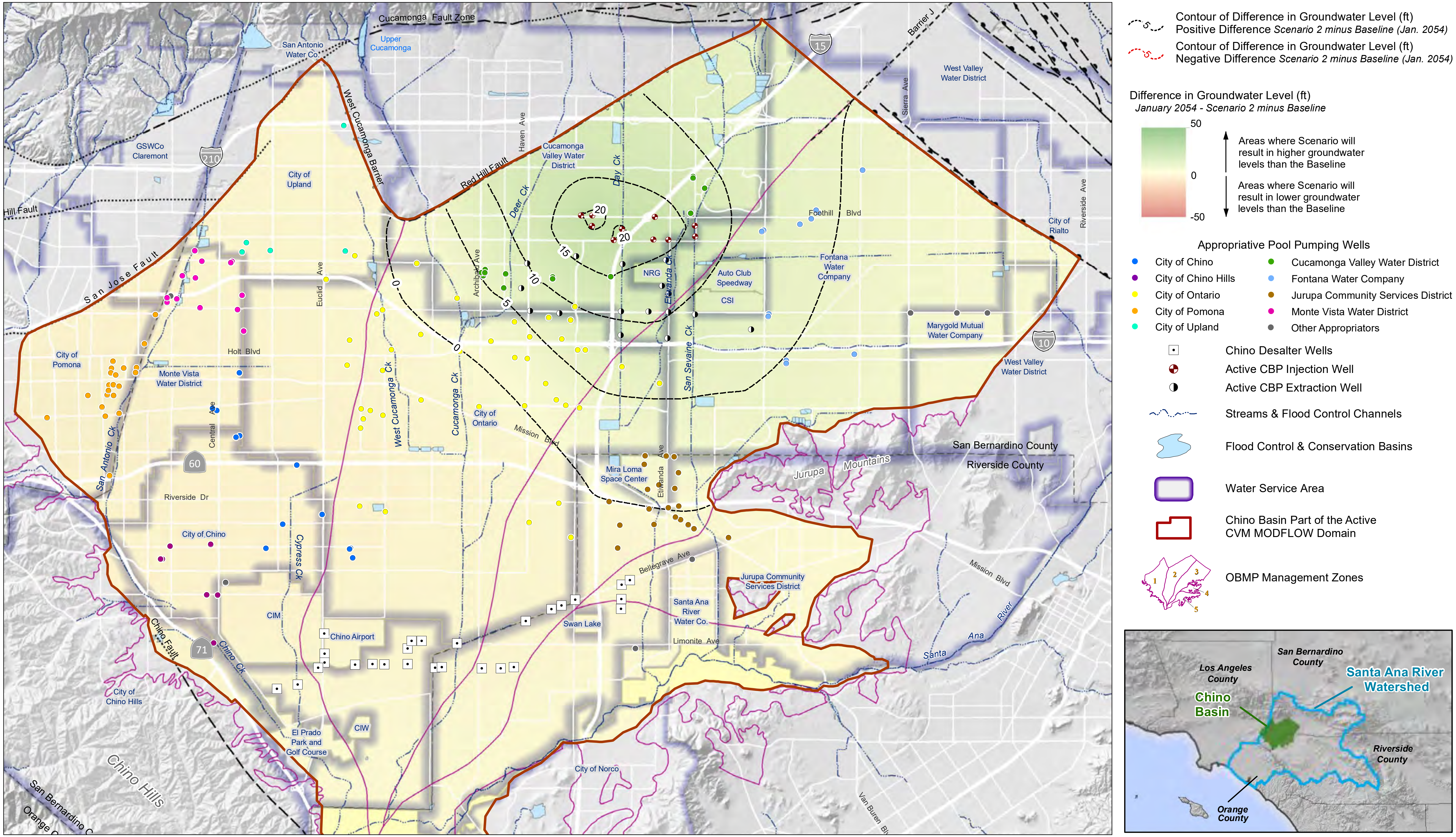
Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1

Scenario 2 minus Baseline (January 2042)

Figure 9



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WEST YOST

Author: GR
Date: 10/4/2021
File: Fig10 GWLch S2-BL 2054.mxd

Evaluation of the Chino Basin Program

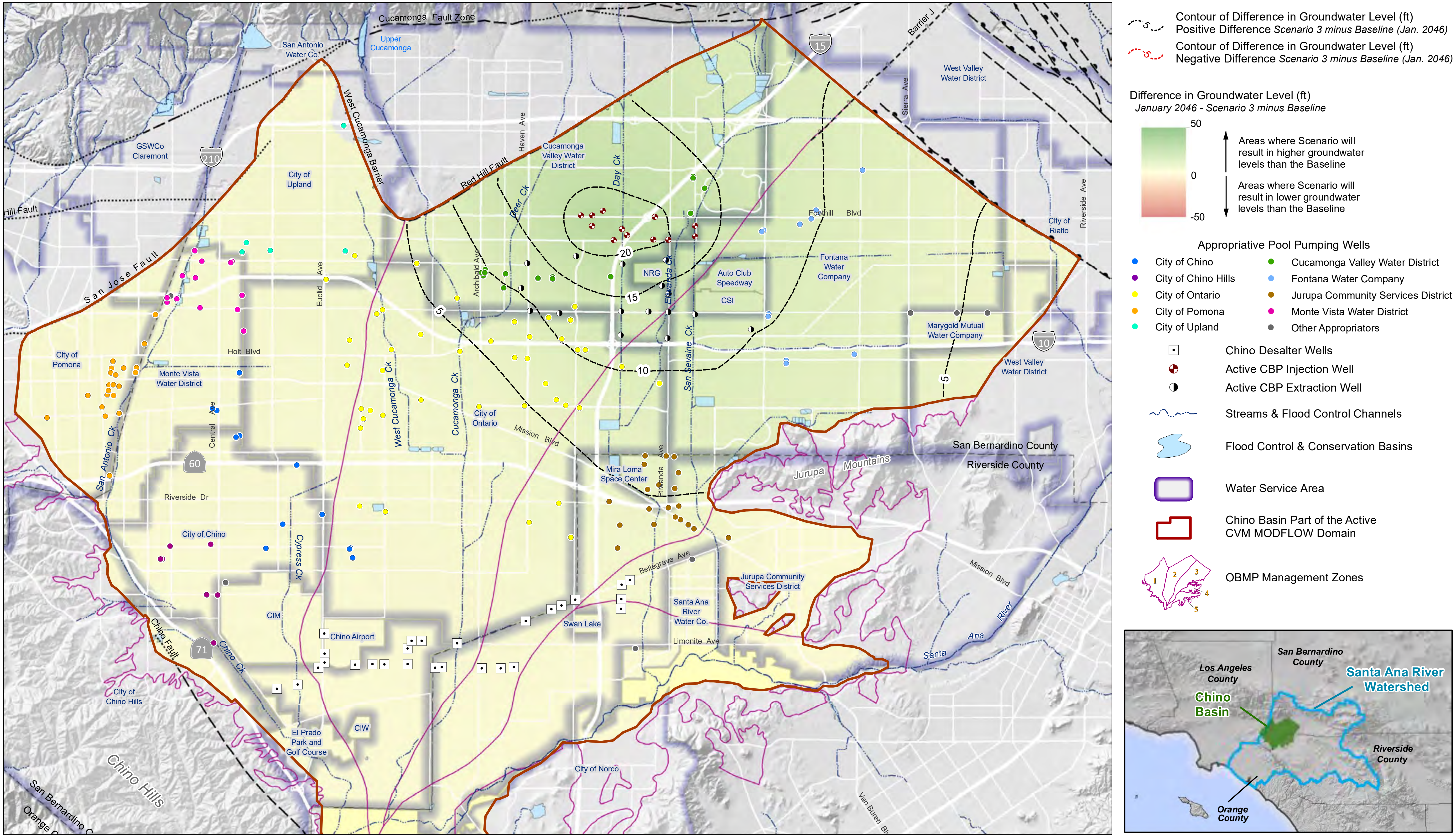
Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1

Scenario 2 minus Baseline (January 2054)

Figure 10



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig11 GWLch S3-BL 2046.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

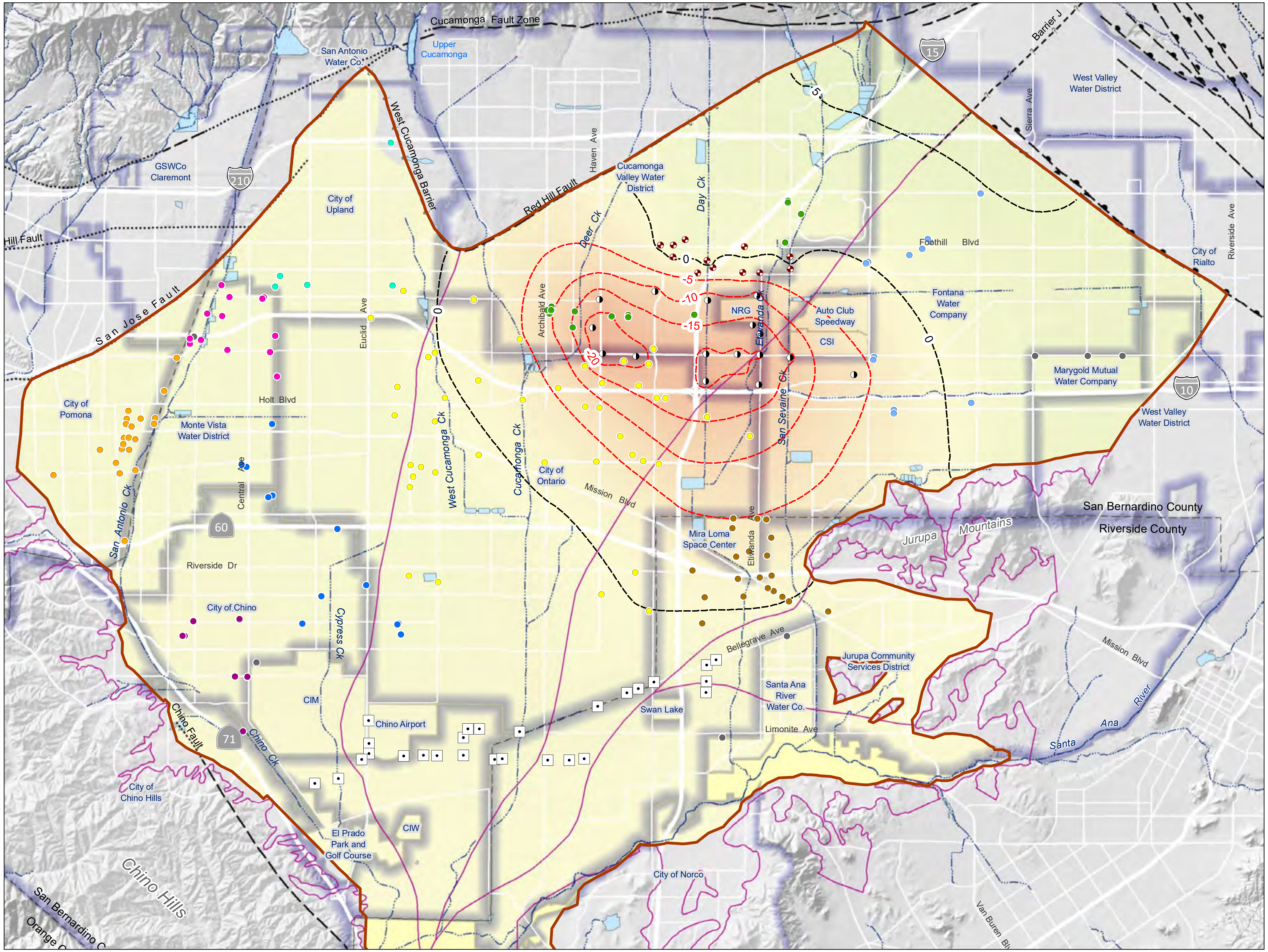
Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1

Scenario 3 minus Baseline (January 2046)

Figure 11



Contour of Difference in Groundwater Level (ft)
Positive Difference *Scenario 3 minus Baseline (Jan. 2049)*

Contour of Difference in Groundwater Level (ft)
Negative Difference *Scenario 3 minus Baseline (Jan. 2049)*

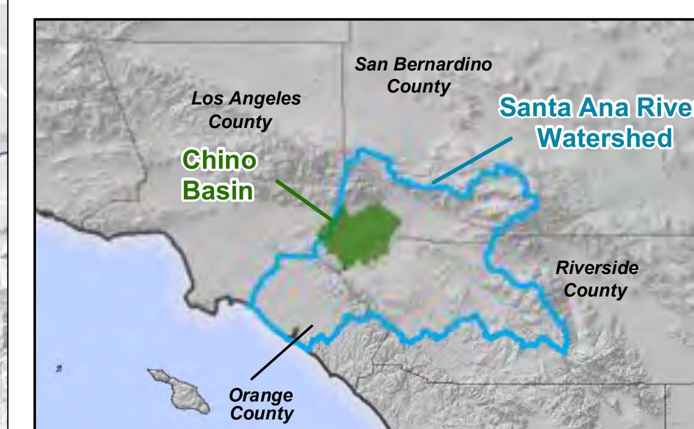
Difference in Groundwater Level (ft)
January 2049 - Scenario 3 minus Baseline

50 — Areas where Scenario will result in higher groundwater levels than the Baseline
0
-50 — Areas where Scenario will result in lower groundwater levels than the Baseline

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Chino Desalter Wells
Active CBP Injection Well
Active CBP Extraction Well
Streams & Flood Control Channels
Flood Control & Conservation Basins
Water Service Area
Chino Basin Part of the Active CVM MODFLOW Domain
OBMP Management Zones



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig12 GWLch S3-BL 2049.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

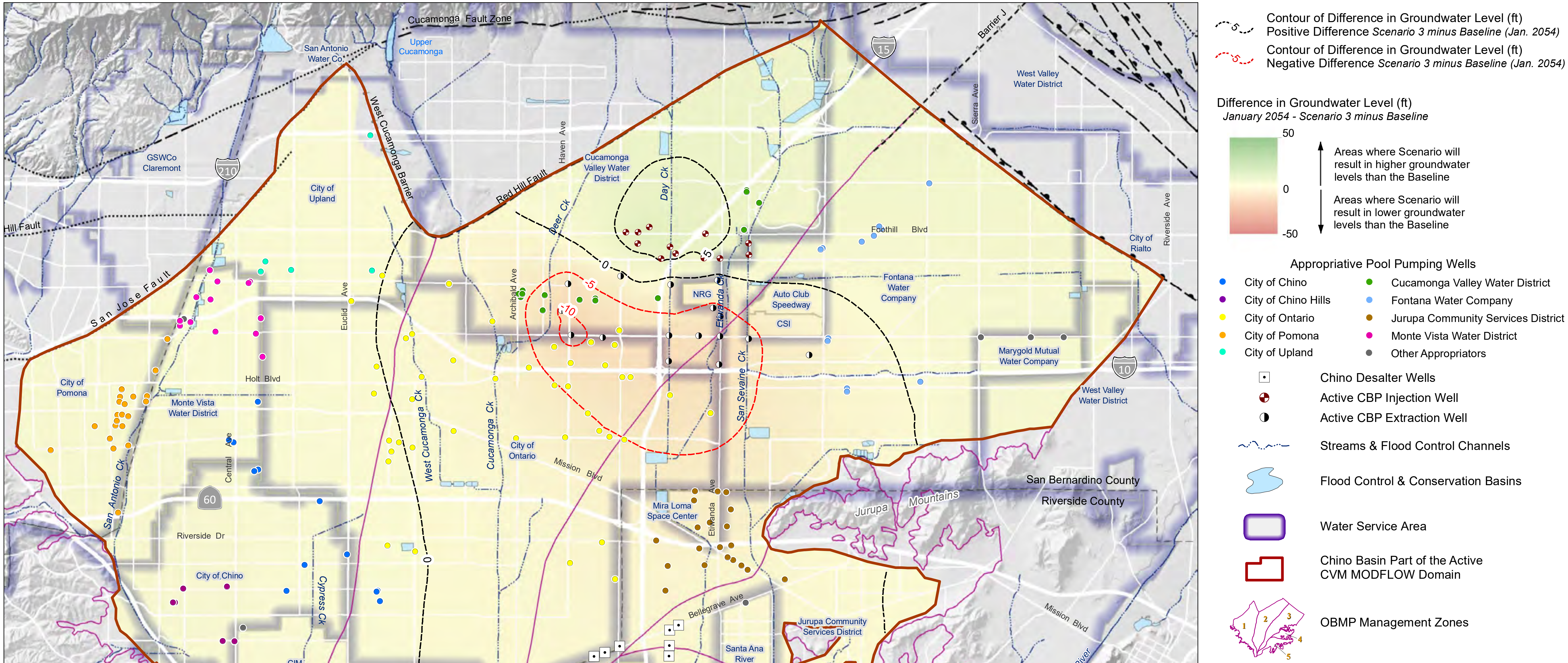
Evaluation of the Chino Basin Program

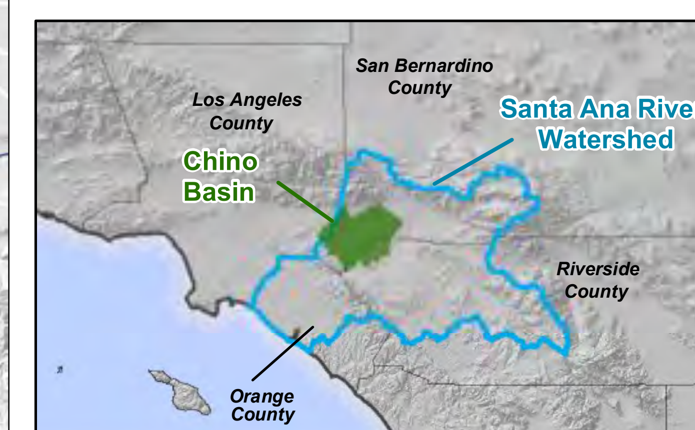
Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 3 minus Baseline (January 2049)

Figure 12





Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig13 GWLch S3-BL 2054.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

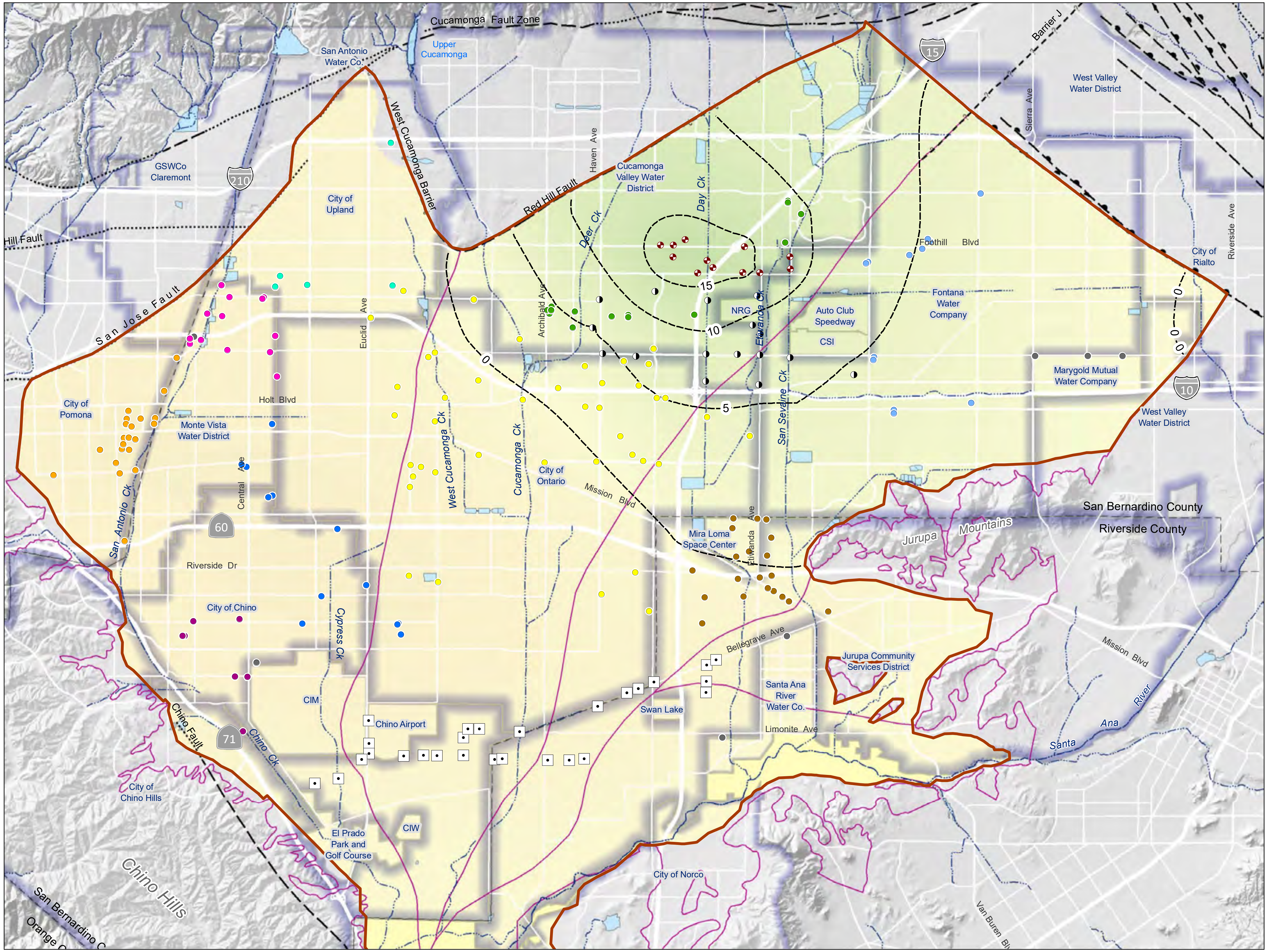
Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1

Scenario 3 minus Baseline (January 2054)

Figure 13



Contour of Difference in Groundwater Level (ft) Positive Difference *Scenario 4 minus Baseline (Jan. 2049)*

Contour of Difference in Groundwater Level (ft) Negative Difference *Scenario 4 minus Baseline (Jan. 2049)*

Difference in Groundwater Level (ft)
January 2049 - Scenario 4 minus Baseline

50 — Areas where Scenario will result in higher groundwater levels than the Baseline

0

-50 — Areas where Scenario will result in lower groundwater levels than the Baseline

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Chino Desalter Wells

Active CBP Injection Well

Active CBP Extraction Well

Streams & Flood Control Channels

Flood Control & Conservation Basins

Water Service Area

Chino Basin Part of the Active CVM MODFLOW Domain

OBMP Management Zones

Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig14 GWLch S4-BL 2049.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

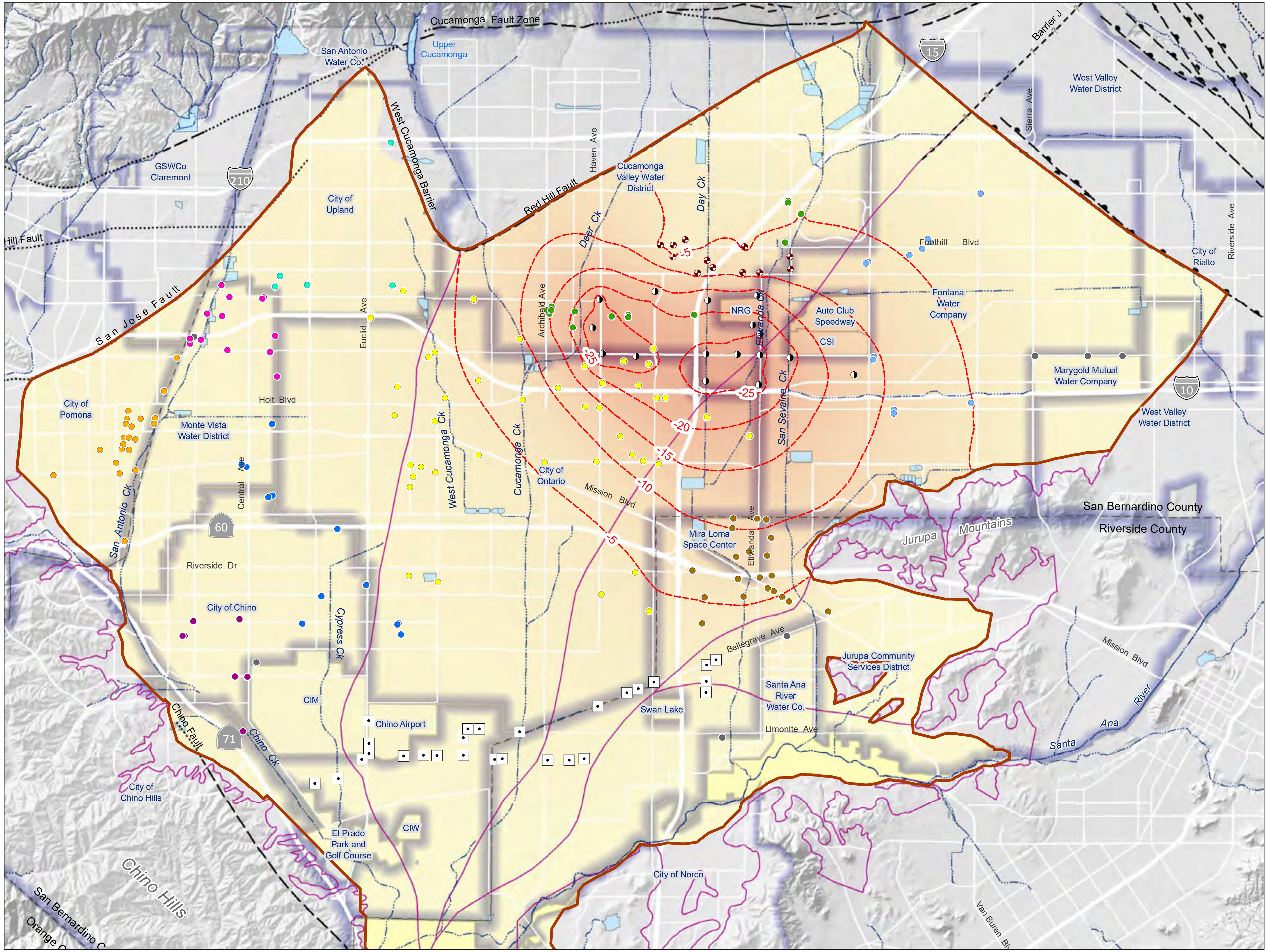
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 4 minus Baseline (January 2049)

Figure 14



Contour of Difference in Groundwater Level (ft)
Positive Difference *Scenario 4 minus Baseline (Jan. 2042)*

Contour of Difference in Groundwater Level (ft)
Negative Difference *Scenario 4 minus Baseline (Jan. 2042)*

Difference in Groundwater Level (ft)
January 2042 - Scenario 4 minus Baseline

50 / 0 / -50

Areas where Scenario will result in higher groundwater levels than the Baseline

Areas where Scenario will result in lower groundwater levels than the Baseline

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Chino Desalter Wells

Active CBP Injection Well

Active CBP Extraction Well

Streams & Flood Control Channels

Flood Control & Conservation Basins

Water Service Area

Chino Basin Part of the Active CVM MODFLOW Domain

OBMP Management Zones

Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig15 GWLch S4-BL 2042.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

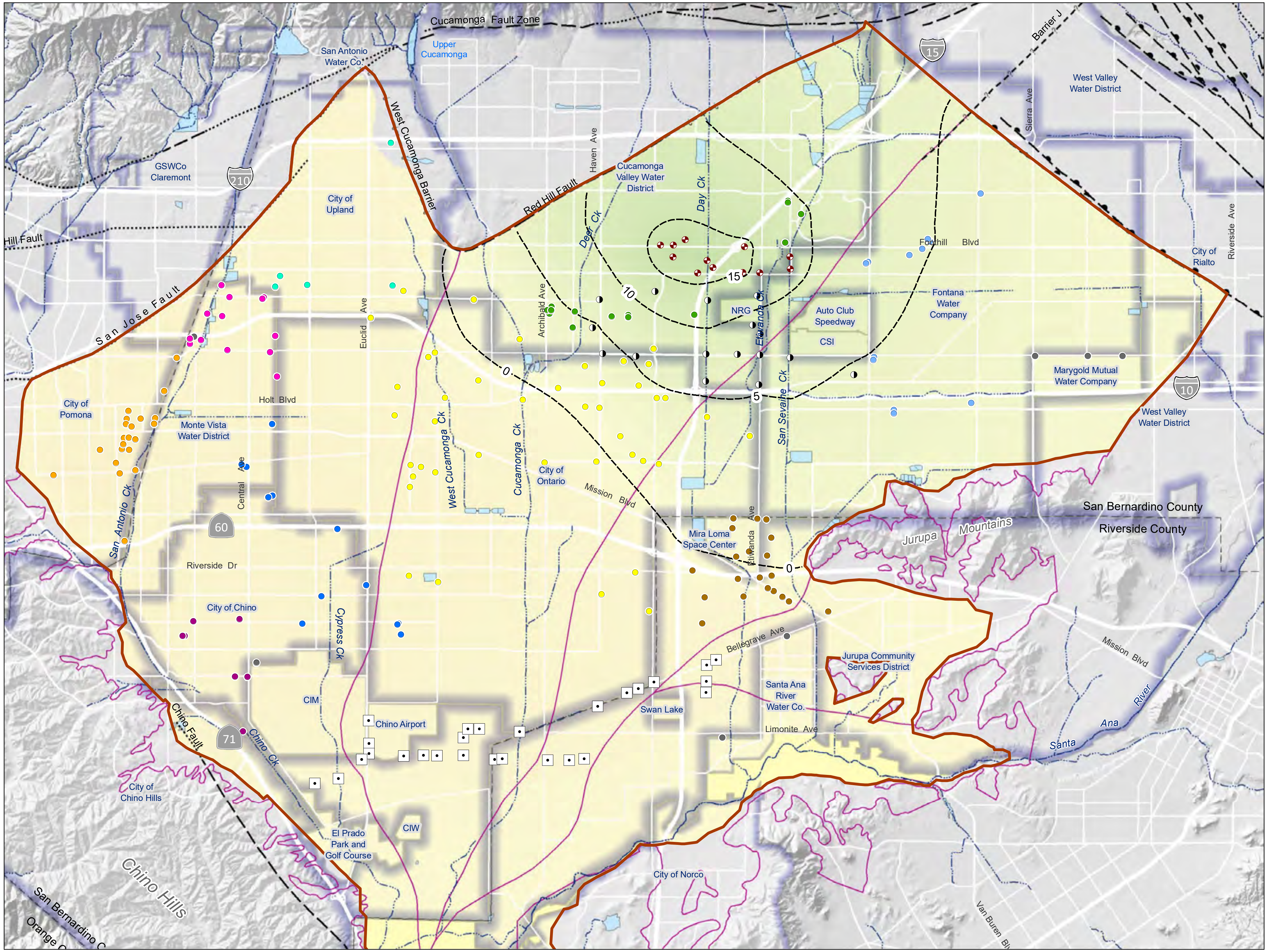
Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1

Scenario 4 minus Baseline (January 2042)

Figure 15



Contour of Difference in Groundwater Level (ft)
Positive Difference *Scenario 4 minus Baseline (Jan. 2054)*

Contour of Difference in Groundwater Level (ft)
Negative Difference *Scenario 4 minus Baseline (Jan. 2054)*

Difference in Groundwater Level (ft)
January 2054 - Scenario 4 minus Baseline

50 — Areas where Scenario will result in higher groundwater levels than the Baseline

0

-50 — Areas where Scenario will result in lower groundwater levels than the Baseline

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Chino Desalter Wells

Active CBP Injection Well

Active CBP Extraction Well

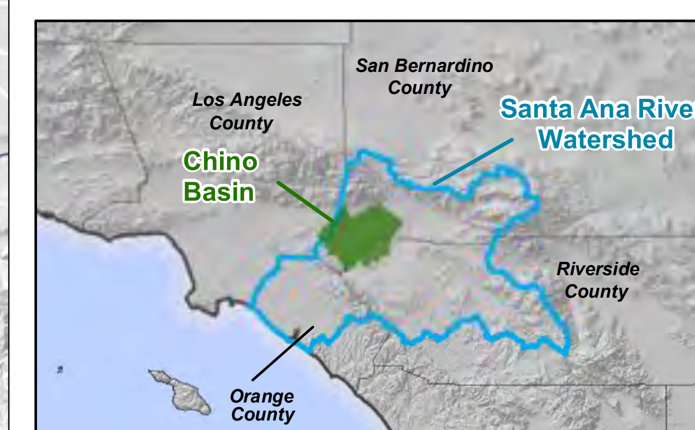
Streams & Flood Control Channels

Flood Control & Conservation Basins

Water Service Area

Chino Basin Part of the Active CVM MODFLOW Domain

OBMP Management Zones



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig16 GWLch S4-BL 2054.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

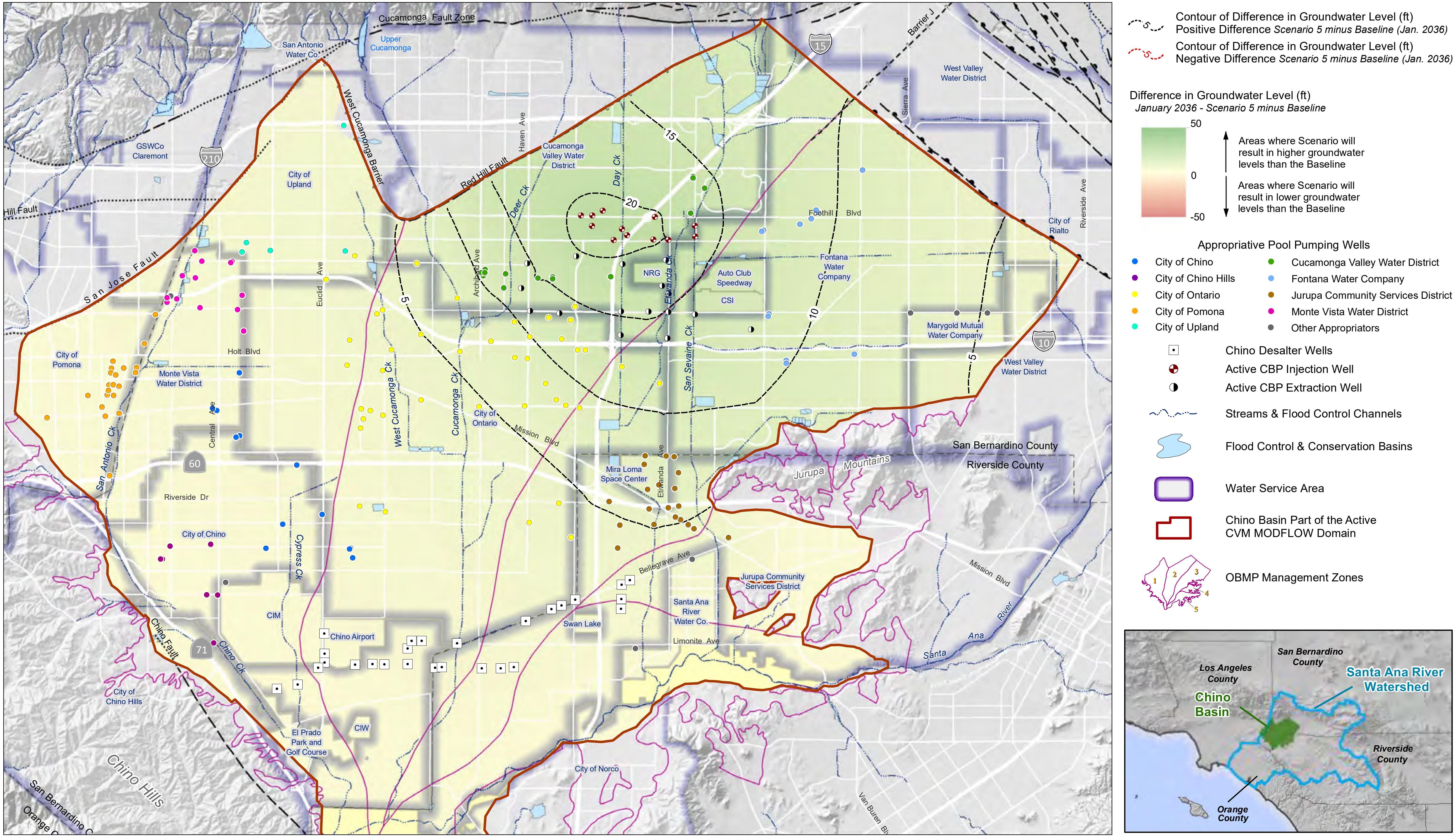
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 4 minus Baseline (January 2054)

Figure 16



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig17 GWLch S5-BL 2036.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

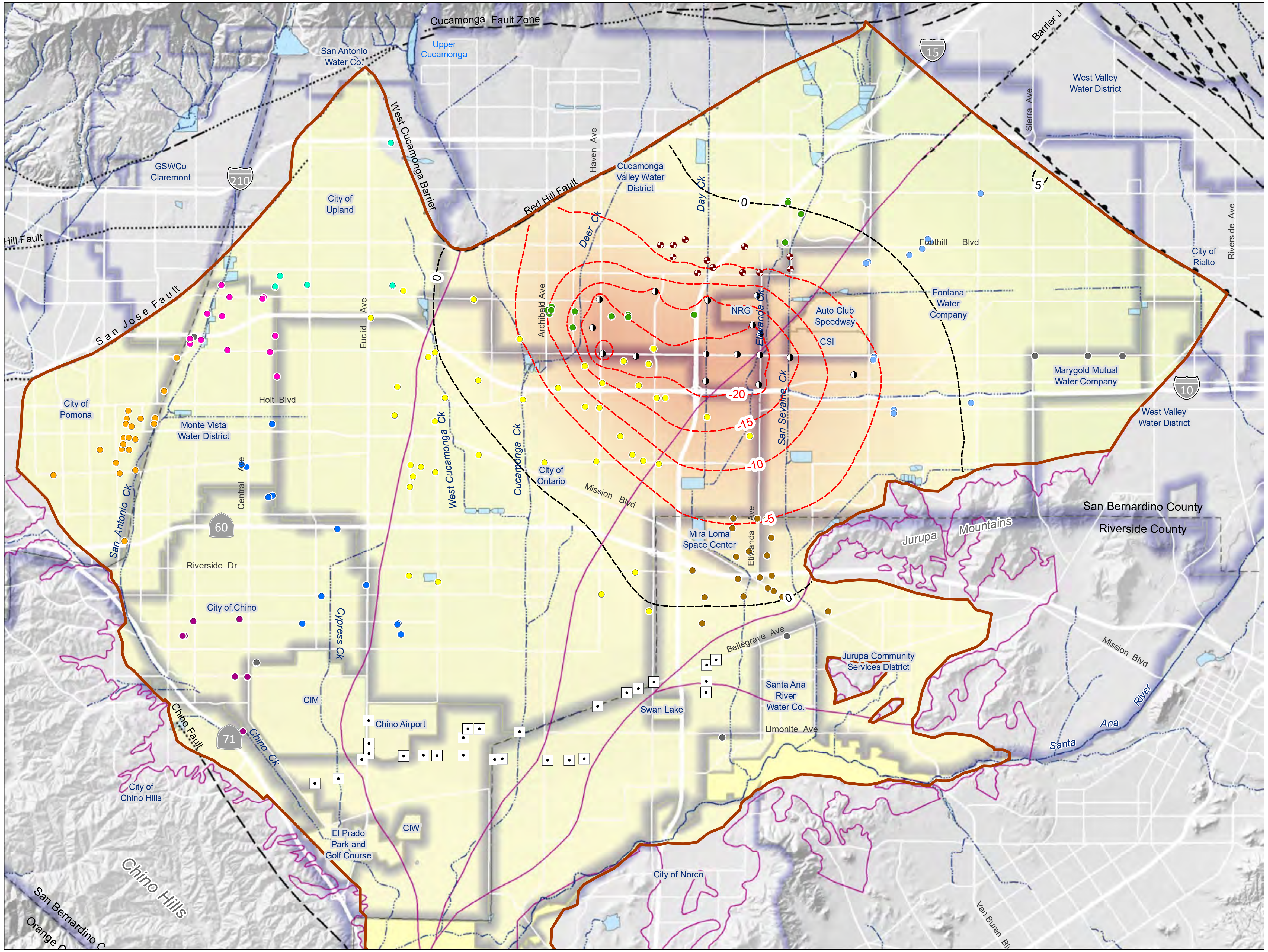
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 5 minus Baseline (January 2036)

Figure 17



Contour of Difference in Groundwater Level (ft)
Positive Difference *Scenario 5 minus Baseline (Jan. 2049)*

Contour of Difference in Groundwater Level (ft)
Negative Difference *Scenario 5 minus Baseline (Jan. 2049)*

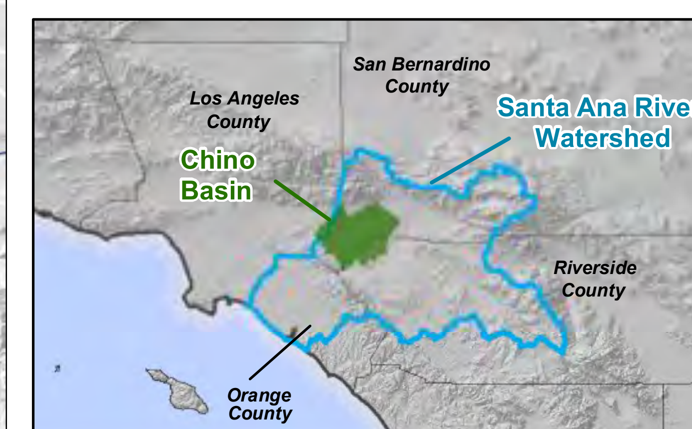
Difference in Groundwater Level (ft)
January 2049 - Scenario 5 minus Baseline

50 — Areas where Scenario will result in higher groundwater levels than the Baseline
0
-50 — Areas where Scenario will result in lower groundwater levels than the Baseline

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

- Chino Desalter Wells
- Active CBP Injection Well
- Active CBP Extraction Well
- Streams & Flood Control Channels
- Flood Control & Conservation Basins
- Water Service Area
- Chino Basin Part of the Active CVM MODFLOW Domain
- OBMP Management Zones



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig18 GWLch S5-BL 2049.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

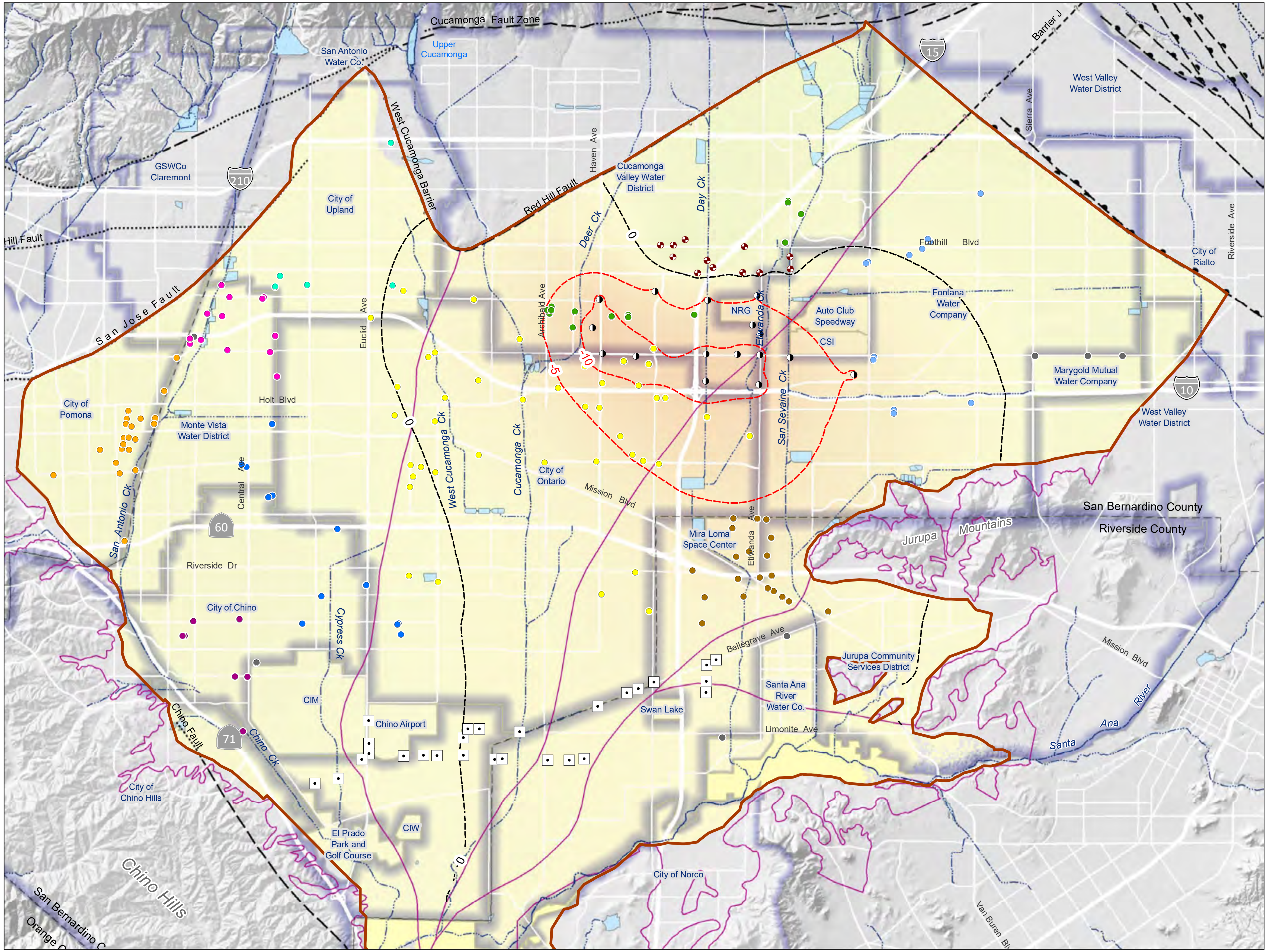
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 5 minus Baseline (January 2049)

Figure 18



Contour of Difference in Groundwater Level (ft)
Positive Difference *Scenario 5 minus Baseline (Jan. 2054)*

Contour of Difference in Groundwater Level (ft)
Negative Difference *Scenario 5 minus Baseline (Jan. 2054)*

Difference in Groundwater Level (ft)
January 2054 - Scenario 5 minus Baseline

50 — Areas where Scenario will result in higher groundwater levels than the Baseline
0
-50 — Areas where Scenario will result in lower groundwater levels than the Baseline

Appropriative Pool Pumping Wells

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Monte Vista Water District
- Other Appropriators

Chino Desalter Wells
Active CBP Injection Well
Active CBP Extraction Well
Streams & Flood Control Channels
Flood Control & Conservation Basins
Water Service Area
Chino Basin Part of the Active CVM MODFLOW Domain
OBMP Management Zones

Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig19 GWLch S5-BL 2054.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

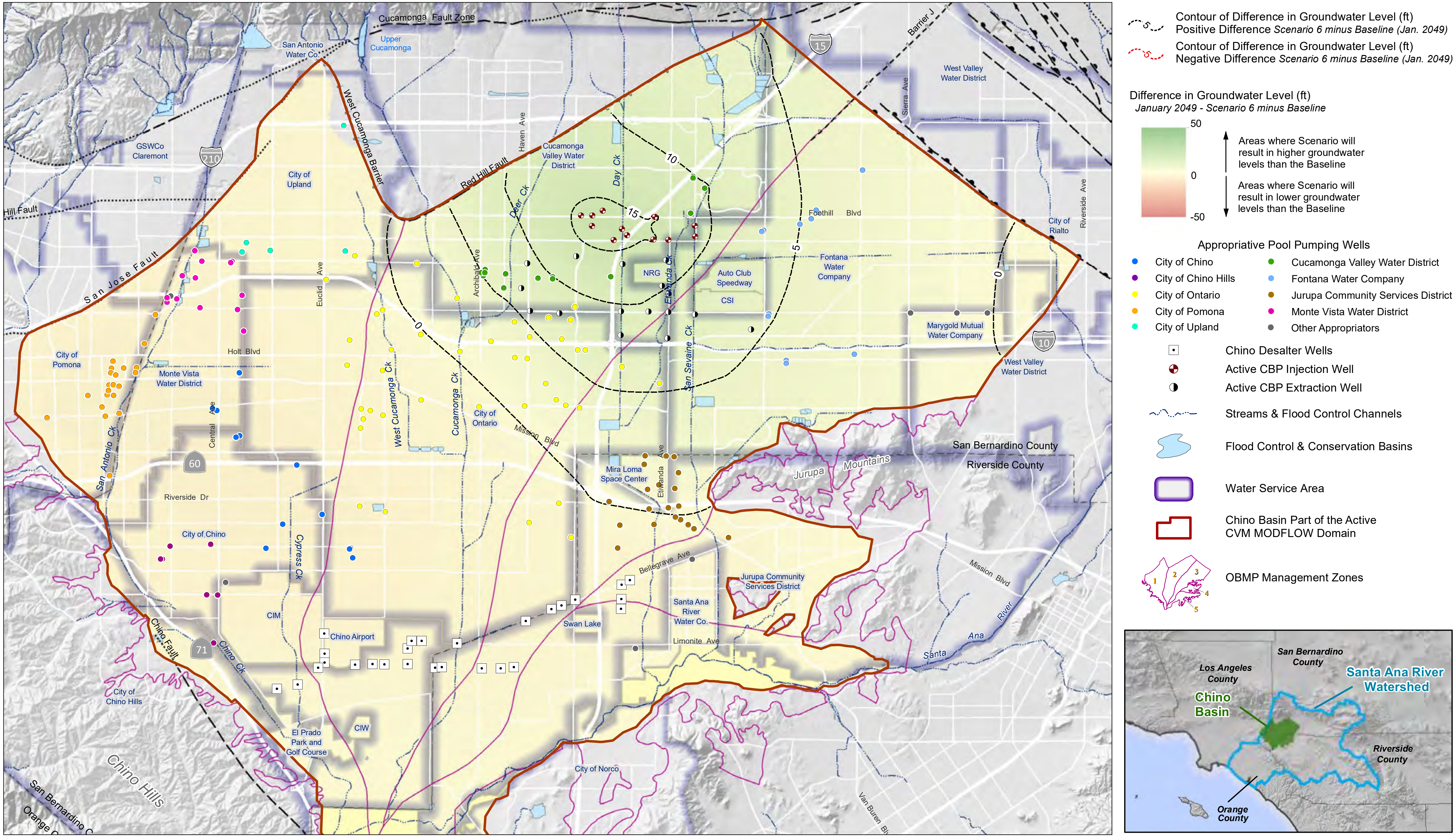
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 5 minus Baseline (January 2054)

Figure 19



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig20 GWLch S6-BL 2049.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

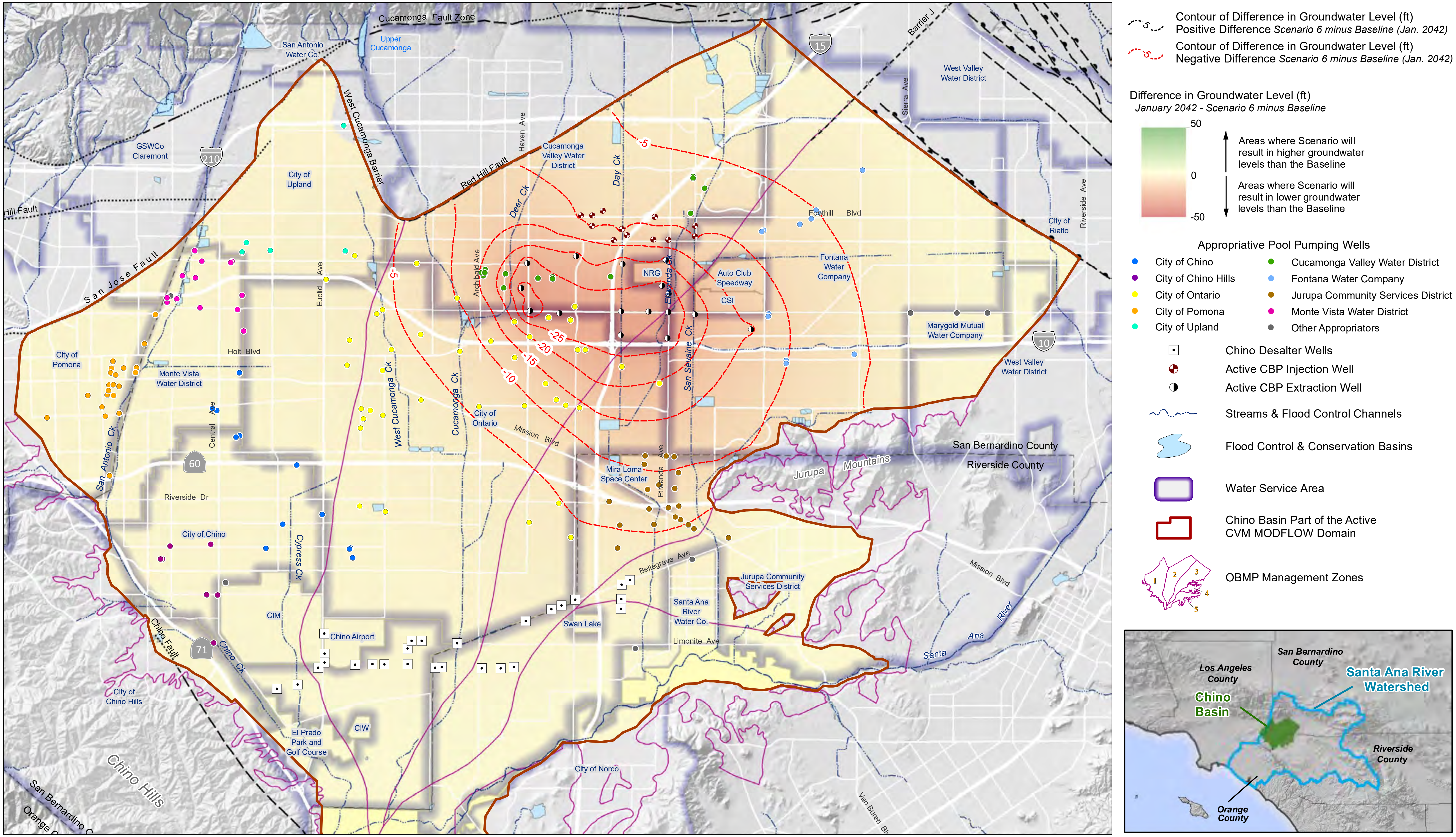
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 6 minus Baseline (January 2049)

Figure 20



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig21 GWLch S6-BL 2042.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

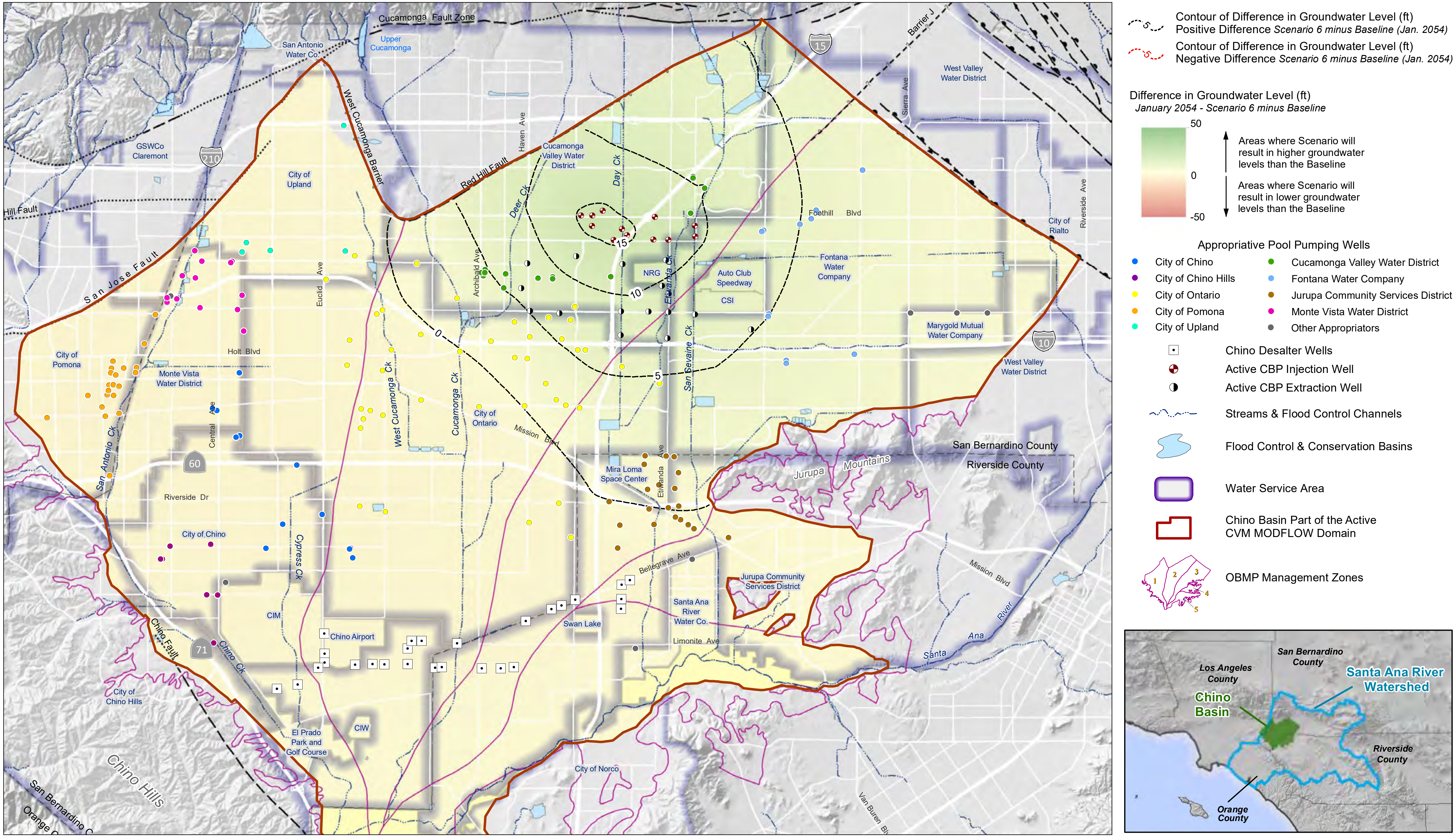
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1
Scenario 6 minus Baseline (January 2042)

Figure 21



Prepared by:

WEST YOST

Author: GR
Date: 10/4/2021
File: Fig22 GWLch S6-BL 2054.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

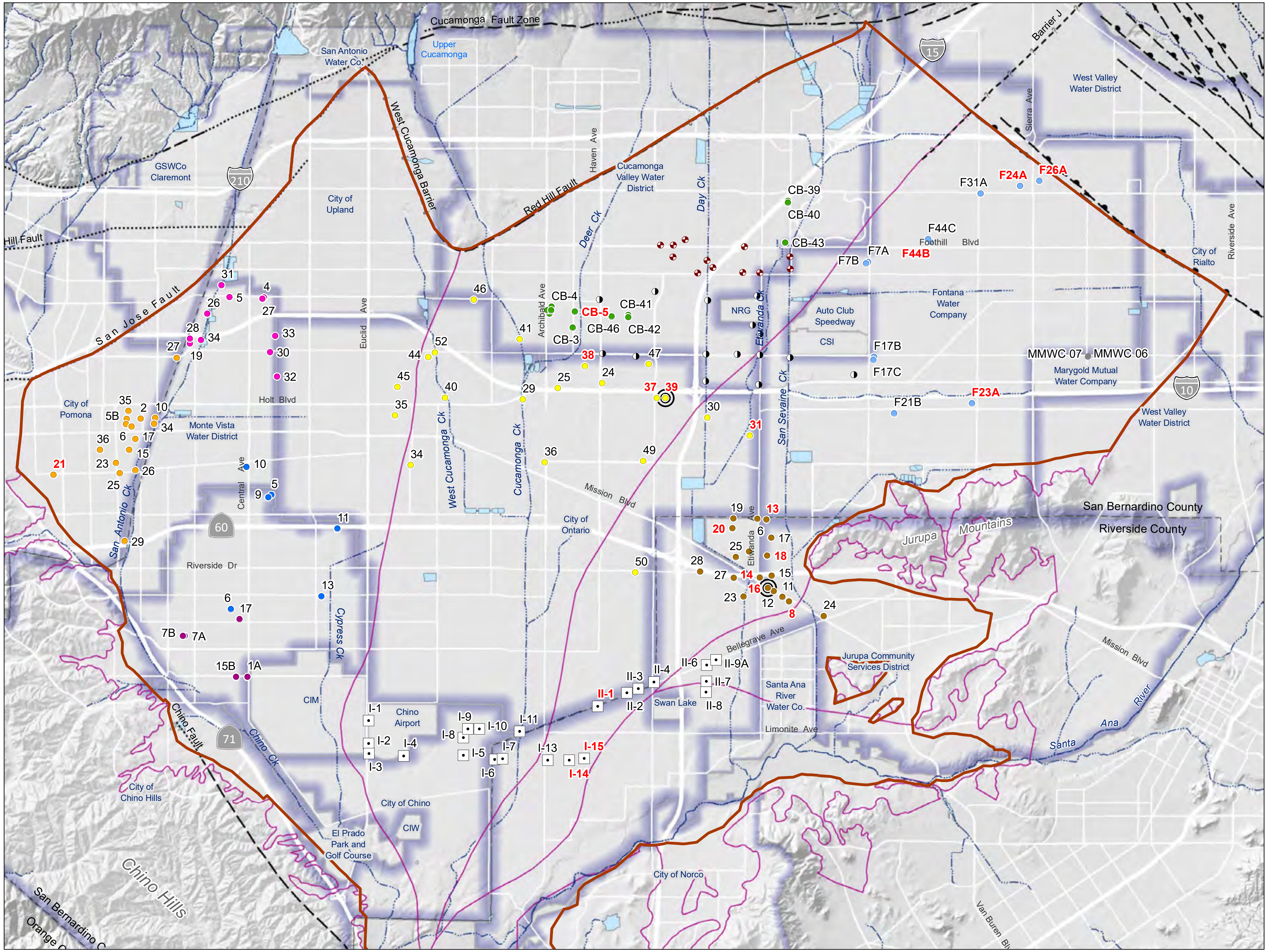
Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Projected Difference in Groundwater Levels for Layer 1

Scenario 6 minus Baseline (January 2054)

Figure 22



Wells with Pumping Sustainability Metric[1]

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- Cucamonga Valley Water District
- Fontana Water Company
- Jurupa Community Services District
- Marygold Mutual Water Company
- Monte Vista Water District
- Chino Basin Desalter Authority

[1] Wells labeled in red are projected to have groundwater levels below the pumping sustainability metric under the baseline or CBP scenario during the program period. These wells are shown in Table 3.

- Well with projected groundwater levels above the sustainability metric in the baseline scenario but below the sustainability metric in one or more CBP scenarios
- Active CBP Injection Well
- Active CBP Extraction Well
- Streams & Flood Control Channels
- Flood Control & Conservation Basins
- Water Service Area
- Chino Basin Part of the Active CVM MODFLOW Domain
- OBMP Management Zones

Prepared by:

WEST YOST

Author: LS
Date: 10/4/2021
File: Figure 23 PSME Map.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

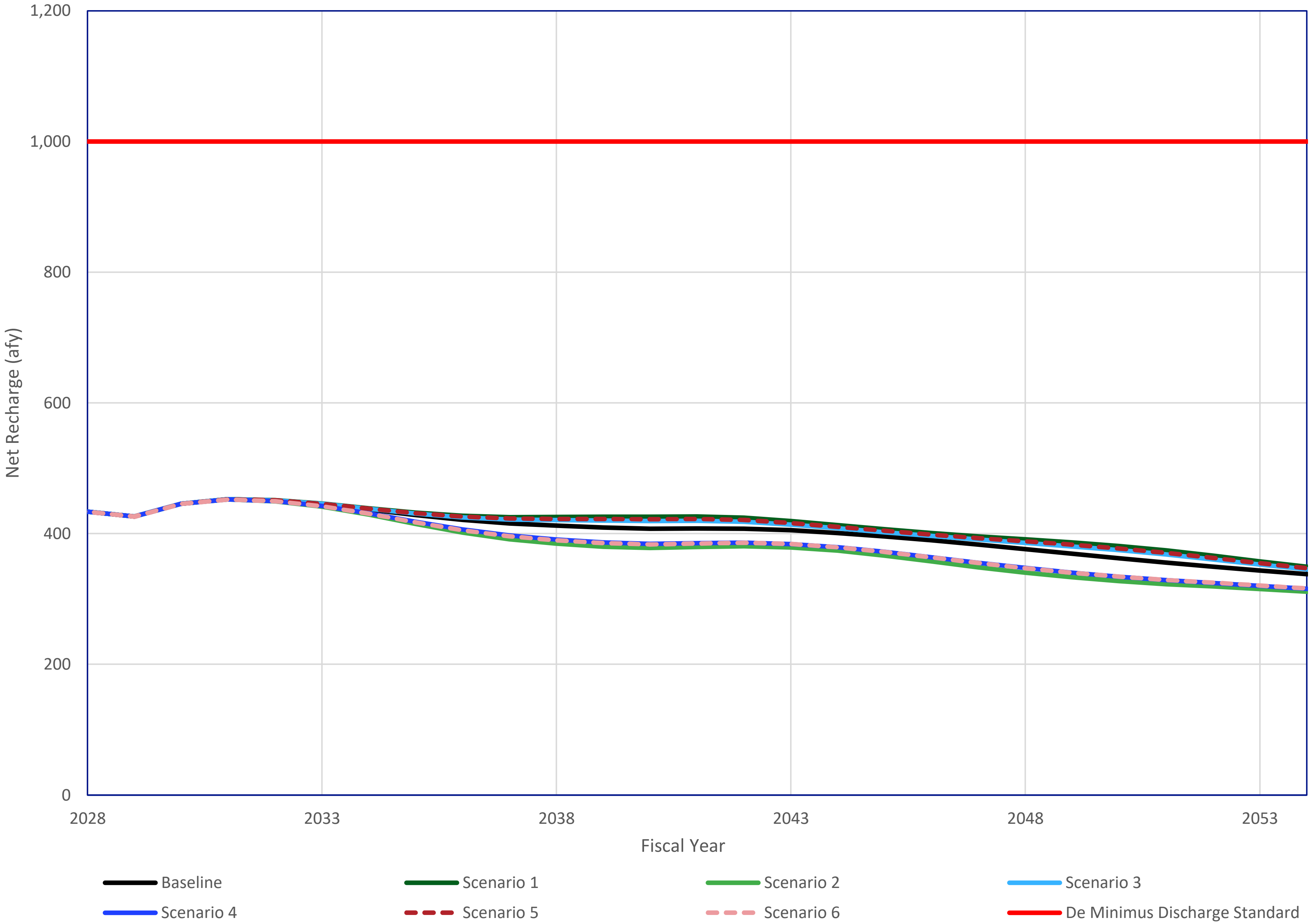
Prepared for:

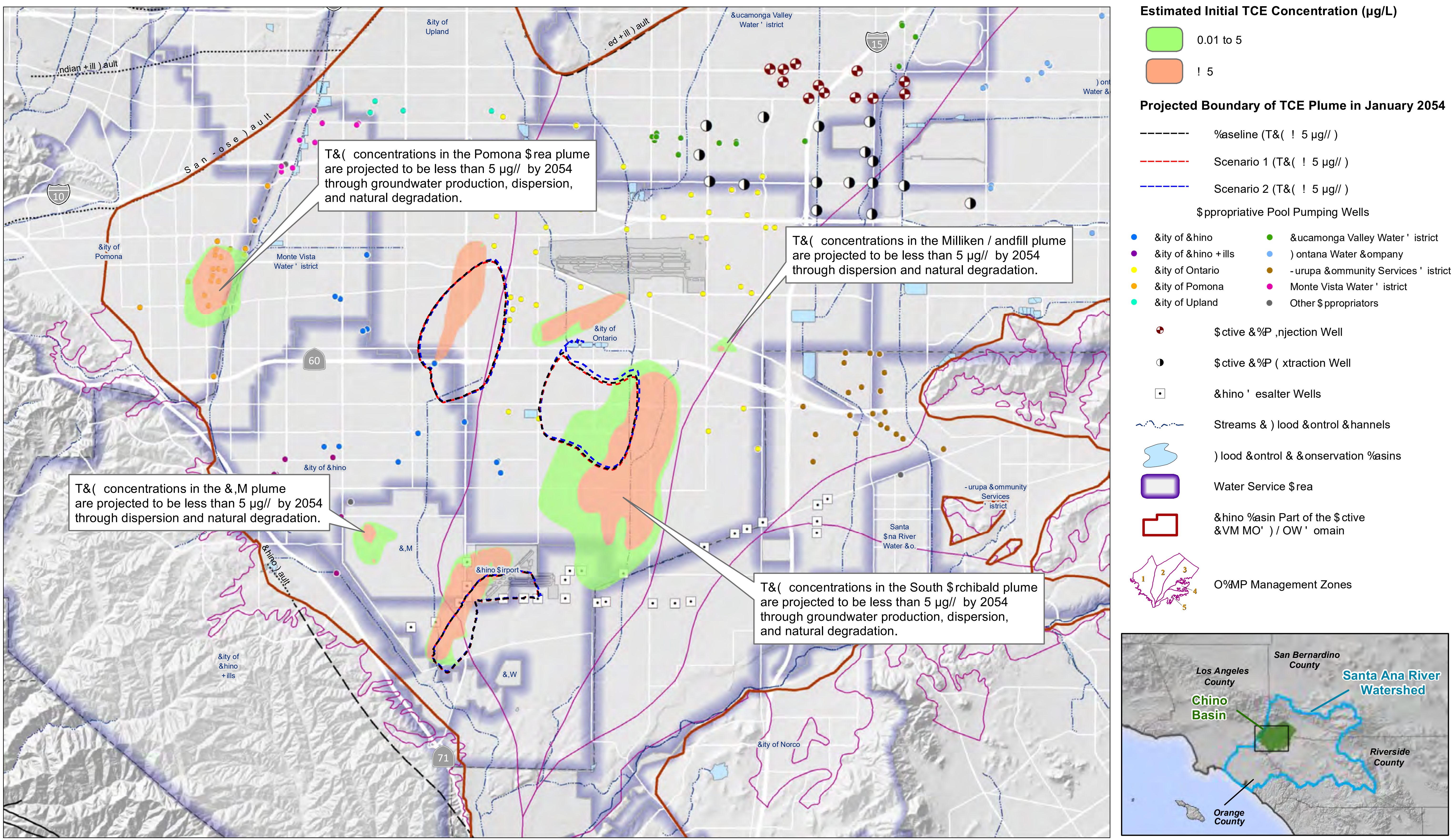
Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Wells with Pumping Sustainability Metric

Figure 23

Figure 24. Projected Discharge through the Chino Creek Wellfield for the Baseline and CBP Scenarios





Prepared by:

WEST YOST

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' ate: 10/15/2021
) ile:) igure 25 WQ_$nomalies_2054.mxd

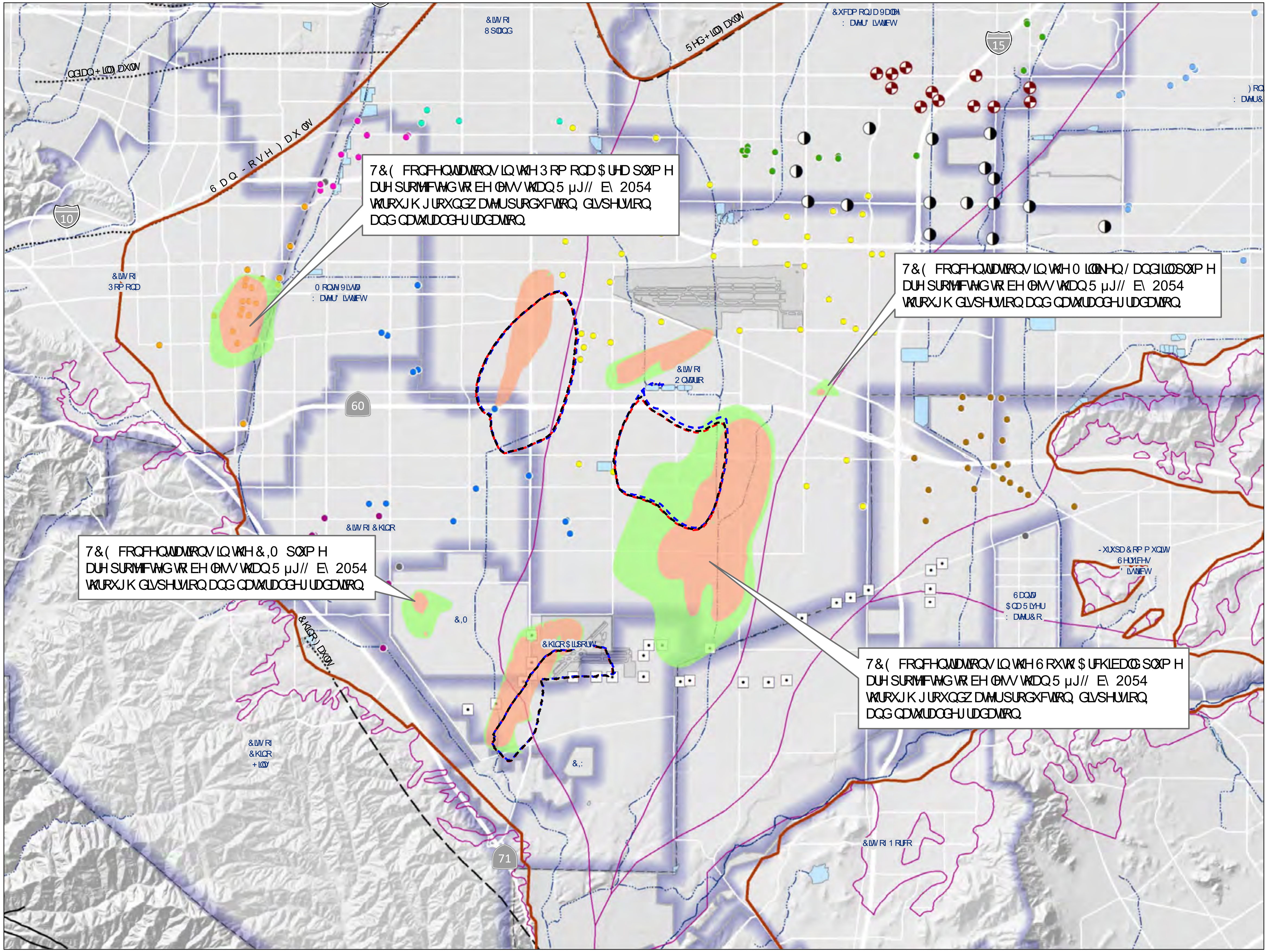
Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Estimated Location of Water Quality Anomalies, Baseline and CBP Scenarios
Scenarios 1 and 2 - January 2054

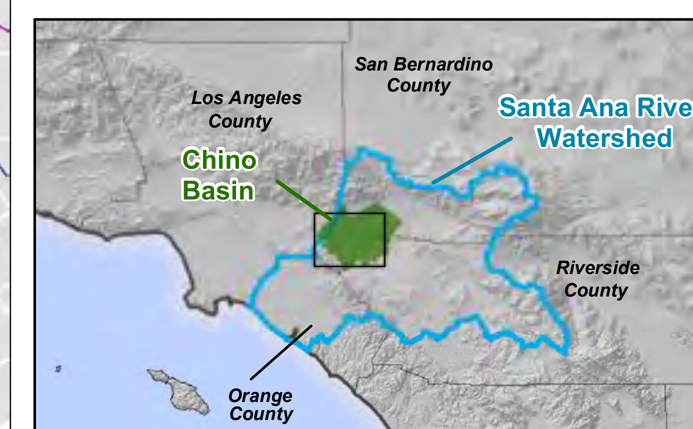
Figure 25



Estimated Initial TCE Concentration (µg/L)

0.01

Projected Boundary of TCE Plume in January 2054



WEST YOST

10/15/2021

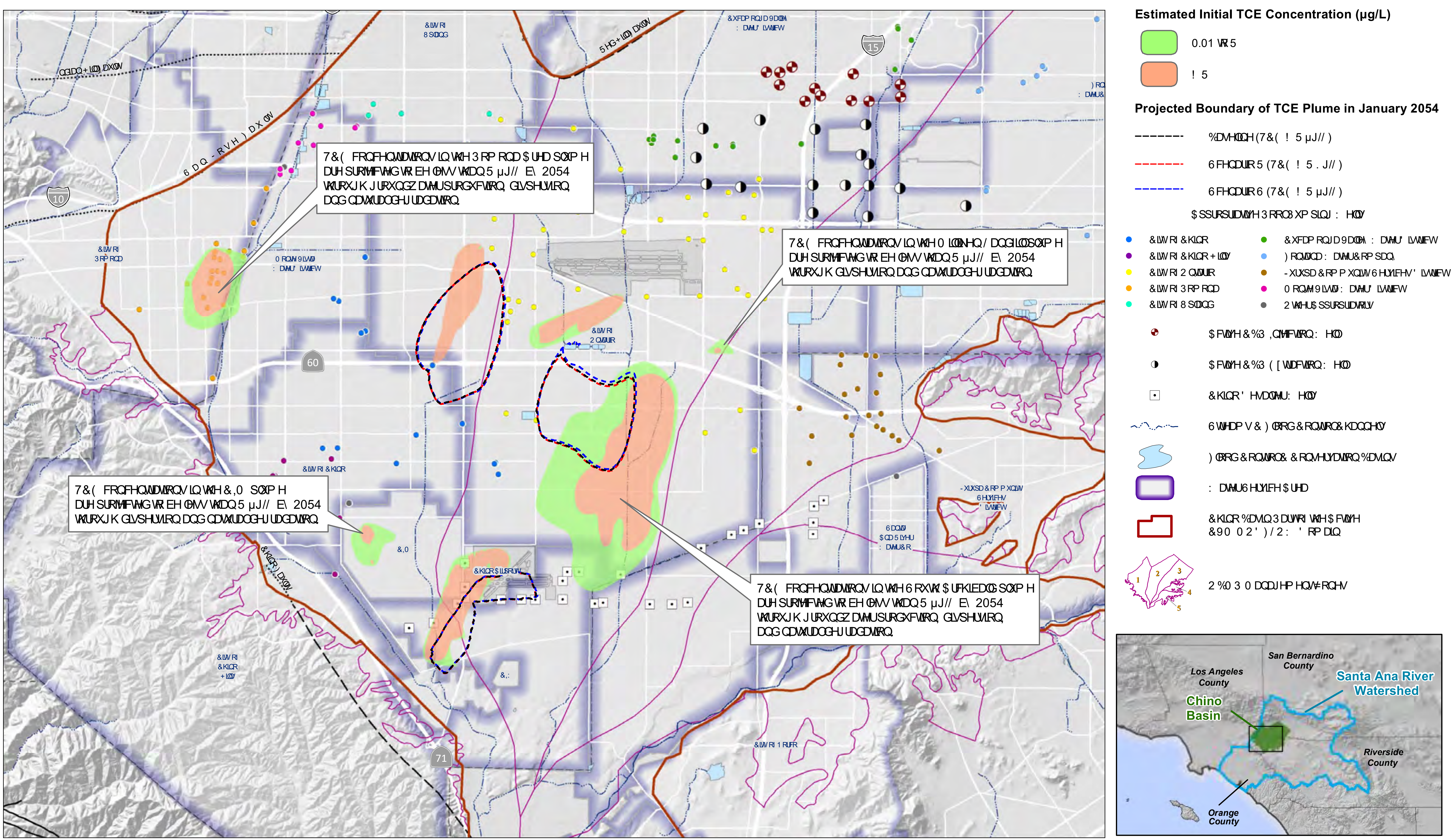
Evaluation of the Chino Basin Program

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Estimated Location of Water Quality Anomalies, Baseline and CBP Scenarios

Scenarios 3 and 4 - January 2054

Figure 26



0 1 2 3 Miles

0 1 2 3 4 Km

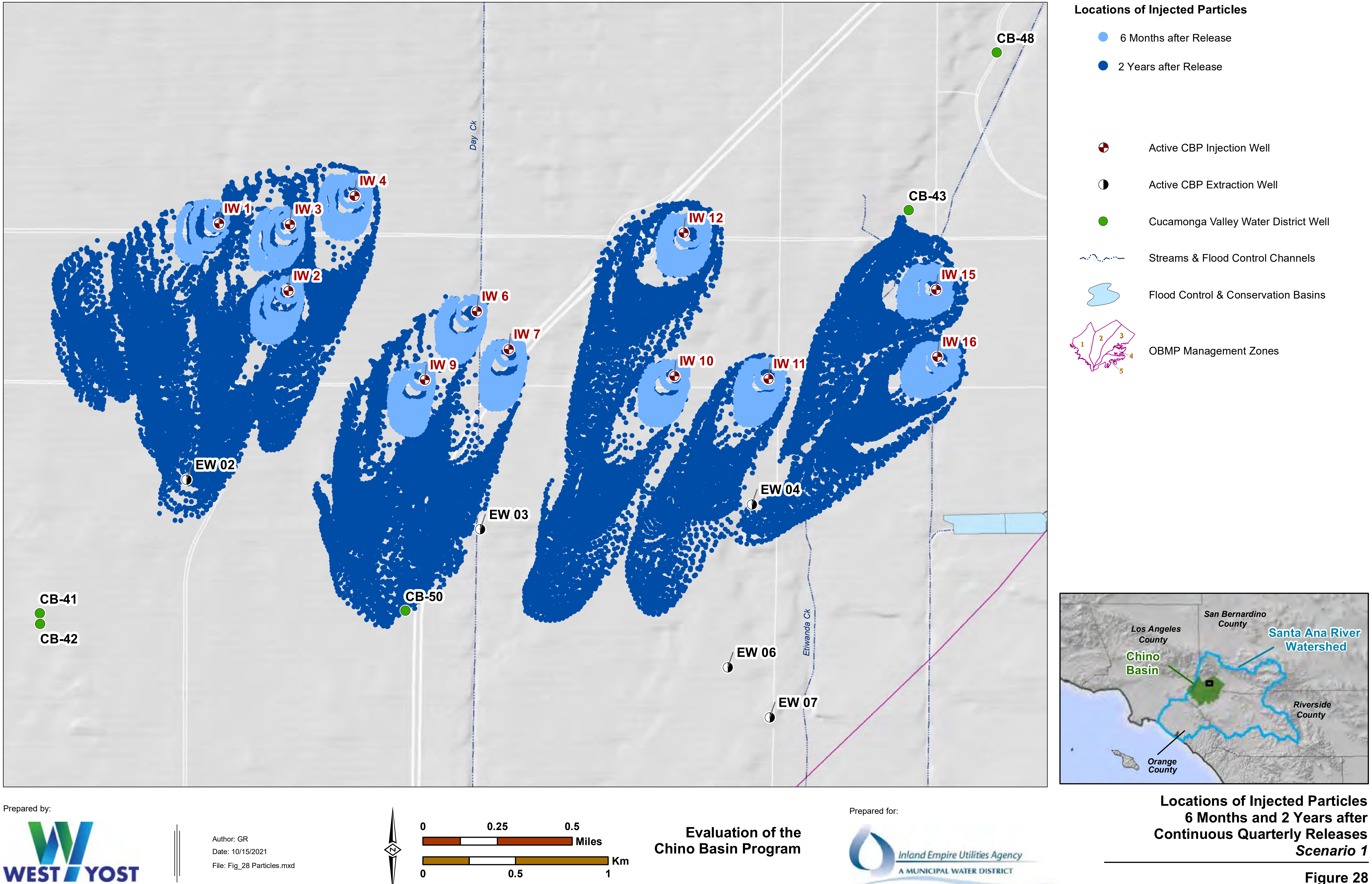
Date: 10/15/2021

Evaluation of the Chino Basin Program

Estimated Location of Water Quality Anomalies, Baseline and CBP Scenarios

Scenarios 5 and 6 - January 2054

Figure 27



Prepared by:

WEST YOST

Author: GR
Date: 10/15/2021
File: Fig_28 Particles.mxd

Evaluation of the Chino Basin Program

Prepared for:

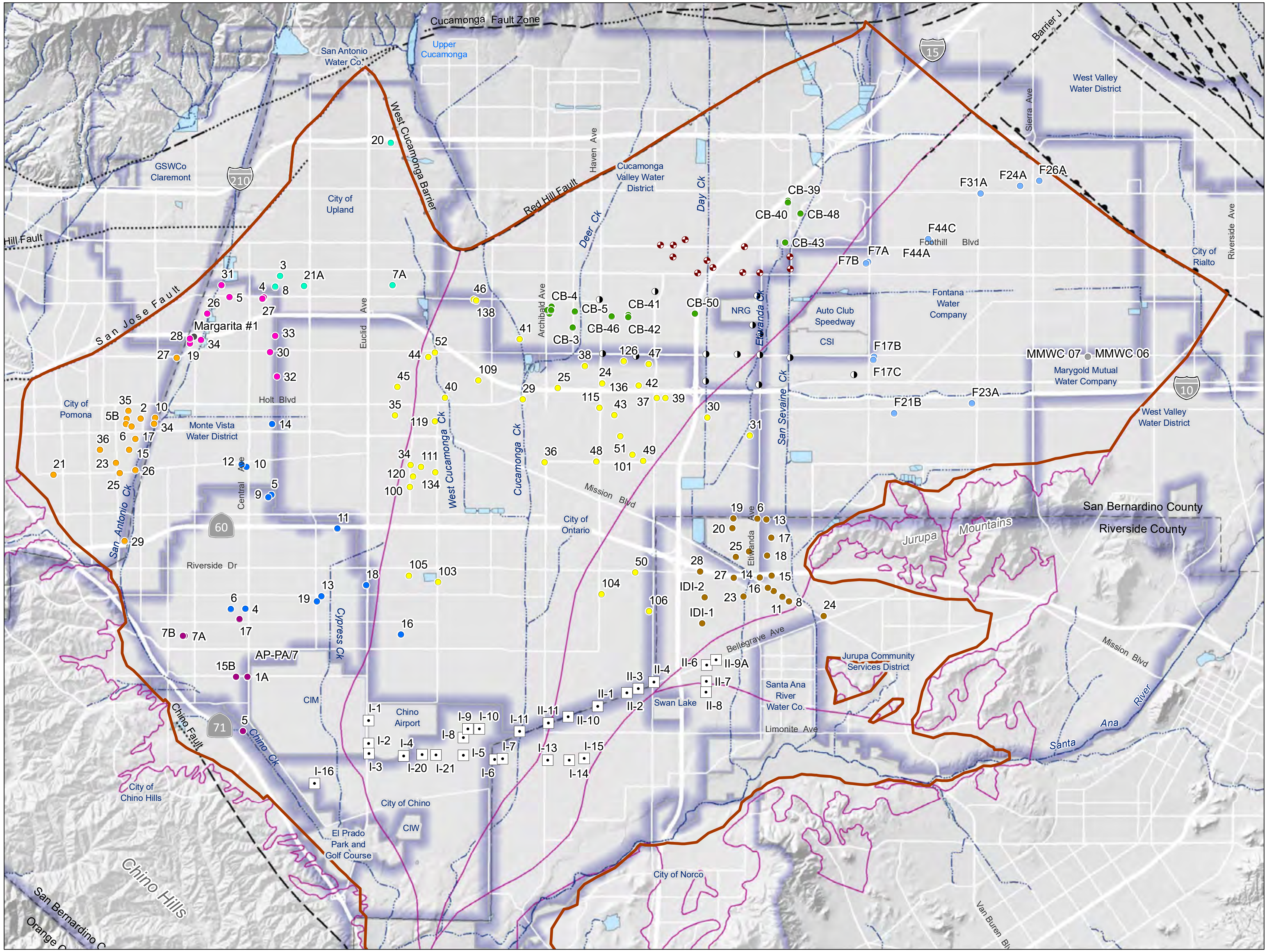
Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Locations of Injected Particles 6 Months and 2 Years after Continuous Quarterly Releases
Scenario 1

Figure 28

Attachment A

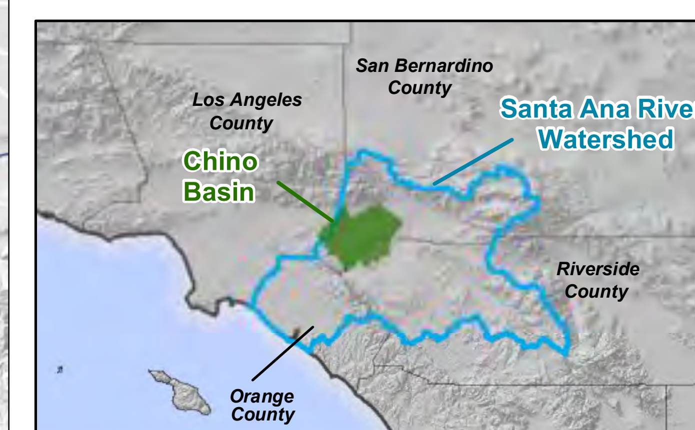
Hydrographs



Hydrograph Well Locations

- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Fontana Water Company
- Golden State Water Company
- Jurupa Community Services District
- Marygold Mutual Water Company
- Monte Vista Water District
- Chino Basin Desalter Authority

- Active CBP Injection Well
- Active CBP Extraction Well
- Streams & Flood Control Channels
- Flood Control & Conservation Basins
- Water Service Area
- Chino Basin Part of the Active CVM MODFLOW Domain
- OBMP Management Zones



Prepared by:

WEST YOST

Author: LS
Date: 10/4/2021
File: Figure A-1 Hydrograph Map.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Hydrograph Well Locations

Figure A-1

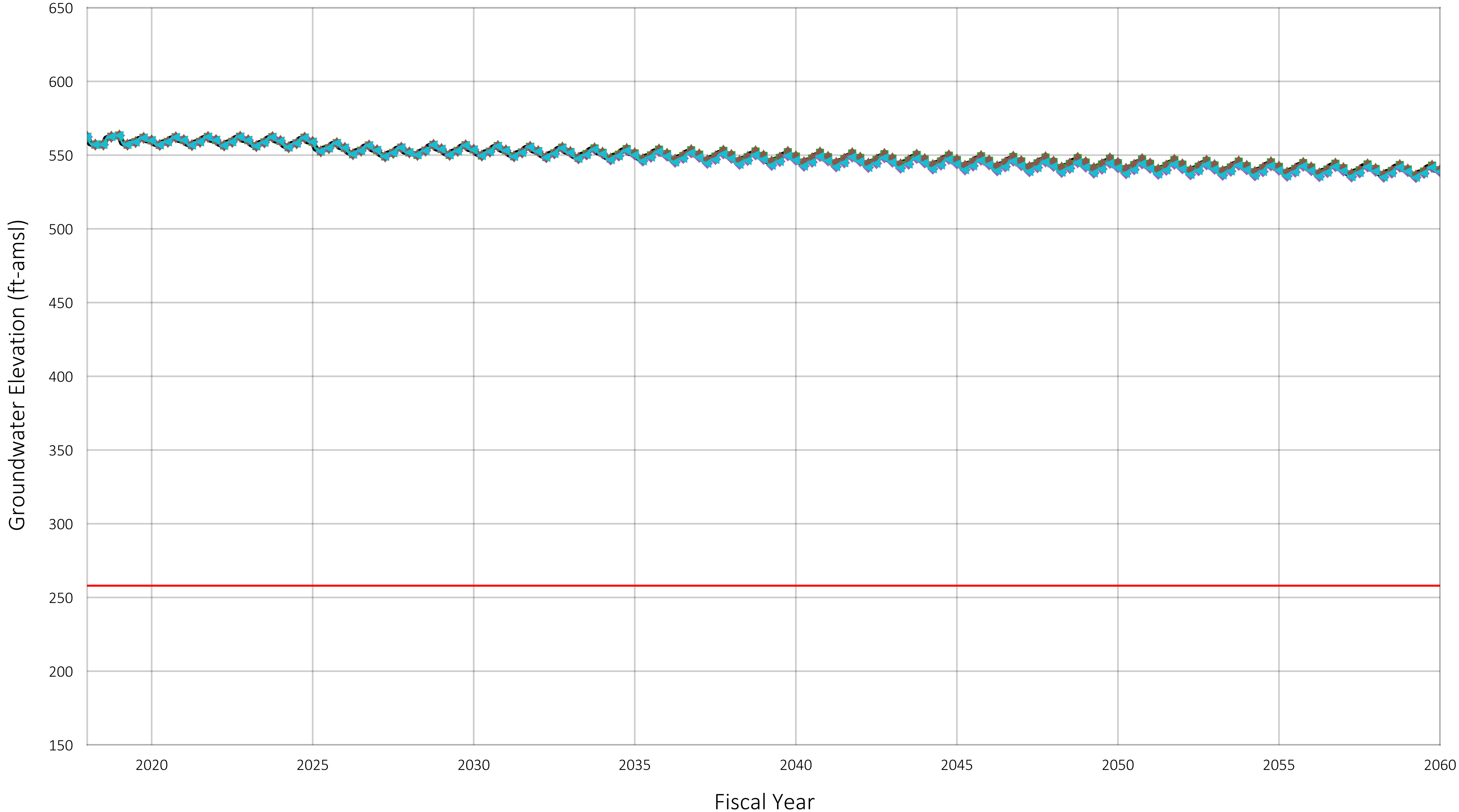
Table A-1. List of Wells with Hydrographs					
Well ID	**Well_name**	**Well Owner**	**Latitude**	**Longitude**	**Pumping Sustainability Metric Elevation (ft-amsl)**
1004280	1A	City of Chino Hills	33.9899	-117.6894	258
1207336	5	City of Chino Hills	33.9752	-117.6908	-
1004215	7A	City of Chino Hills	34.0007	-117.7098	241
1004216	7B	City of Chino Hills	34.0008	-117.7105	241
1203214	15B	City of Chino Hills	33.9898	-117.6932	471
1004179	17	City of Chino Hills	34.0053	-117.6922	394
1004178	4	City of Chino	34.0081	-117.6903	-
1002741	5	City of Chino	34.0389	-117.6821	545
1004176	6	City of Chino	34.0081	-117.6950	489
1002743	9	City of Chino	34.0382	-117.6831	493
1203283	10	City of Chino	34.0464	-117.6902	475
1003741	11	City of Chino	34.0299	-117.6607	455
1002739	12	City of Chino	34.0471	-117.6919	-
1004185	13	City of Chino	34.0117	-117.6657	348
1002645	14	City of Chino	34.0580	-117.6820	-
1208673	16	City of Chino	34.0015	-117.6399	-
1234063	19	City of Chino	34.0103	-117.6671	-
1224773	18	City of Chino	34.0147	-117.6513	-
1002309	CB-1	Cucamonga Valley Water District	34.0882	-117.5924	543
1002312	CB-3	Cucamonga Valley Water District	34.0845	-117.5849	553
1002307	CB-4	Cucamonga Valley Water District	34.0901	-117.5918	493
1002311	CB-5	Cucamonga Valley Water District	34.0888	-117.5843	613
1002308	CB-30	Cucamonga Valley Water District	34.0891	-117.5931	489
1206753	CB-38	Cucamonga Valley Water District	34.0891	-117.5918	509
1207928	CB-39	Cucamonga Valley Water District	34.1189	-117.5154	655
1207929	CB-40	Cucamonga Valley Water District	34.1185	-117.5153	441
1207936	CB-41	Cucamonga Valley Water District	34.0879	-117.5669	475
1207937	CB-42	Cucamonga Valley Water District	34.0874	-117.5668	511
1220079	CB-43	Cucamonga Valley Water District	34.1077	-117.5162	434
1220080	CB-46	Cucamonga Valley Water District	34.0875	-117.5722	501
Projected	CB-48	Cucamonga Valley Water District	34.1155	-117.5113	-
Projected	CB-50	Cucamonga Valley Water District	34.0884	-117.5453	-
1002211	F7A	Fontana Water Company	34.1026	-117.4892	646.7
1221726	F7B	Fontana Water Company	34.1022	-117.4899	646.37
1002237	F17B	Fontana Water Company	34.0770	-117.4872	639.1
1201069	F17C	Fontana Water Company	34.0762	-117.4875	551.8
1232847	F21B	Fontana Water Company	34.0619	-117.4806	675.43
1002239	F23A	Fontana Water Company	34.0646	-117.4554	722.8
1200218	F24A	Fontana Water Company	34.1232	-117.4402	768.9
1200219	F26A	Fontana Water Company	34.1247	-117.4340	765.3
1002081	F31A	Fontana Water Company	34.1212	-117.4529	684.4
1206933	F44A	Fontana Water Company	34.1083	-117.4691	652.8
1207340	F44B	Fontana Water Company	34.1082	-117.4692	702.8
1207341	F44C	Fontana Water Company	34.1088	-117.4699	662.8
1002554	Margarita #1	Golden State Water Company	34.0814	-117.7075	-
1003470	6	Jurupa Community Services District	34.0332	-117.5247	610
1003507	8	Jurupa Community Services District	34.0110	-117.5144	581
1003506	11	Jurupa Community Services District	34.0122	-117.5165	559
1003505	12	Jurupa Community Services District	34.0137	-117.5193	557
1003466	13	Jurupa Community Services District	34.0330	-117.5218	627

Well ID	Well_name	Well Owner	Latitude	Longitude	Pumping Sustainability Metric Elevation (ft-amsl)
1003501	14	Jurupa Community Services District	34.0174	-117.5239	560
1003498	15	Jurupa Community Services District	34.0179	-117.5200	565
1003502	16	Jurupa Community Services District	34.0146	-117.5213	552
1003467	17	Jurupa Community Services District	34.0282	-117.5202	566
1003469	18	Jurupa Community Services District	34.0233	-117.5215	580
1003471	19	Jurupa Community Services District	34.0332	-117.5325	546
1003472	20	Jurupa Community Services District	34.0306	-117.5328	580
1220154	22	Jurupa Community Services District	34.0244	-117.5274	537
1220155	23	Jurupa Community Services District	34.0122	-117.5291	492
1003515	24	Jurupa Community Services District	34.0071	-117.5031	547
1220158	25	Jurupa Community Services District	34.0229	-117.5317	525
1233787	27	Jurupa Community Services District	34.0172	-117.5322	490
1233788	28	Jurupa Community Services District	34.0189	-117.5432	496
1207942	IDI-1	Jurupa Community Services District	34.0049	-117.5424	-
999902	IDI-2	Jurupa Community Services District	34.0120	-117.5417	-
1221751	MMWC 06	Marygold Mutual Water Company	34.0774	-117.4179	563.9
1221752	MMWC 07	Marygold Mutual Water Company	34.0773	-117.4179	656.4
1002541	4	Monte Vista Water District	34.0921	-117.6850	511
1002544	5	Monte Vista Water District	34.0922	-117.6962	442
1002563	19	Monte Vista Water District	34.0795	-117.7088	433
1206744	26	Monte Vista Water District	34.0876	-117.7032	444
1206745	27	Monte Vista Water District	34.0917	-117.6854	498
1206746	28	Monte Vista Water District	34.0808	-117.7088	303
1208781	30	Monte Vista Water District	34.0774	-117.6829	499
1208782	31	Monte Vista Water District	34.0953	-117.6988	326
1208771	32	Monte Vista Water District	34.0708	-117.6806	442
1220173	33	Monte Vista Water District	34.0818	-117.6812	489
1224765	34	Monte Vista Water District	34.0804	-117.7053	372
1002339	24	City of Ontario	34.0695	-117.5752	581
1002337	25	City of Ontario	34.0682	-117.5896	517
1002333	29	City of Ontario	34.0650	-117.6009	541
1002253	30	City of Ontario	34.0605	-117.5411	558
1002254	31	City of Ontario	34.0556	-117.5274	635
1002367	34	City of Ontario	34.0471	-117.6371	451
1002350	35	City of Ontario	34.0605	-117.6423	498
1002372	36	City of Ontario	34.0481	-117.5937	517
1002230	37	City of Ontario	34.0656	-117.5576	609
1006998	38	City of Ontario	34.0741	-117.5809	589
1206945	39	City of Ontario	34.0657	-117.5548	609
1207502	40	City of Ontario	34.0654	-117.6261	492
1207503	41	City of Ontario	34.0813	-117.6021	483
1220168	42	City of Ontario	34.0689	-117.5634	-
1220169	43	City of Ontario	34.0610	-117.5713	-
1220170	44	City of Ontario	34.0763	-117.6316	573
1207950	45	City of Ontario	34.0682	-117.6415	500
1207946	46	City of Ontario	34.0919	-117.6169	541
1207948	47	City of Ontario	34.0747	-117.5602	559
1220171	48	City of Ontario	34.0484	-117.5770	-
1207952	49	City of Ontario	34.0486	-117.5618	538
1208387	50	City of Ontario	34.0186	-117.5642	519
1220172	51	City of Ontario	34.0553	-117.5692	-
1221753	52	City of Ontario	34.0775	-117.6294	485

Well ID	Well_name	Well Owner	Latitude	Longitude	Pumping Sustainability Metric Elevation (ft-amsl)
Projected	100	City of Ontario	34.0413	-117.6373	-
Projected	101	City of Ontario	34.0503	-117.5653	-
Projected	103	City of Ontario	34.0157	-117.6280	-
Projected	104	City of Ontario	34.0127	-117.5750	-
Projected	105	City of Ontario	34.0173	-117.6375	-
Projected	106	City of Ontario	34.0081	-117.5596	-
Projected	109	City of Ontario	34.0701	-117.6153	-
Projected	111	City of Ontario	34.0467	-117.6338	-
Projected	119	City of Ontario	34.0590	-117.6293	-
Projected	115	City of Ontario	34.0629	-117.5760	-
Projected	120	City of Ontario	34.0441	-117.6363	-
Projected	126	City of Ontario	34.0755	-117.5682	-
Projected	134	City of Ontario	34.0452	-117.6291	-
Projected	136	City of Ontario	34.0695	-117.5752	-
Projected	138	City of Ontario	34.0916	-117.6162	-
1002653	2	City of Pomona	34.0592	-117.7247	465.7
1205314	5B	City of Pomona	34.0591	-117.7292	460.3
1002650	6	City of Pomona	34.0577	-117.7293	424
1002656	10	City of Pomona	34.0594	-117.7199	525.8
1002664	15	City of Pomona	34.0508	-117.7282	494
1002654	16	City of Pomona	34.0571	-117.7275	494.6
1002659	17	City of Pomona	34.0537	-117.7263	491
1002678	21	City of Pomona	34.0439	-117.7527	612.8
1002704	23	City of Pomona	34.0472	-117.7326	472.2
1002706	25	City of Pomona	34.0445	-117.7313	509
1002703	26	City of Pomona	34.0453	-117.7262	543.6
1201236	27	City of Pomona	34.0757	-117.7131	466
1203062	29	City of Pomona	34.0262	-117.7296	497.9
1201247	34	City of Pomona	34.0579	-117.7203	494.1
1201246	35	City of Pomona	34.0612	-117.7286	464
1205309	36	City of Pomona	34.0507	-117.7377	467.2
1002535	3	City of Upland	34.0979	-117.6798	-
1006997	7A	City of Upland	34.0956	-117.6433	-
1002531	8	City of Upland	34.0950	-117.6813	-
1206654	20	City of Upland	34.1339	-117.6441	-
1207956	21A	City of Upland	34.0952	-117.6720	-
1206675	I-1	Chino Basin Desalter Authority	33.9782	-117.6502	402
1206676	I-2	Chino Basin Desalter Authority	33.9721	-117.6501	304
1206677	I-3	Chino Basin Desalter Authority	33.9693	-117.6500	353
1206678	I-4	Chino Basin Desalter Authority	33.9688	-117.6387	356
1206679	I-5	Chino Basin Desalter Authority	33.9690	-117.6195	410
1206684	I-6	Chino Basin Desalter Authority	33.9680	-117.6094	496
1206685	I-7	Chino Basin Desalter Authority	33.9682	-117.6068	491
1206680	I-8	Chino Basin Desalter Authority	33.9739	-117.6195	390
1206681	I-9	Chino Basin Desalter Authority	33.9762	-117.6180	499
1206682	I-10	Chino Basin Desalter Authority	33.9762	-117.6143	511
1206683	I-11	Chino Basin Desalter Authority	33.9756	-117.6013	409
1206958	I-13	Chino Basin Desalter Authority	33.9679	-117.5921	476
1206959	I-14	Chino Basin Desalter Authority	33.9679	-117.5852	533
1206960	I-15	Chino Basin Desalter Authority	33.9684	-117.5803	528
1222970	I-16	Chino Basin Desalter Authority	33.9612	-117.6675	-
1224801	I-20	Chino Basin Desalter Authority	33.9692	-117.6328	-

Well ID	Well_name	Well Owner	Latitude	Longitude	Pumping Sustainability Metric Elevation (ft-amsl)
1224812	I-21	Chino Basin Desalter Authority	33.9691	-117.6283	-
1206961	II-1	Chino Basin Desalter Authority	33.9825	-117.5761	574
1206962	II-2	Chino Basin Desalter Authority	33.9861	-117.5666	458
1206963	II-3	Chino Basin Desalter Authority	33.9873	-117.5629	457
1206964	II-4	Chino Basin Desalter Authority	33.9891	-117.5580	468
1206966	II-6	Chino Basin Desalter Authority	33.9937	-117.5409	477
1206967	II-7	Chino Basin Desalter Authority	33.9894	-117.5410	461
1206968	II-8	Chino Basin Desalter Authority	33.9864	-117.5411	472
1206969	II-9A	Chino Basin Desalter Authority	33.9952	-117.5378	510
1234064	II-10	Chino Basin Desalter Authority	33.9796	-117.5856	-
1234065	II-11	Chino Basin Desalter Authority	33.9779	-117.5920	-
1206952	AP-PA/7	Chino Basin Water Master	33.9938	-117.6869	400[1]

[1] Well AP-PA/7 is a monitoring well. The value of 400 ft represents a minimum water level regarding subsidence not pumping.



Location of Well in Chino Basin

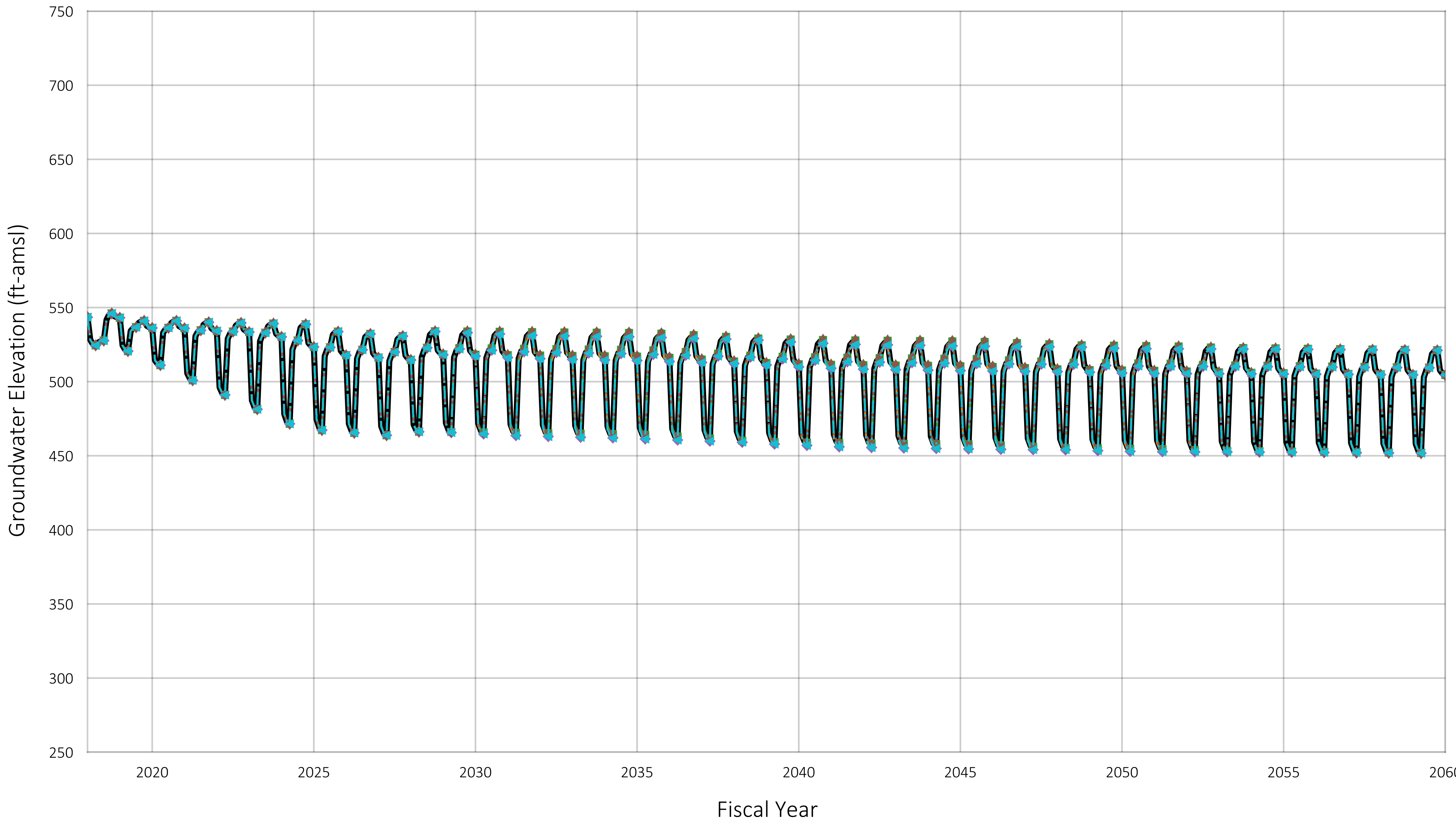
Prepared by:

WEST YOST Water. Engineered

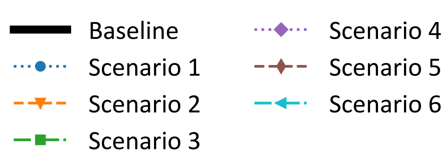
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1004280
Owner: City of Chino Hills
Well Name: 1A

Figure A-2



Location of Well in Chino Basin



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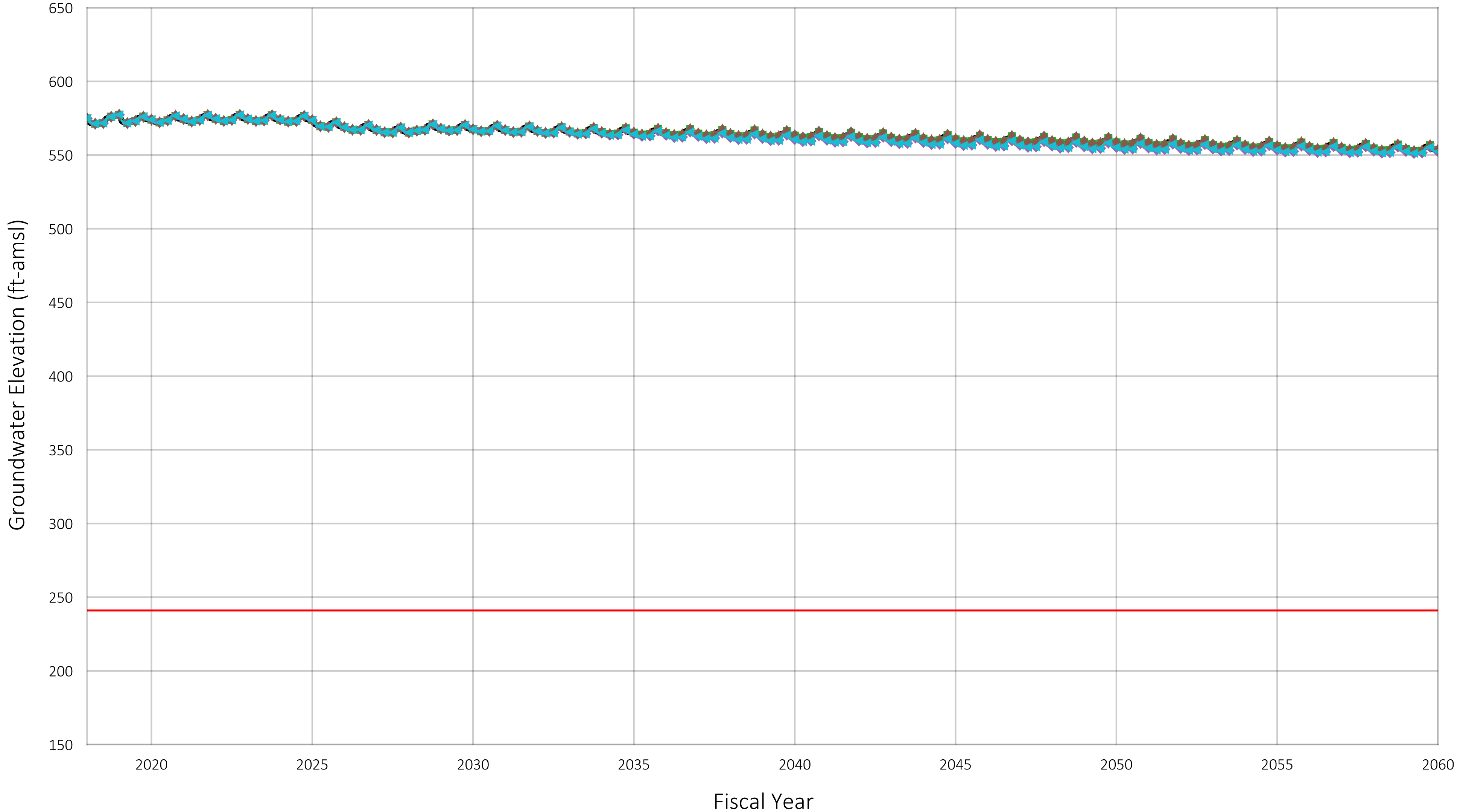
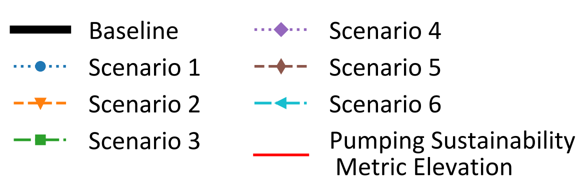
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207336
Owner: City of Chino Hills
Well Name: 5

Figure A-3



Location of Well in Chino Basin



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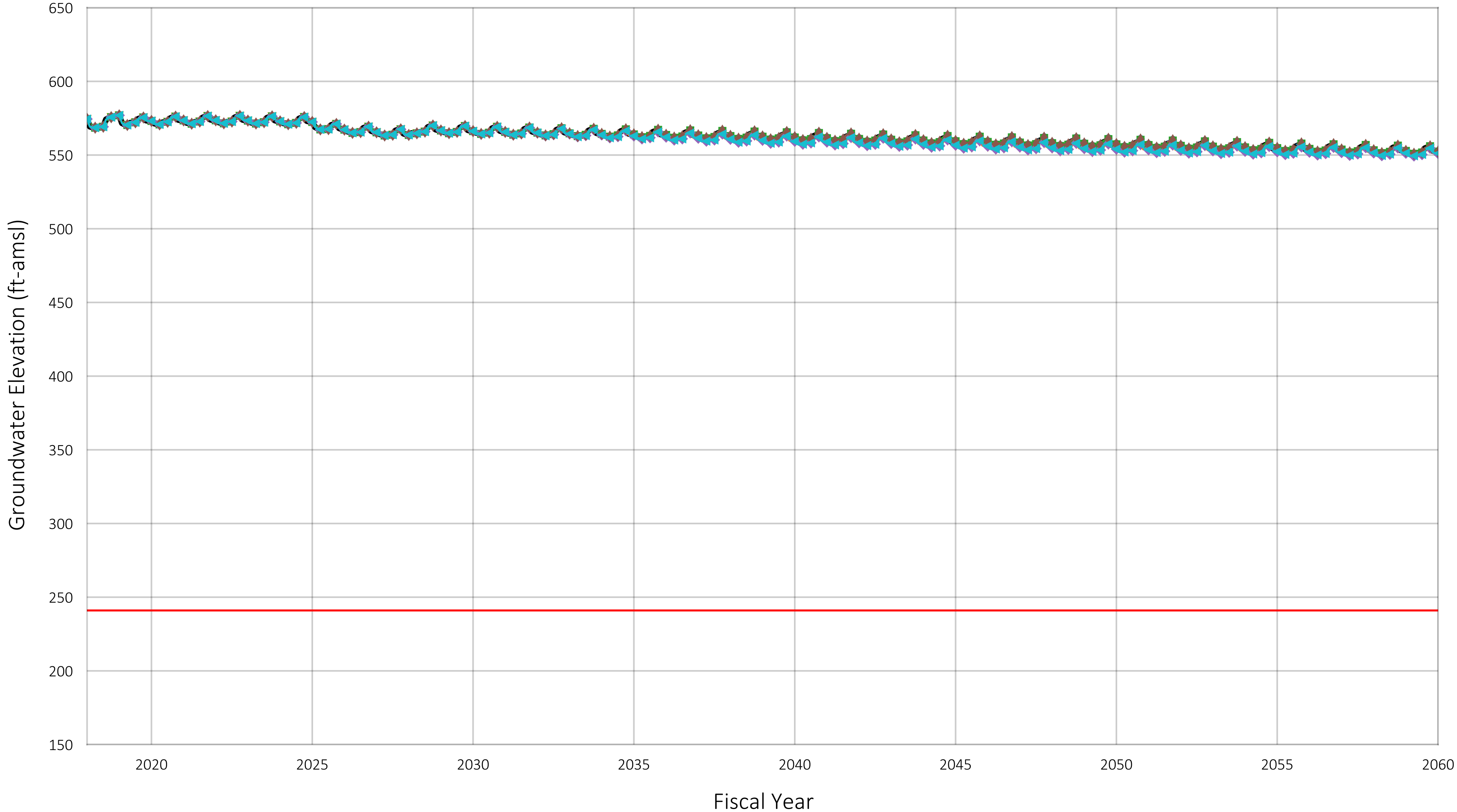
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1004215
Owner: City of Chino Hills
Well Name: 7A

Figure A-4



Location of Well in Chino Basin

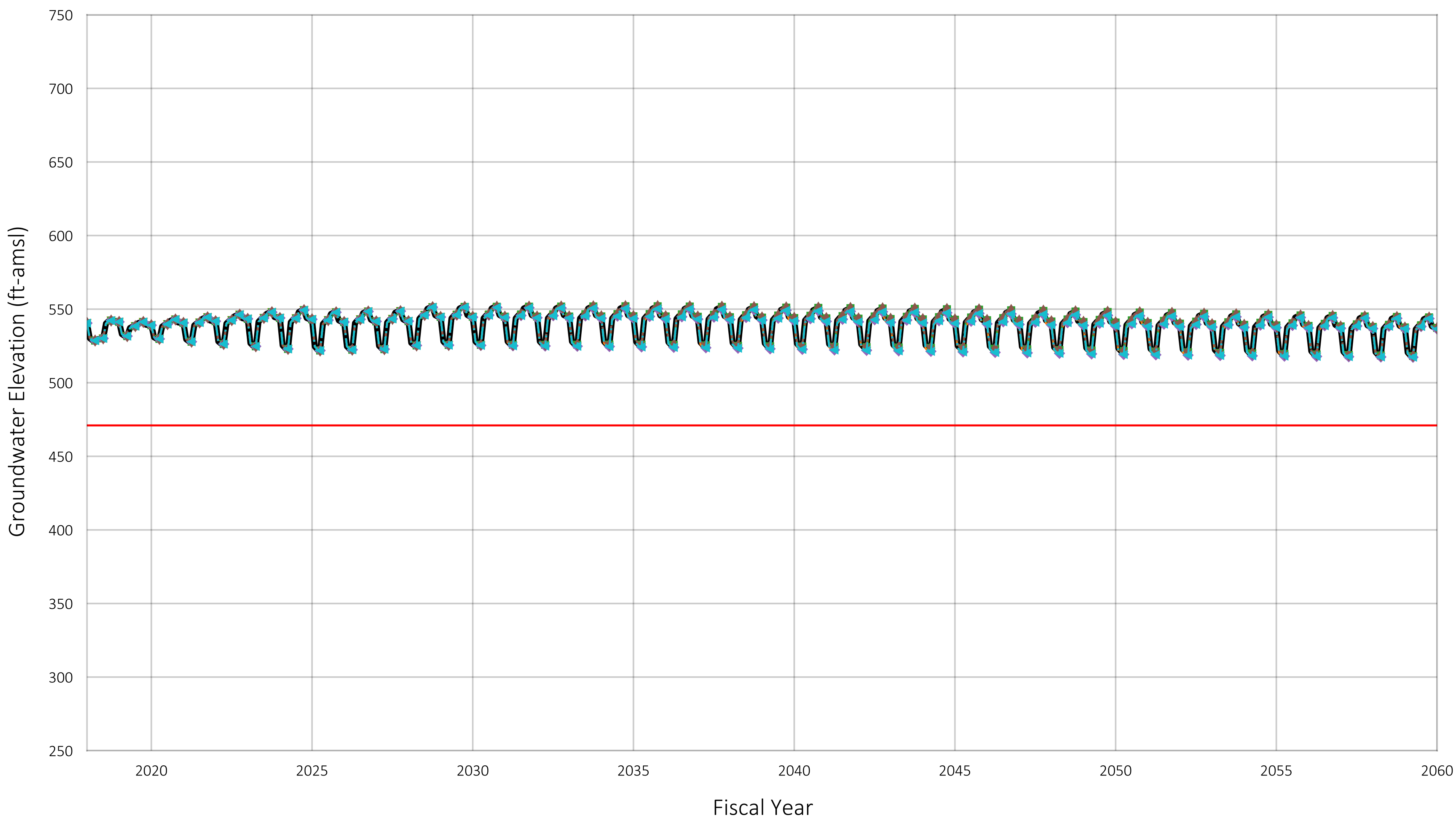
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1004216
Owner: City of Chino Hills
Well Name: 7B

Figure A-5



Location of Well in Chino Basin

Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

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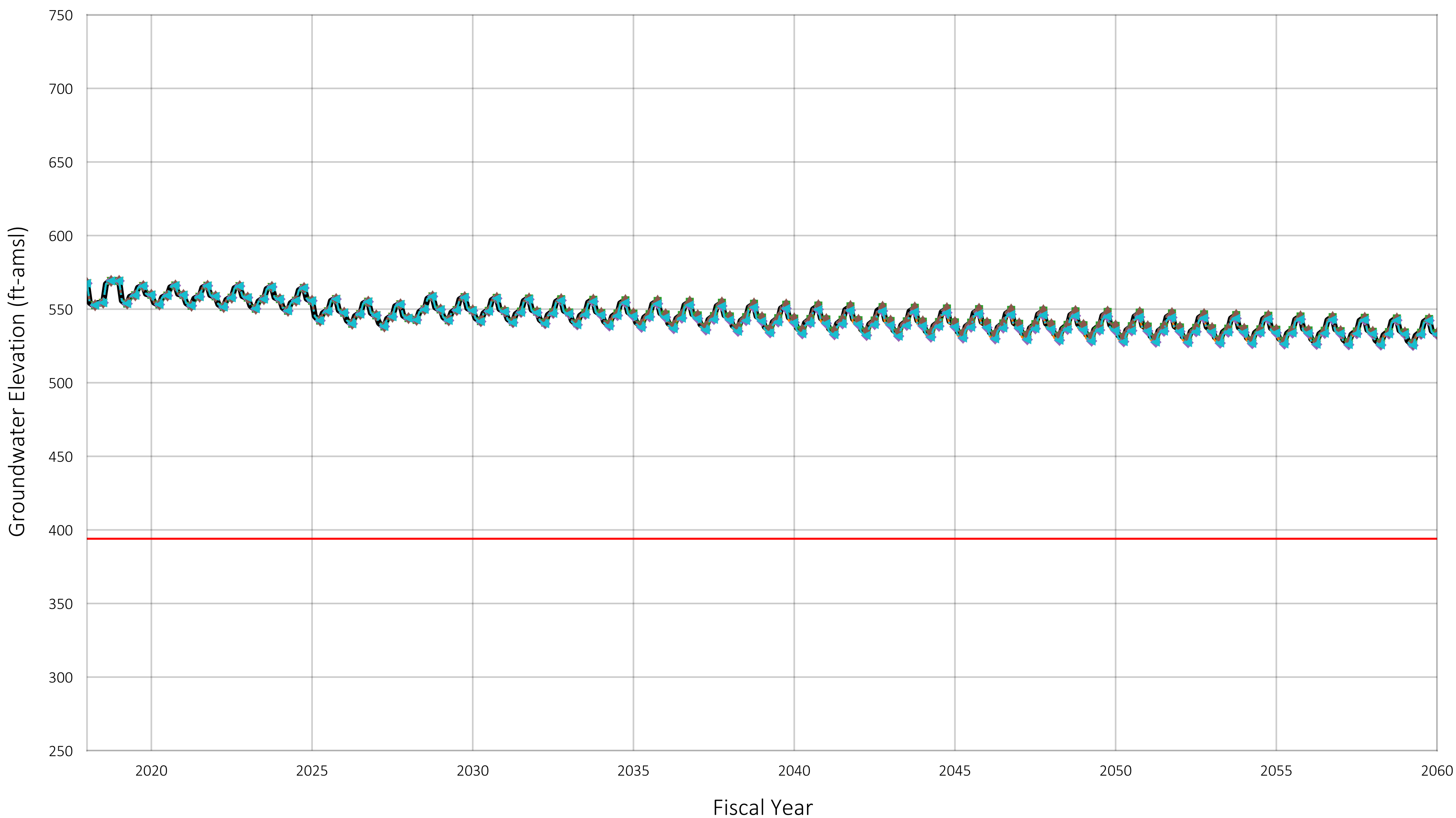
Projected Groundwater Elevation
Well ID#: 1203214
Owner: City of Chino Hills
Well Name: 15B

Figure A-6



Location of Well in Chino Basin

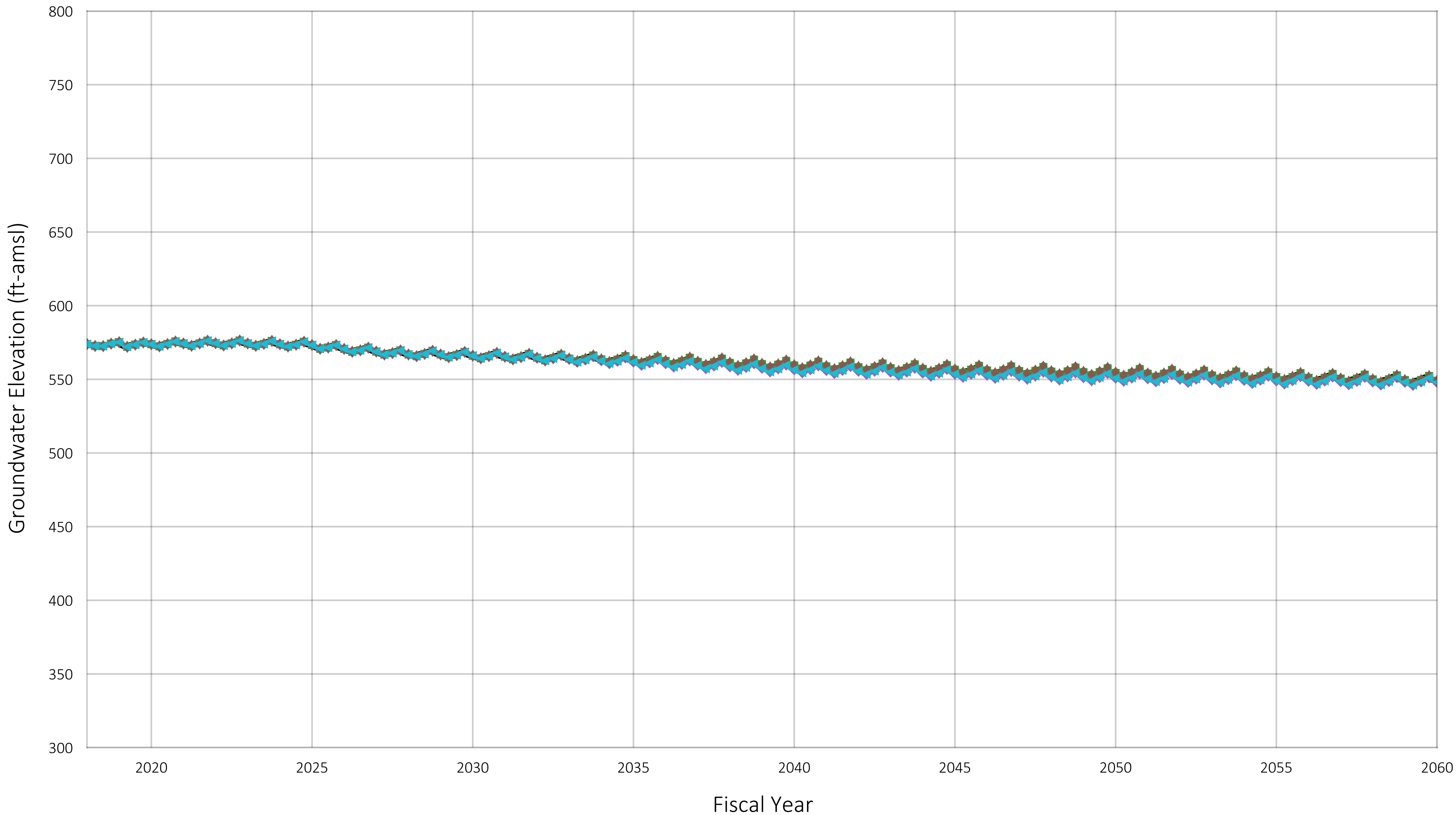
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1004179
Owner: City of Chino Hills
Well Name: 17

Figure A-7



Location of Well in Chino Basin

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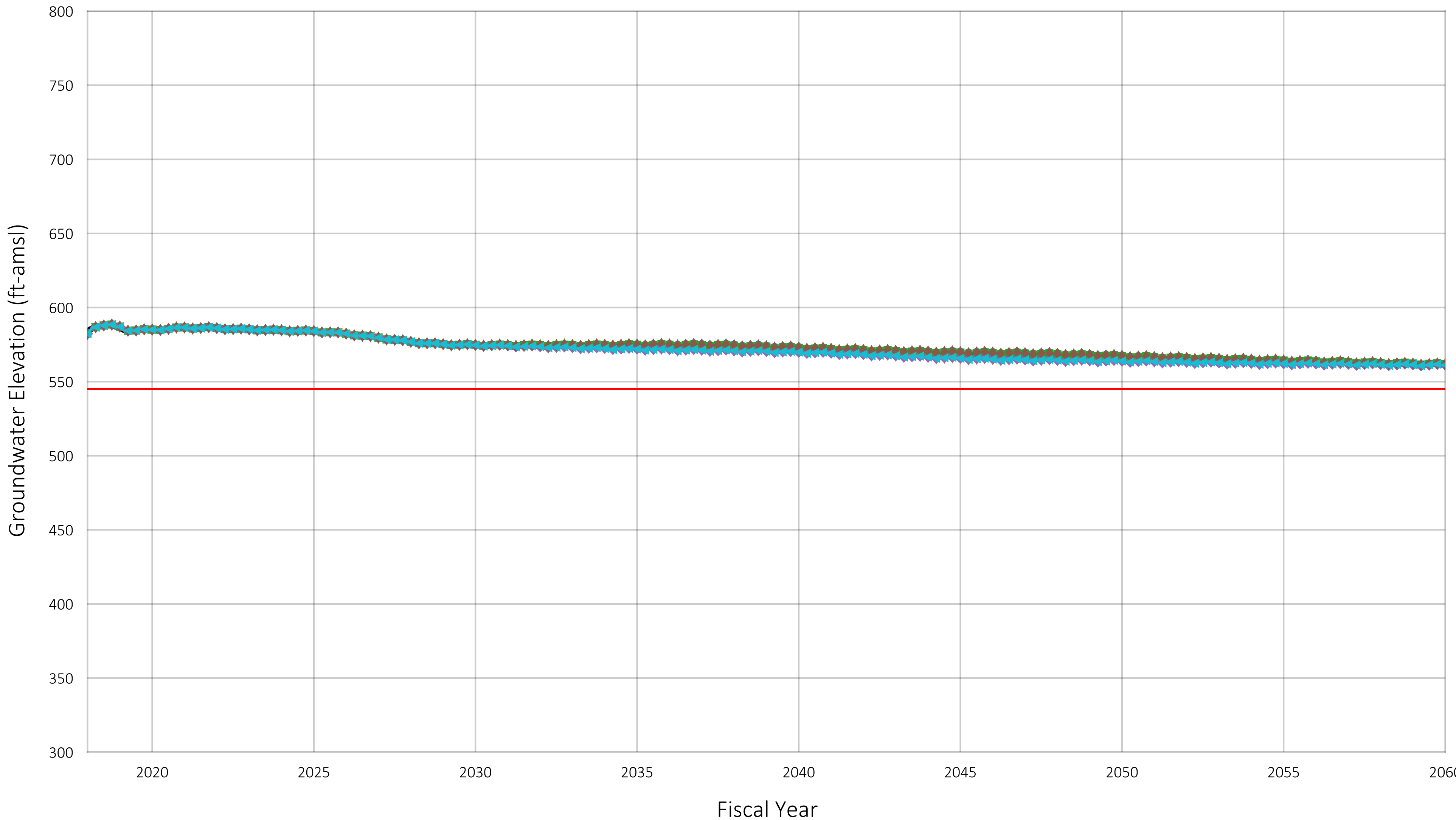
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1004178
Owner: City of Chino
Well Name: 4

Figure A-8



Location of Well in Chino Basin

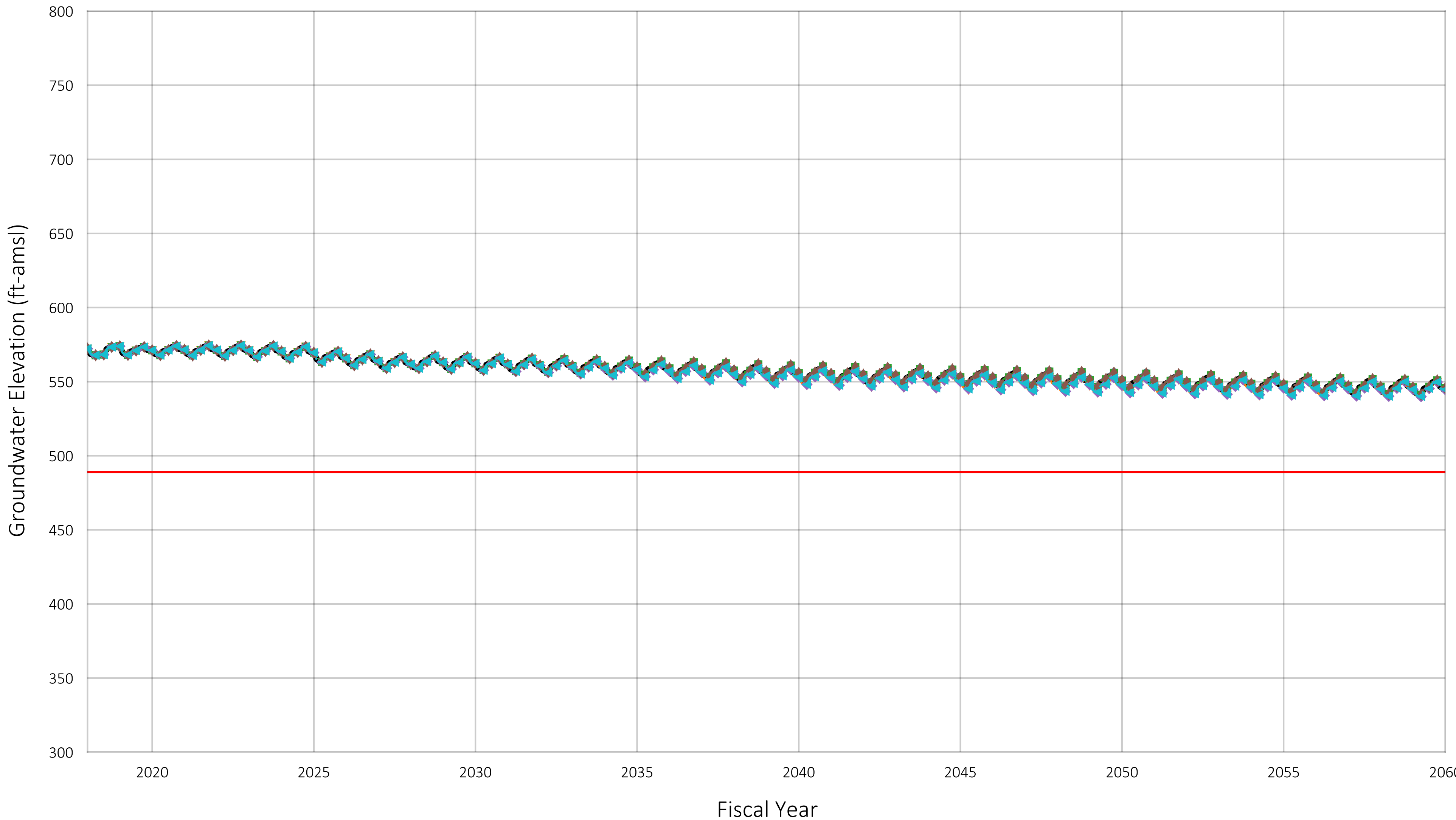
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002741
Owner: City of Chino
Well Name: 5

Figure A-9



Location of Well in Chino Basin

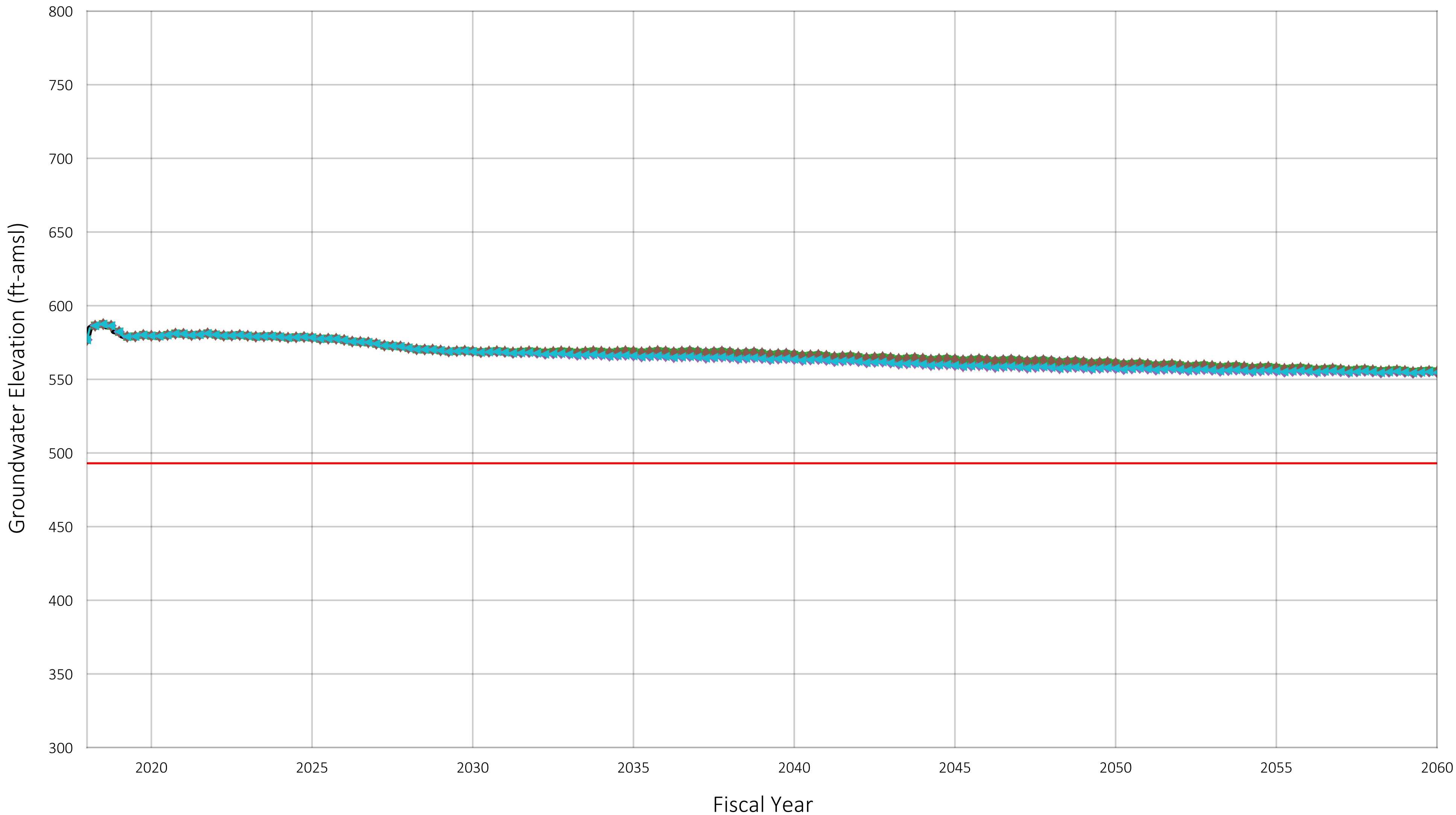
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1004176
Owner: City of Chino
Well Name: 6

Figure A-10



Location of Well in Chino Basin

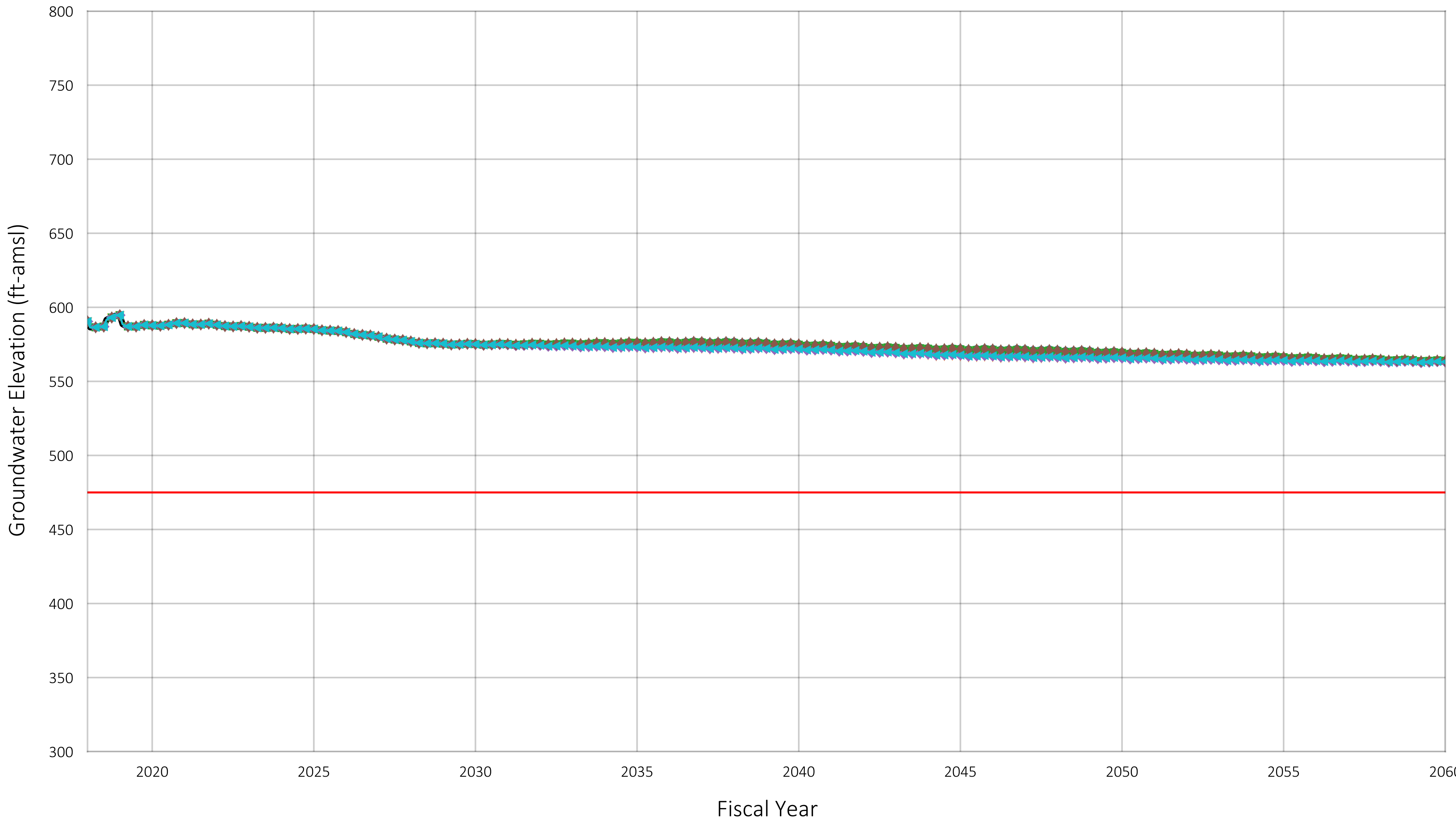
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002743
Owner: City of Chino
Well Name: 9

Figure A-11



Location of Well in Chino Basin

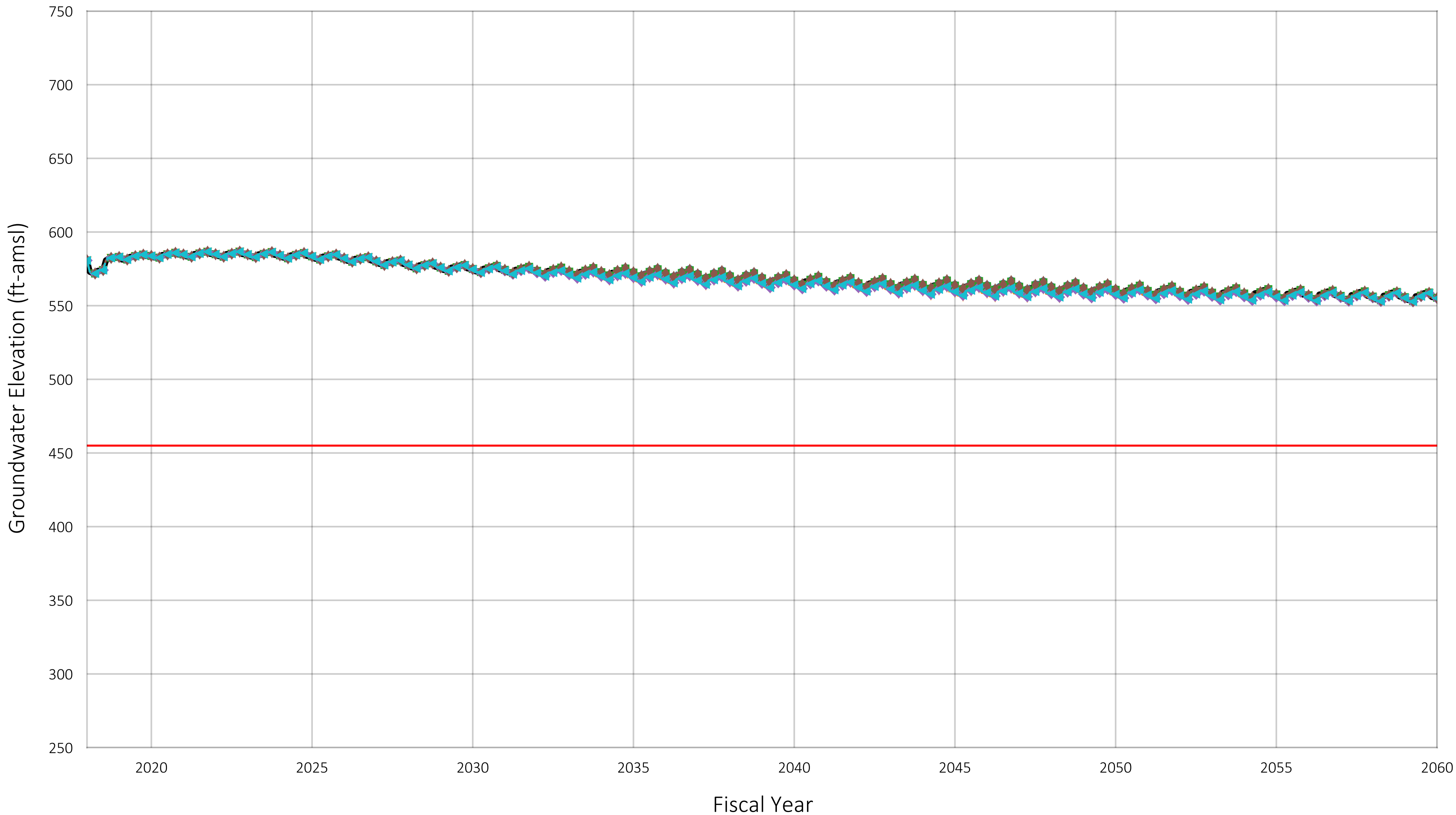
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1203283
Owner: City of Chino
Well Name: 10

Figure A-12



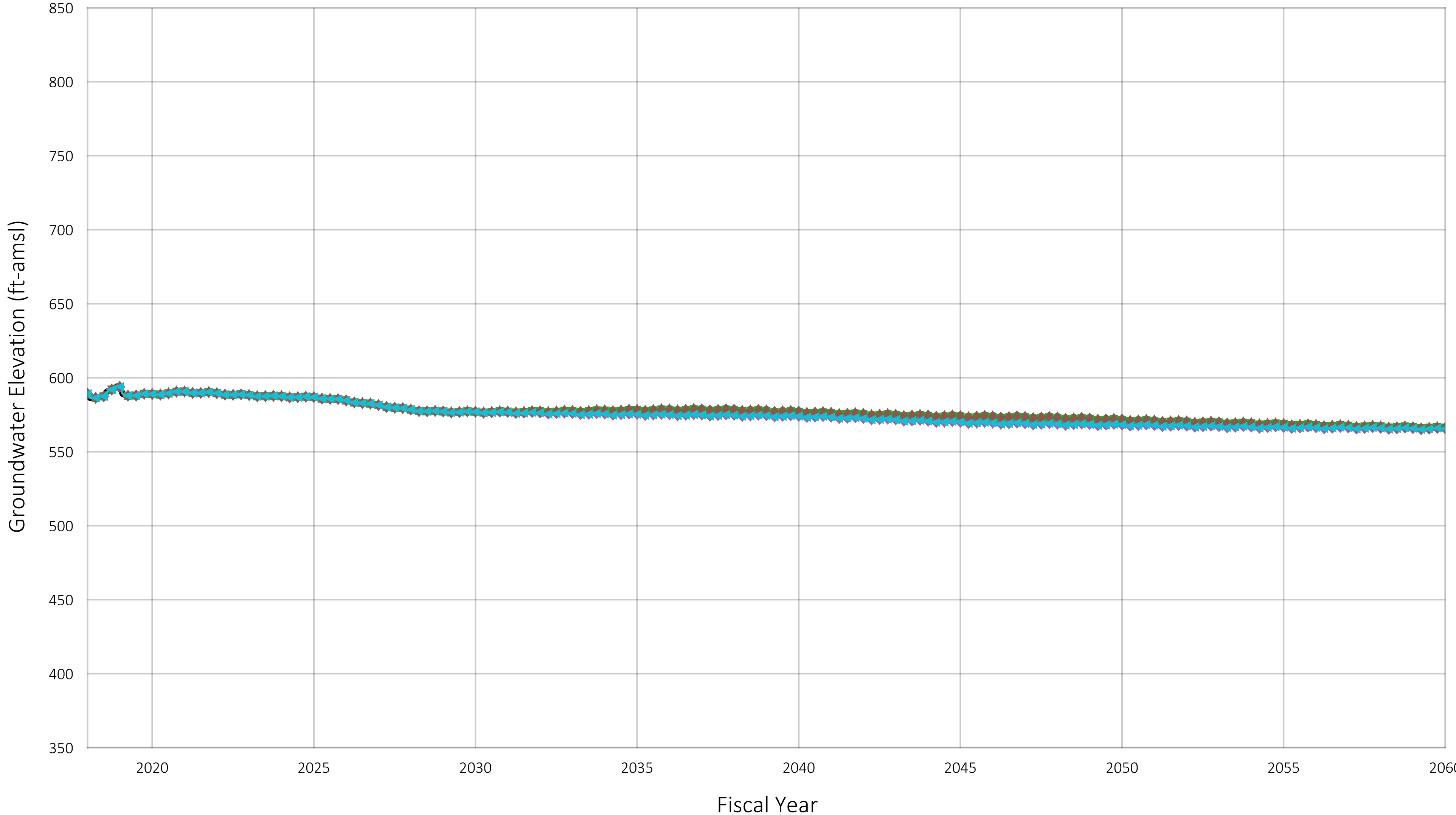
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

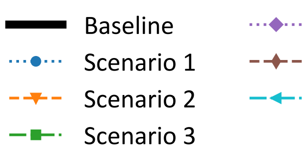
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003741
Owner: City of Chino
Well Name: 11

Figure A-13



Location of Well in Chino Basin

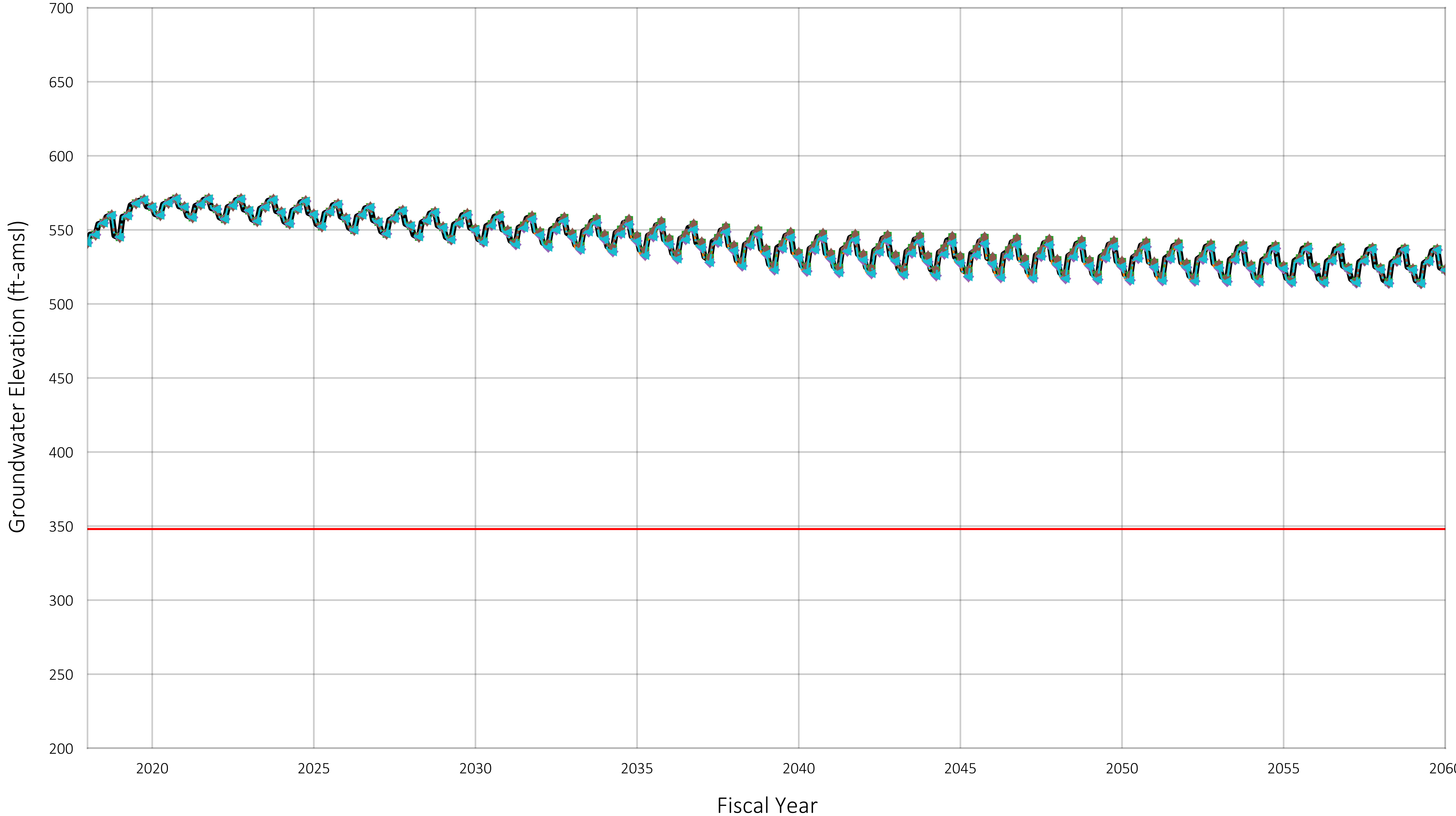


Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002739
Owner: City of Chino
Well Name: 12

Figure A-14



Location of Well in Chino Basin

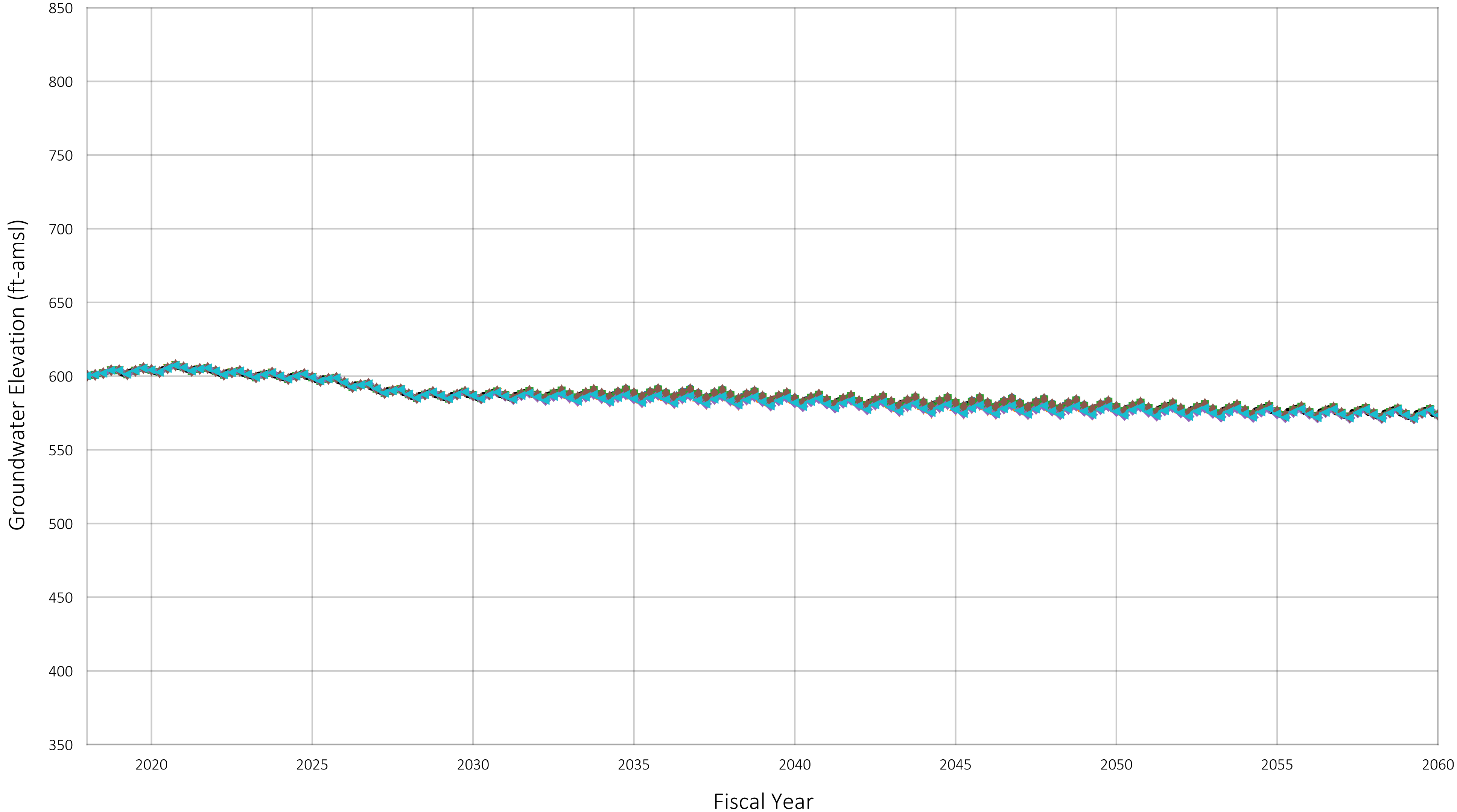
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1004185
Owner: City of Chino
Well Name: 13

Figure A-15



Location of Well in Chino Basin

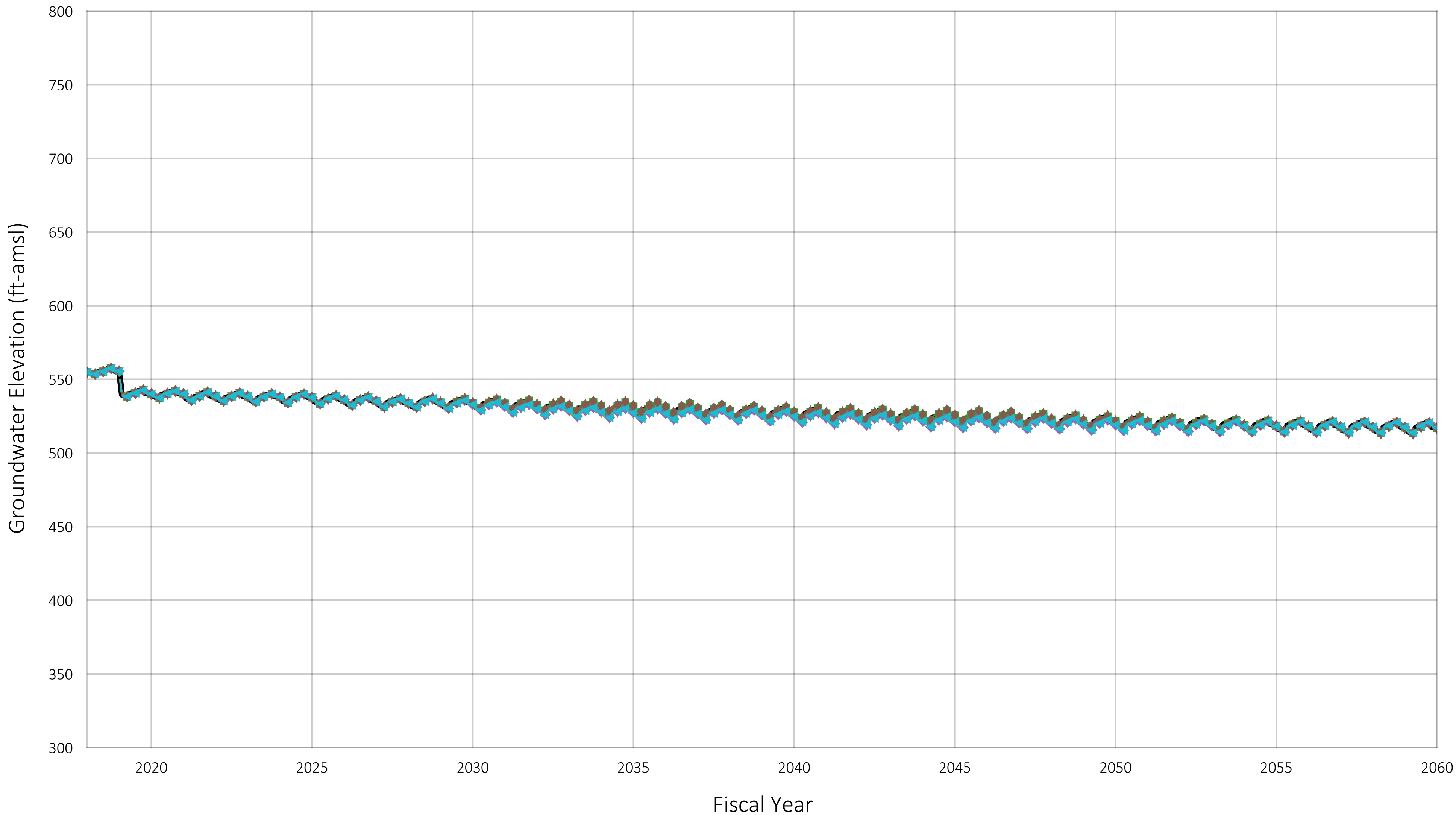
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002645
Owner: City of Chino
Well Name: 14

Figure A-16



Location of Well in Chino Basin

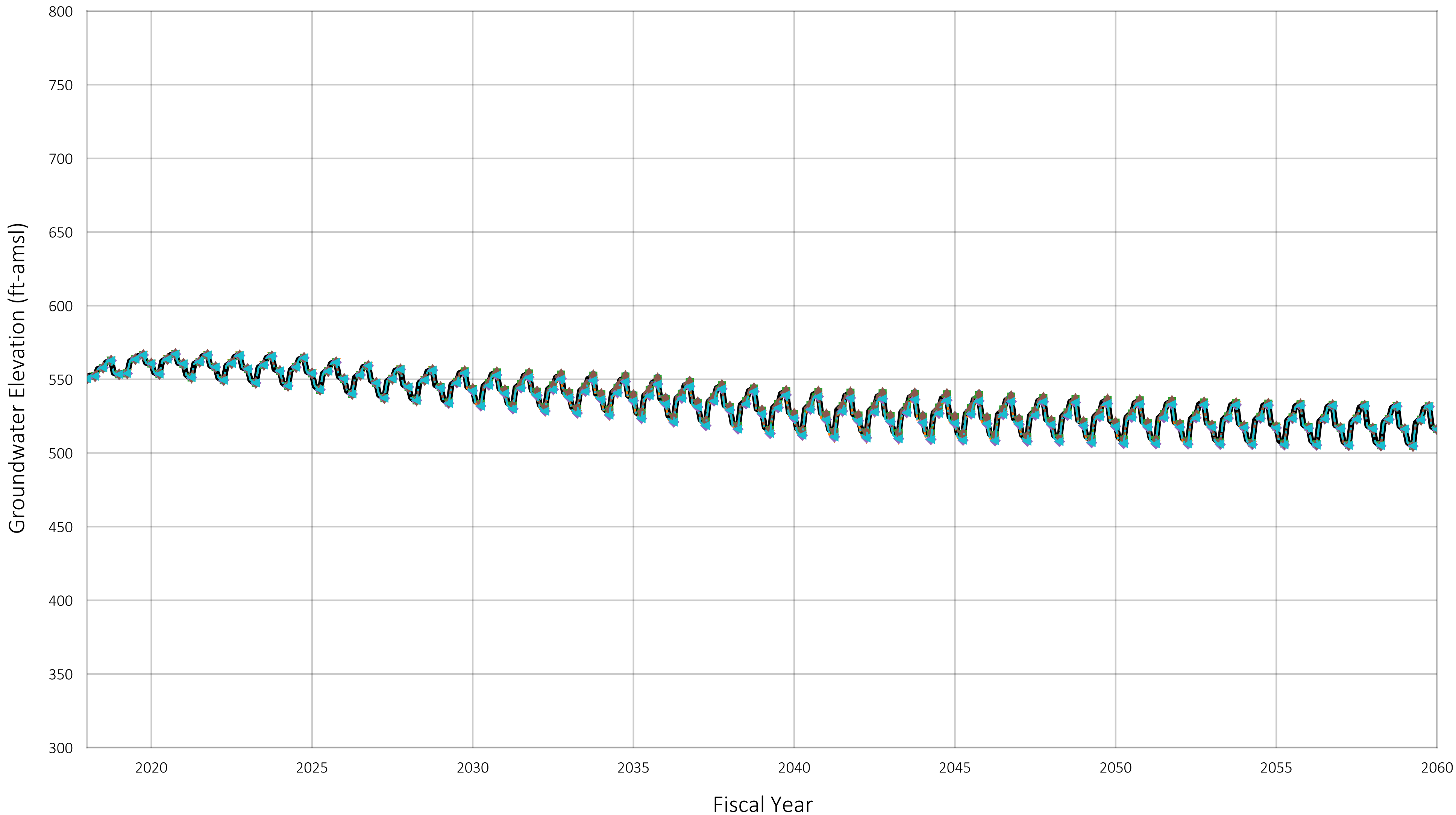
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1208673
Owner: City of Chino
Well Name: 16

Figure A-17



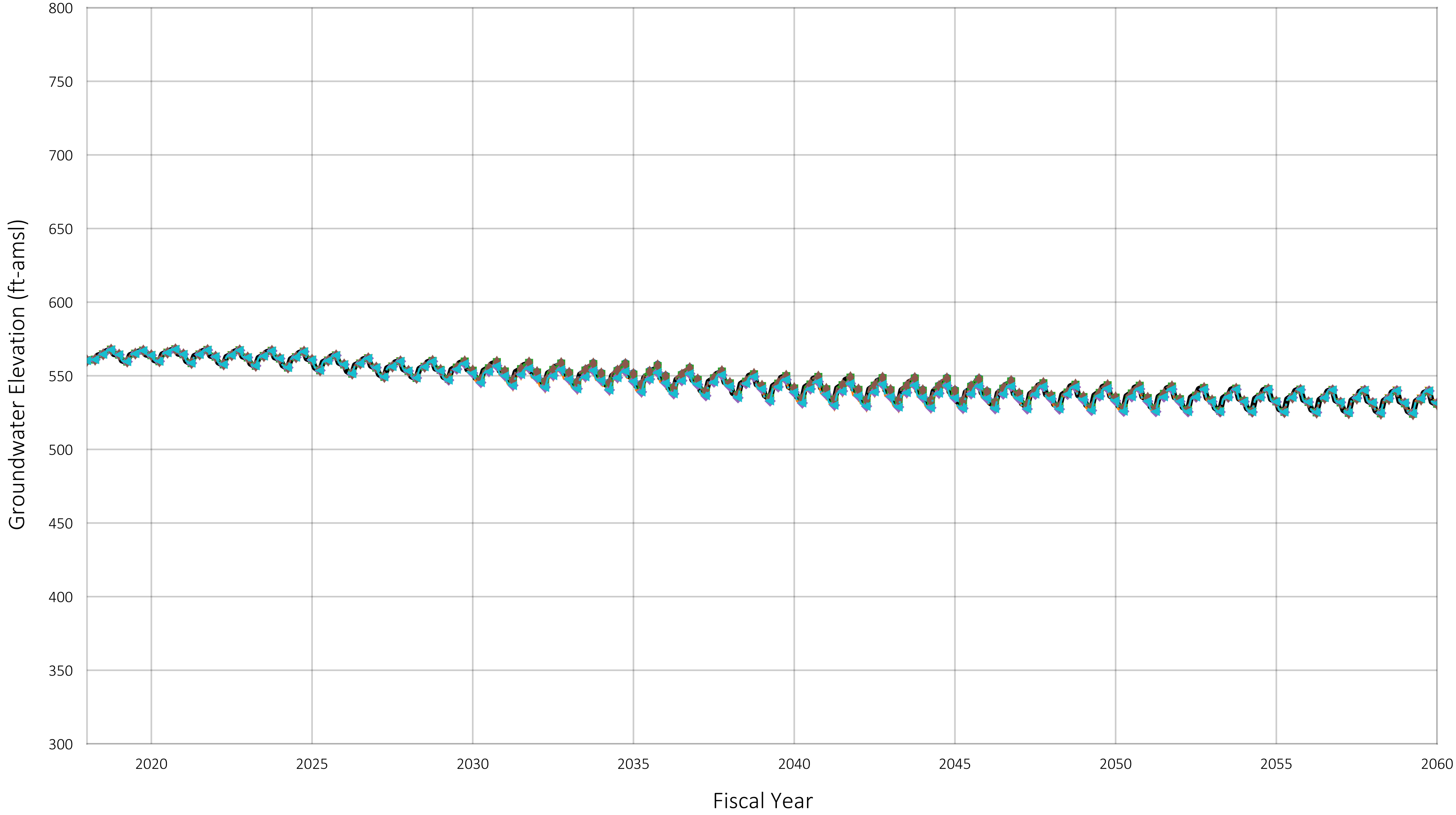
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1234063
Owner: City of Chino
Well Name: 19

Figure A-18



Location of Well in Chino Basin

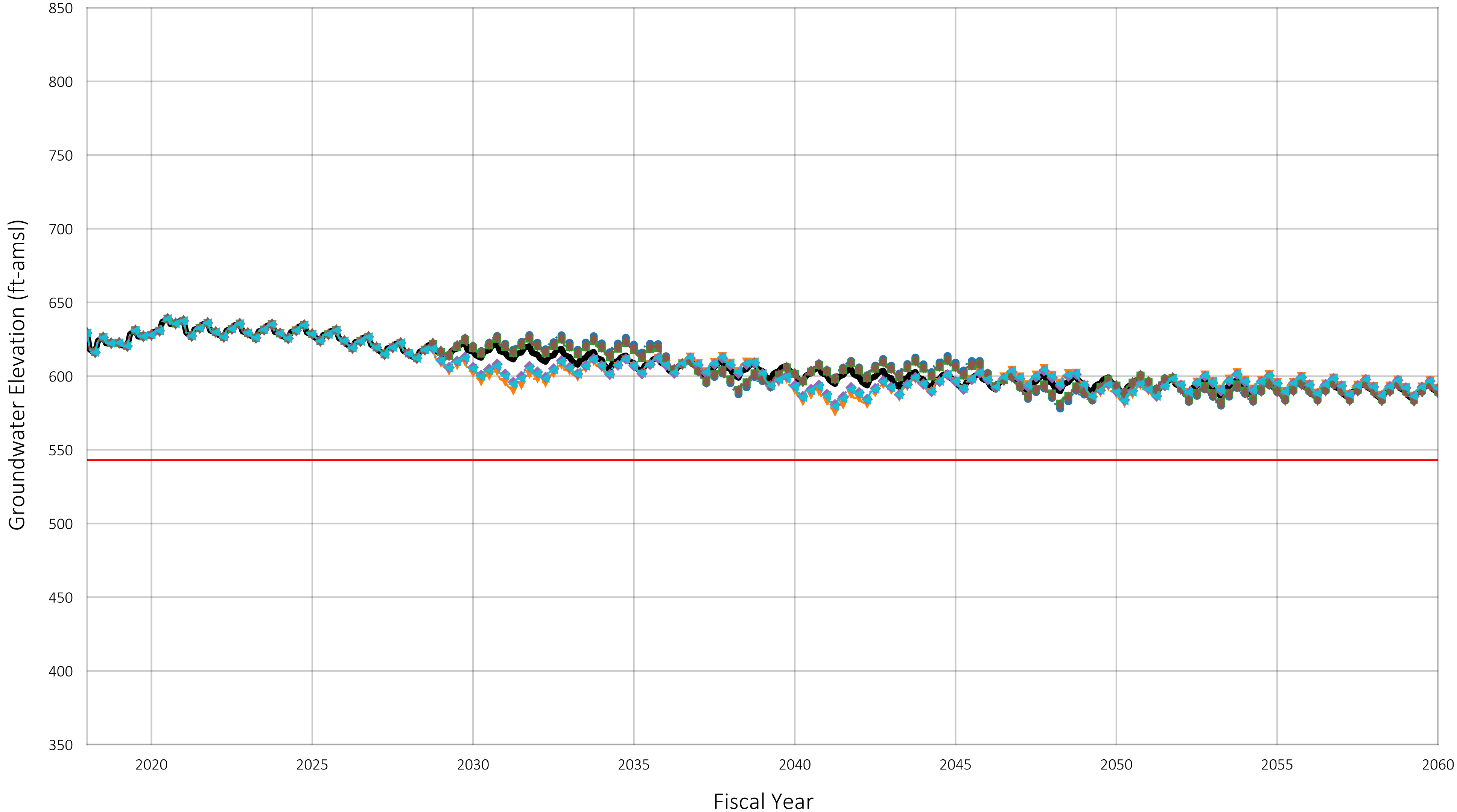
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1224773
Owner: City of Chino
Well Name: 18

Figure A-19



Location of Well in Chino Basin

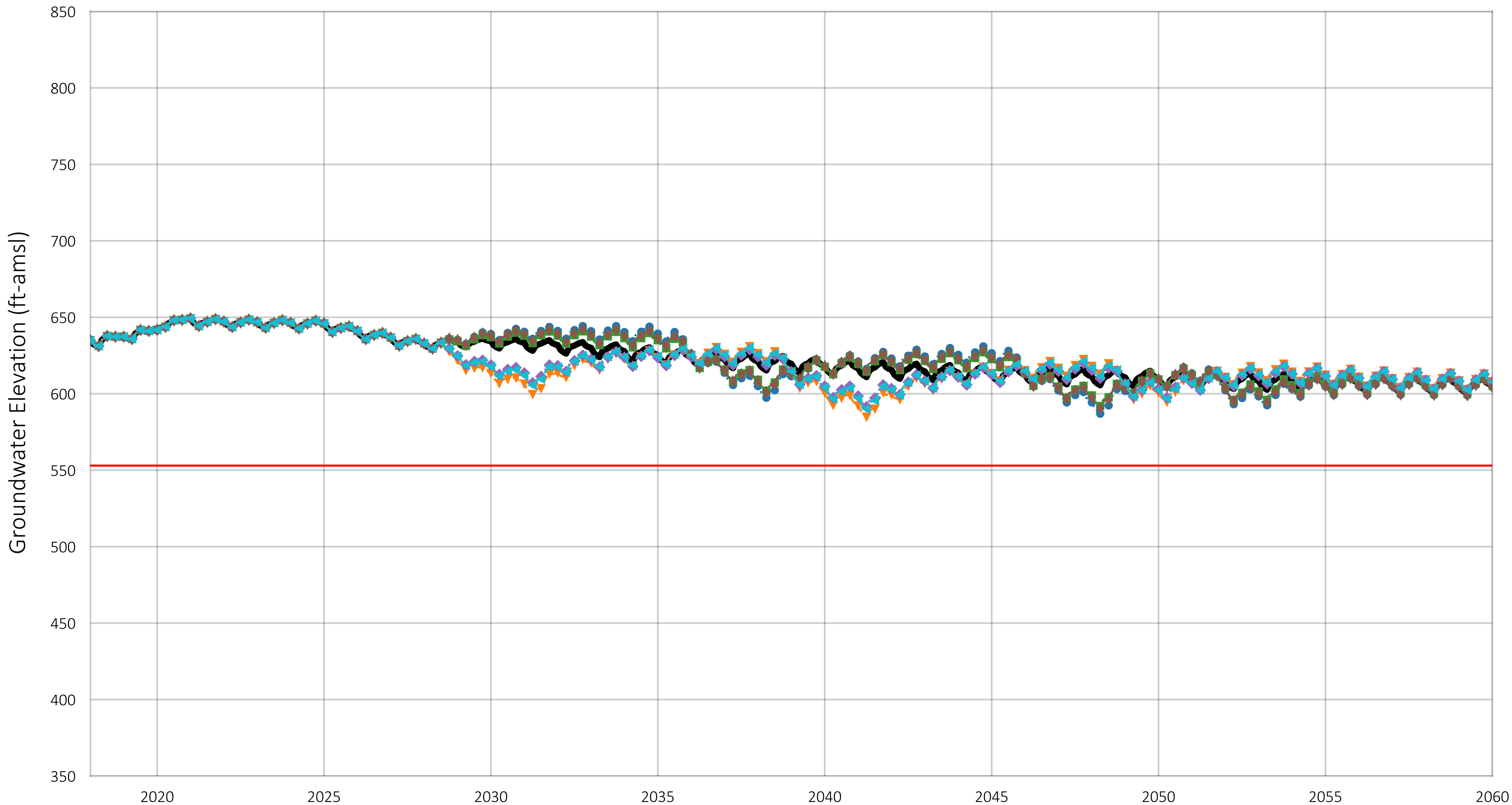
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

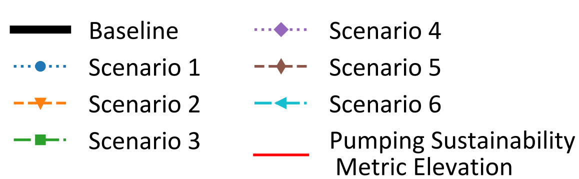
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002309
Owner: Cucamonga Valley Water District
Well Name: CB-1

Figure A-20



Location of Well in Chino Basin

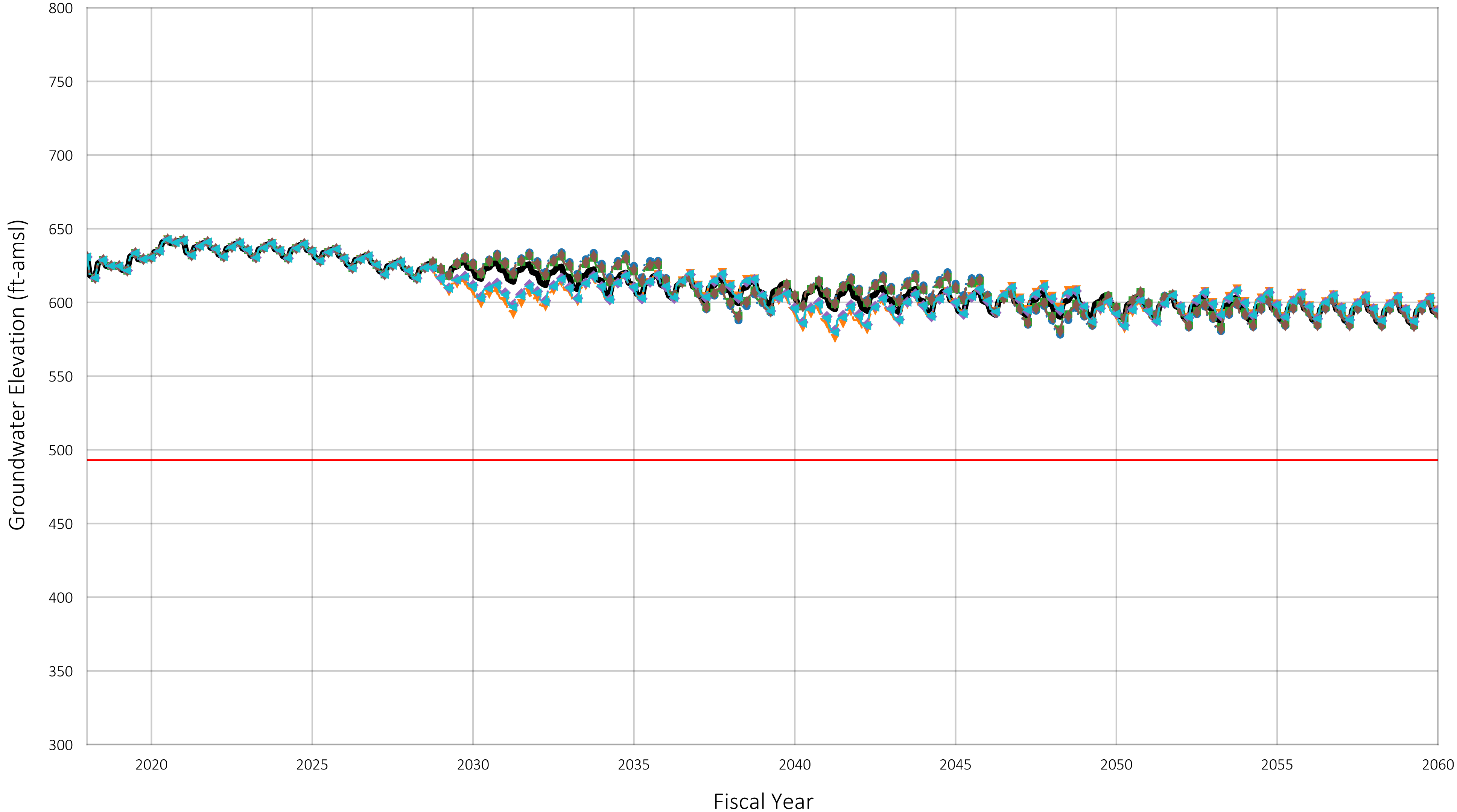


Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002312
Owner: Cucamonga Valley Water District
Well Name: CB-3

Figure A-21



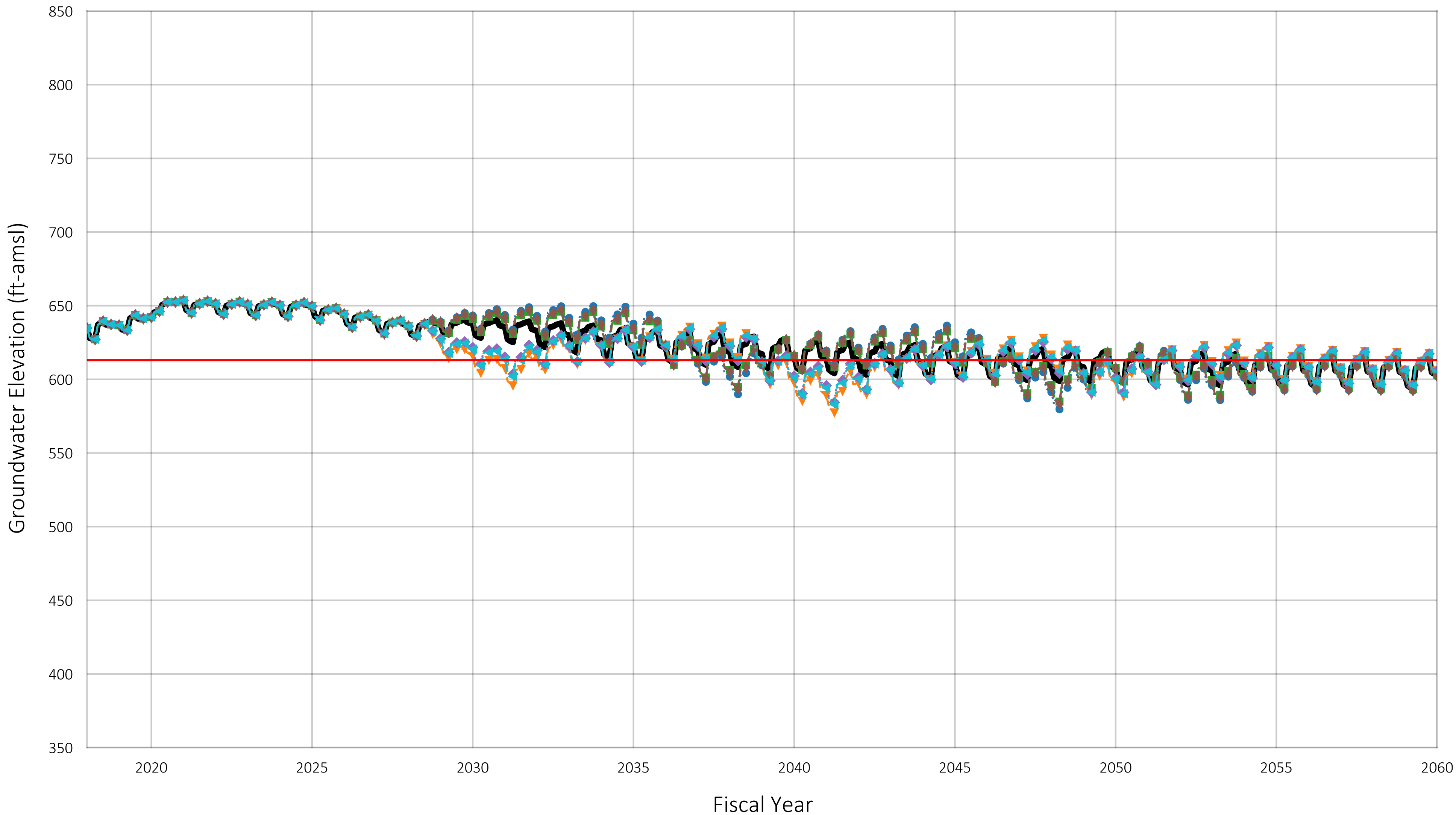
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002307
Owner: Cucamonga Valley Water District
Well Name: CB-4

Figure A-22



Location of Well in Chino Basin

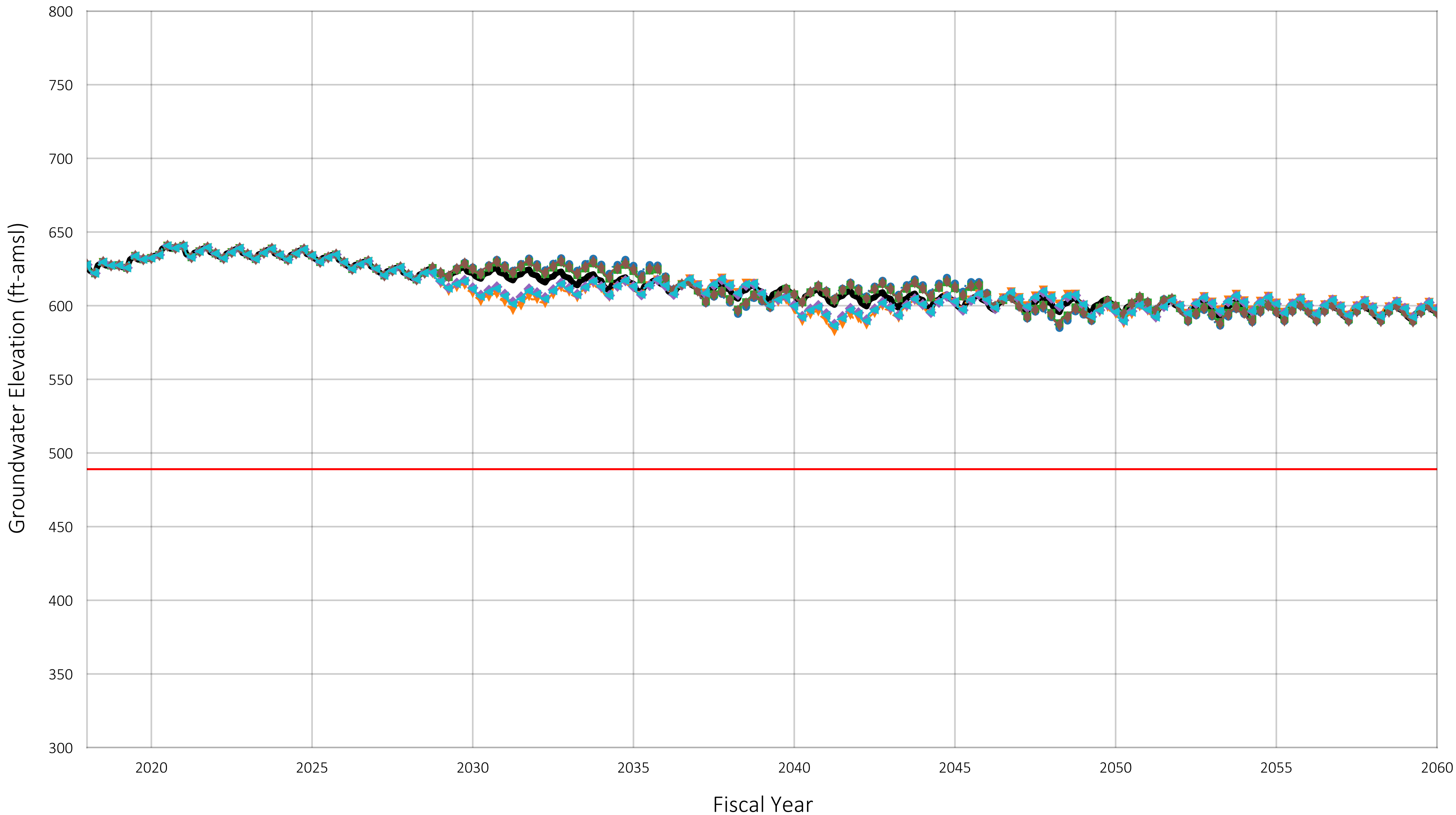
Baseline	Scenario 4
Scenario 1	Scenario 5
Scenario 2	Scenario 6
Scenario 3	Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002311
Owner: Cucamonga Valley Water District
Well Name: CB-5

Figure A-23



Location of Well in Chino Basin

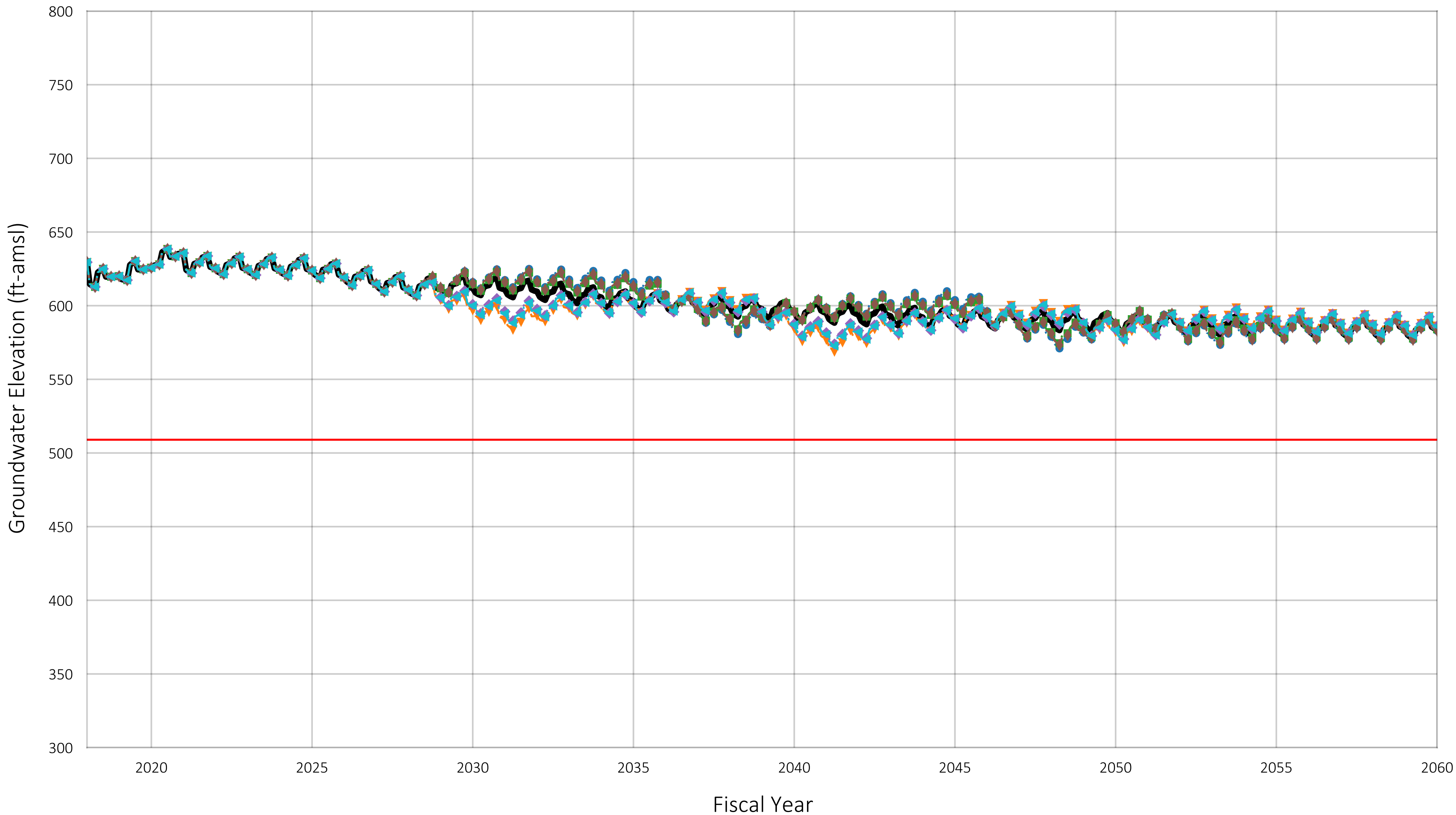
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002308
Owner: Cucamonga Valley Water District
Well Name: CB-30

Figure A-24



Location of Well in Chino Basin

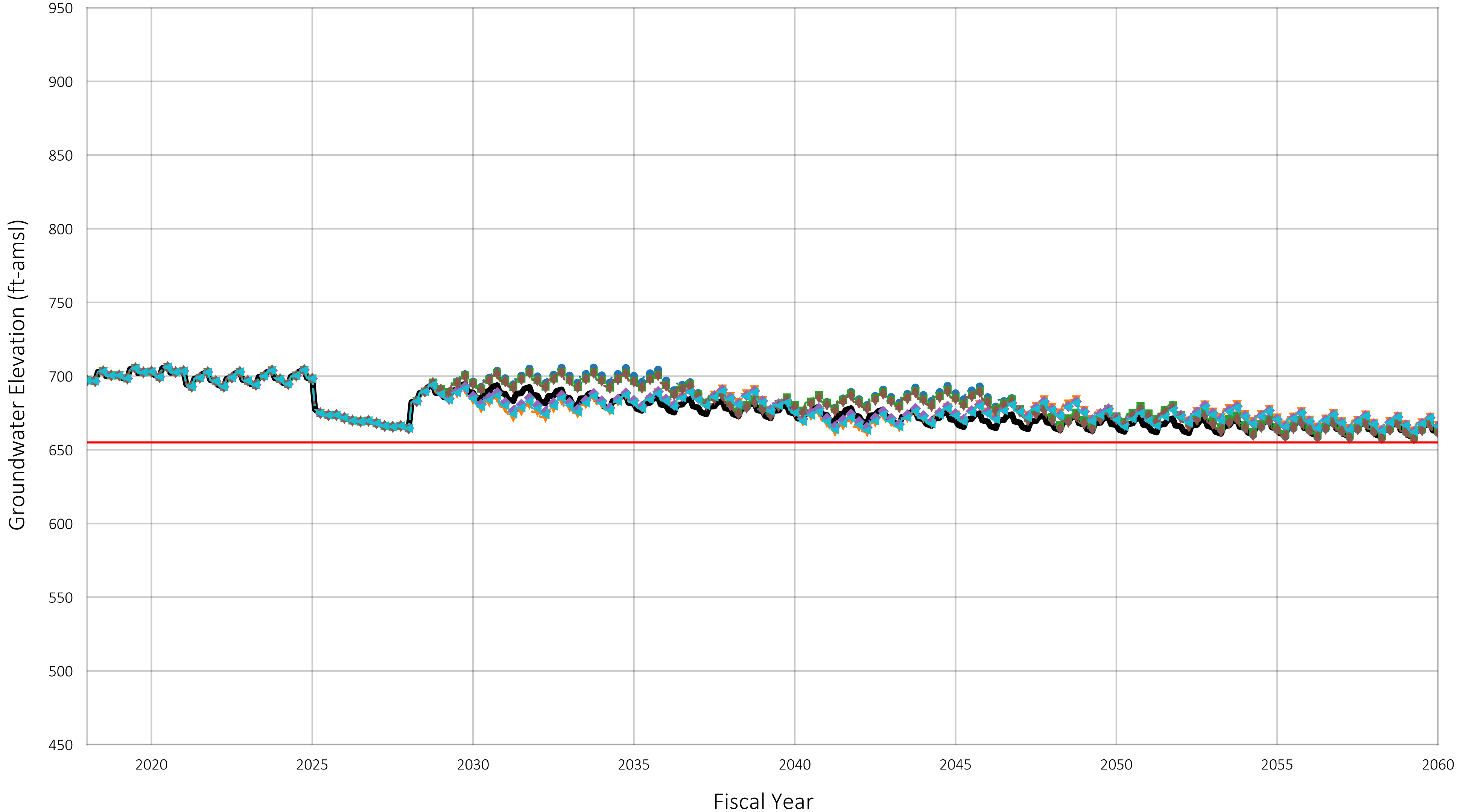
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

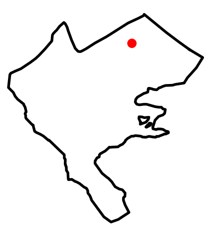
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206753
Owner: Cucamonga Valley Water District
Well Name: CB-38

Figure A-25



Location of Well in Chino Basin



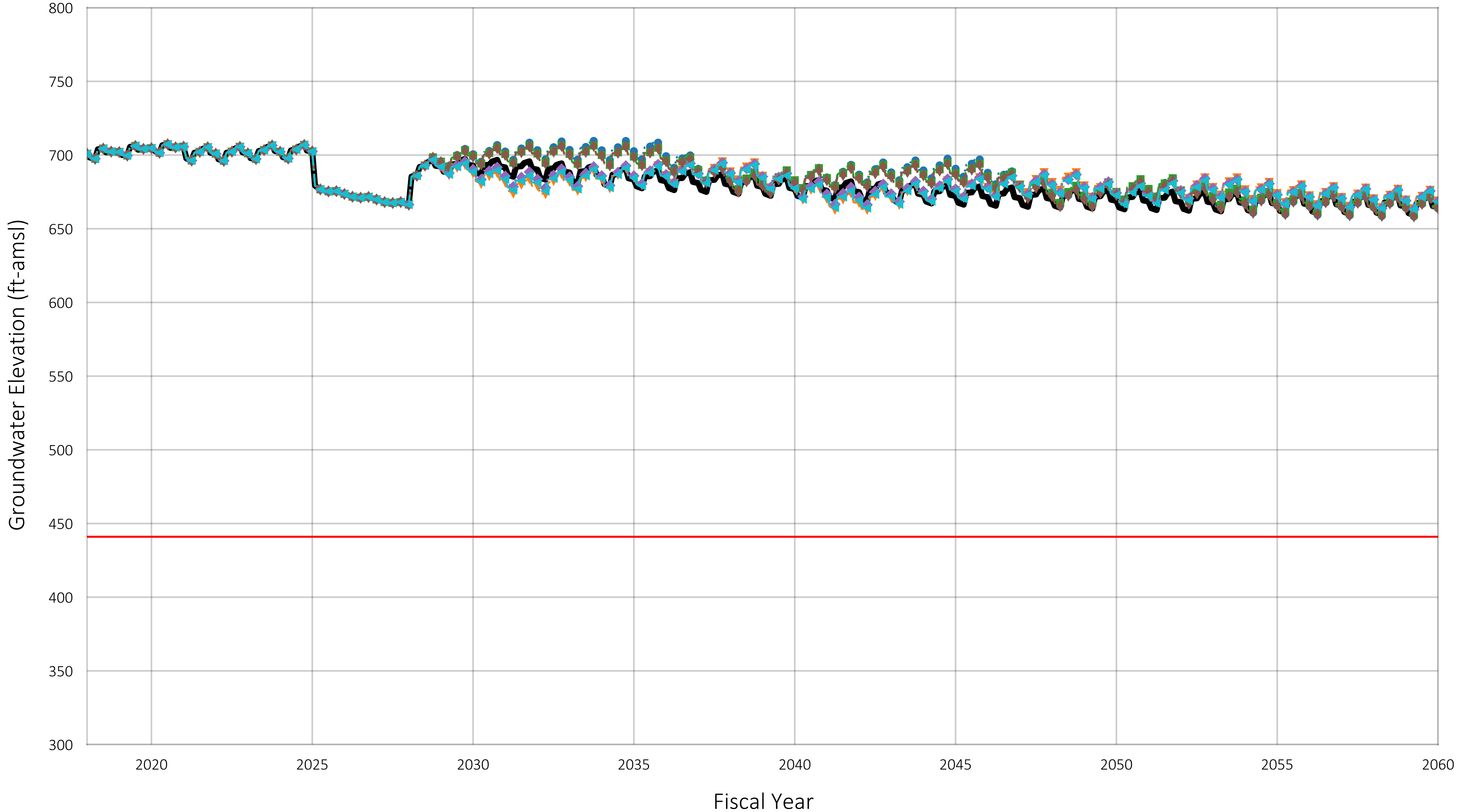
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

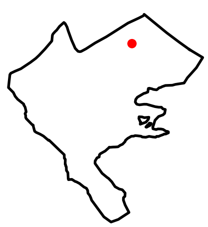
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207928
Owner: Cucamonga Valley Water District
Well Name: CB-39

Figure A-26



Location of Well in Chino Basin



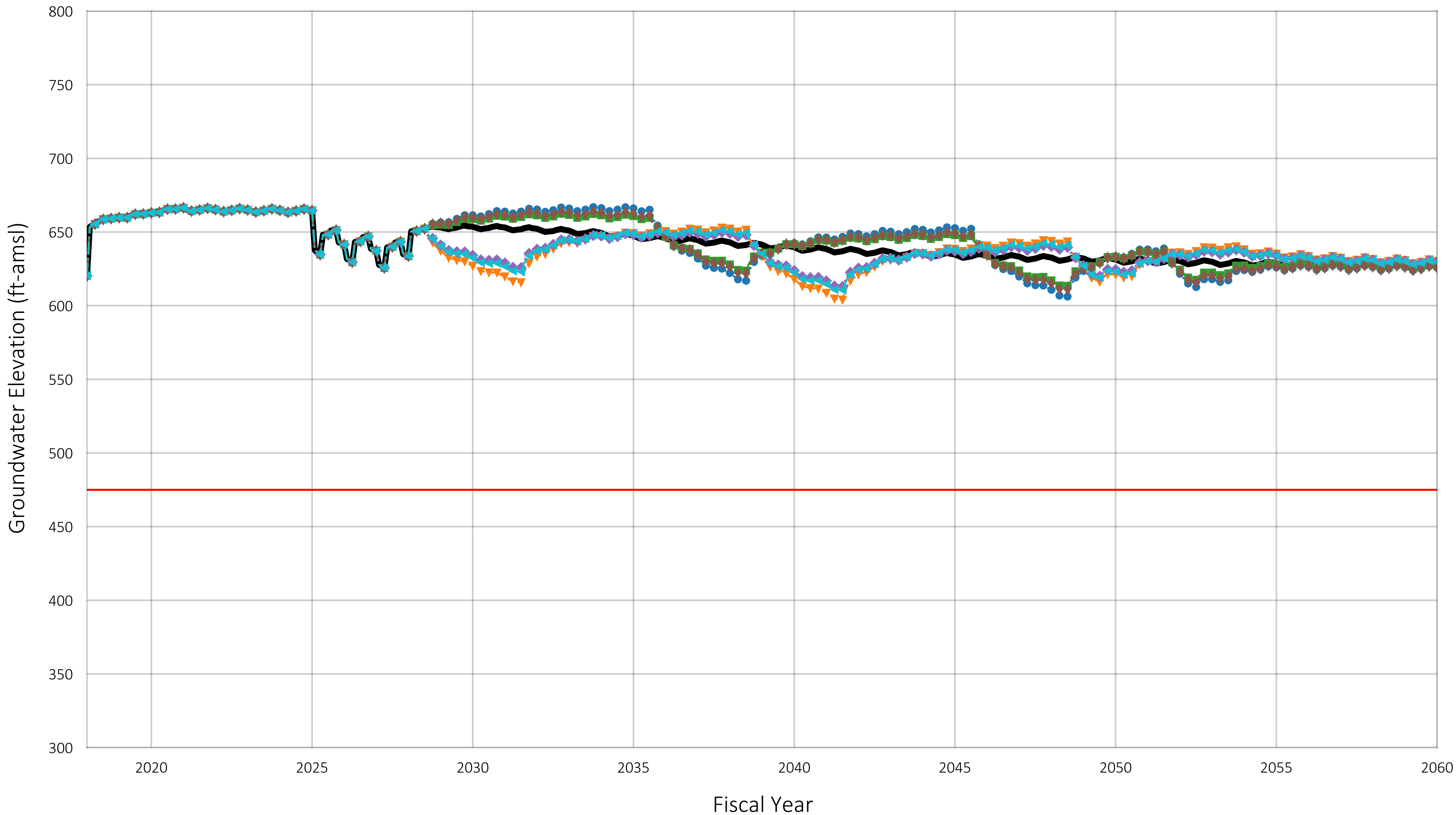
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207929
Owner: Cucamonga Valley Water District
Well Name: CB-40

Figure A-27



Location of Well in Chino Basin

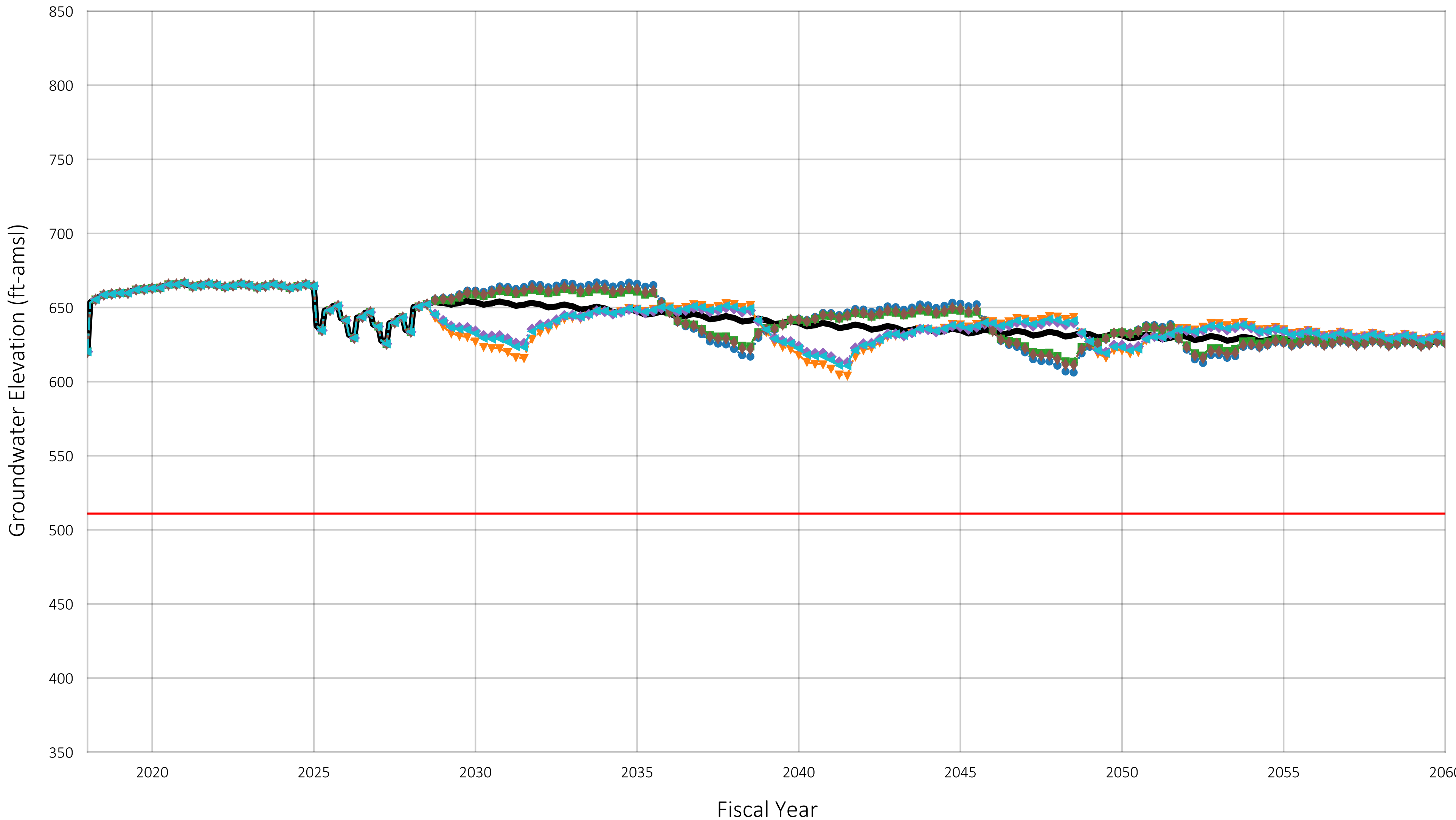
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

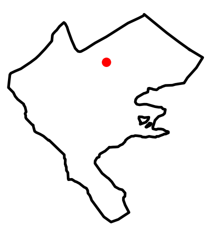
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207936
Owner: Cucamonga Valley Water District
Well Name: CB-41

Figure A-28



Location of Well in Chino Basin



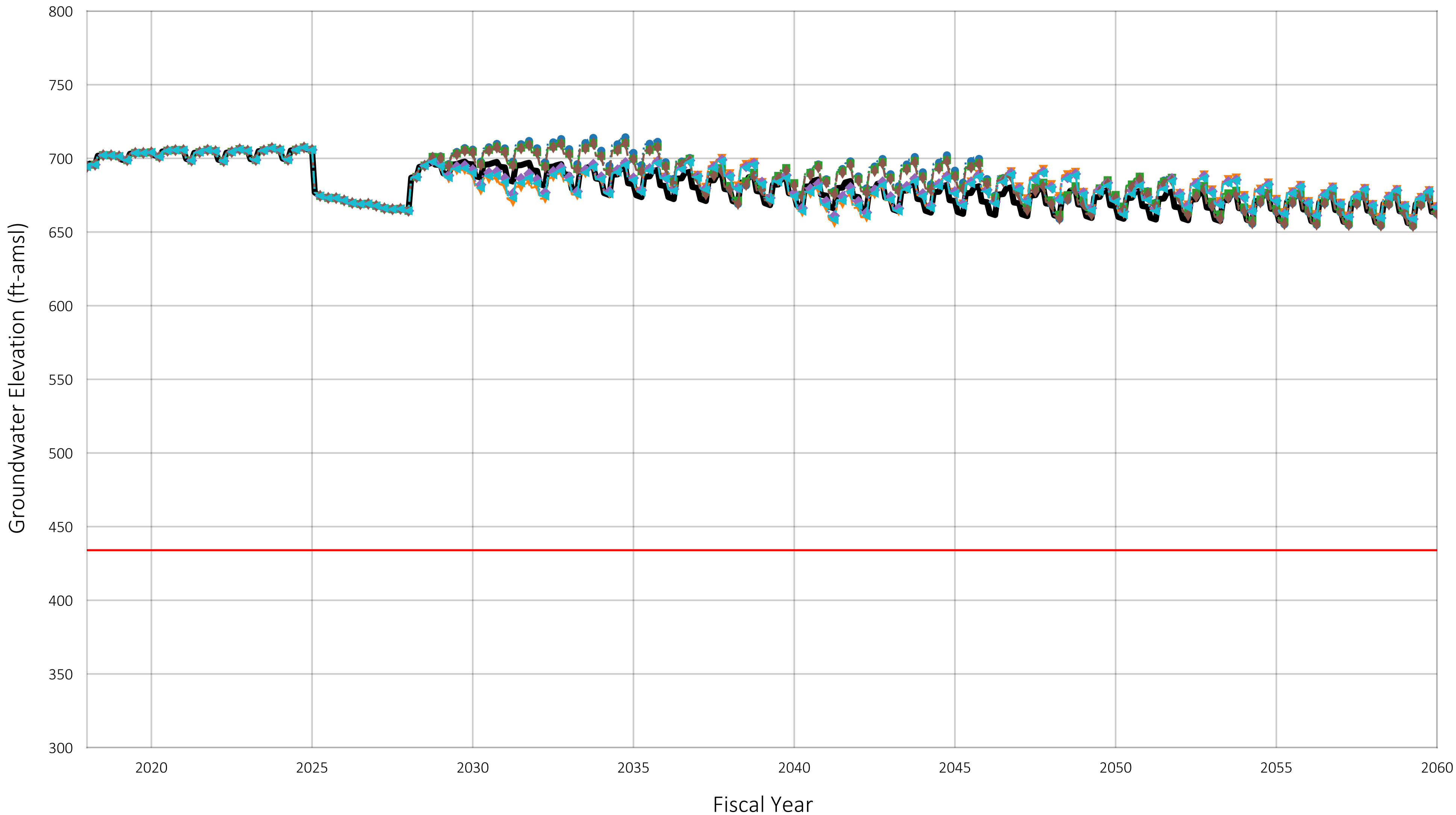
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207937
Owner: Cucamonga Valley Water District
Well Name: CB-42

Figure A-29



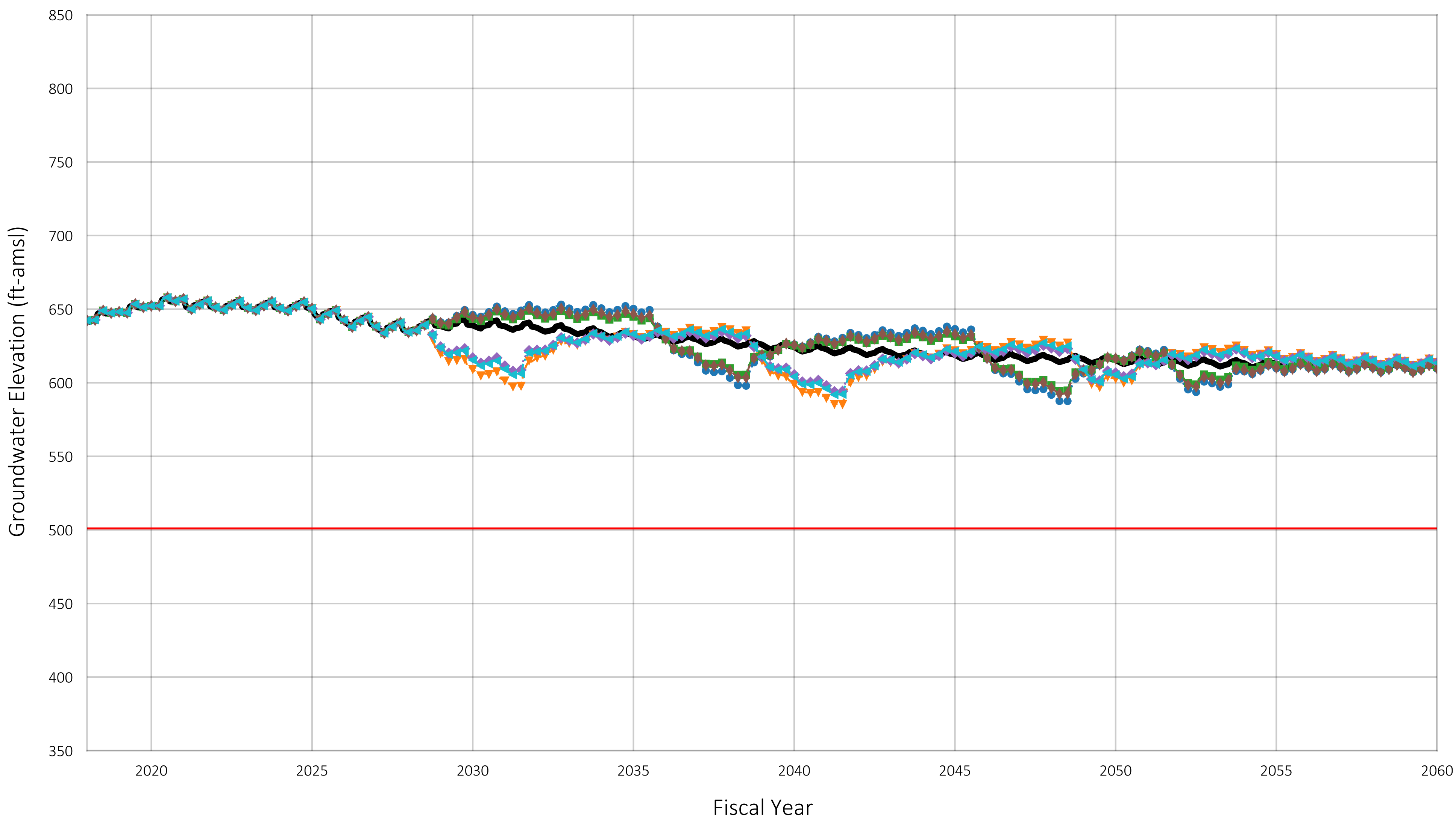
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220079
Owner: Cucamonga Valley Water District
Well Name: CB-43

Figure A-30



Location of Well in Chino Basin

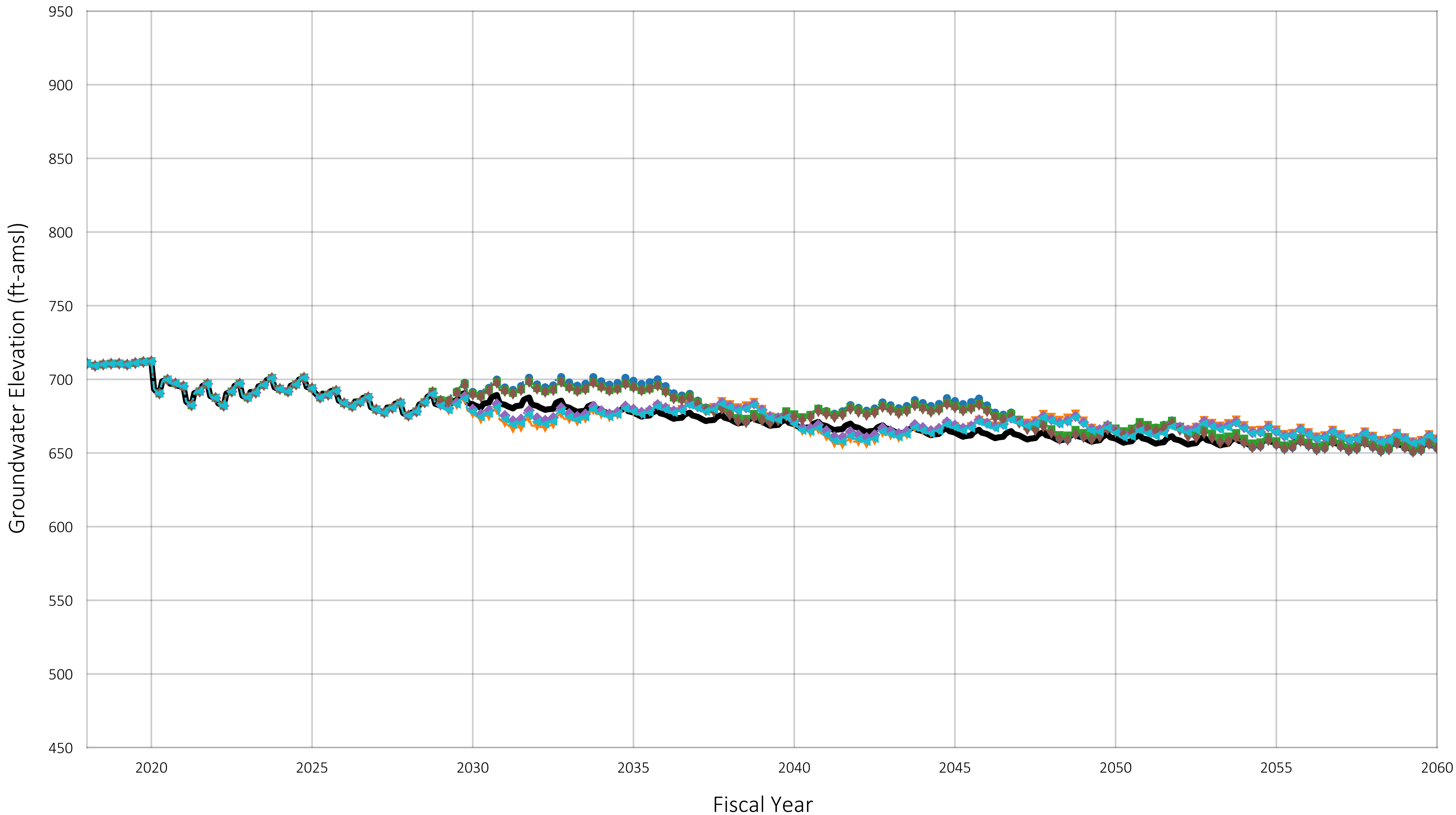
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

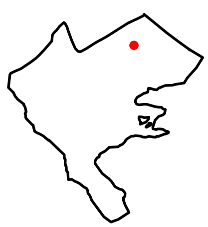
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220080
Owner: Cucamonga Valley Water District
Well Name: CB-46

Figure A-31



Location of Well in Chino Basin



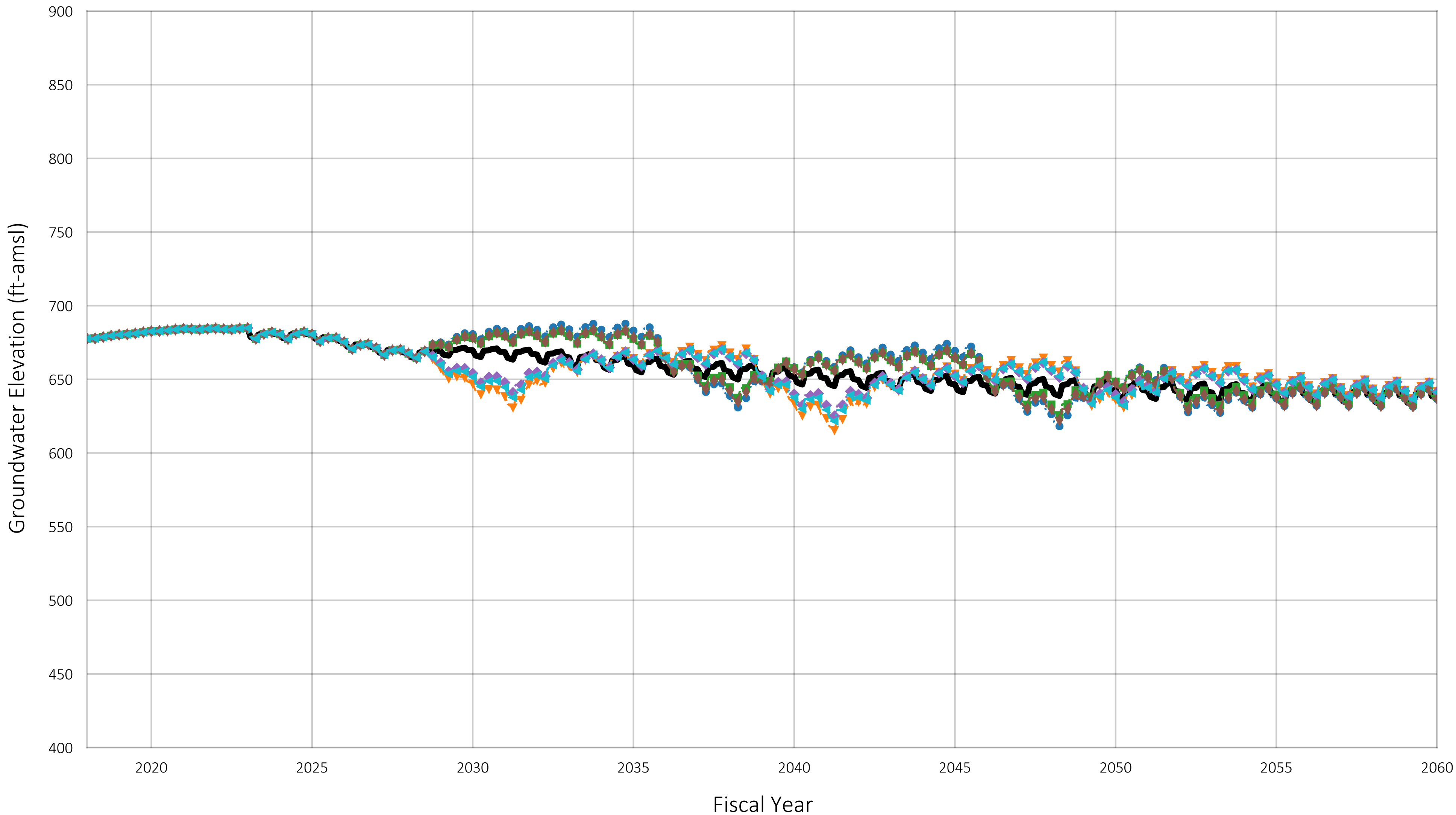
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 999948
Owner: Cucamonga Valley Water District
Well Name: CB-48

Figure A-32



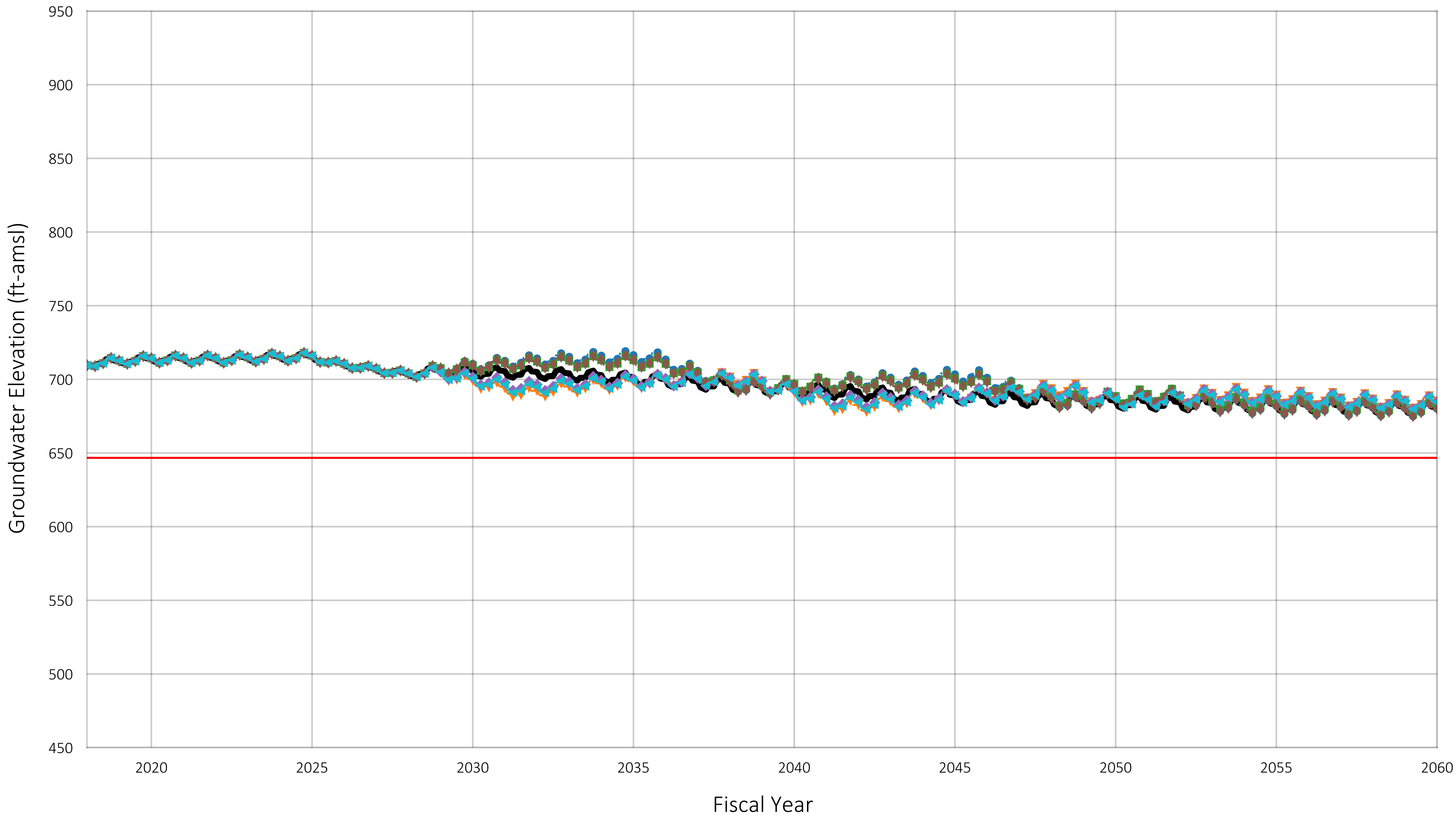
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 999950
Owner: Cucamonga Valley Water District
Well Name: CB-50

Figure A-33



Location of Well in Chino Basin

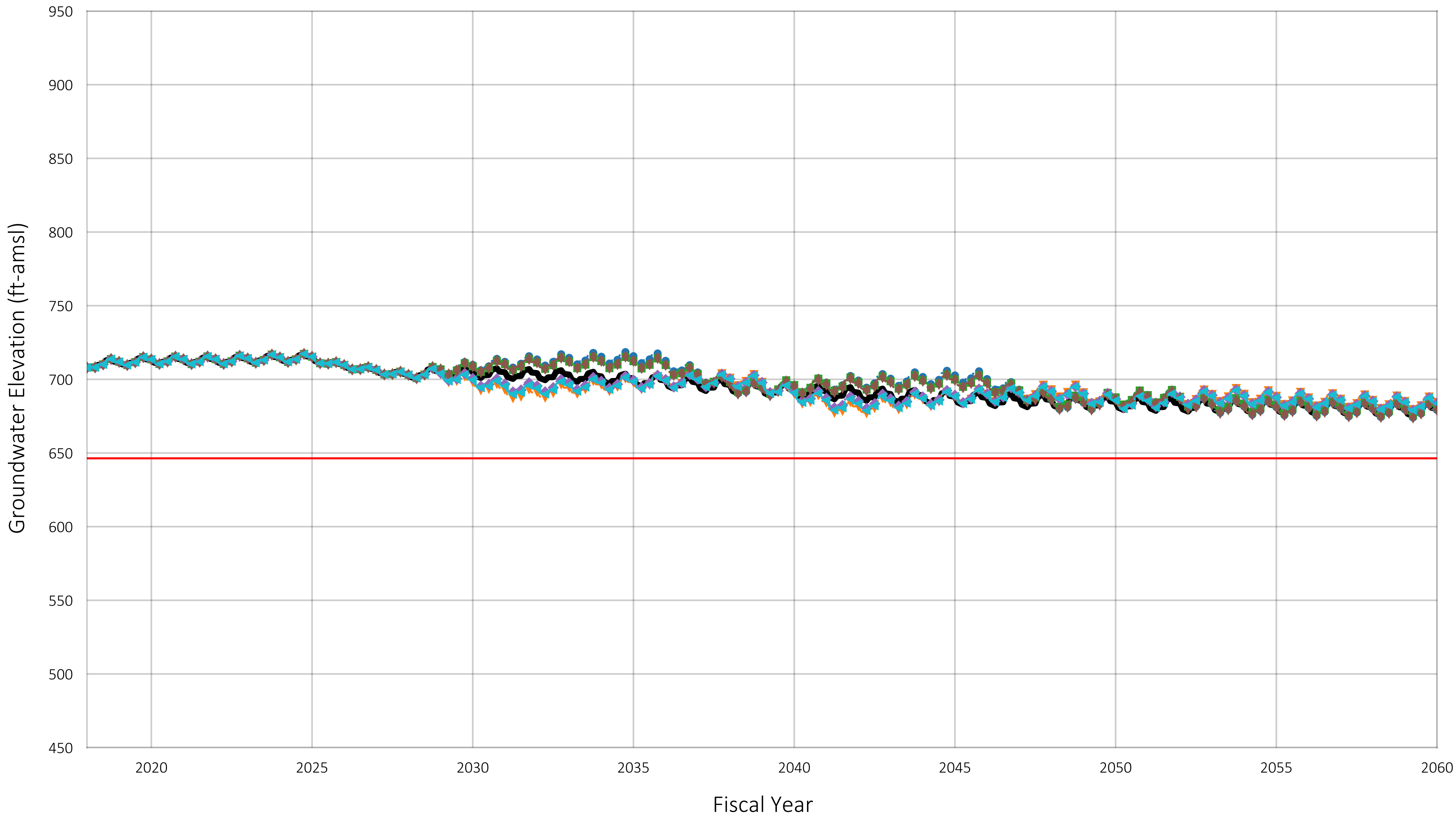
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

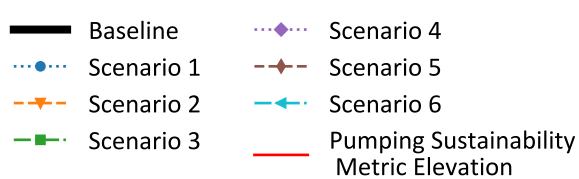
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002211
Owner: Fontana Water Company
Well Name: F7A

Figure A-34



Location of Well in Chino Basin

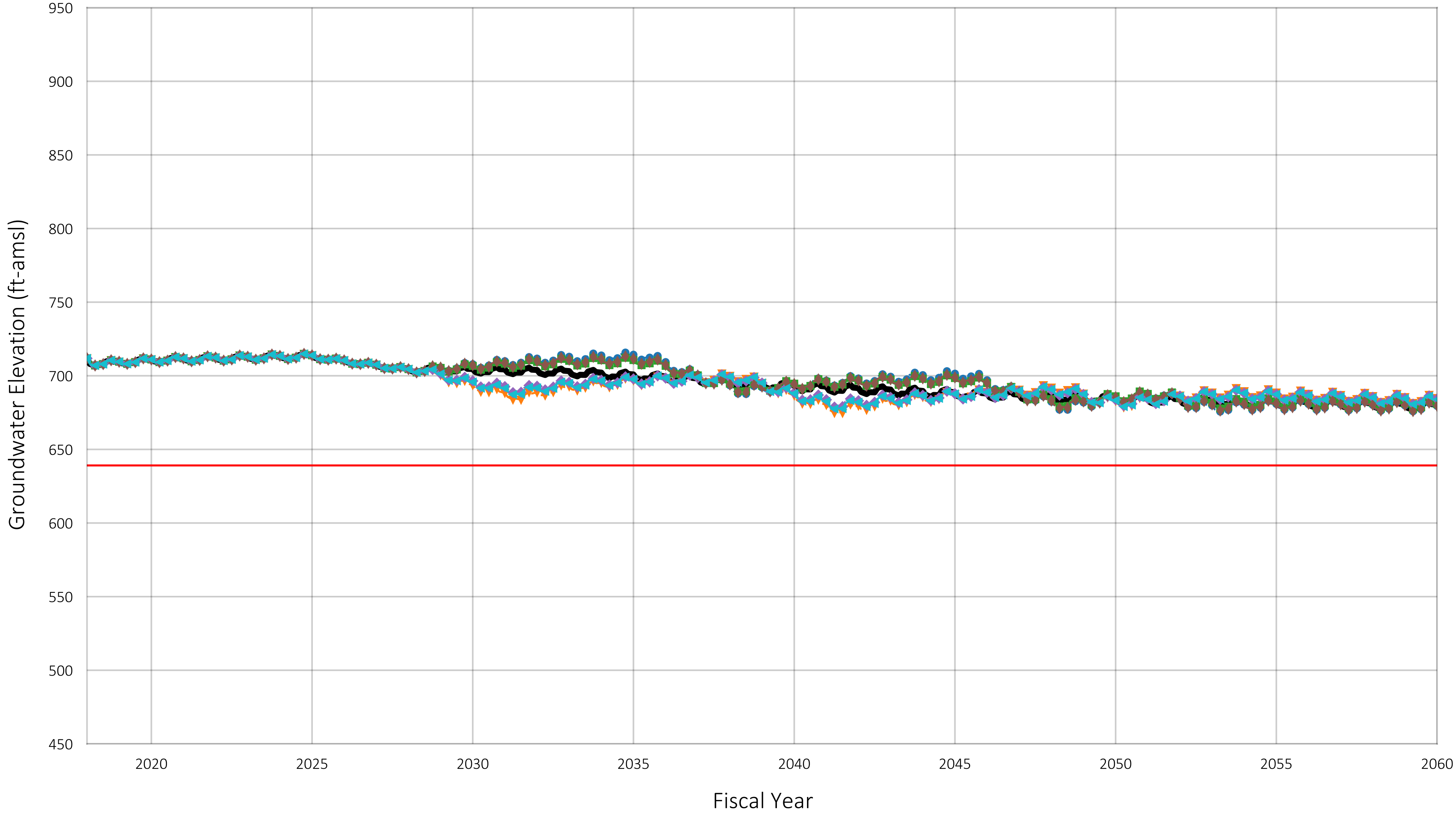


Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1221726
Owner: Fontana Water Company
Well Name: F7B

Figure A-35



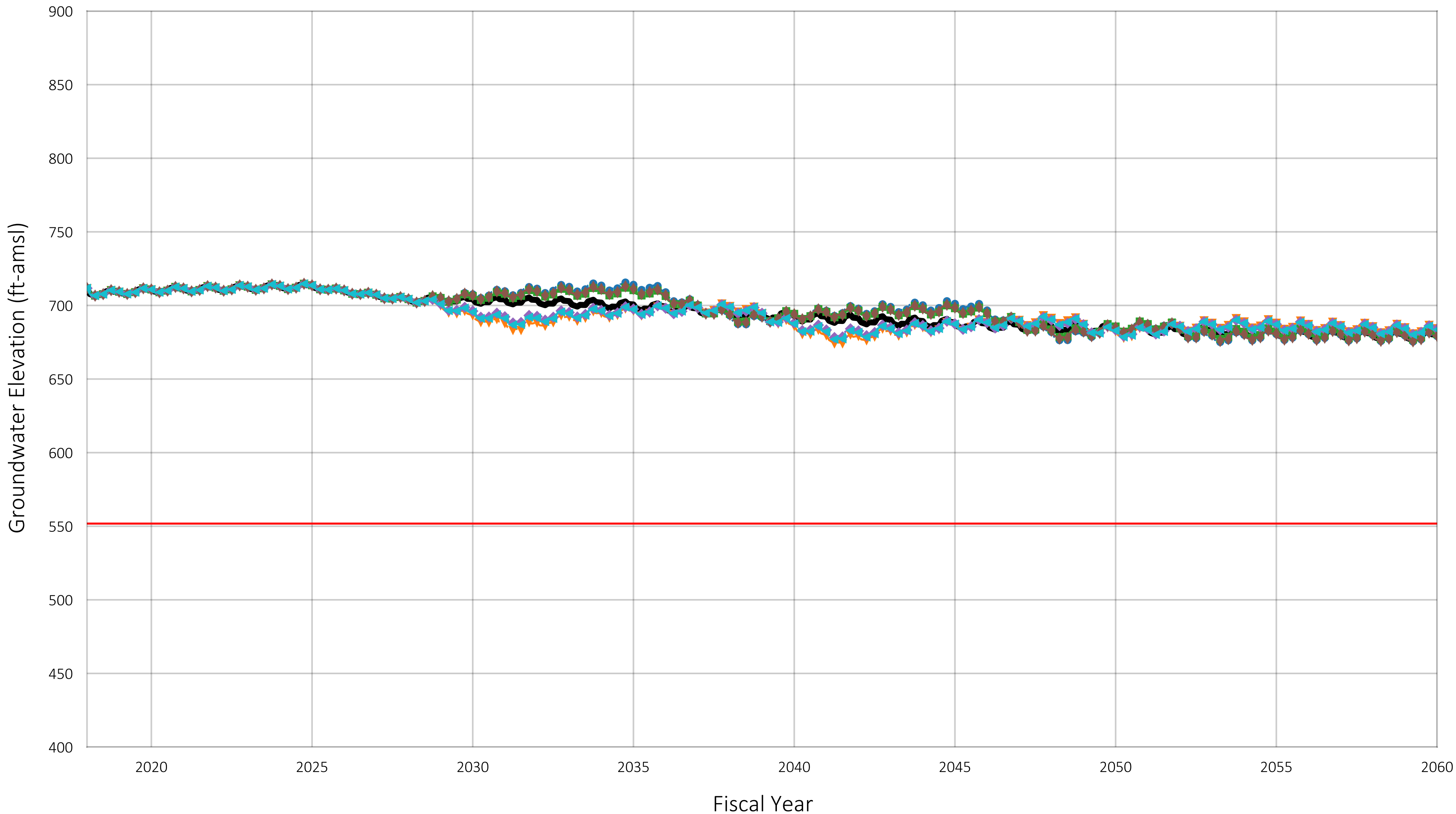
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002237
Owner: Fontana Water Company
Well Name: F17B

Figure A-36



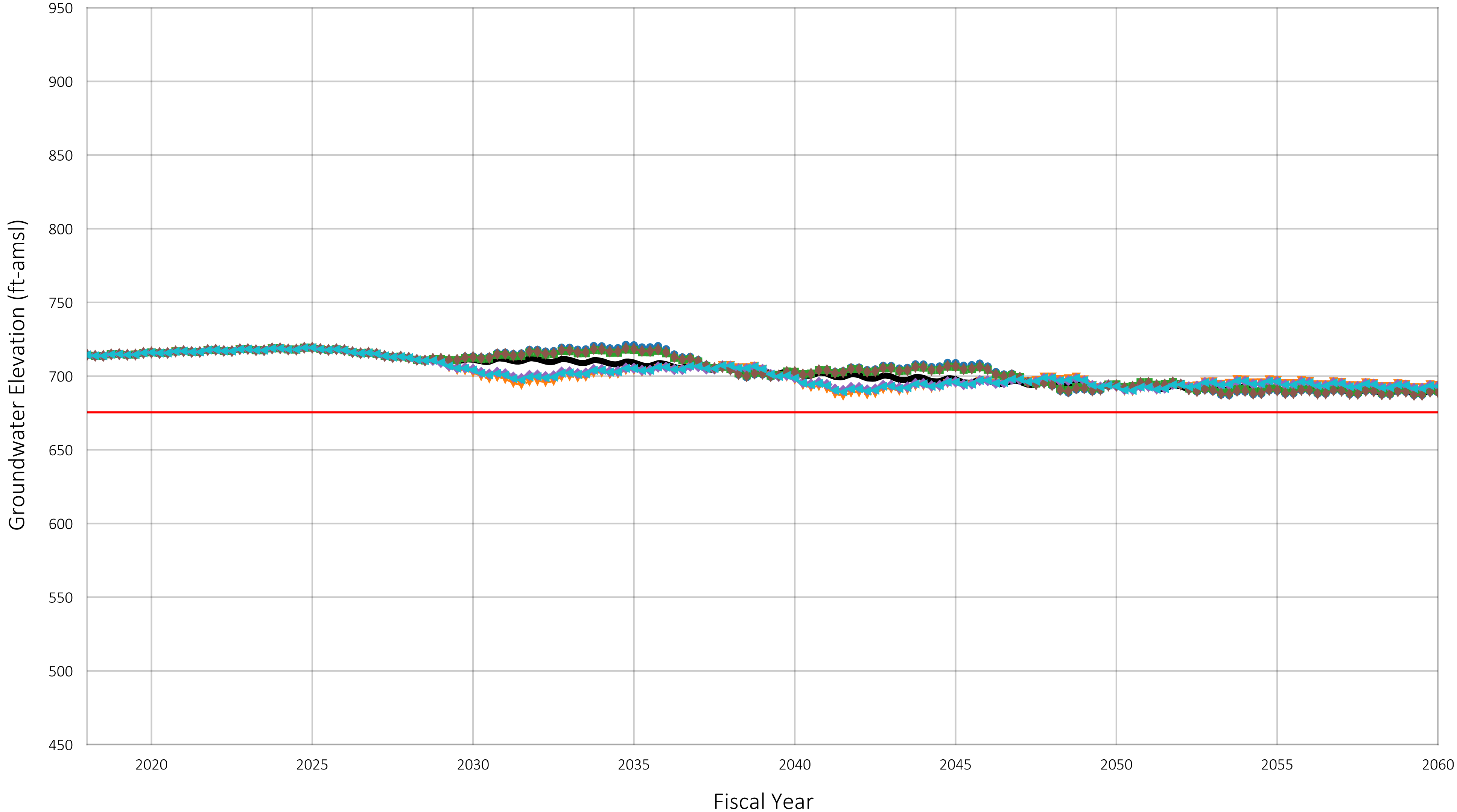
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1201069
Owner: Fontana Water Company
Well Name: F17C

Figure A-37



Location of Well in Chino Basin

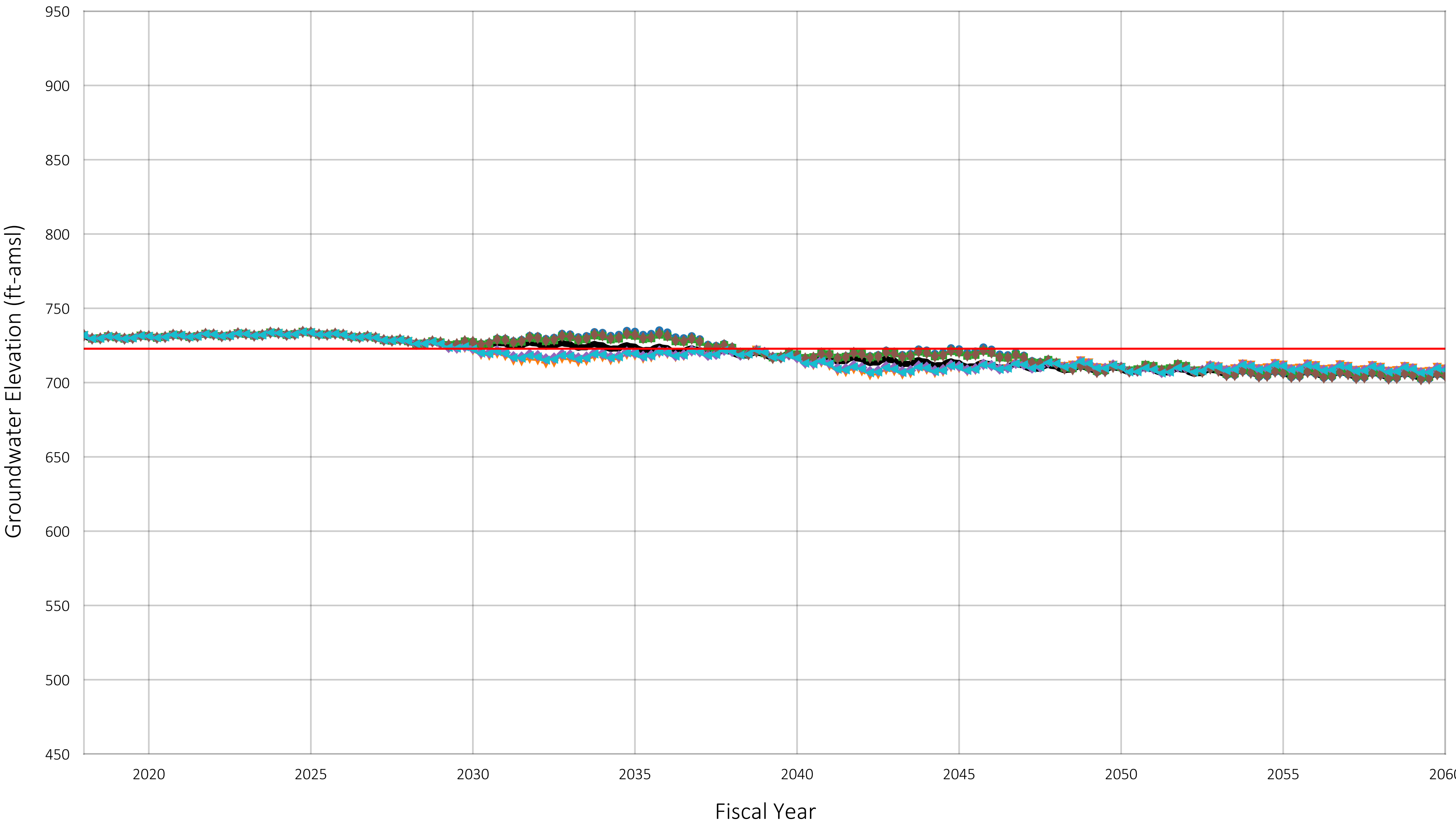
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1232847
Owner: Fontana Water Company
Well Name: F21B

Figure A-38



Location of Well in Chino Basin

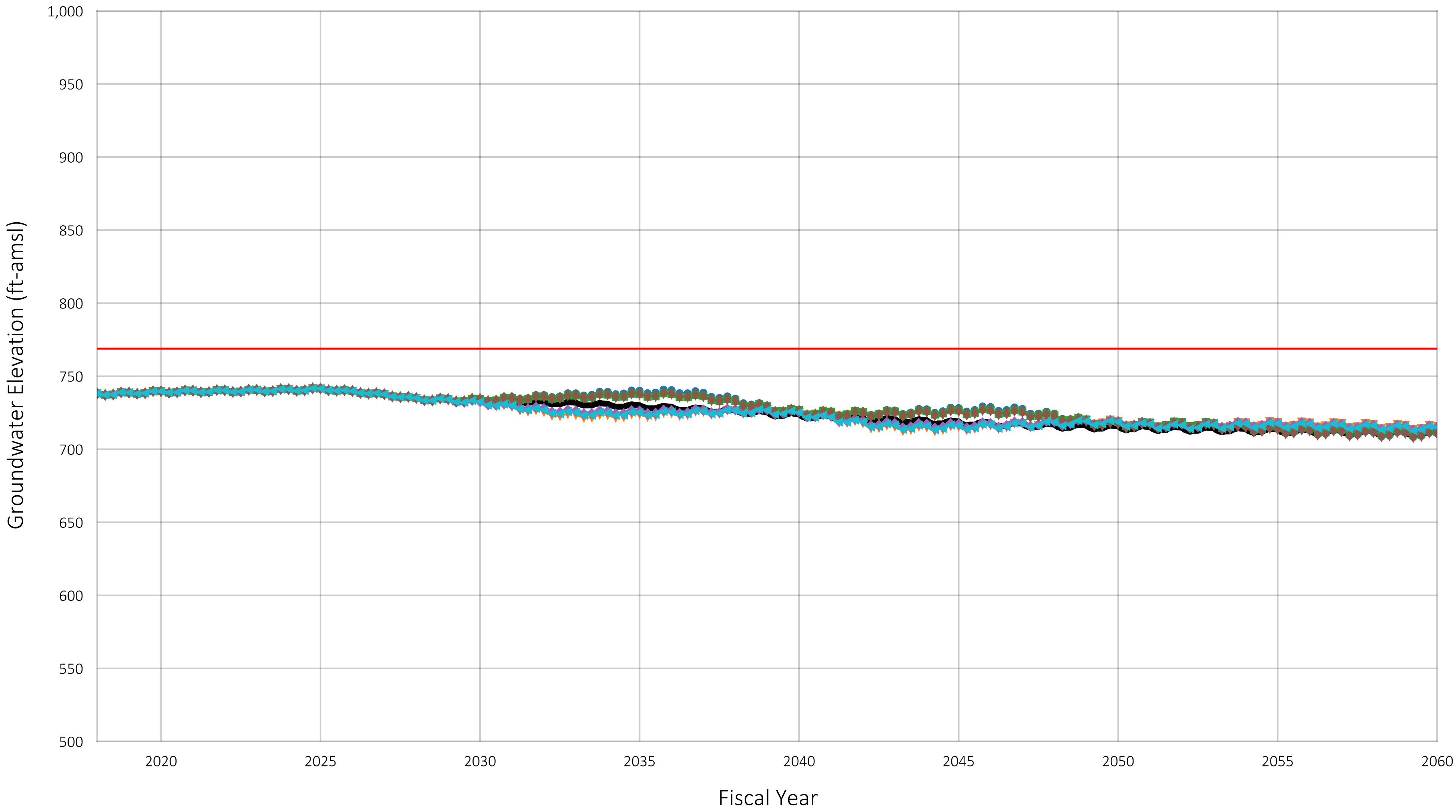
Prepared by:

WEST YOST
Water. Engineered

Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1002239
Owner: Fontana Water Company
Well Name: F23A

Figure A-39



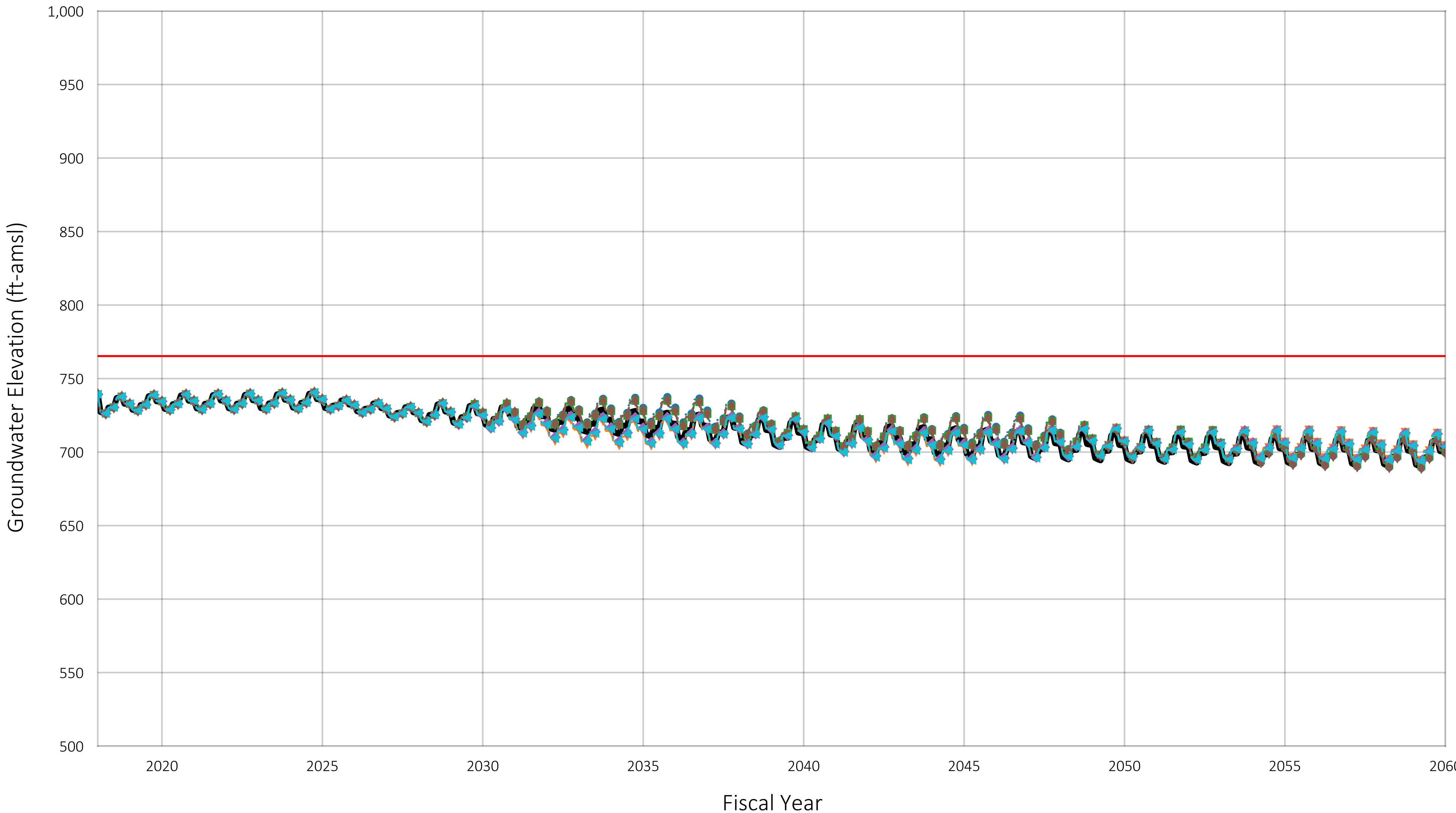
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1200218
Owner: Fontana Water Company
Well Name: F24A

Figure A-40



Location of Well in Chino Basin

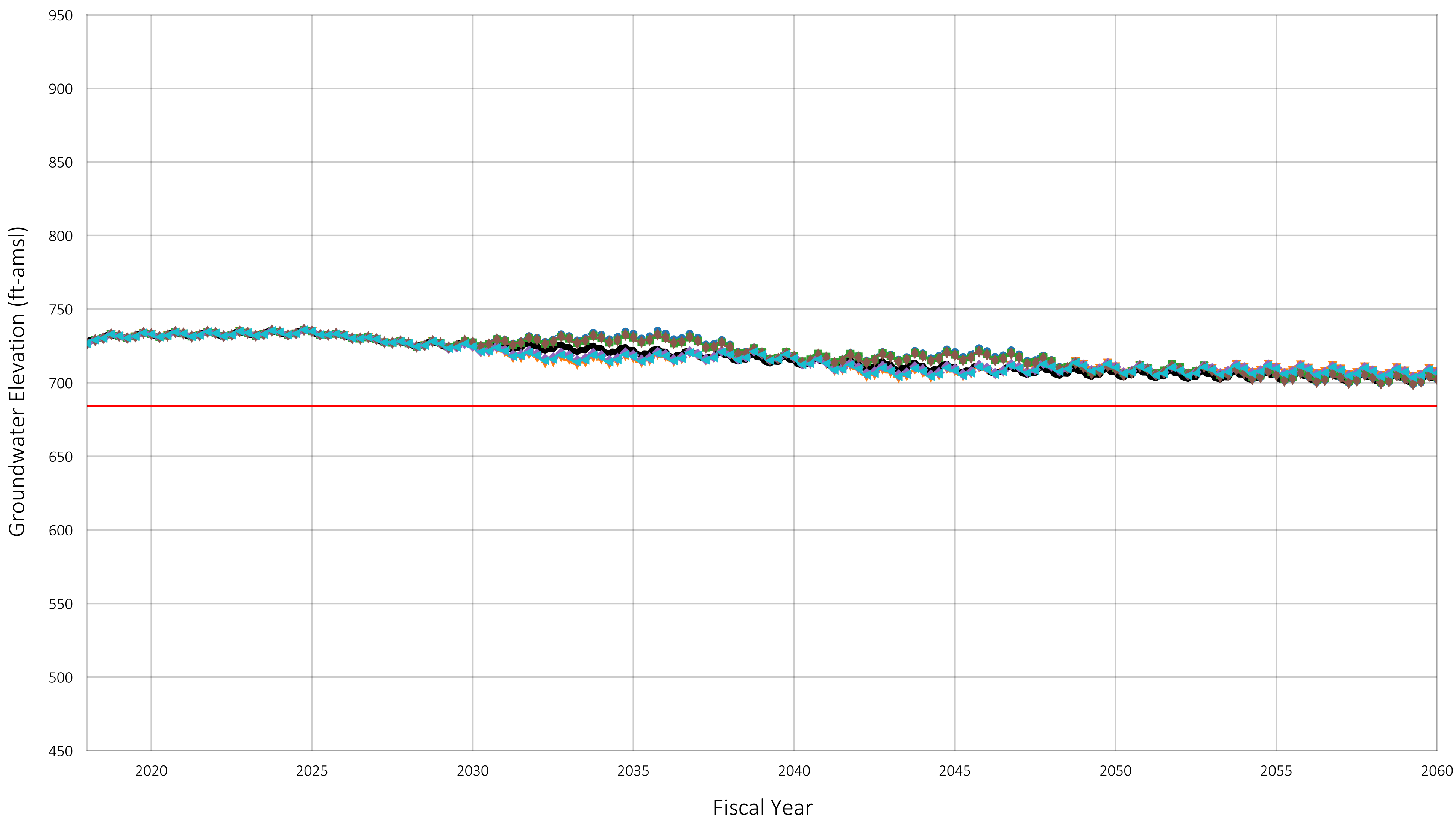
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

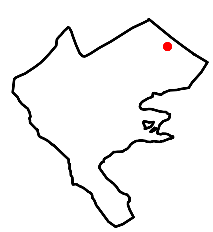
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1200219
Owner: Fontana Water Company
Well Name: F26A

Figure A-41



Location of Well in Chino Basin



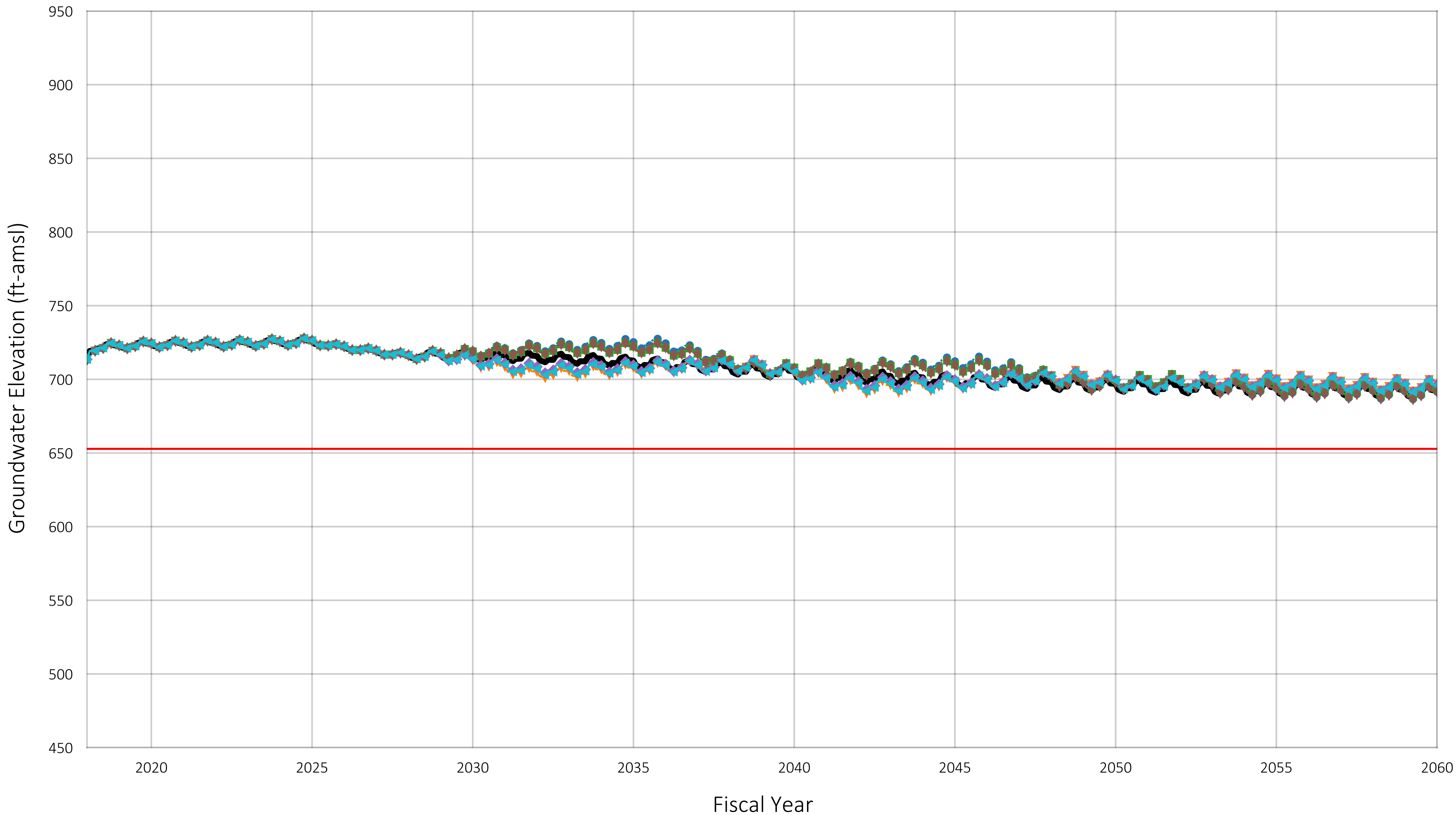
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

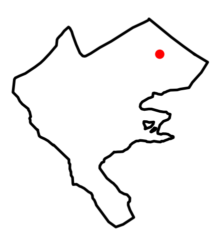
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002081
Owner: Fontana Water Company
Well Name: F31A

Figure A-42



Location of Well in Chino Basin



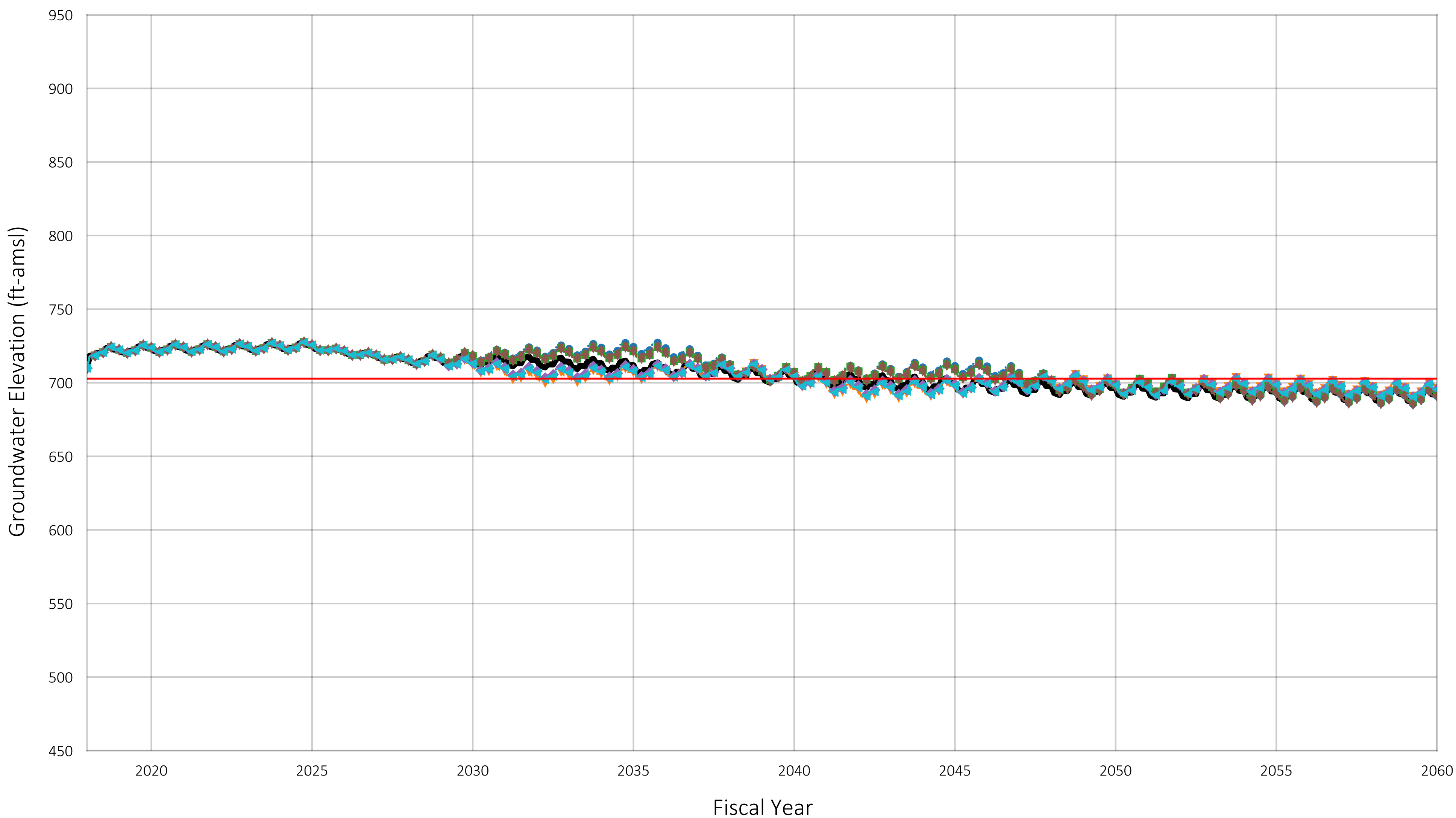
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

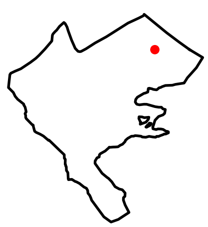
WEST YOST Water. Engineered

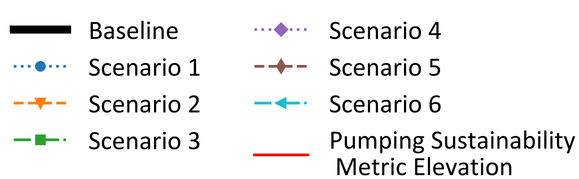
Projected Groundwater Elevation
Well ID#: 1206933
Owner: Fontana Water Company
Well Name: F44A

Figure A-43



Location of Well in Chino Basin



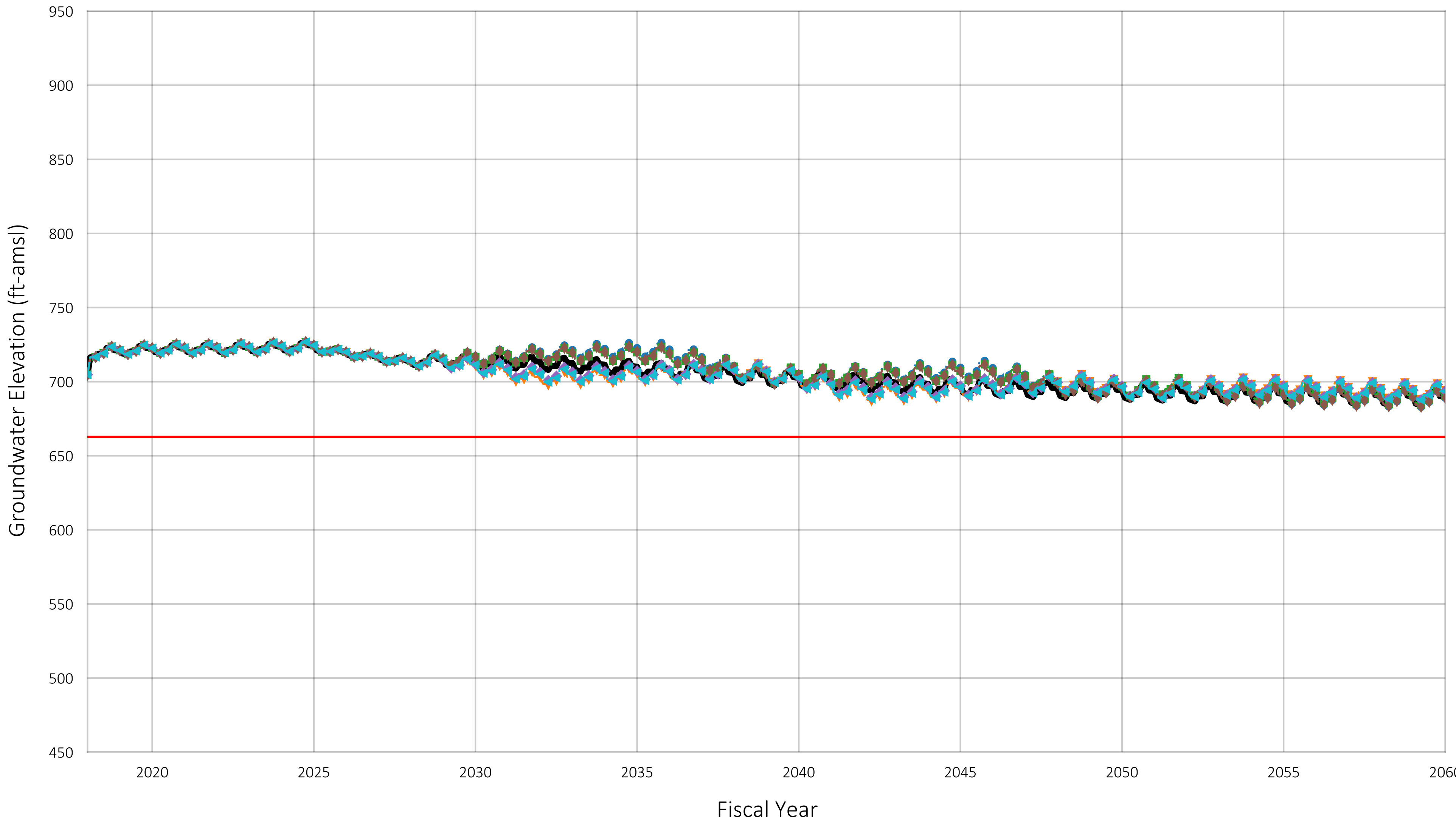


Prepared by:

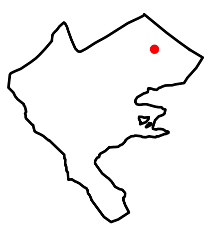
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207340
Owner: Fontana Water Company
Well Name: F44B

Figure A-44



Location of Well in Chino Basin



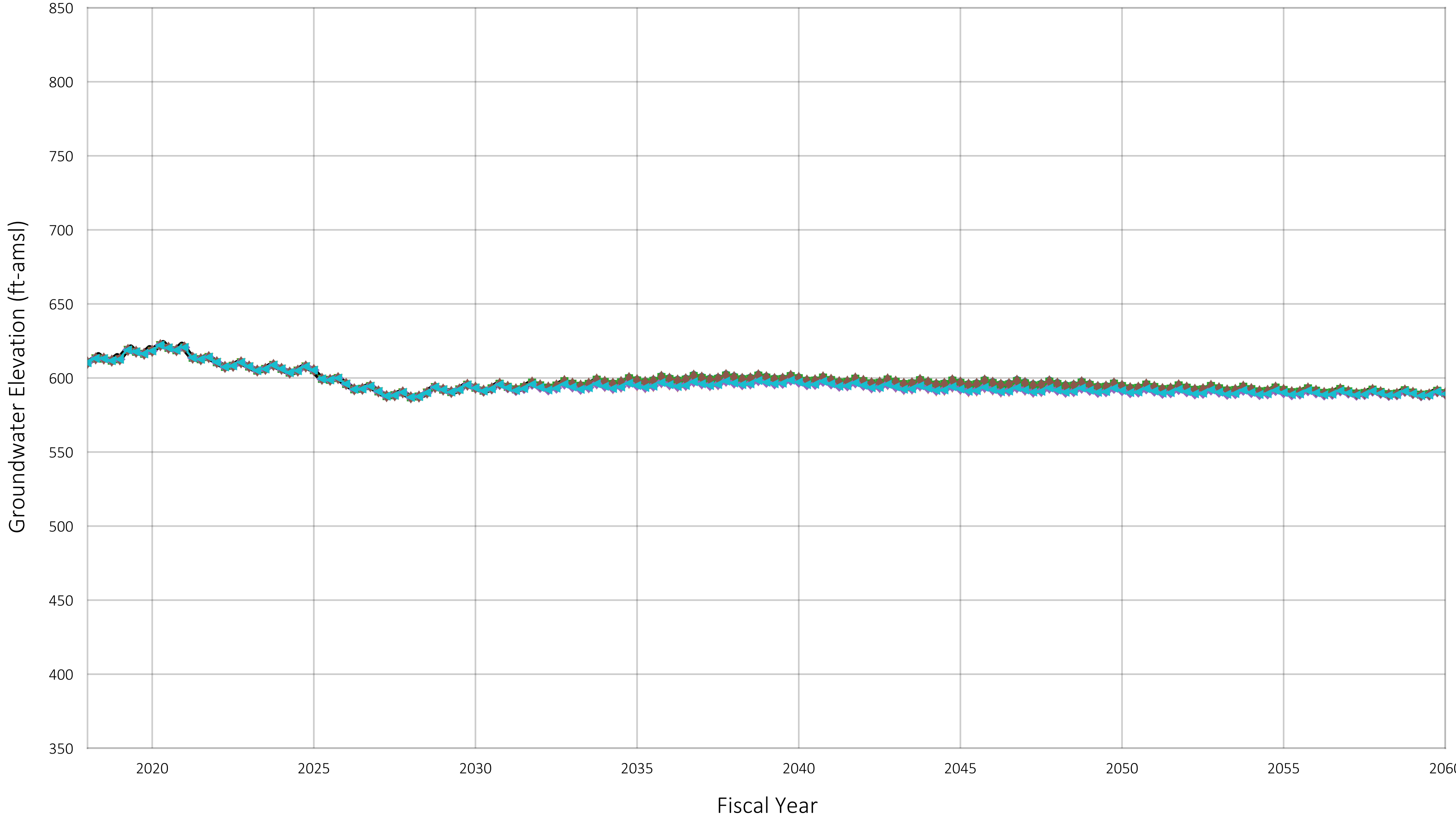
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207341
Owner: Fontana Water Company
Well Name: F44C

Figure A-45



Location of Well in Chino Basin

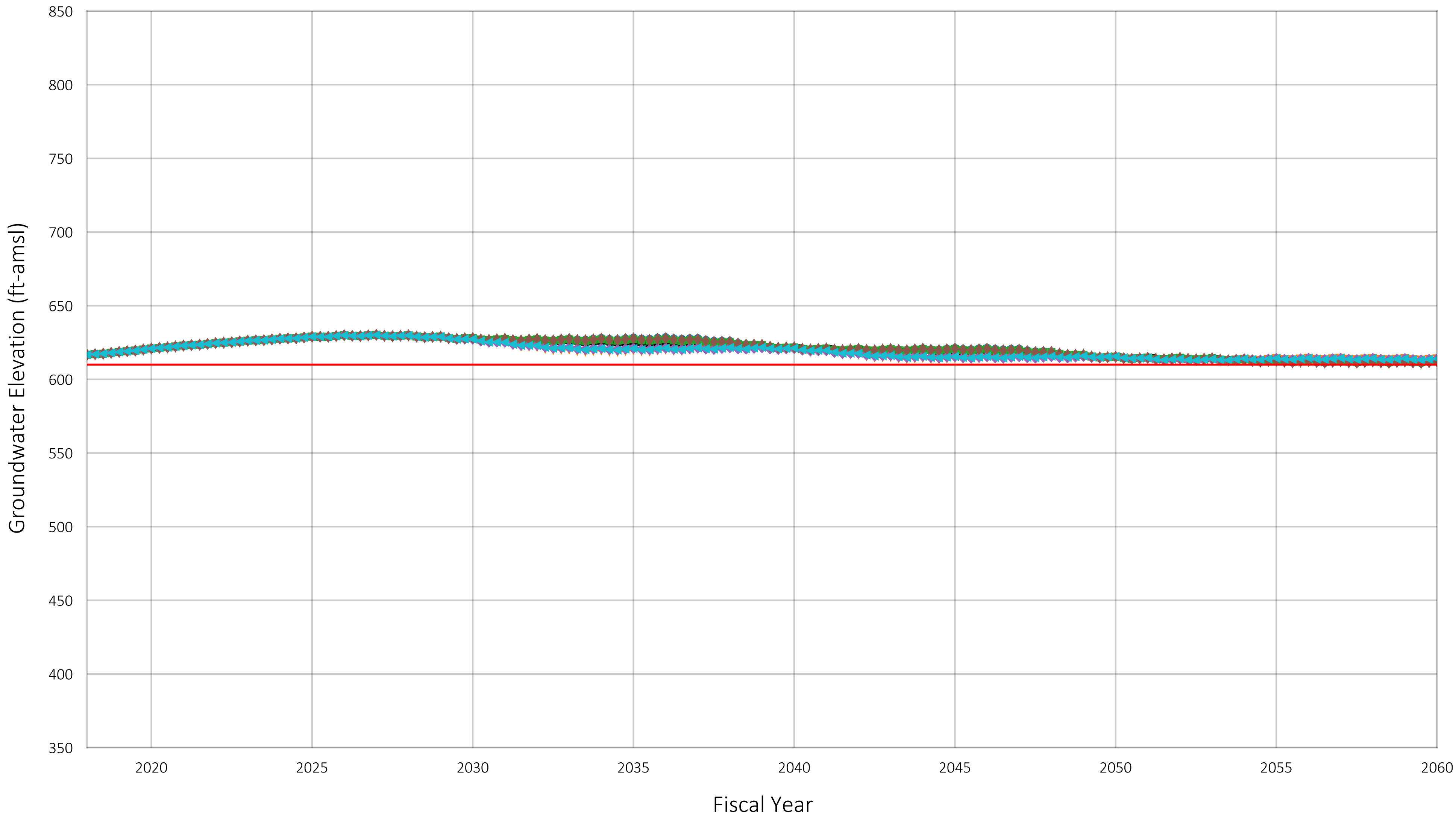
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002554
Owner: Golden State Water Company
Well Name: Margarita #1

Figure A-46



Location of Well in Chino Basin

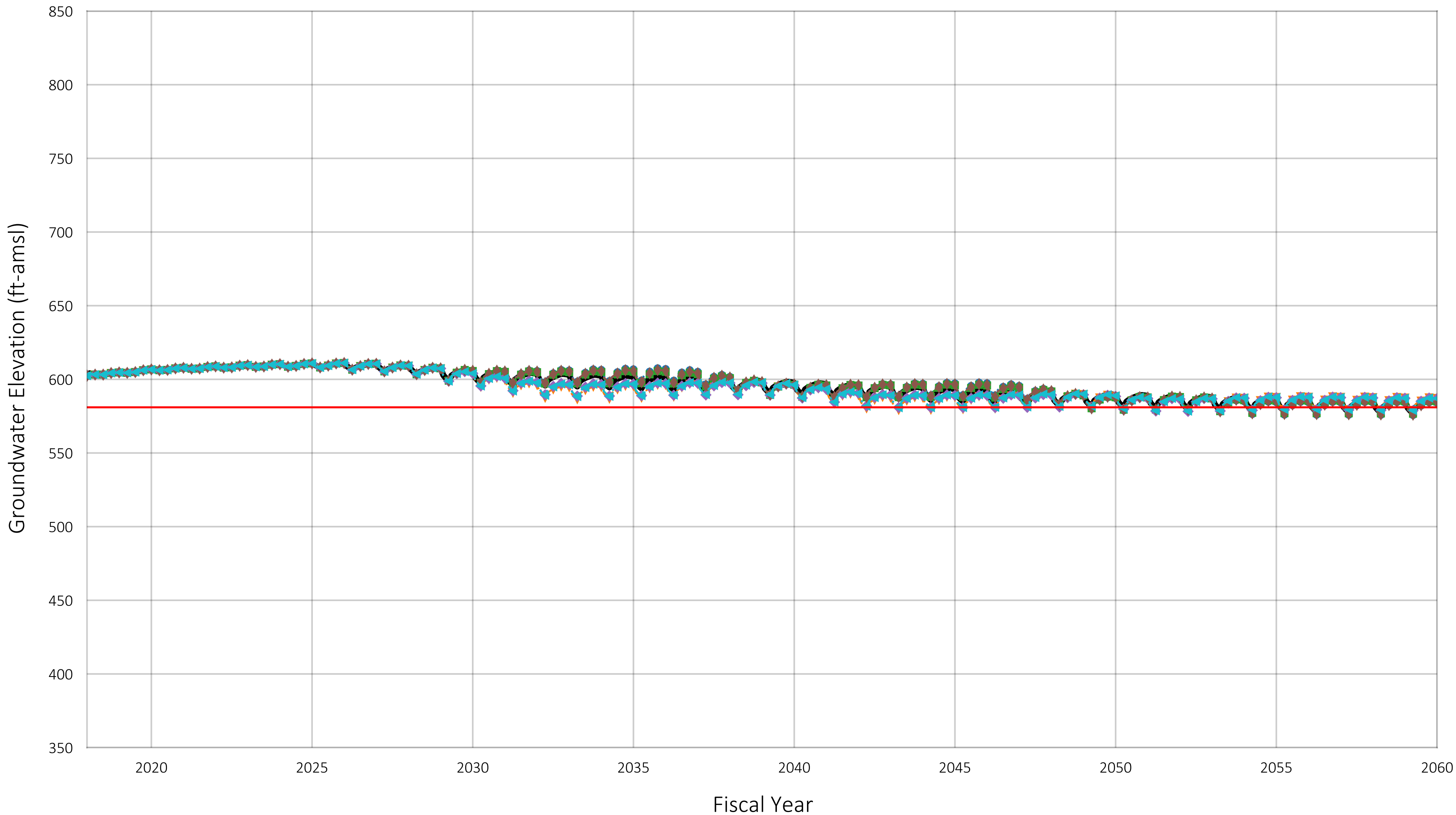
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003470
Owner: Jurupa Community Services District
Well Name: 6

Figure A-47



Location of Well in Chino Basin

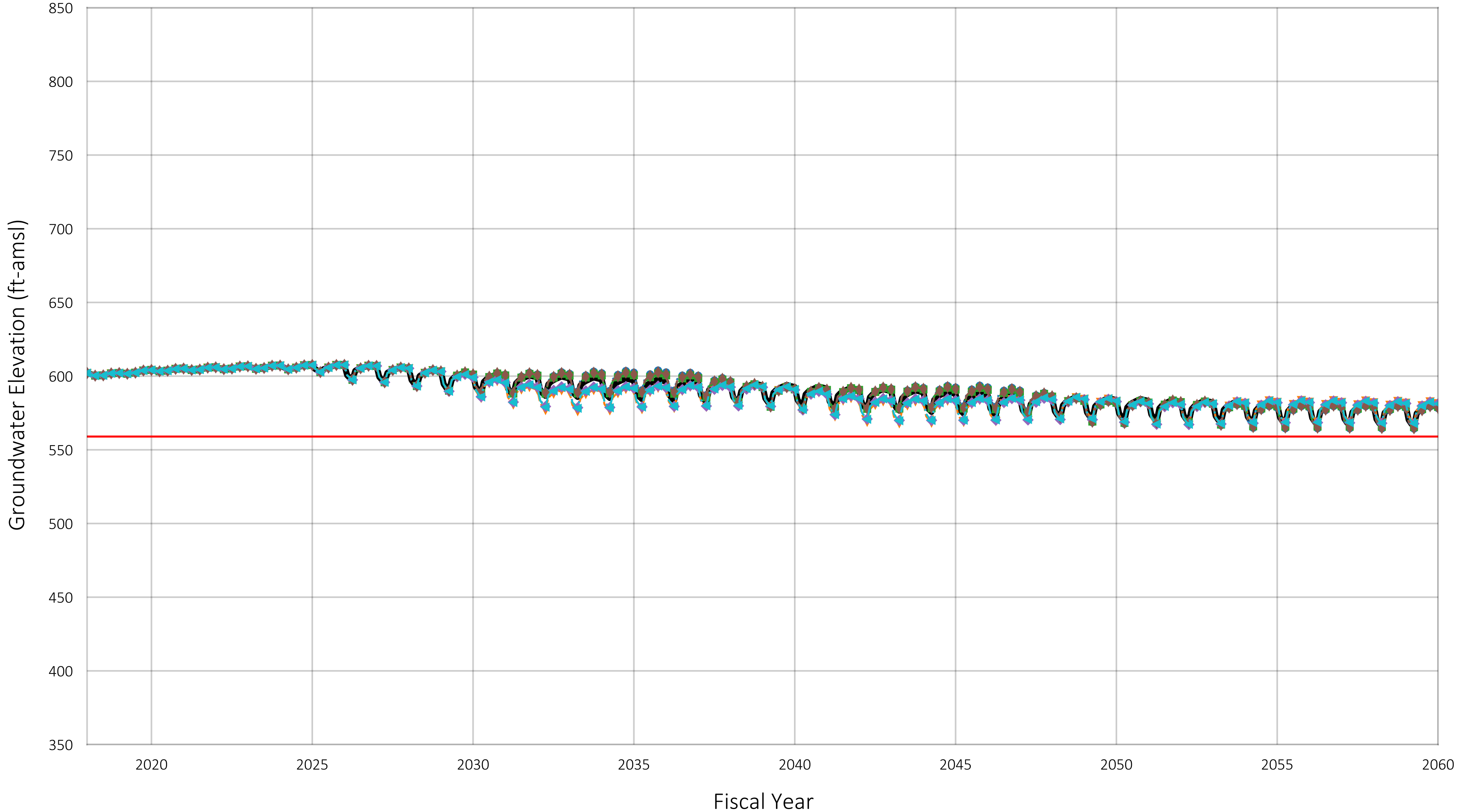
Prepared by:

WEST YOST
Water. Engineered

Baseline	Scenario 4
Scenario 1	Scenario 5
Scenario 2	Scenario 6
Scenario 3	Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1003507
Owner: Jurupa Community Services District
Well Name: 8

Figure A-48



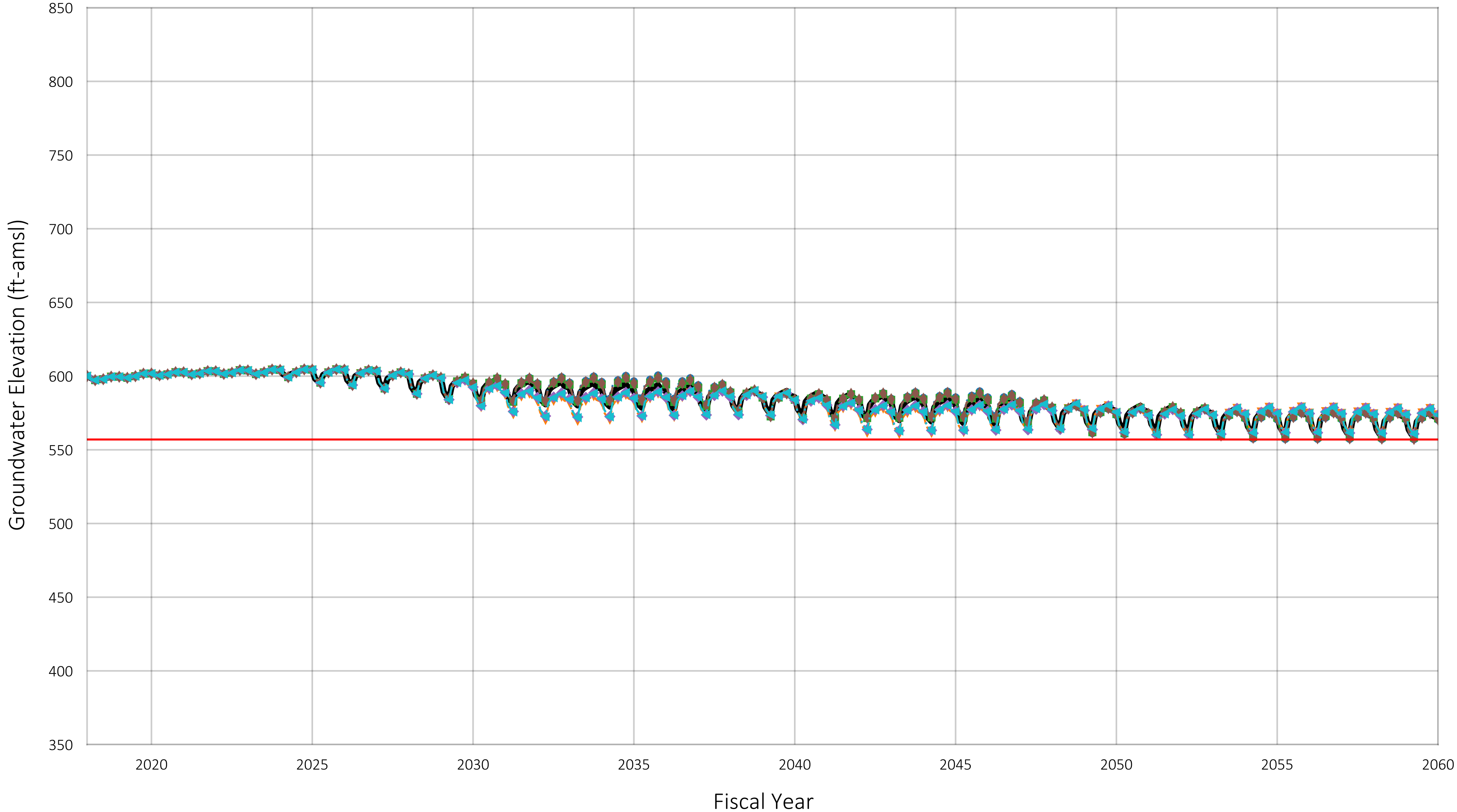
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003506
Owner: Jurupa Community Services District
Well Name: 11

Figure A-49



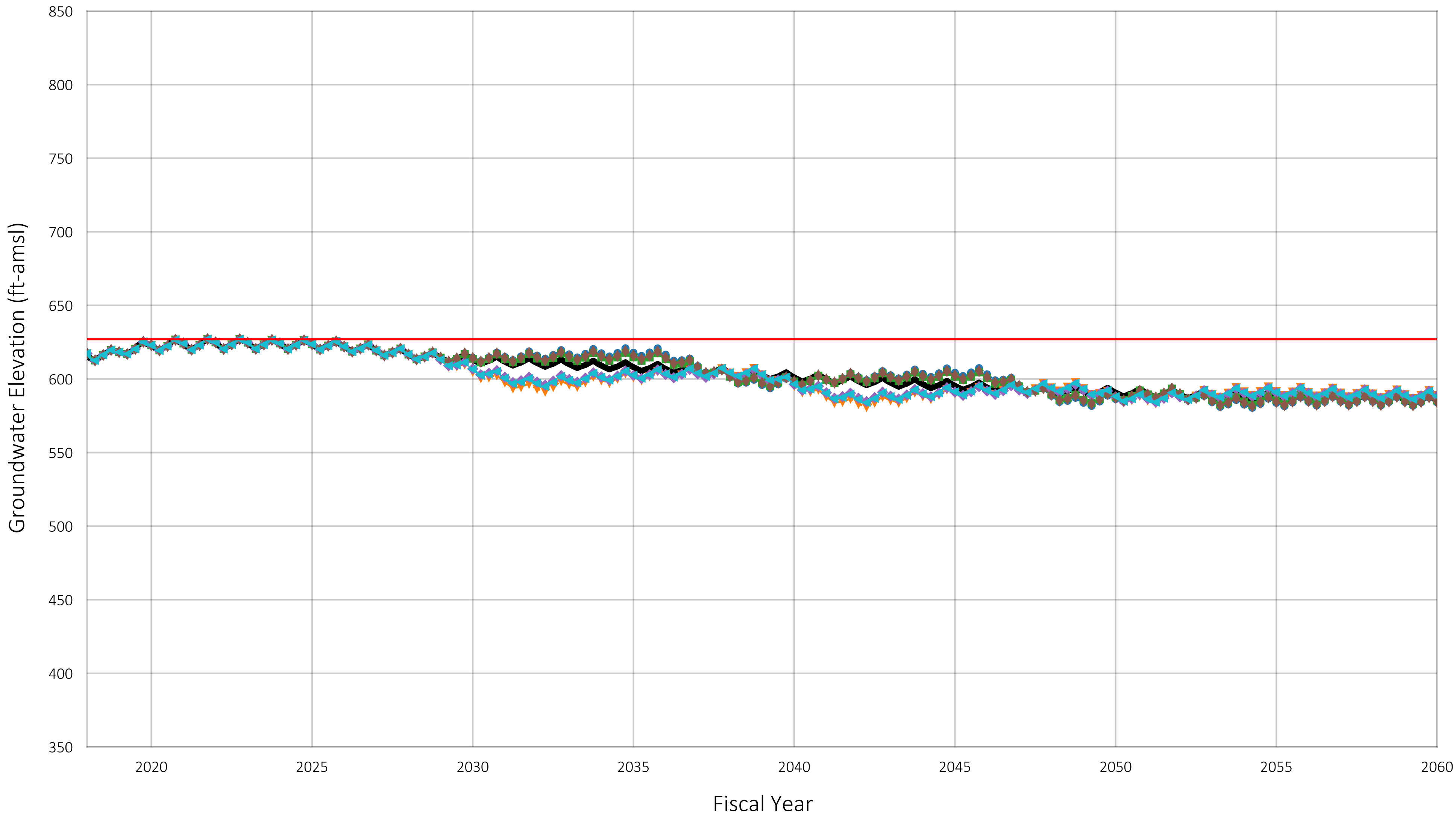
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003505
Owner: Jurupa Community Services District
Well Name: 12

Figure A-50



Location of Well in Chino Basin

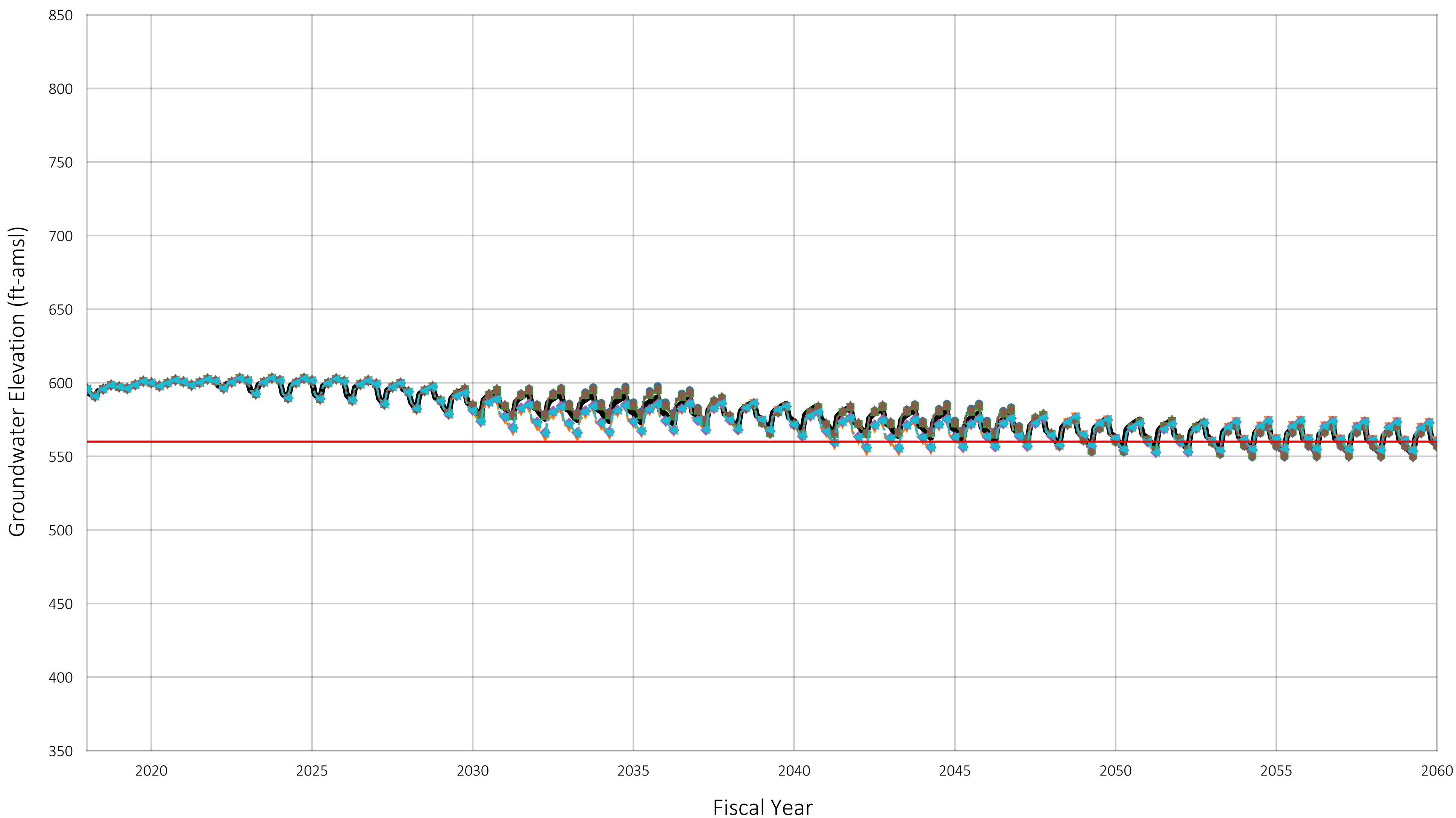
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003466
Owner: Jurupa Community Services District
Well Name: 13

Figure A-51



Location of Well in Chino Basin

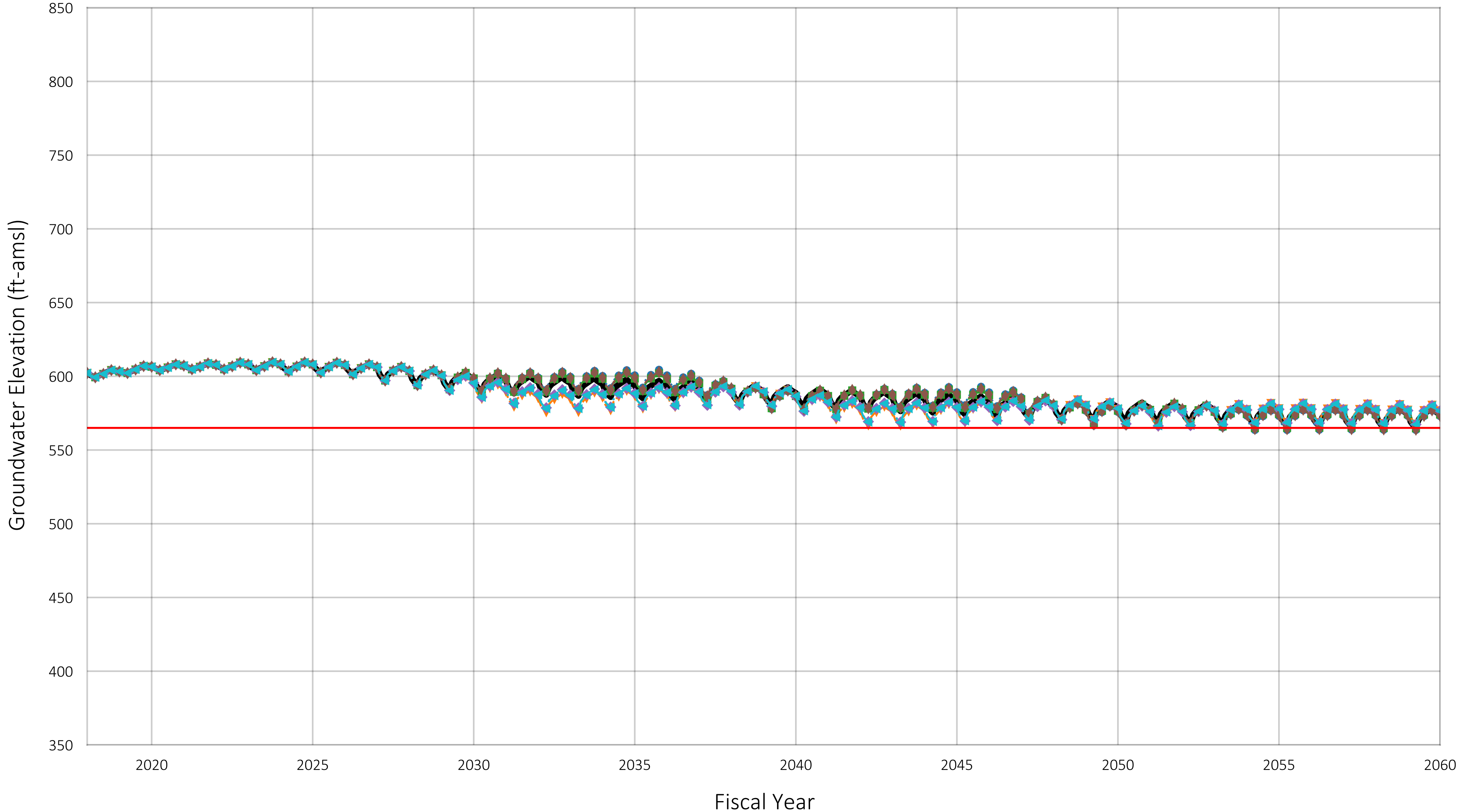
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003501
Owner: Jurupa Community Services District
Well Name: 14

Figure A-52



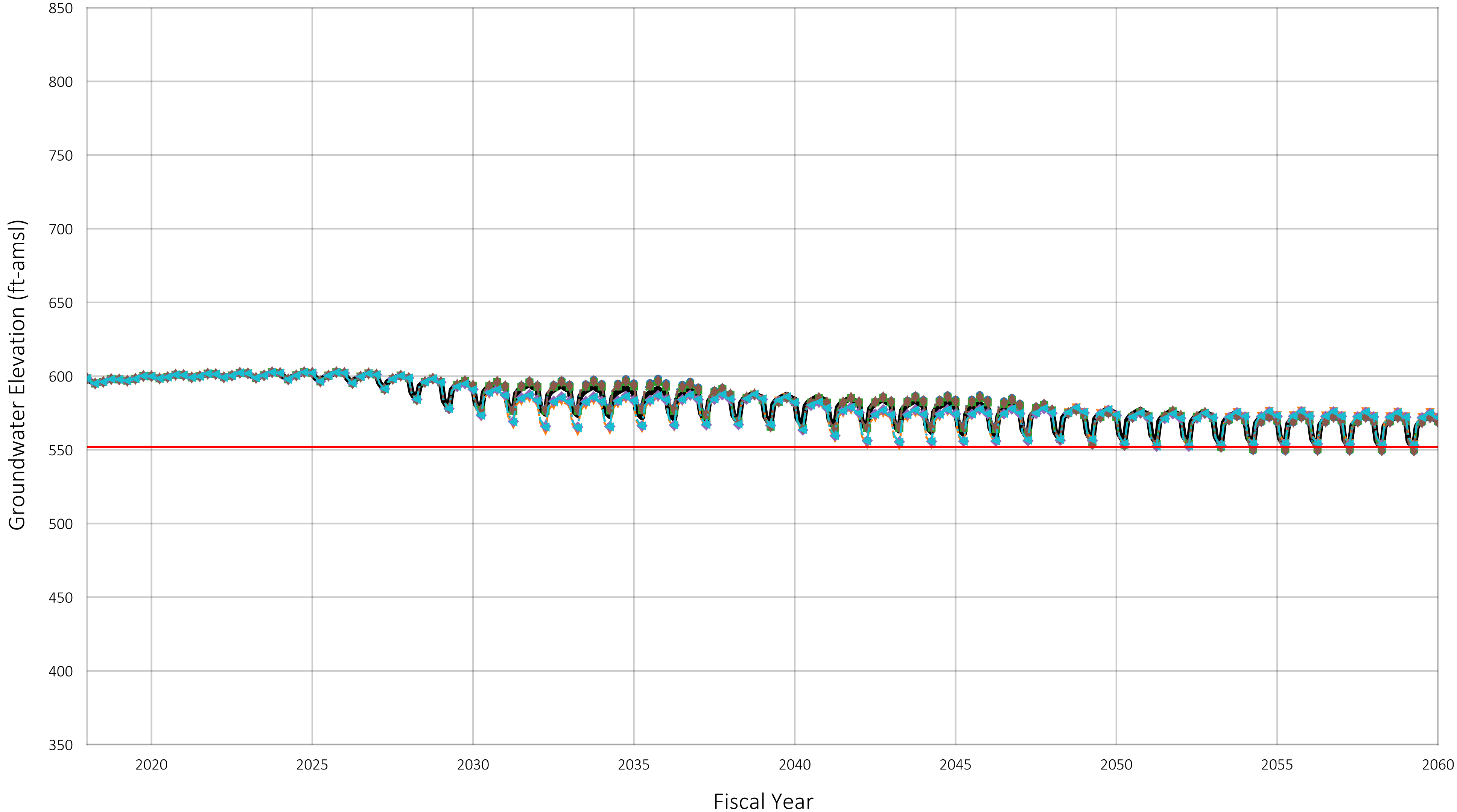
Prepared by:

WEST YOST
Water. Engineered

Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1003498
Owner: Jurupa Community Services District
Well Name: 15

Figure A-53



Location of Well in Chino Basin

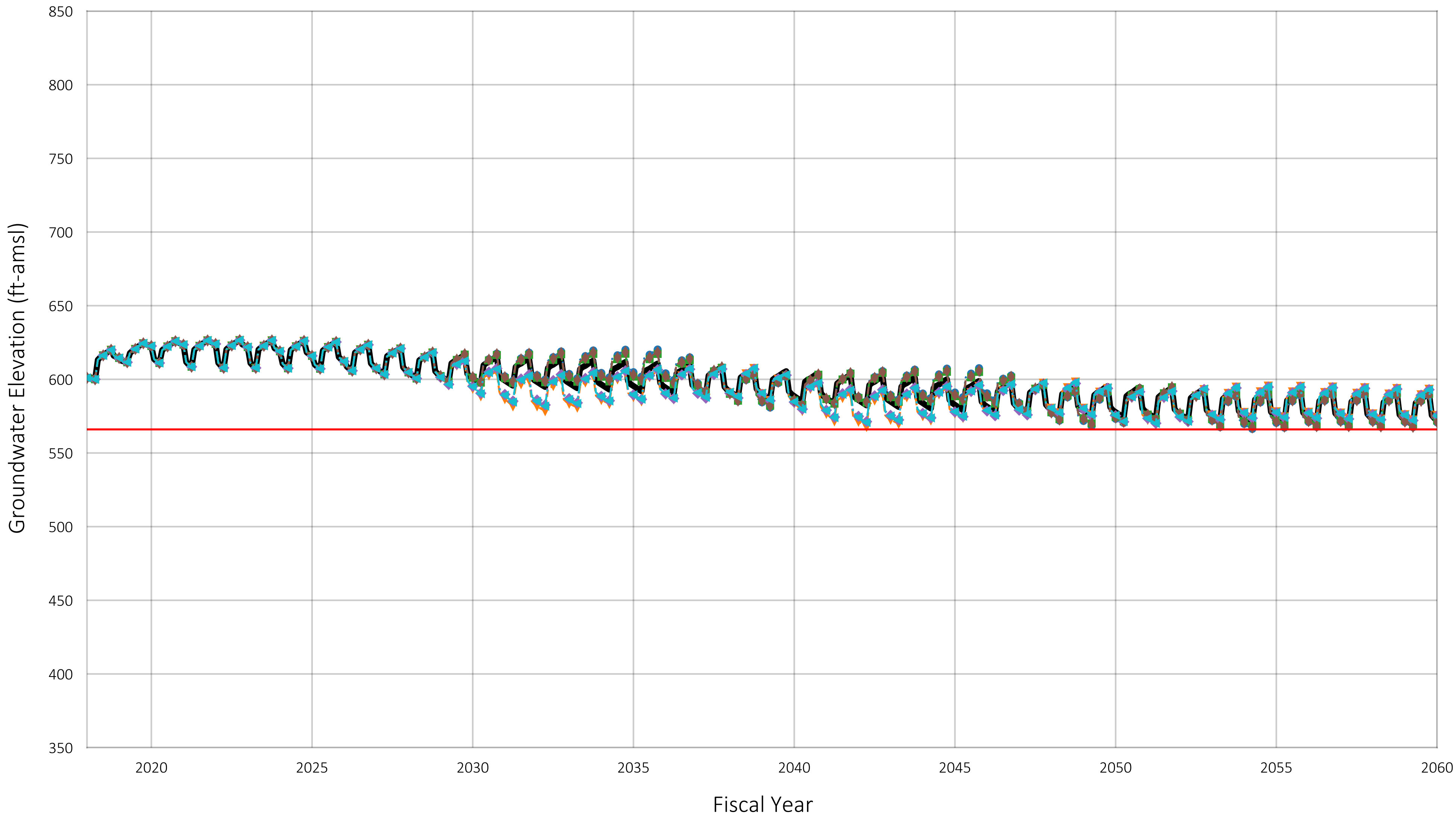
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003502
Owner: Jurupa Community Services District
Well Name: 16

Figure A-54



Location of Well in Chino Basin

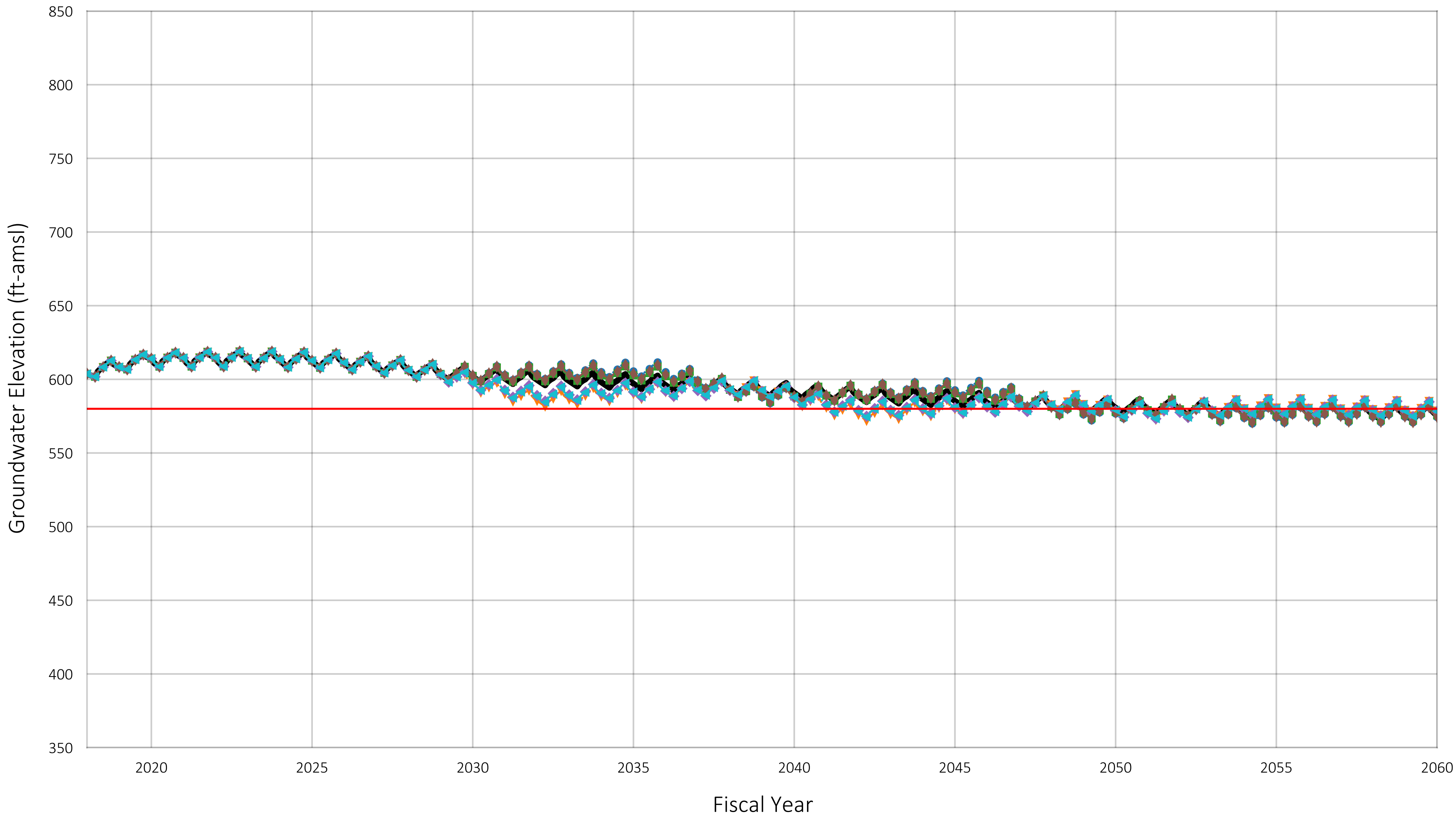
Prepared by:

WEST YOST Water. Engineered

Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1003467
Owner: Jurupa Community Services District
Well Name: 17

Figure A-55



Location of Well in Chino Basin

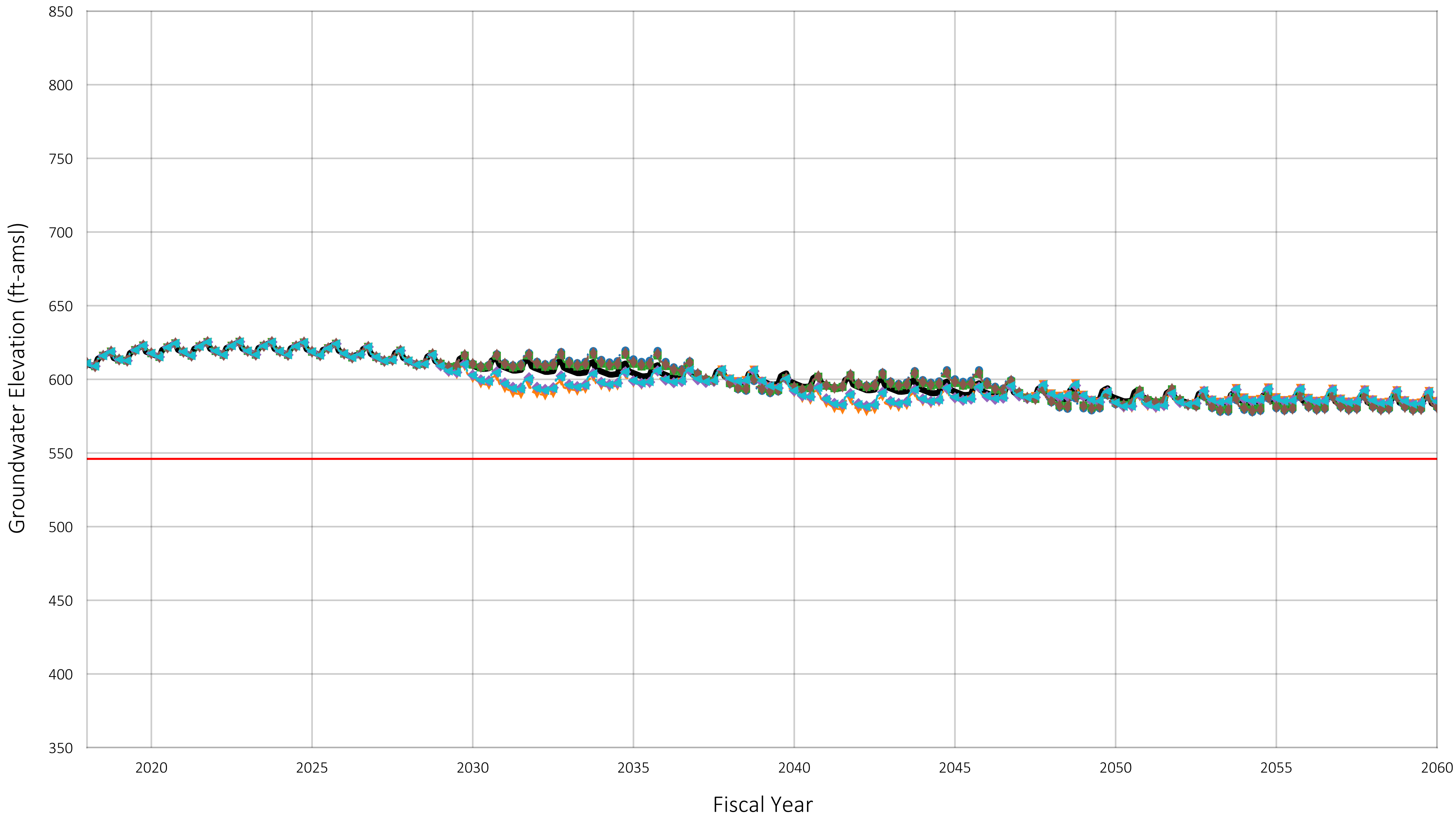
Prepared by:

WEST YOST Water. Engineered

Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1003469
Owner: Jurupa Community Services District
Well Name: 18

Figure A-56



Location of Well in Chino Basin

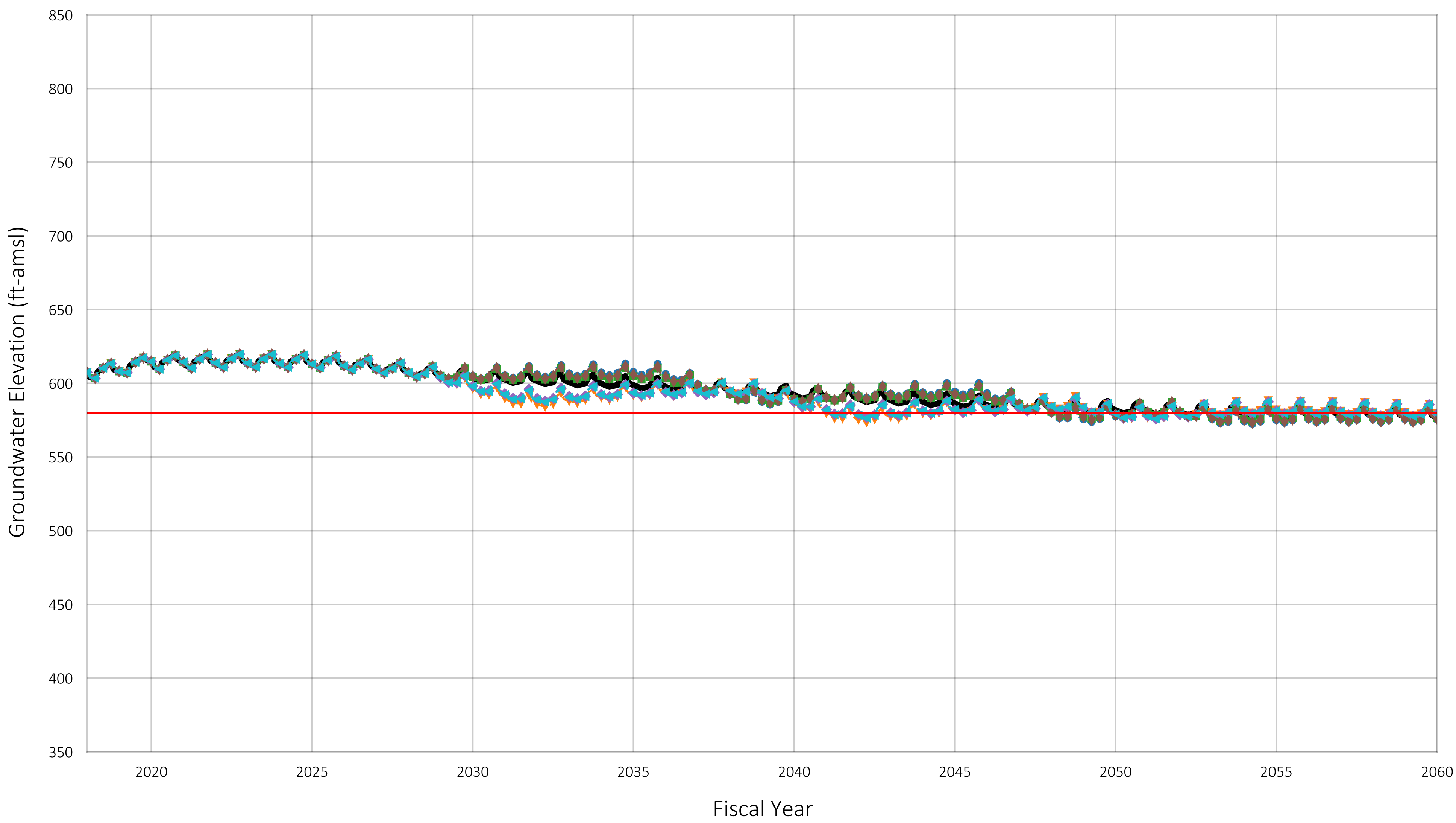
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003471
Owner: Jurupa Community Services District
Well Name: 19

Figure A-57



Location of Well in Chino Basin

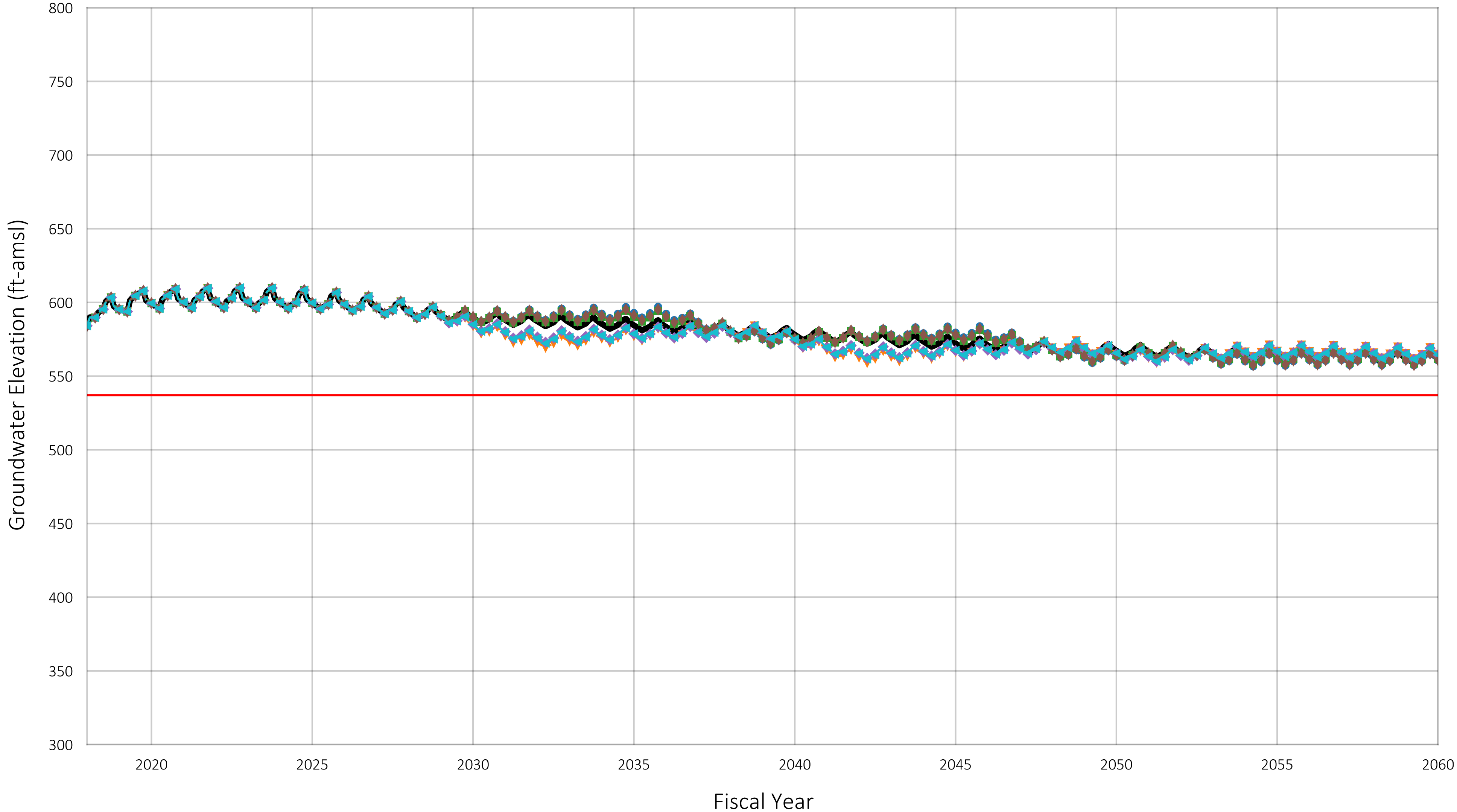
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003472
Owner: Jurupa Community Services District
Well Name: 20

Figure A-58



Location of Well in Chino Basin

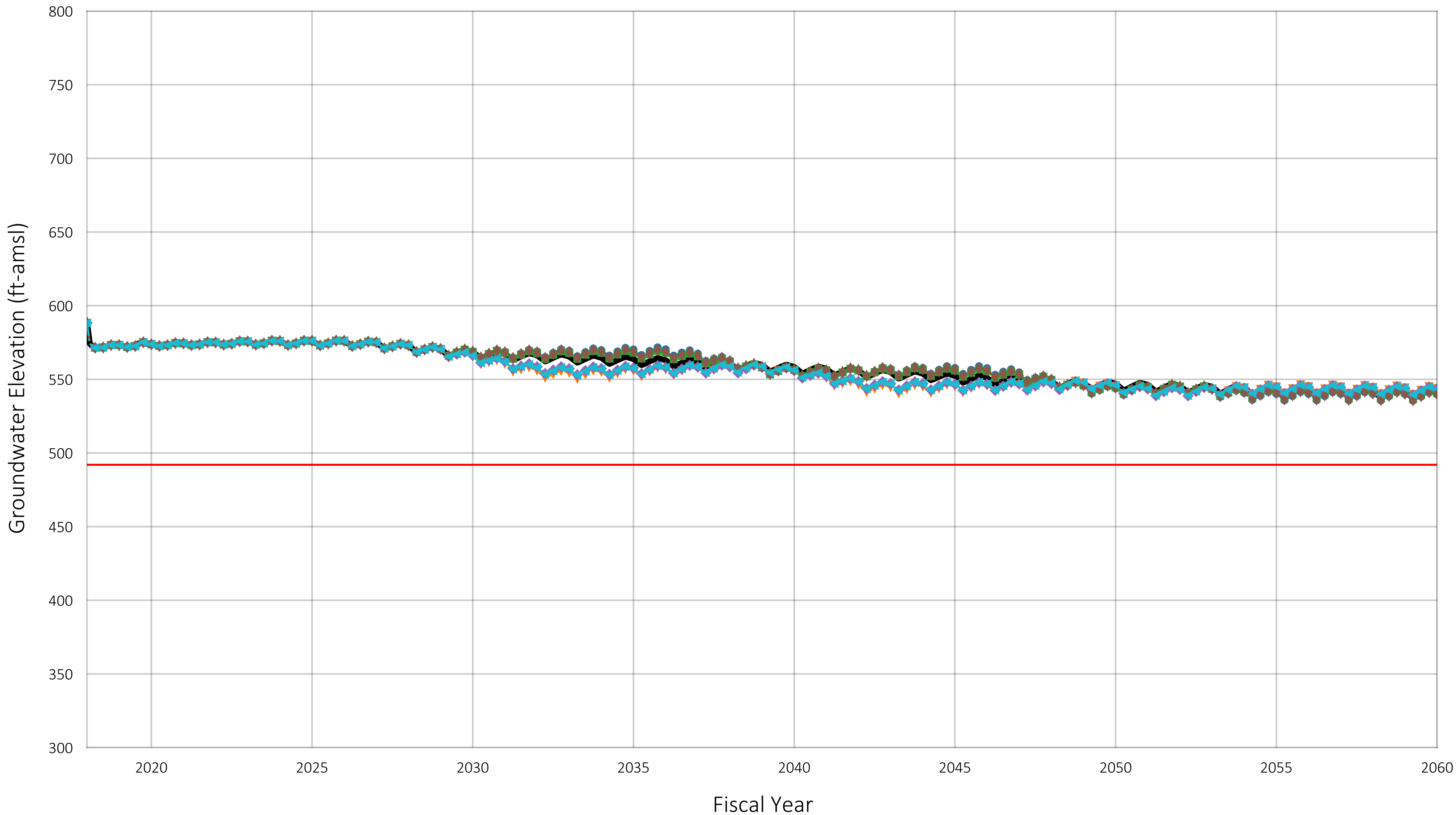
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220154
Owner: Jurupa Community Services District
Well Name: 22

Figure A-59



Location of Well in Chino Basin

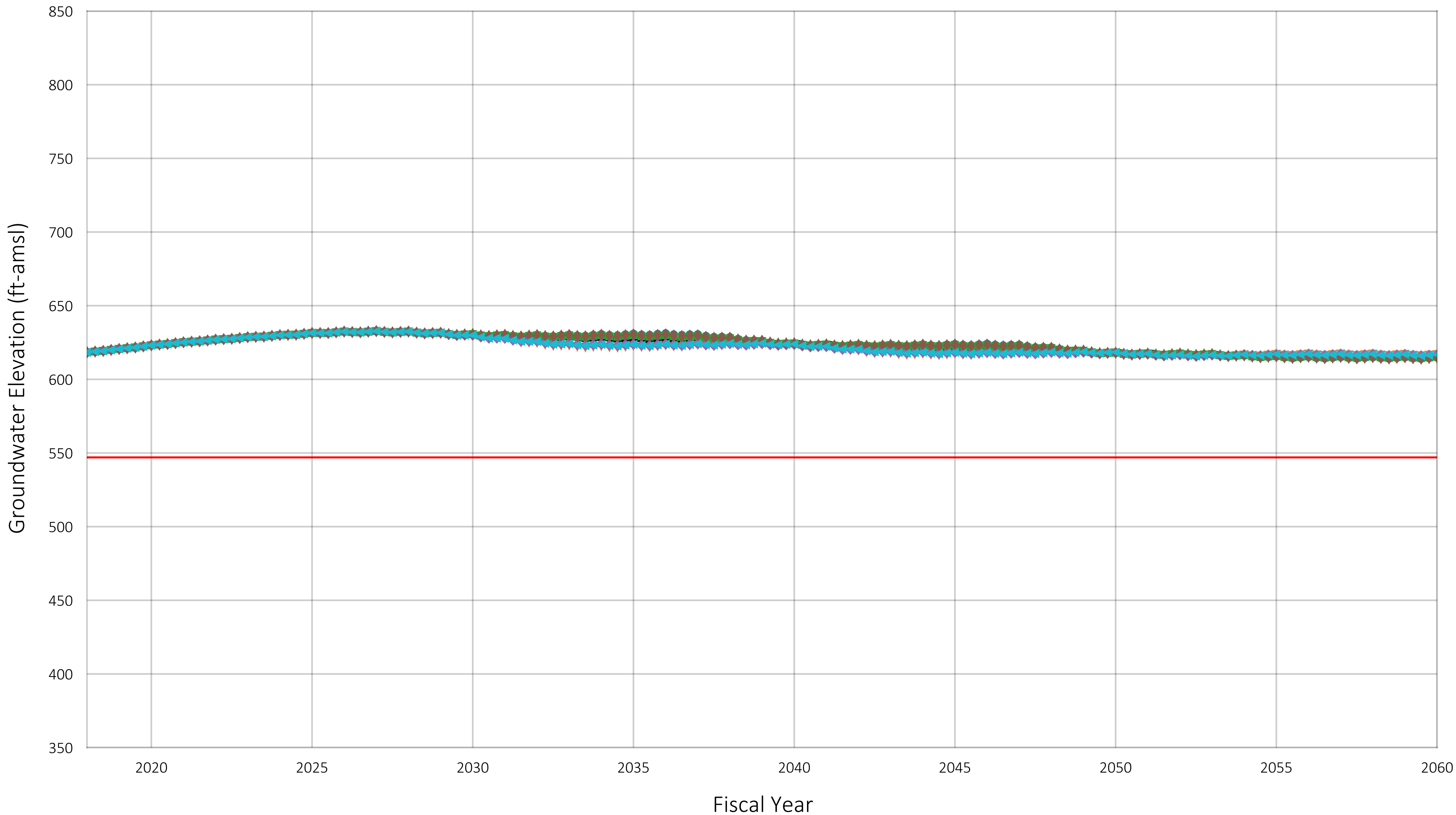
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220155
Owner: Jurupa Community Services District
Well Name: 23

Figure A-60



Location of Well in Chino Basin

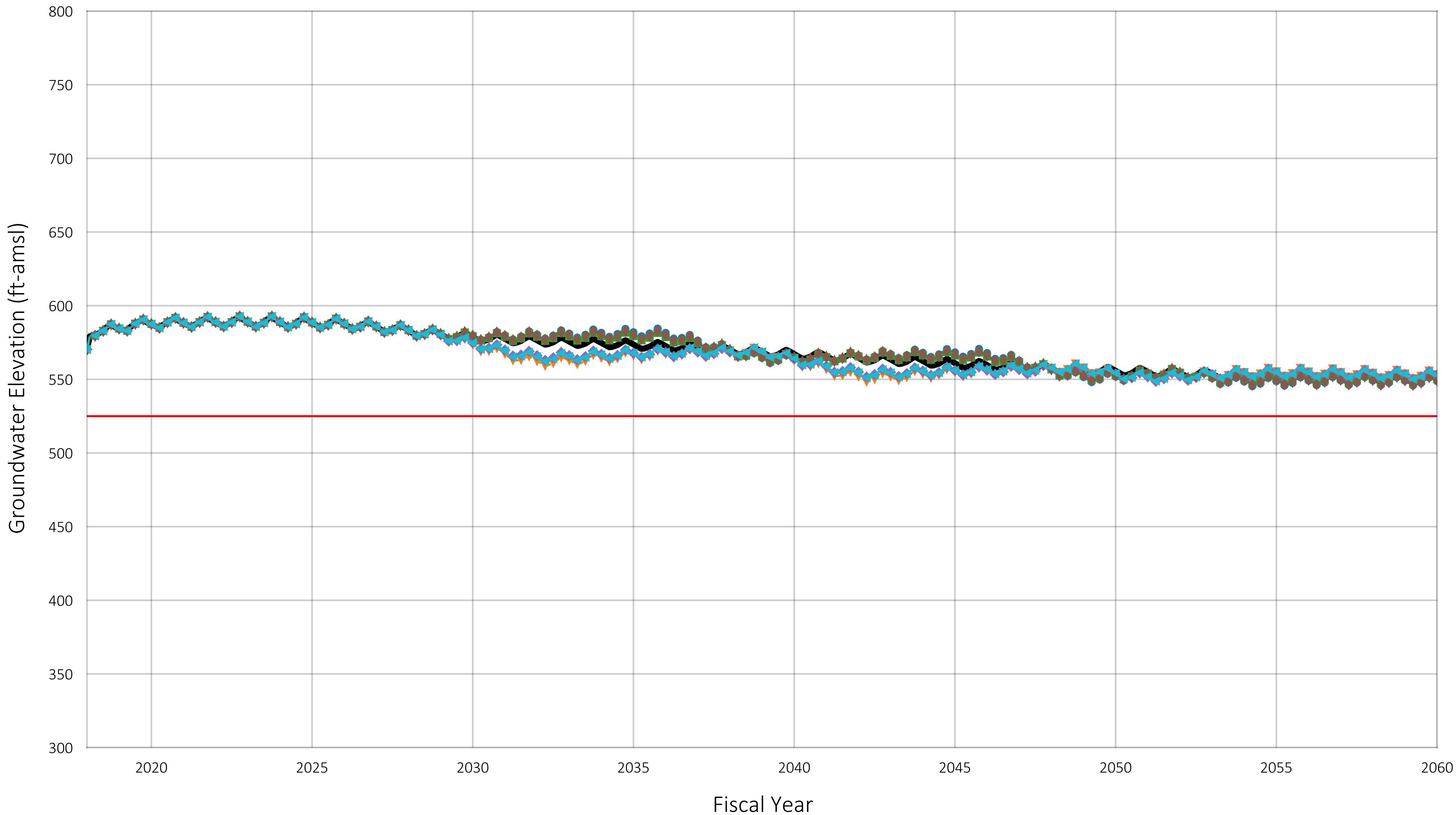
Baseline	Scenario 4
Scenario 1	Scenario 5
Scenario 2	Scenario 6
Scenario 3	Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1003515
Owner: Jurupa Community Services District
Well Name: 24

Figure A-61



Location of Well in Chino Basin

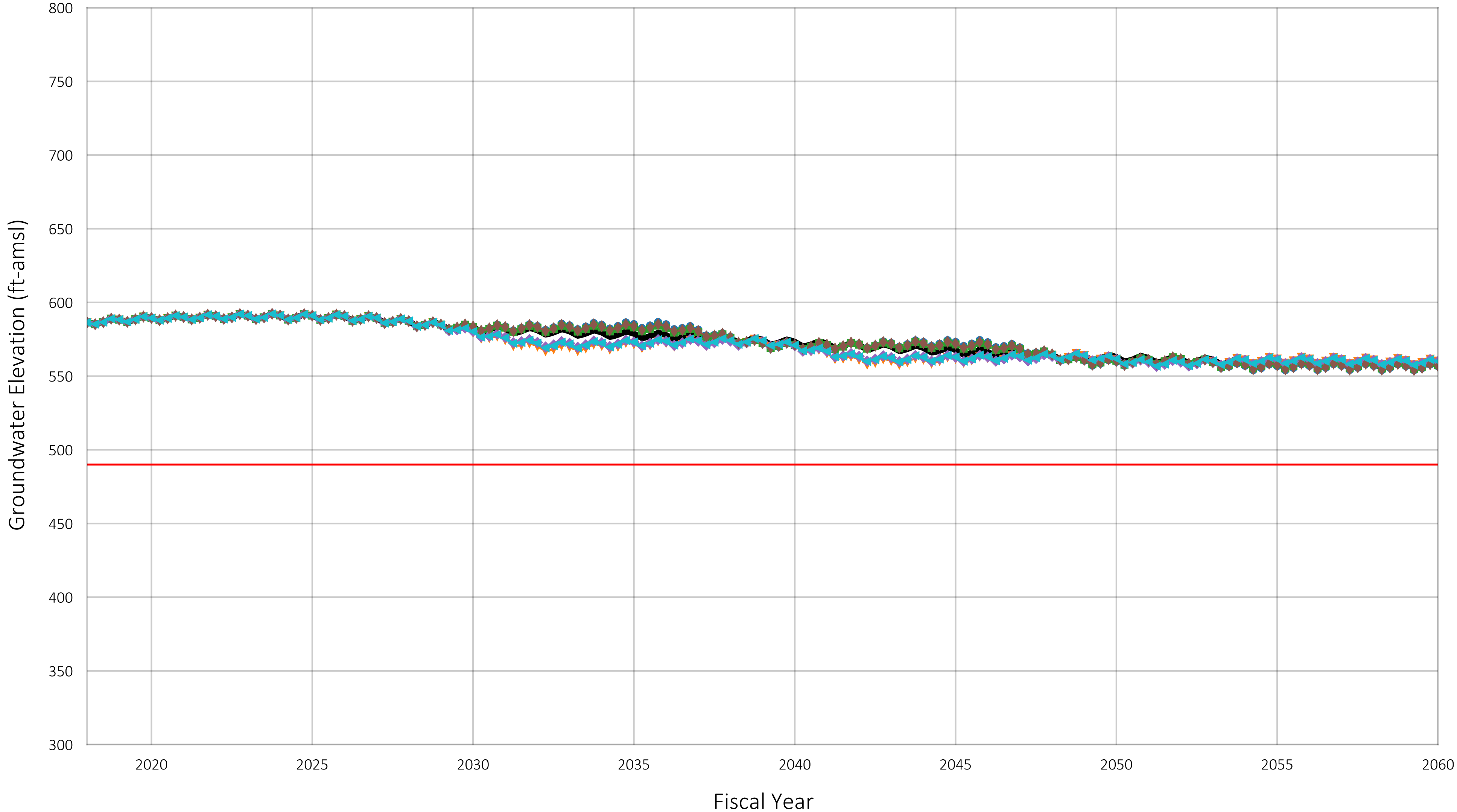
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220158
Owner: Jurupa Community Services District
Well Name: 25

Figure A-62



Location of Well in Chino Basin

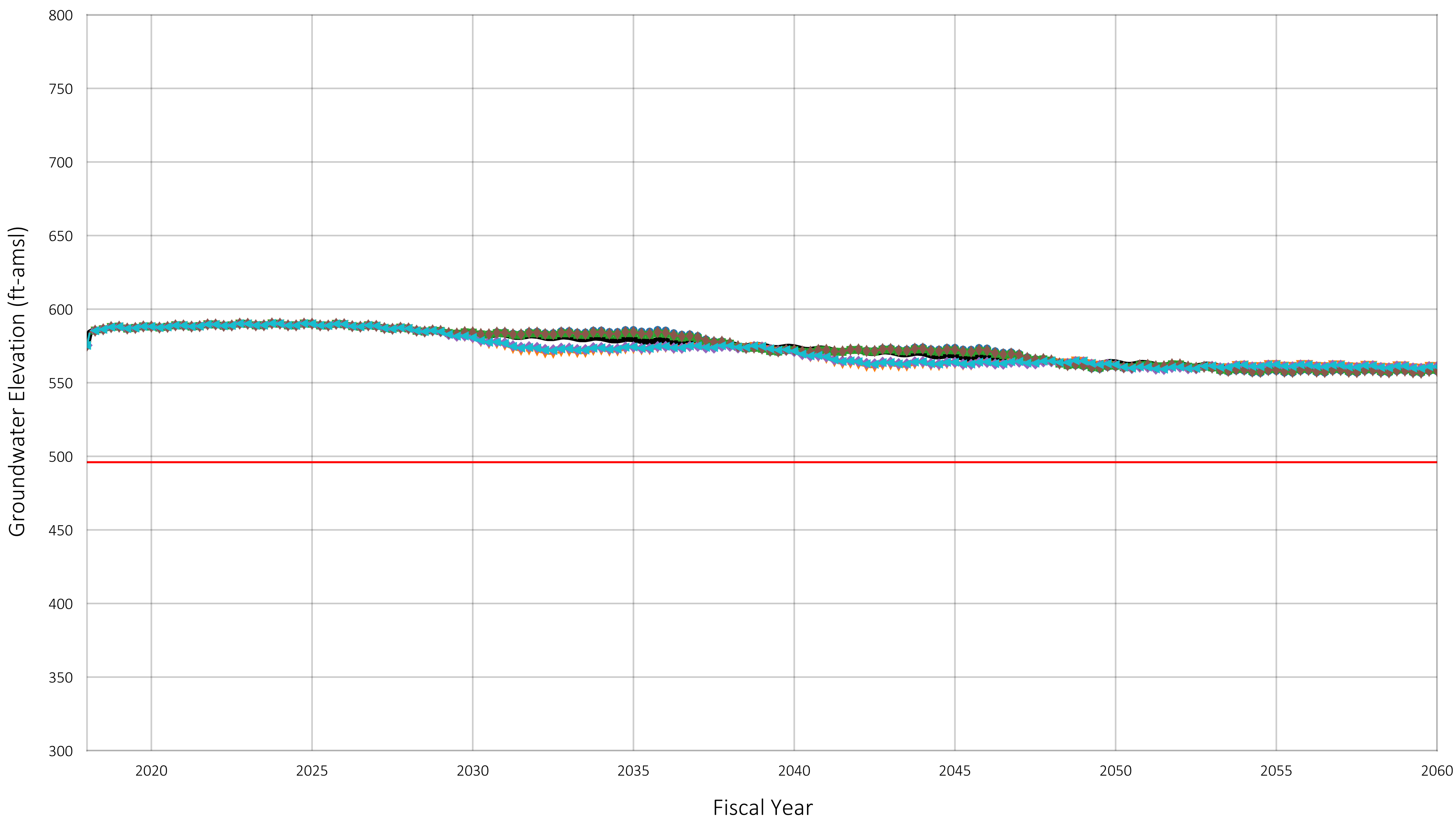
Prepared by:

WEST YOST Water. Engineered

Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1233787
Owner: Jurupa Community Services District
Well Name: 27

Figure A-63



Location of Well in Chino Basin

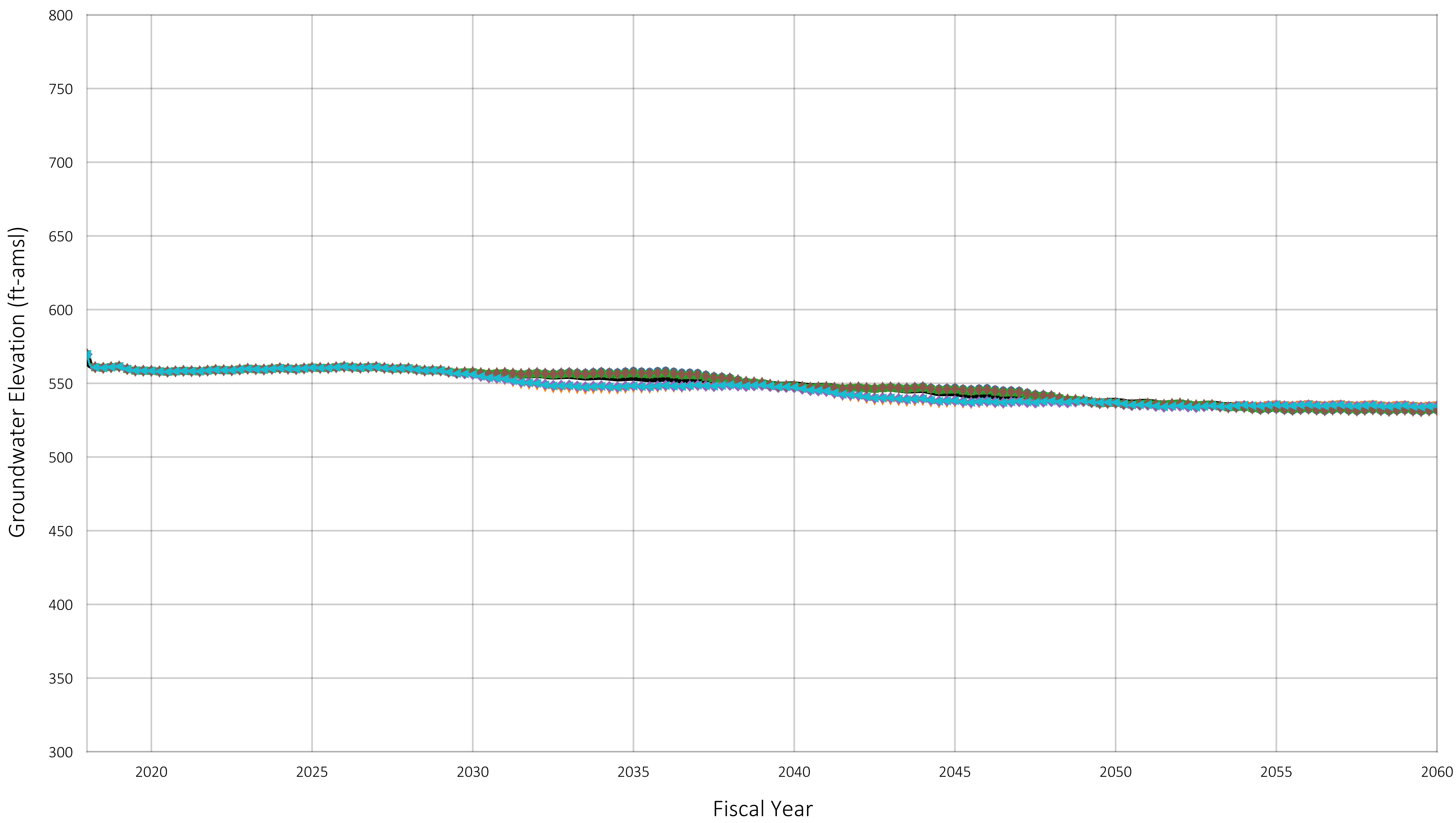
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1233788
Owner: Jurupa Community Services District
Well Name: 28

Figure A-64



Location of Well in Chino Basin

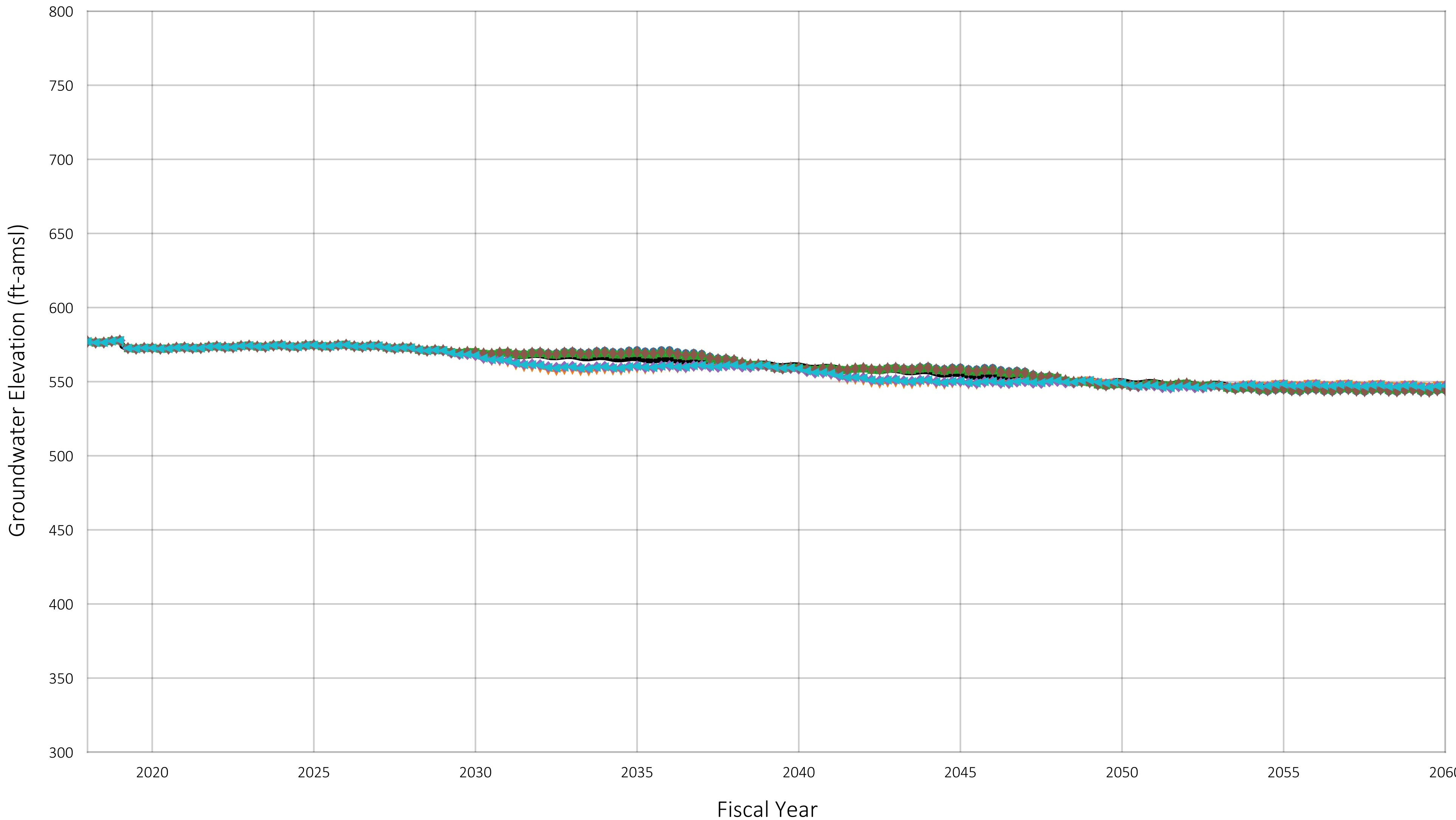
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207942
Owner: Jurupa Community Services District
Well Name: IDI-1

Figure A-65



Location of Well in Chino Basin

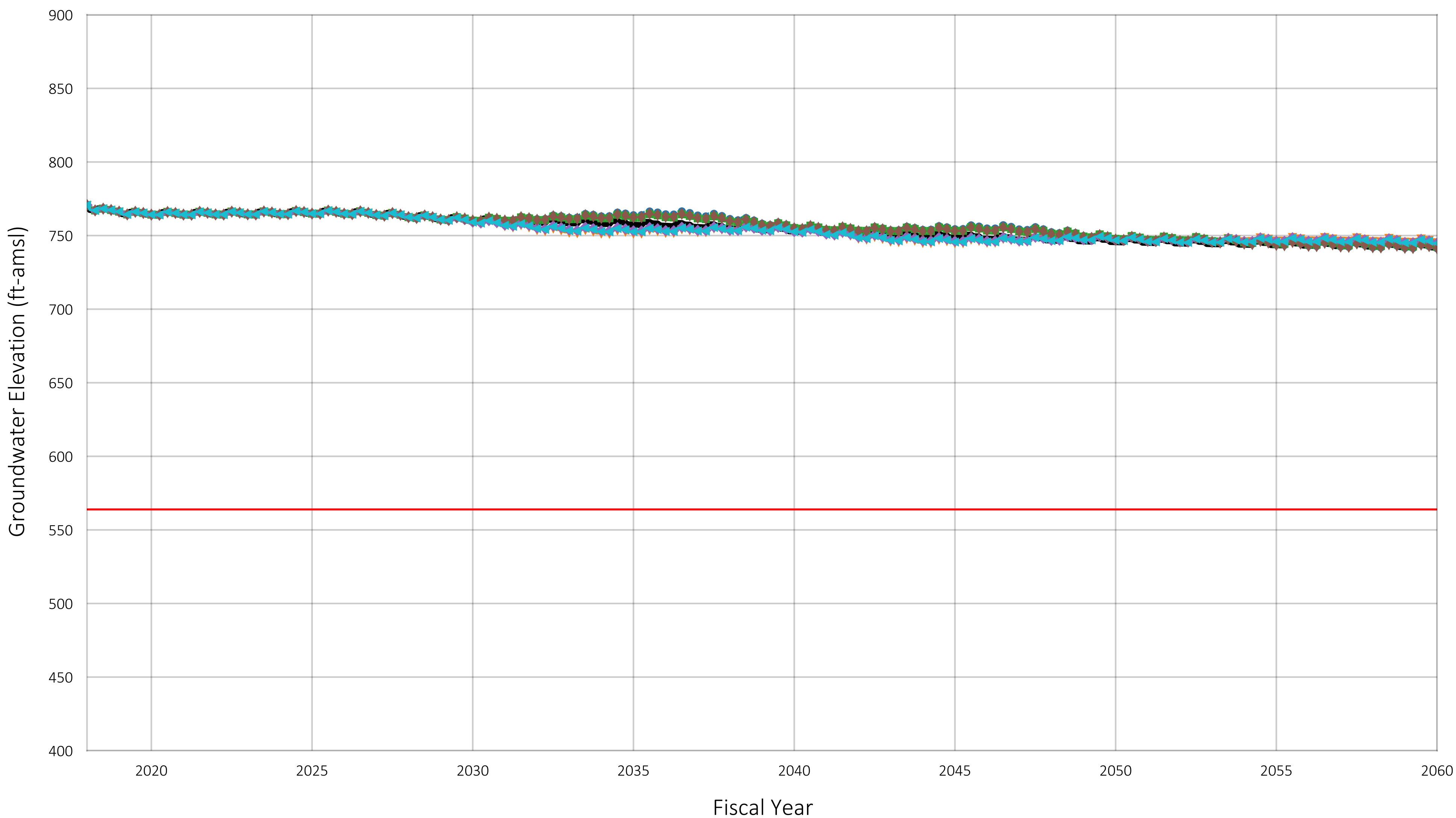
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 999902
Owner: Jurupa Community Services District
Well Name: IDI-2

Figure A-66



Location of Well in Chino Basin

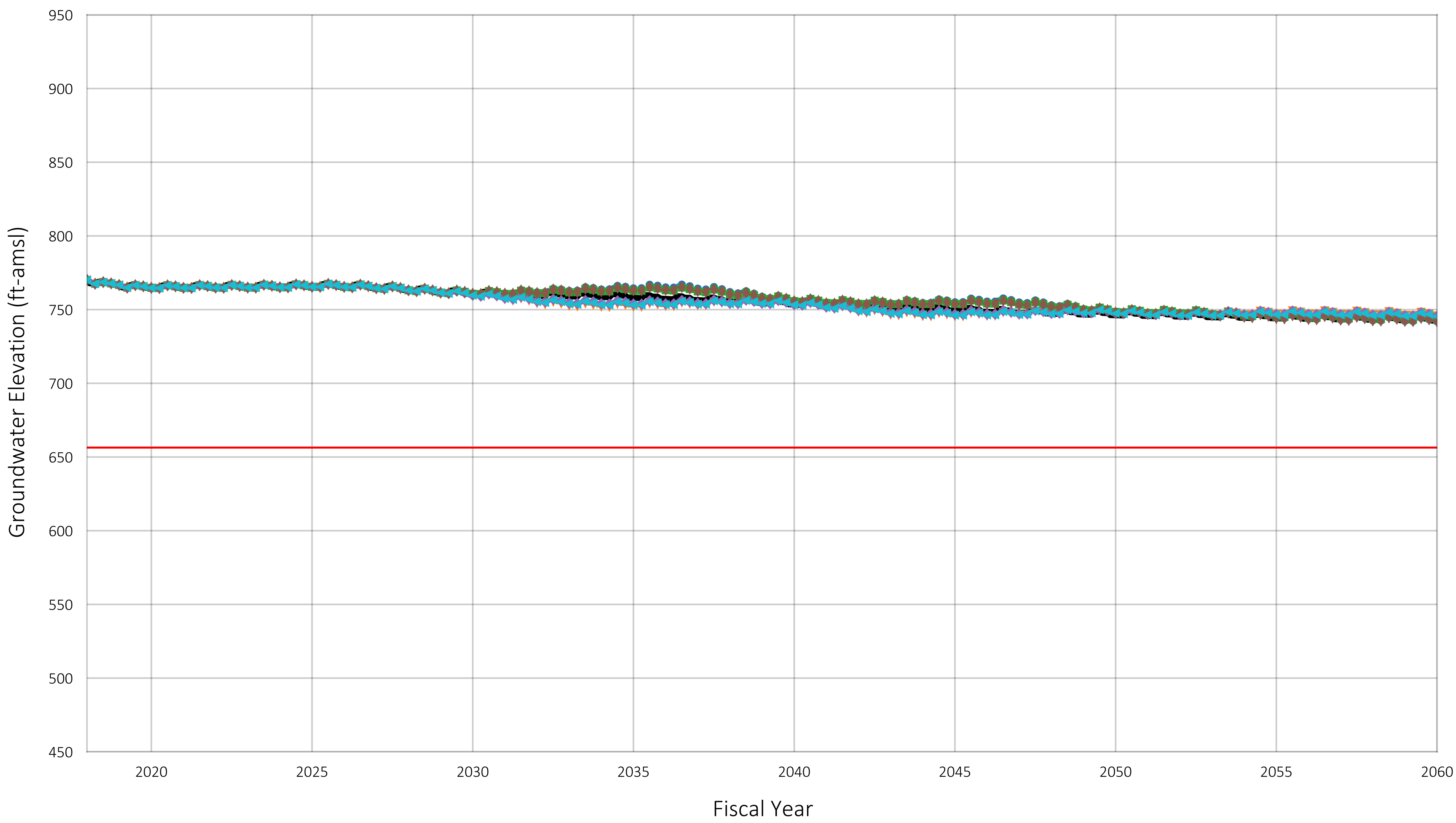
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1221751
Owner: Marygold Mutual Water Company
Well Name: MMWC 06

Figure A-67



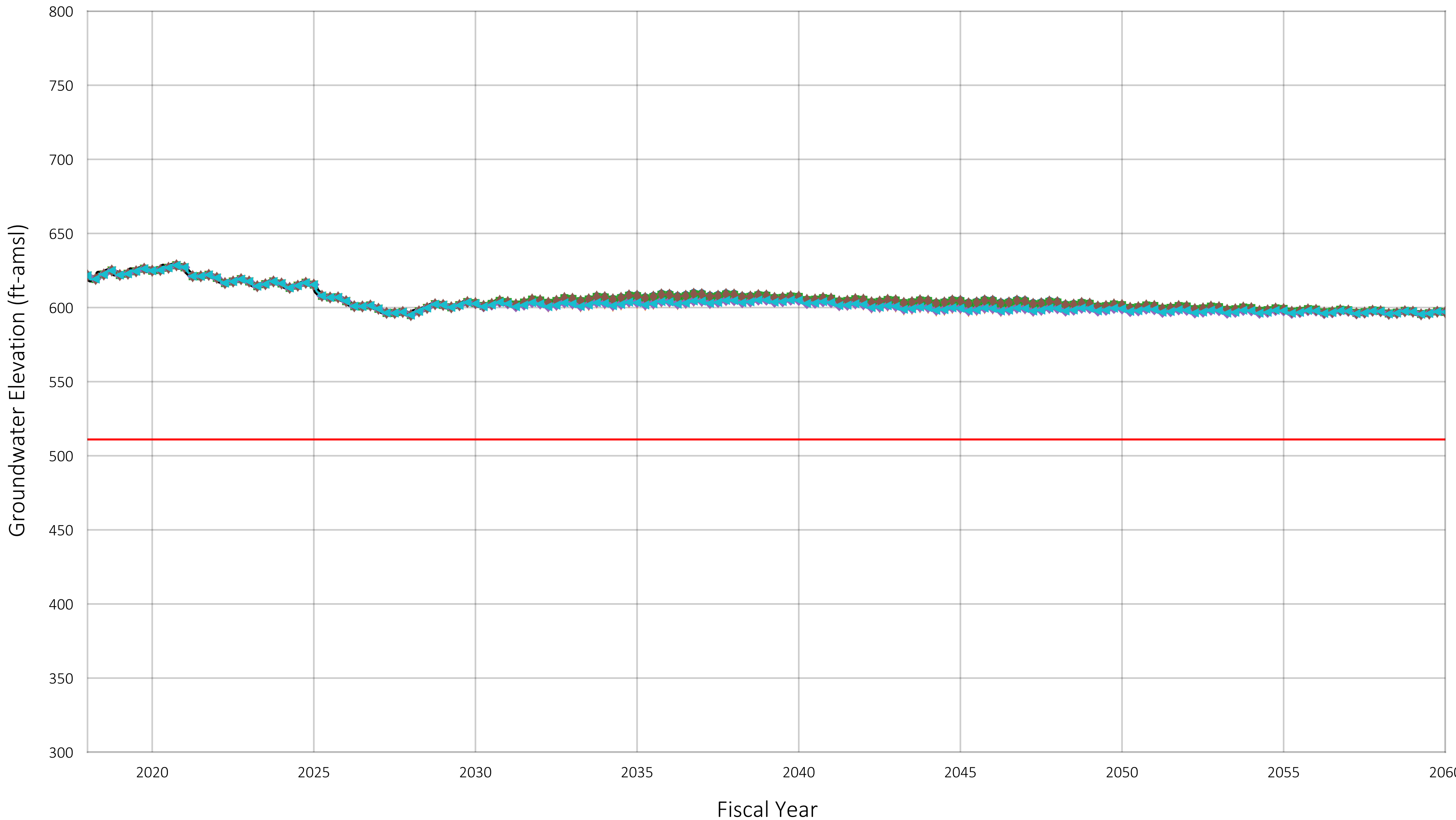
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1221752
Owner: Marygold Mutual Water Company
Well Name: MMWC 07

Figure A-68



Location of Well in Chino Basin

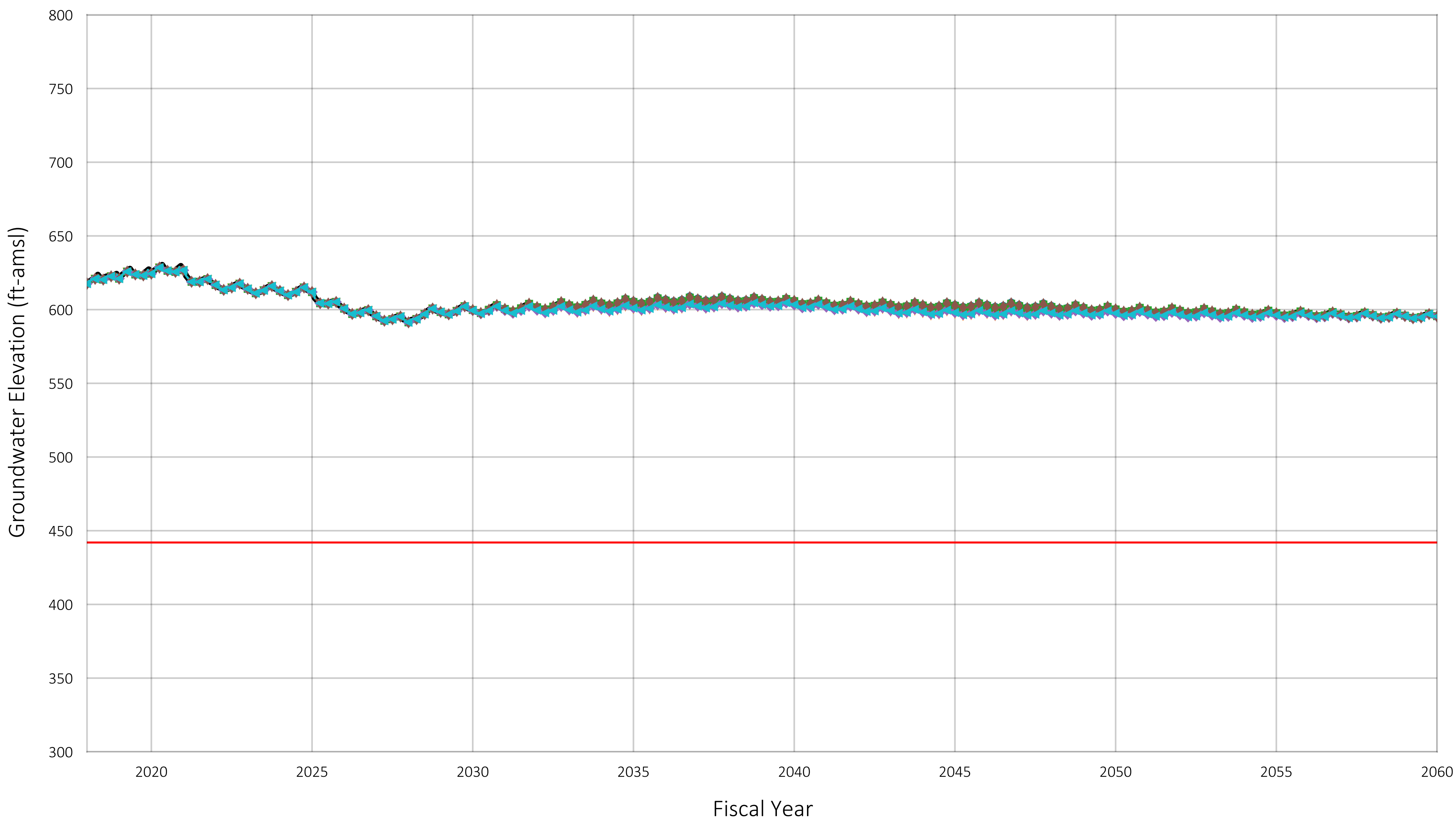
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

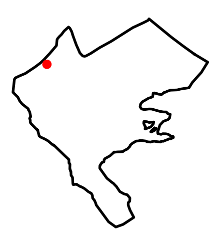
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002541
Owner: Monte Vista Water District
Well Name: 4

Figure A-69



Location of Well in Chino Basin



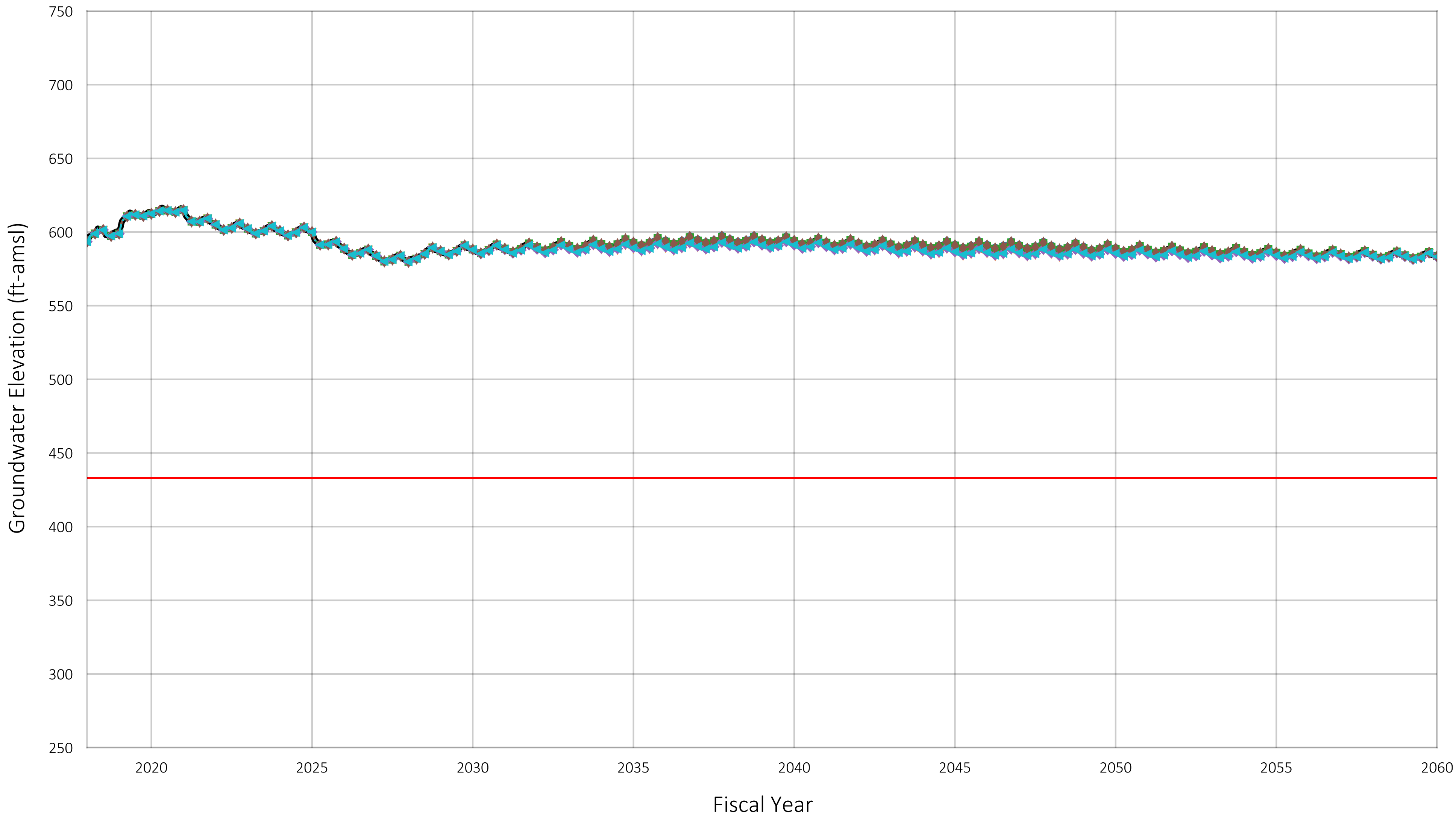
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002544
Owner: Monte Vista Water District
Well Name: 5

Figure A-70



Location of Well in Chino Basin

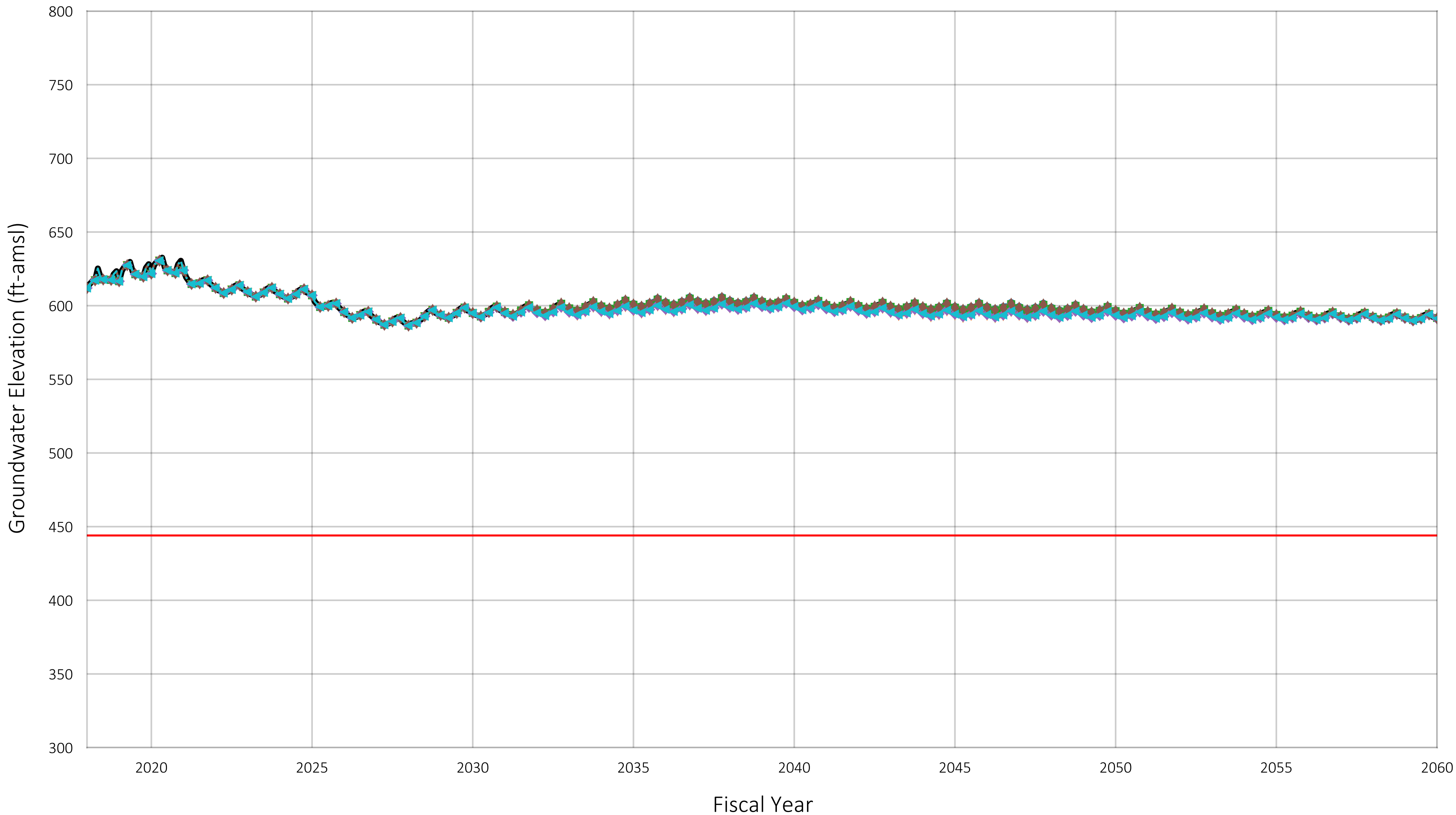
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002563
Owner: Monte Vista Water District
Well Name: 19

Figure A-71



Location of Well in Chino Basin

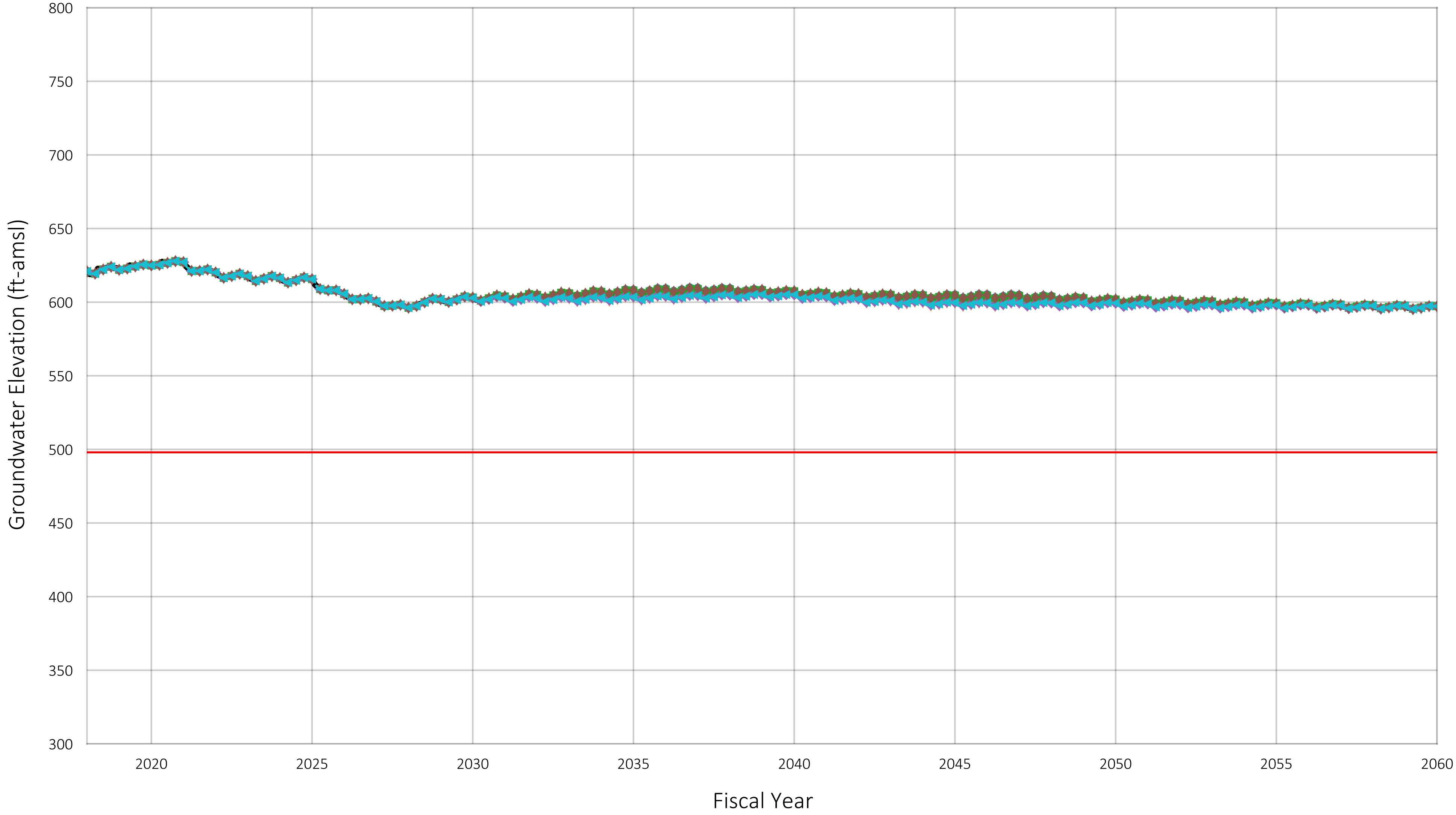
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206744
Owner: Monte Vista Water District
Well Name: 26

Figure A-72



Location of Well in Chino Basin

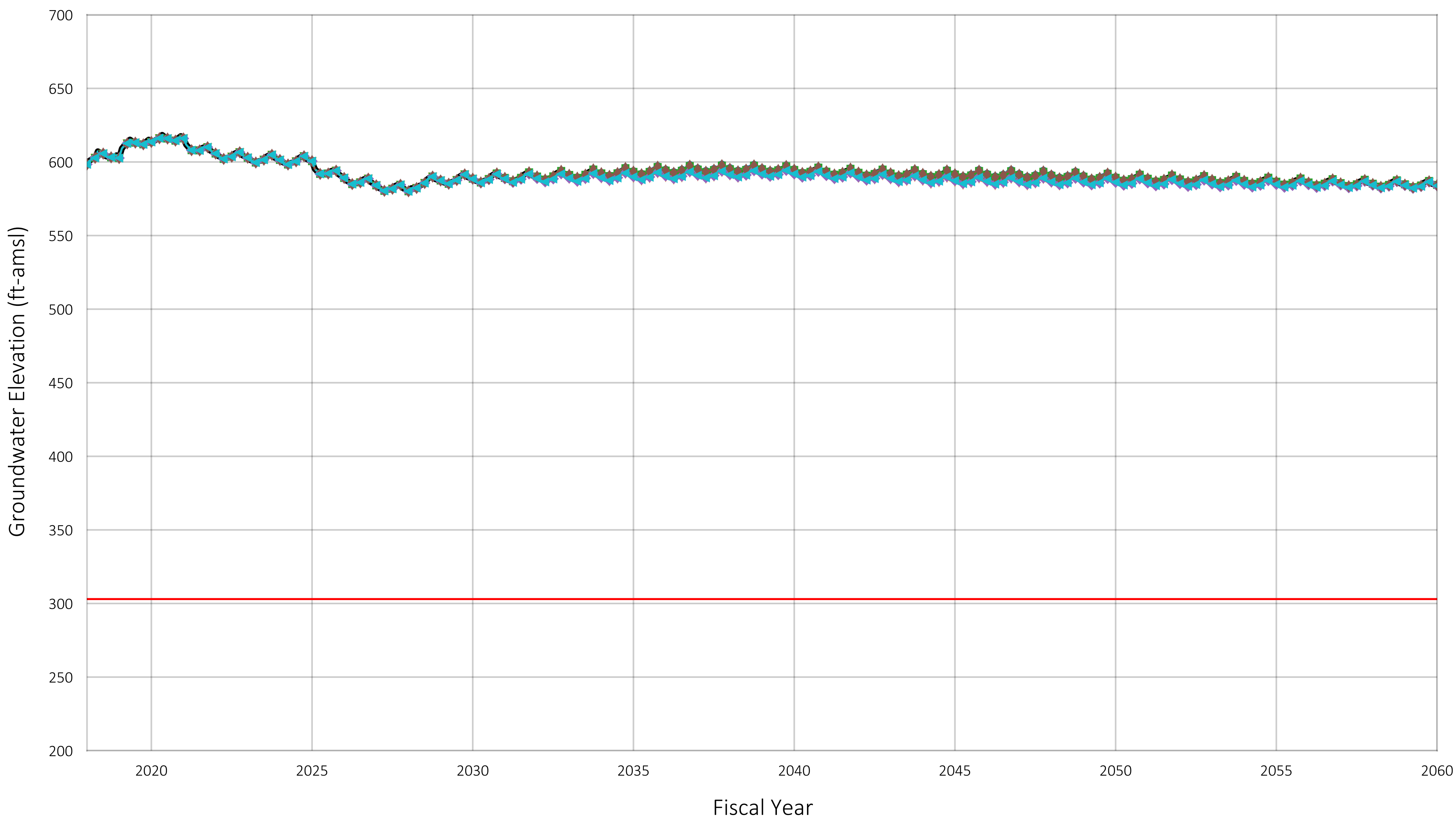
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206745
Owner: Monte Vista Water District
Well Name: 27

Figure A-73



Location of Well in Chino Basin

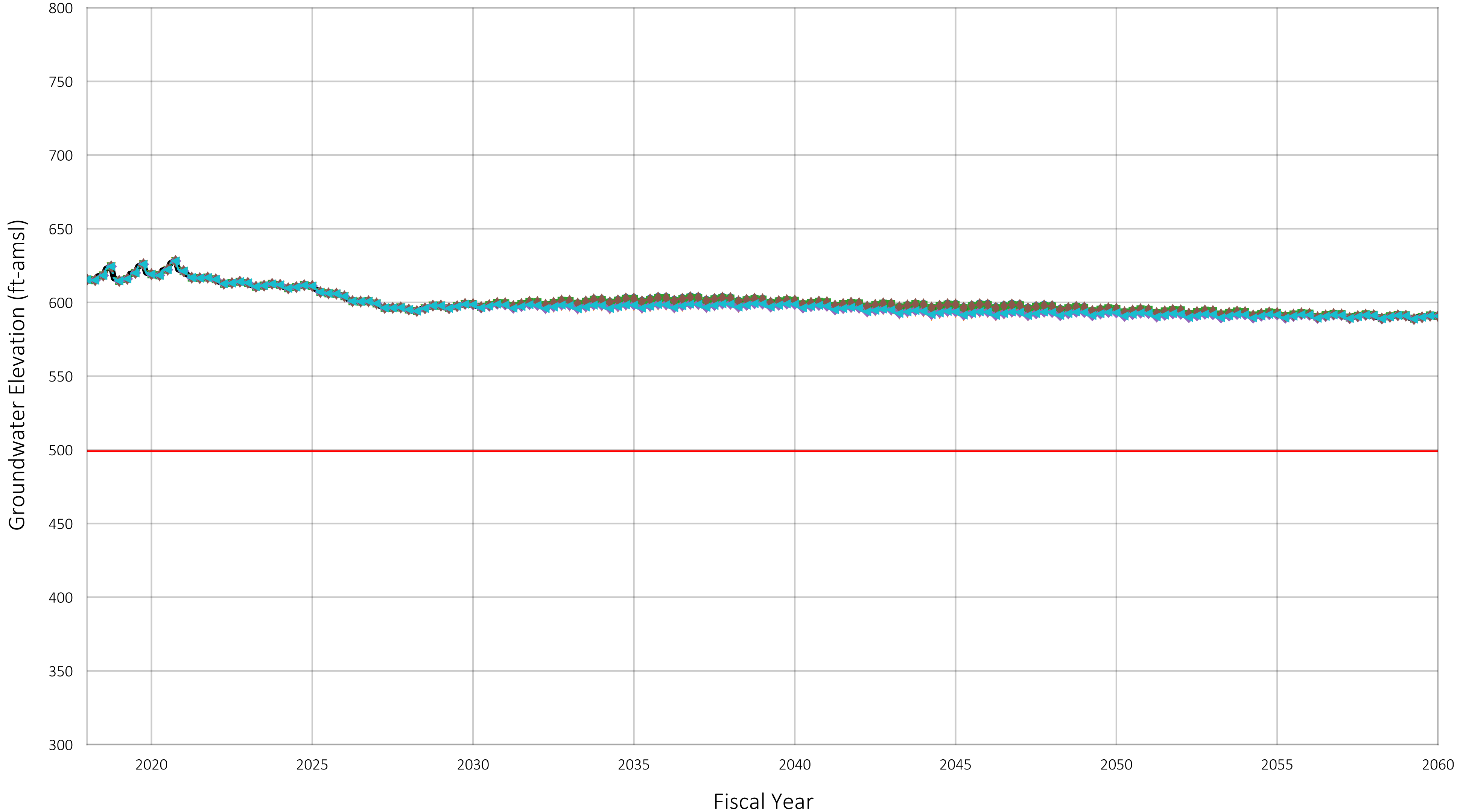
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206746
Owner: Monte Vista Water District
Well Name: 28

Figure A-74



Location of Well in Chino Basin

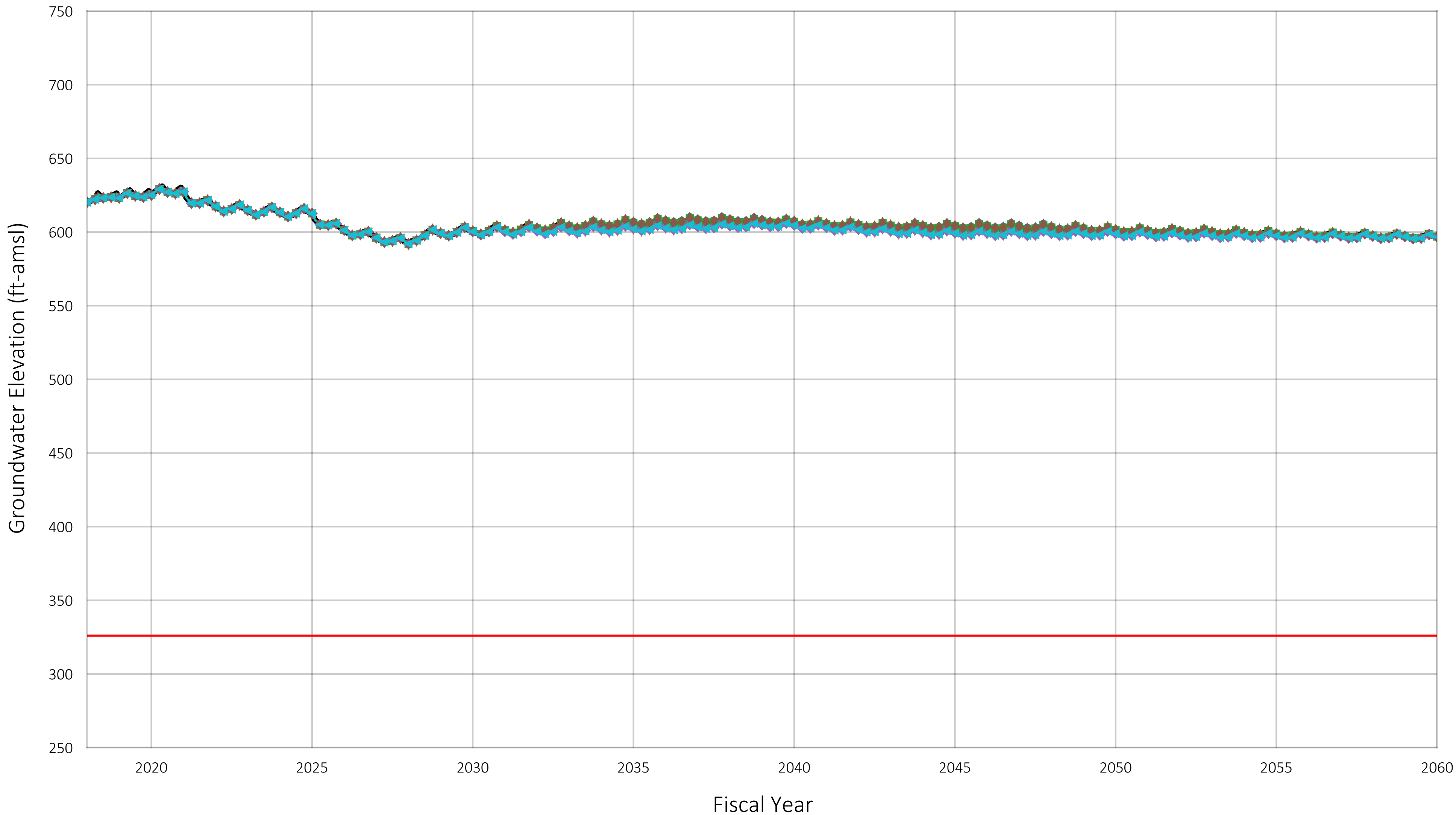
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1208781
Owner: Monte Vista Water District
Well Name: 30

Figure A-75



Location of Well in Chino Basin

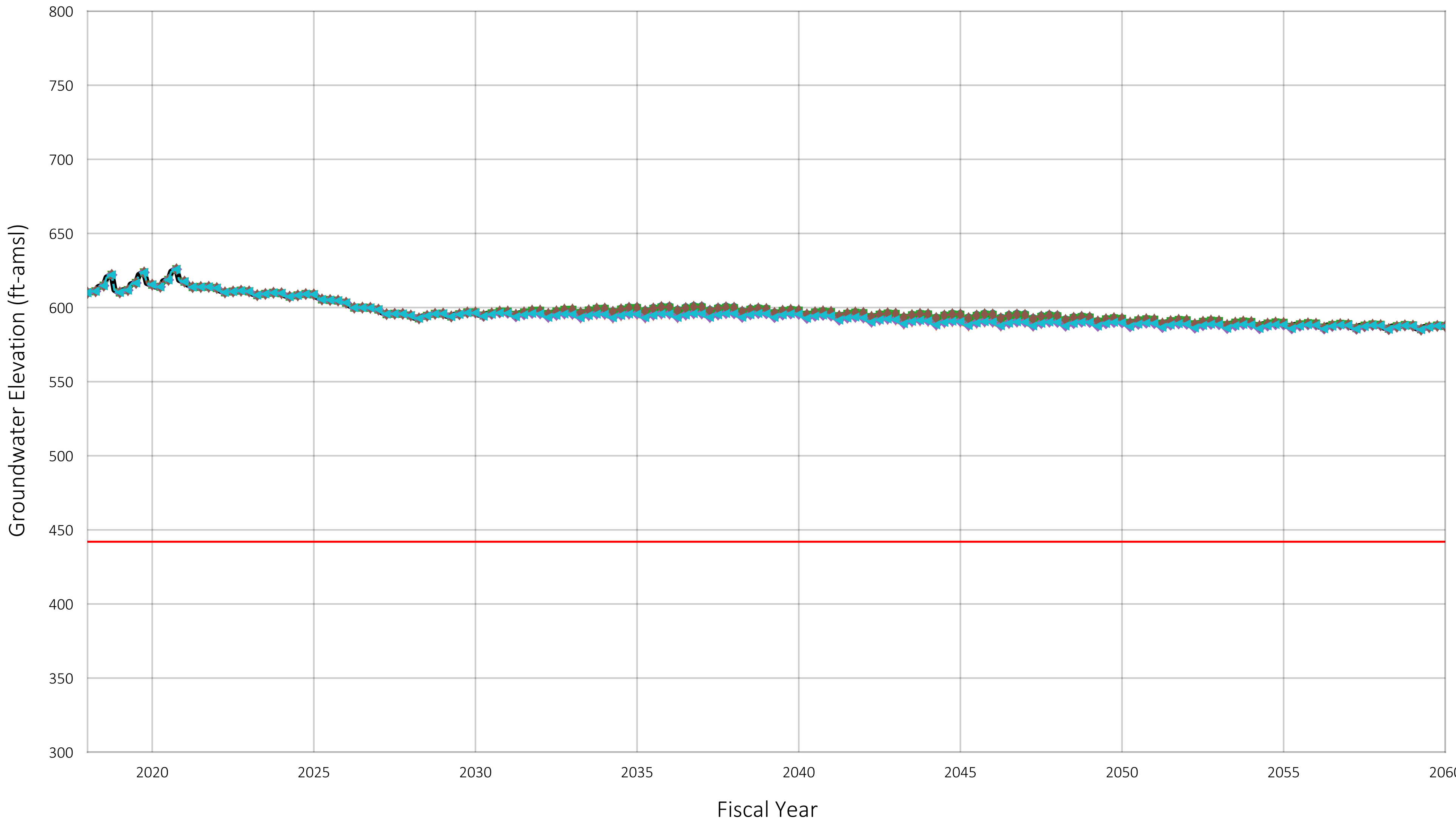
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1208782
Owner: Monte Vista Water District
Well Name: 31

Figure A-76



Location of Well in Chino Basin

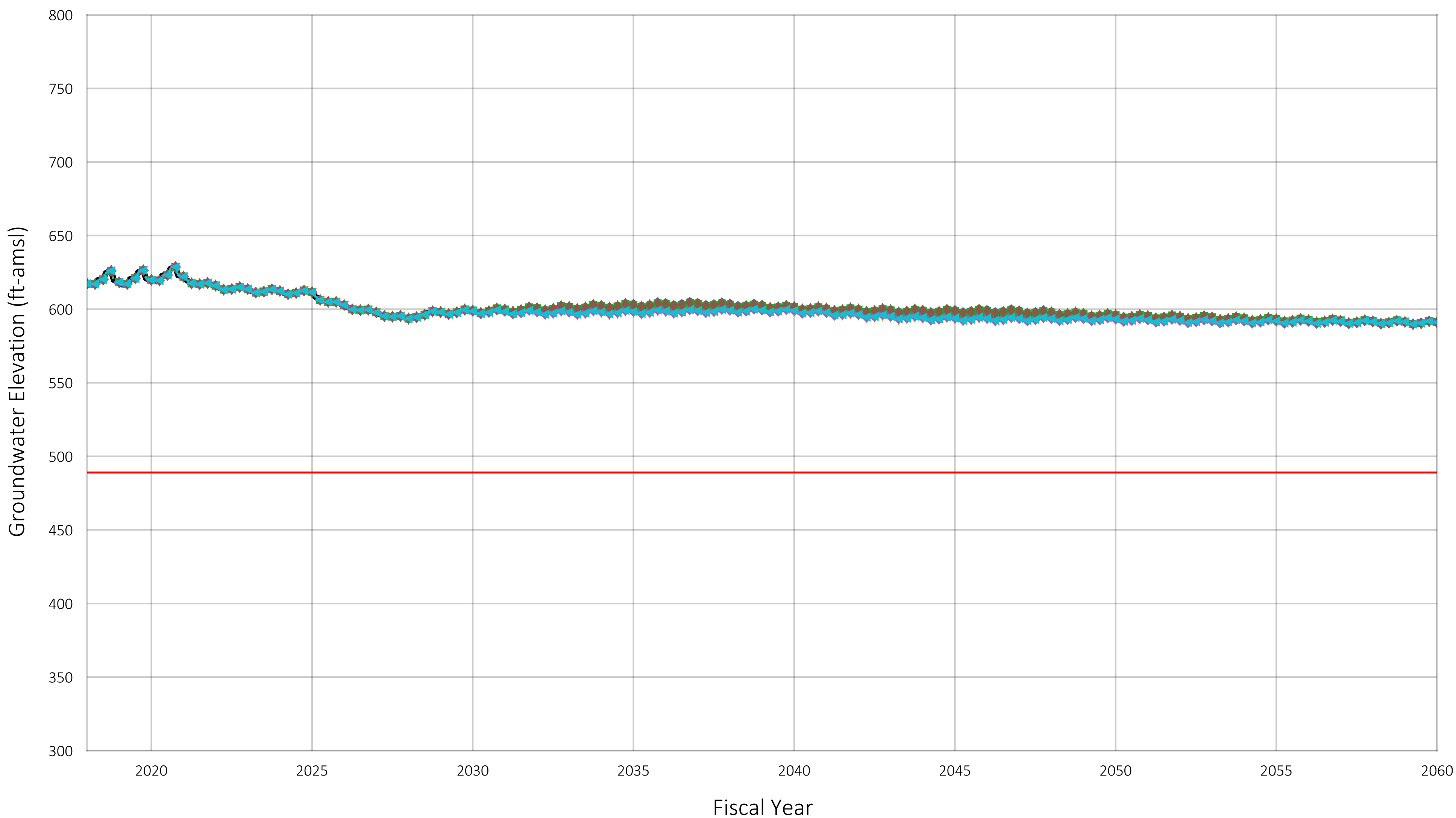
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1208771
Owner: Monte Vista Water District
Well Name: 32

Figure A-77



Location of Well in Chino Basin

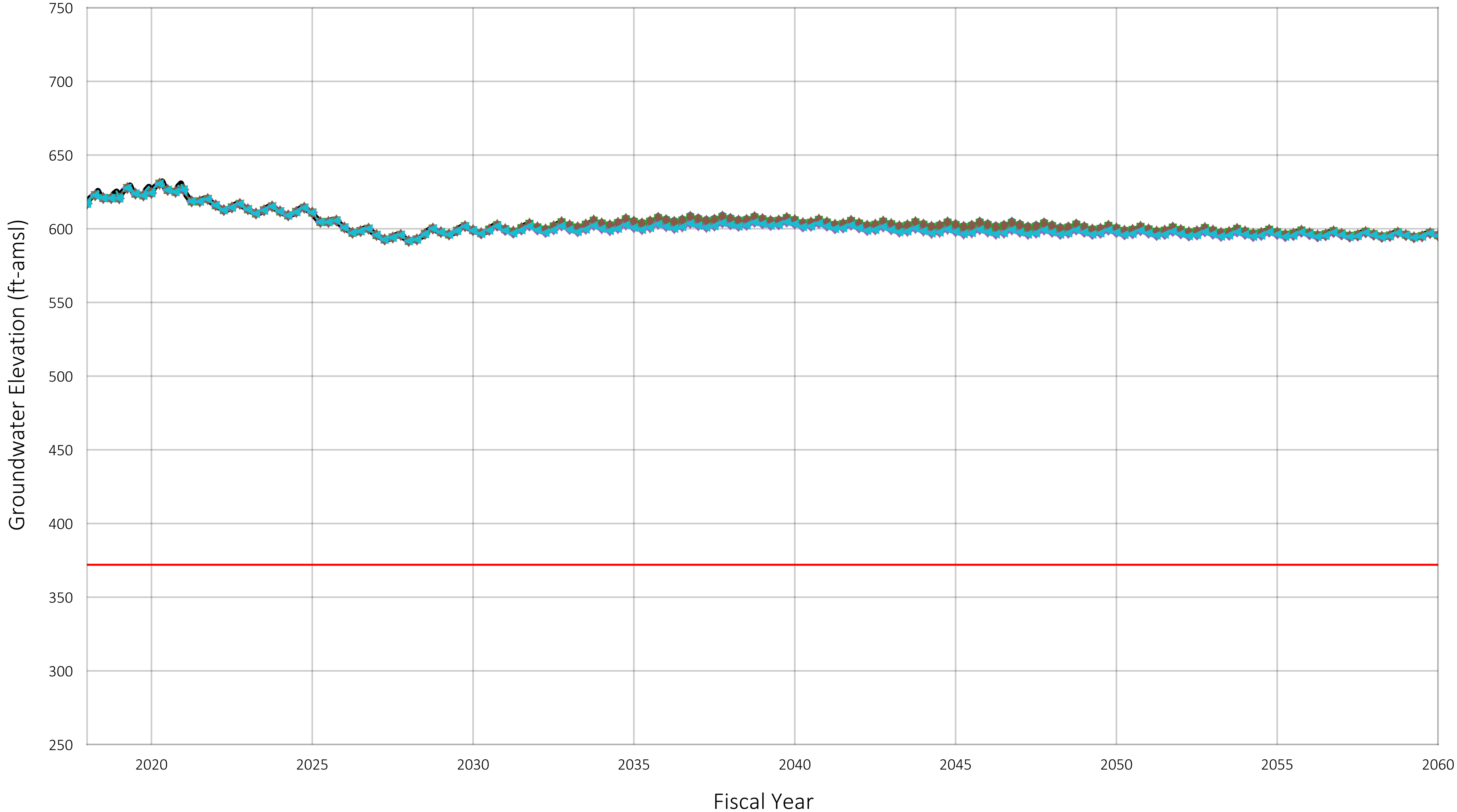
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220173
Owner: Monte Vista Water District
Well Name: 33

Figure A-78



Location of Well in Chino Basin

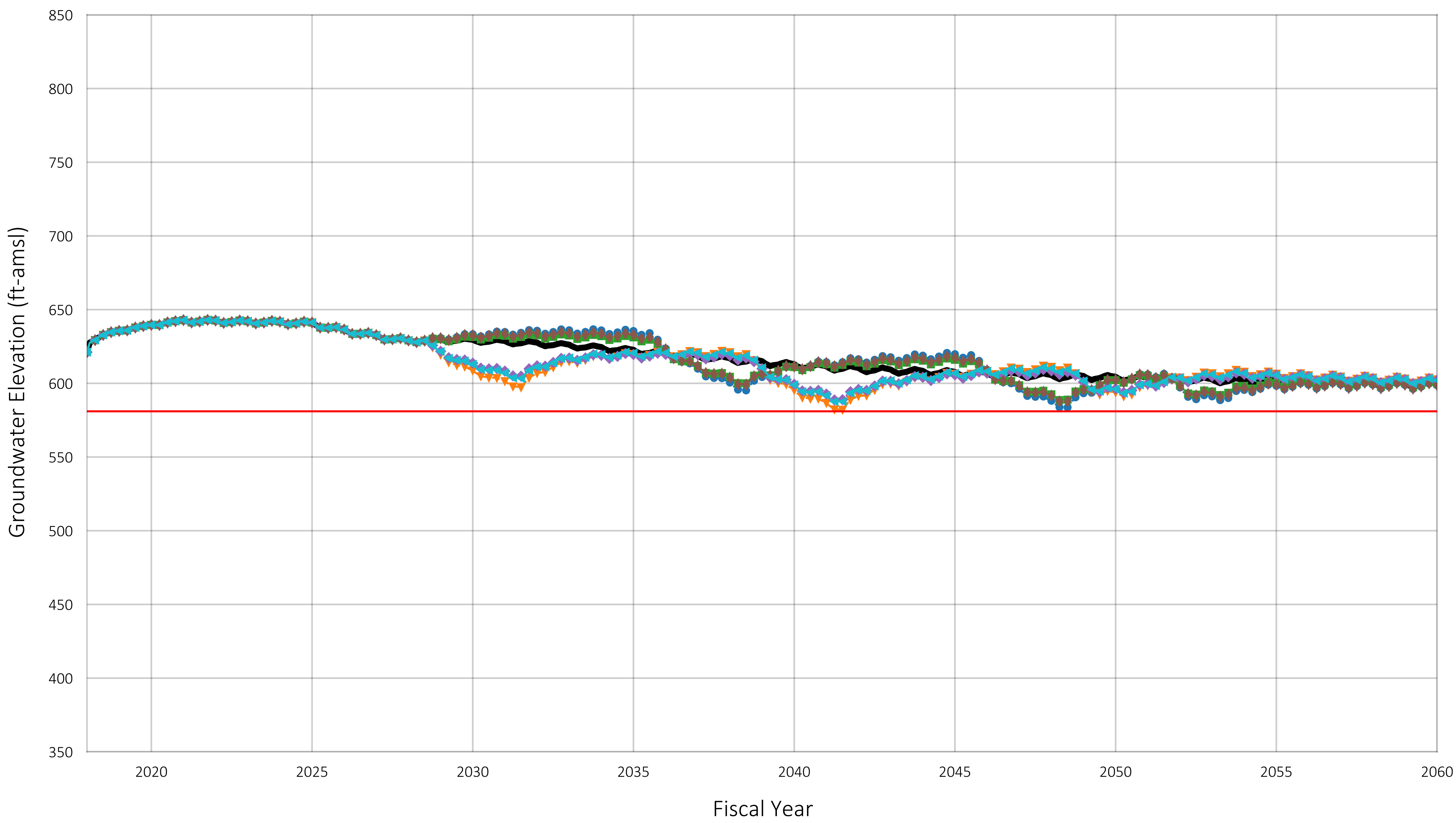
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1224765
Owner: Monte Vista Water District
Well Name: 34

Figure A-79



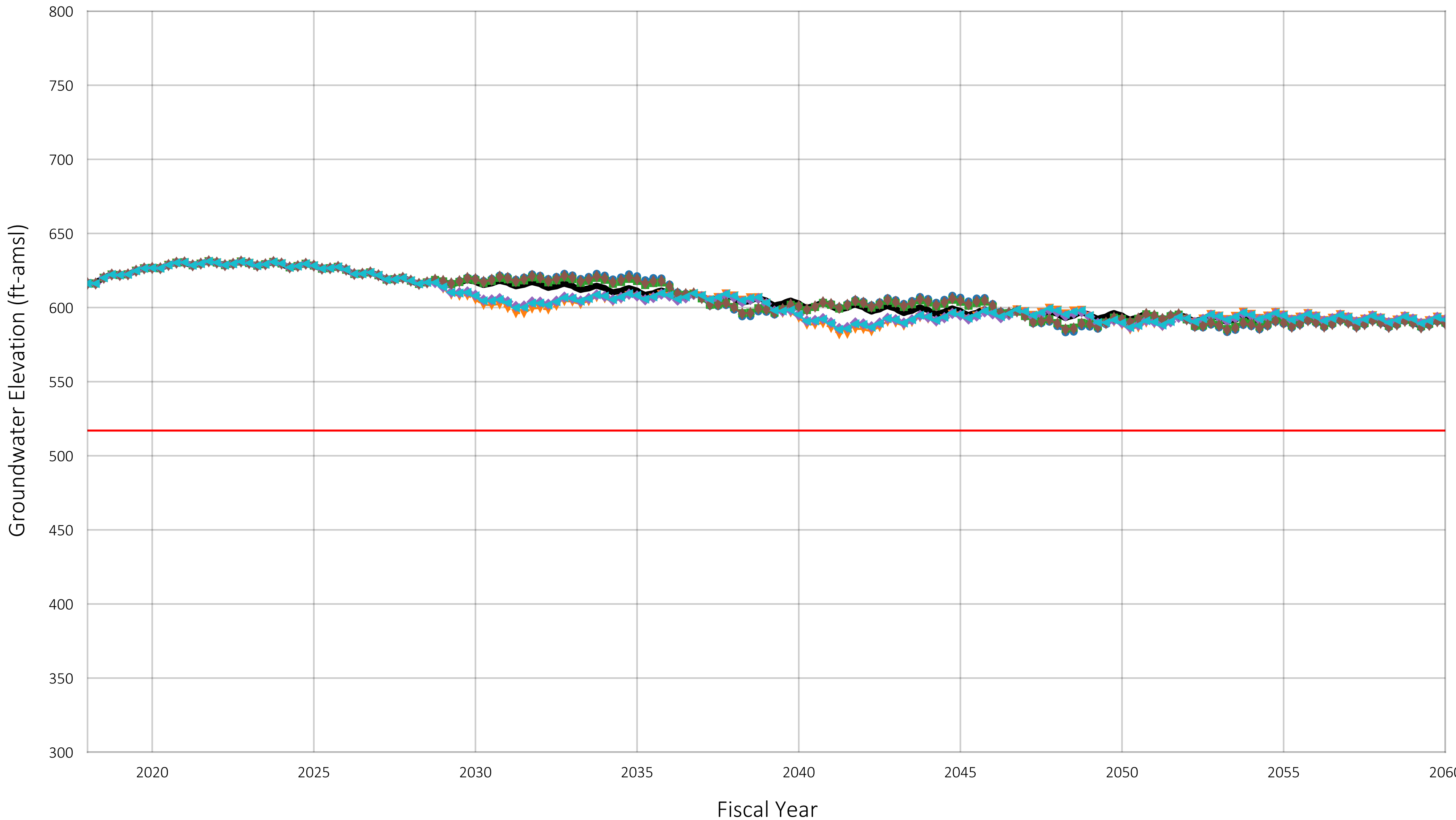
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002339
Owner: City of Ontario
Well Name: 24

Figure A-80



Location of Well in Chino Basin

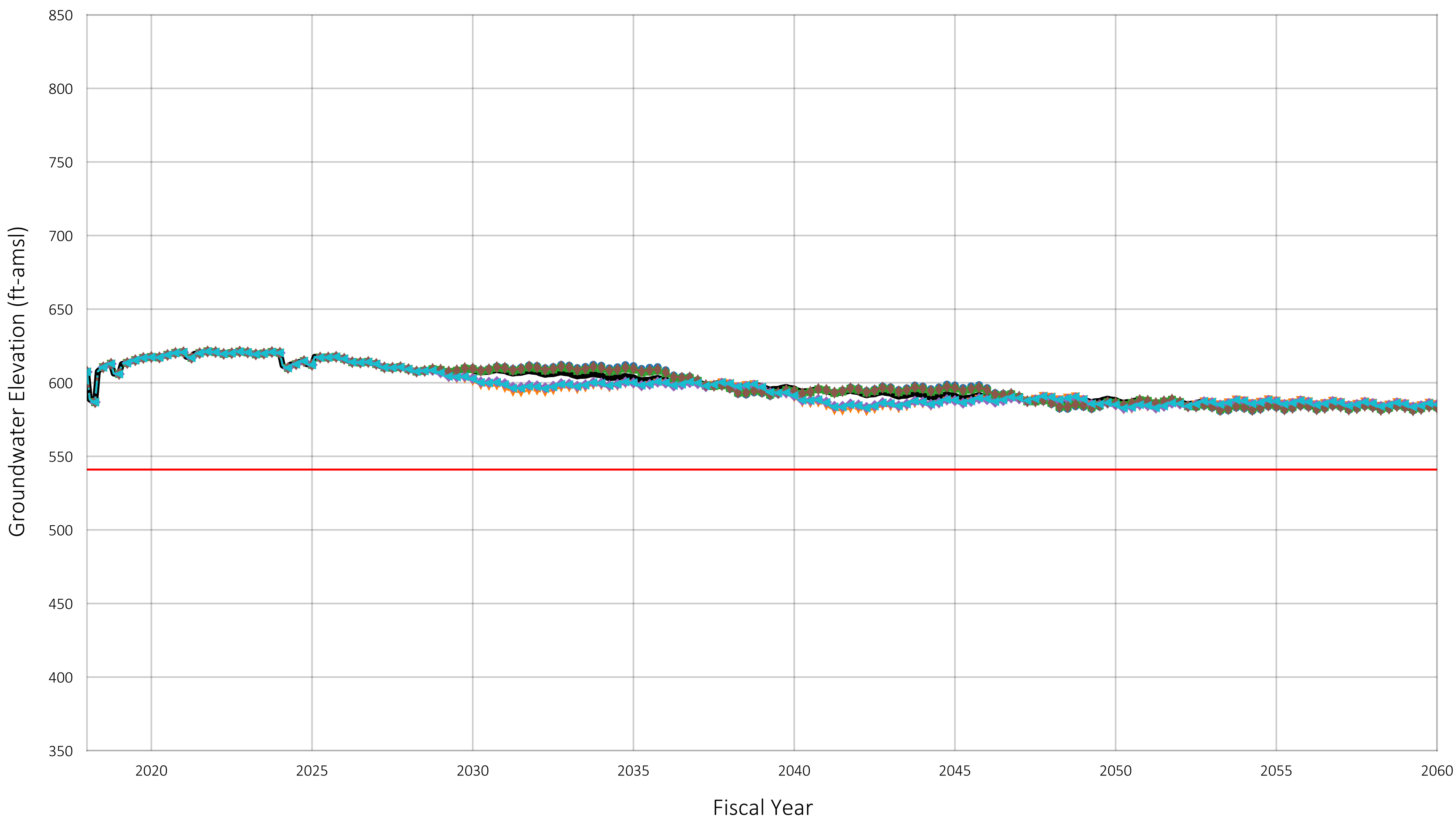
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002337
Owner: City of Ontario
Well Name: 25

Figure A-81



Location of Well in Chino Basin

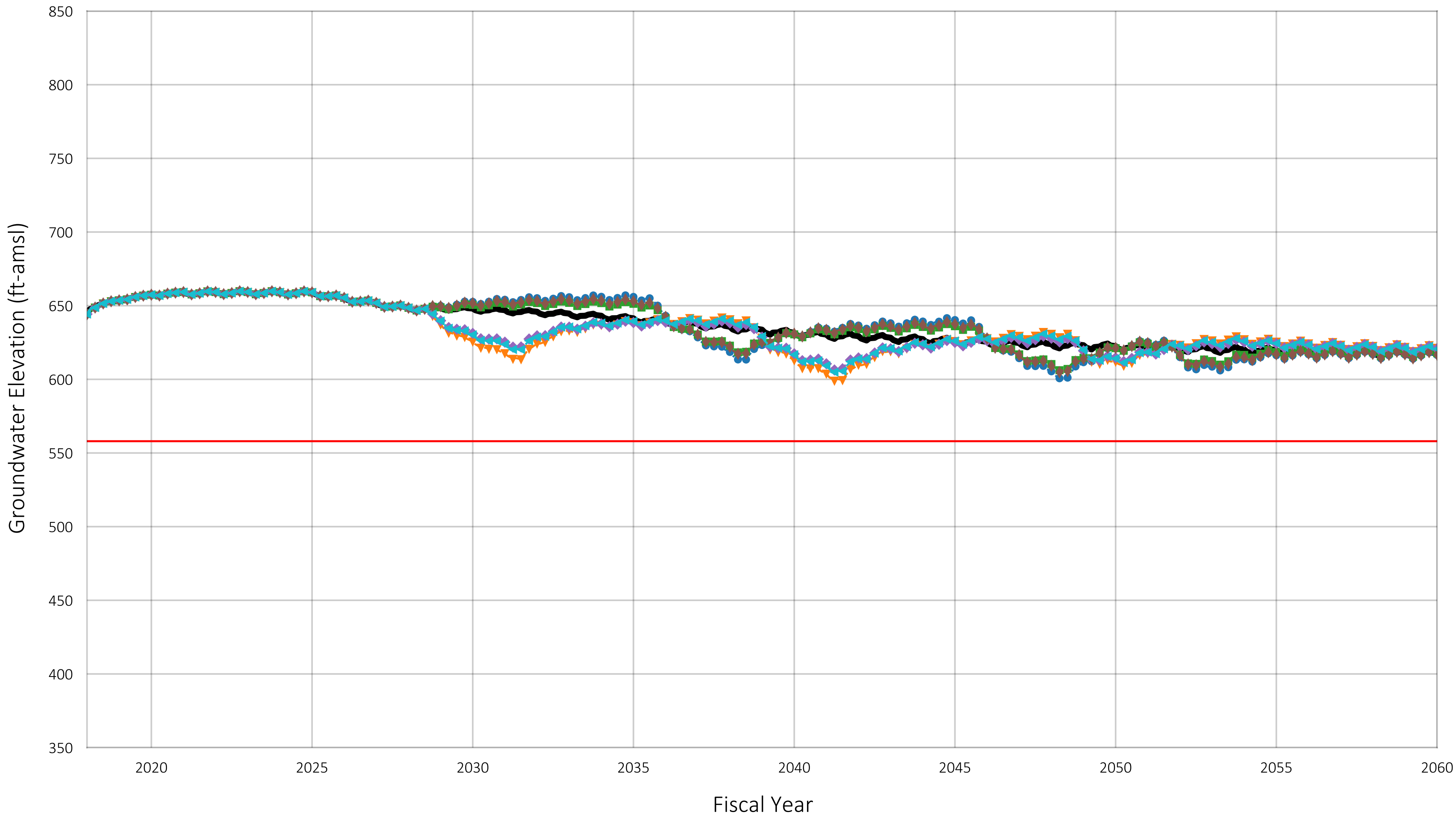
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002333
Owner: City of Ontario
Well Name: 29

Figure A-82



Location of Well in Chino Basin

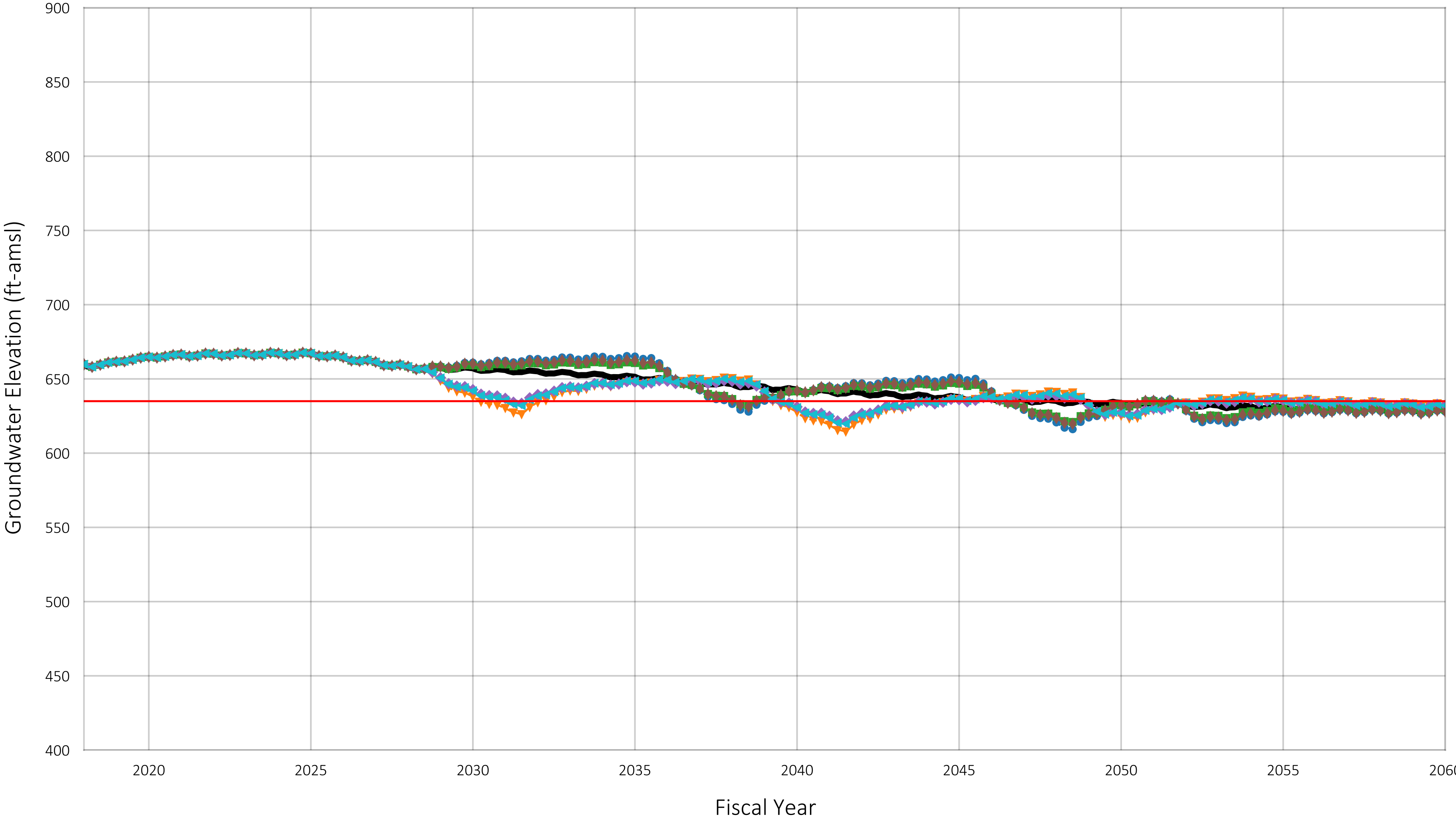
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002253
Owner: City of Ontario
Well Name: 30

Figure A-83



Location of Well in Chino Basin

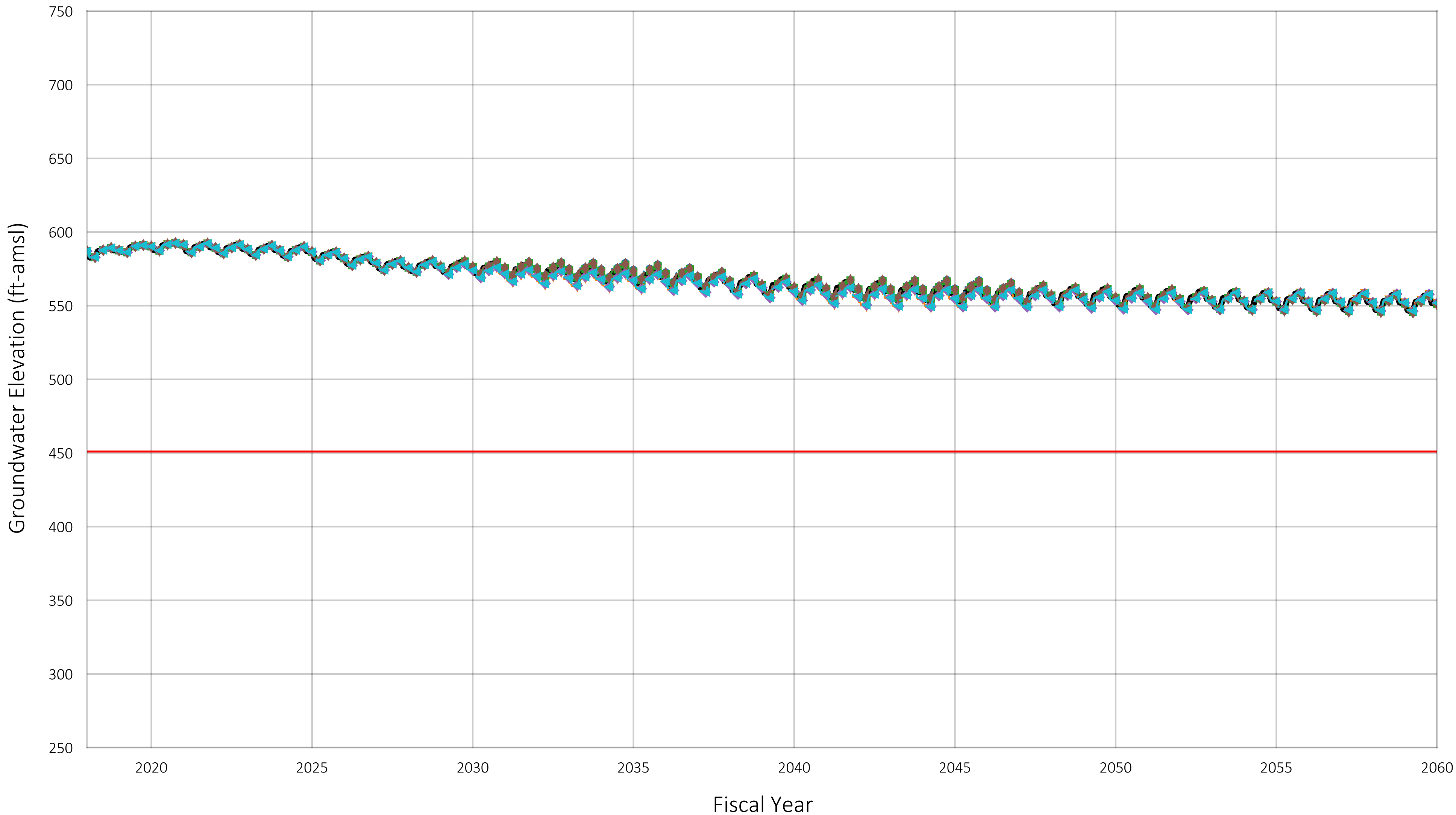
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002254
Owner: City of Ontario
Well Name: 31

Figure A-84



Location of Well in Chino Basin

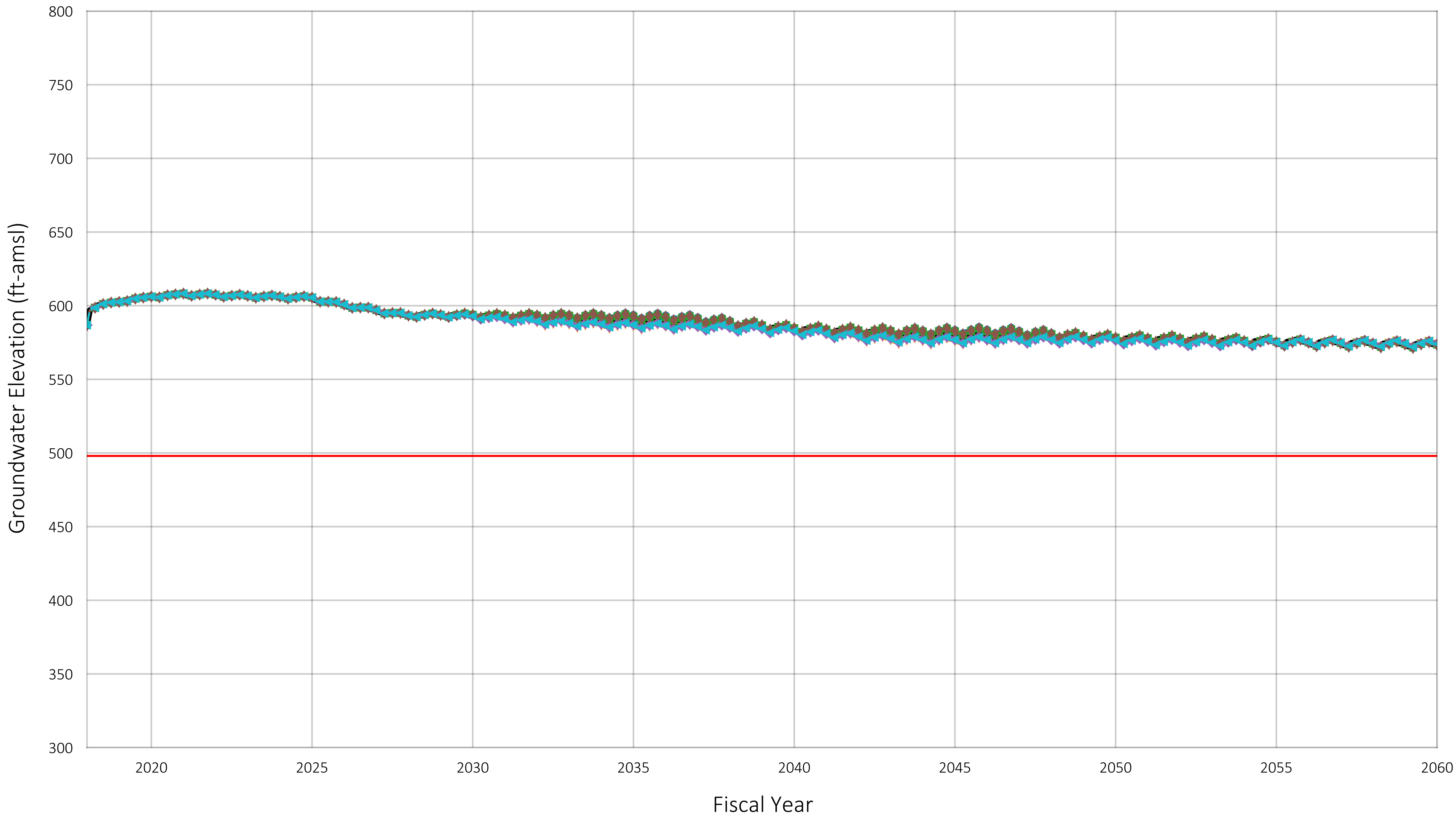
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002367
Owner: City of Ontario
Well Name: 34

Figure A-85



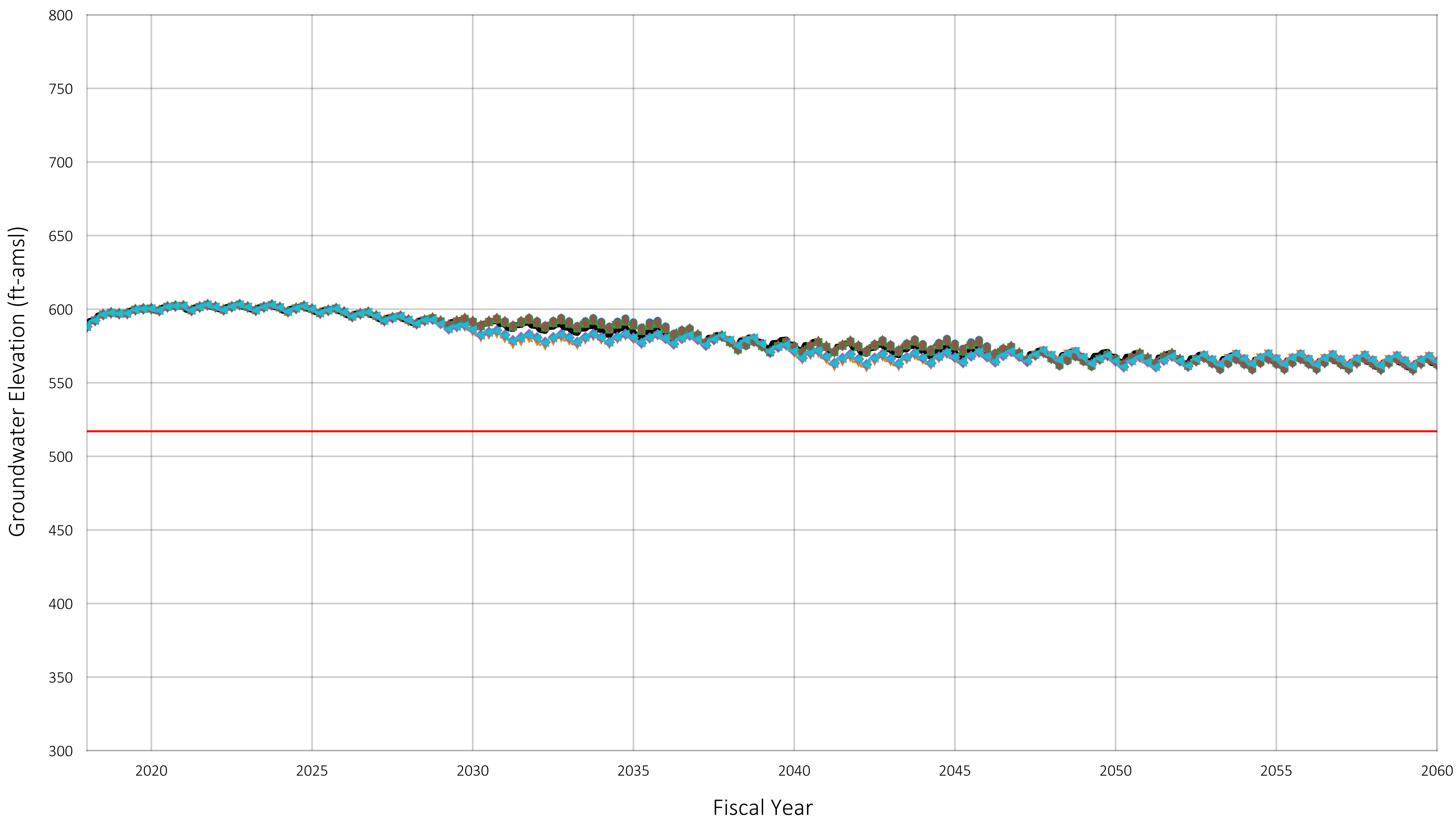
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002350
Owner: City of Ontario
Well Name: 35

Figure A-86



Location of Well in Chino Basin

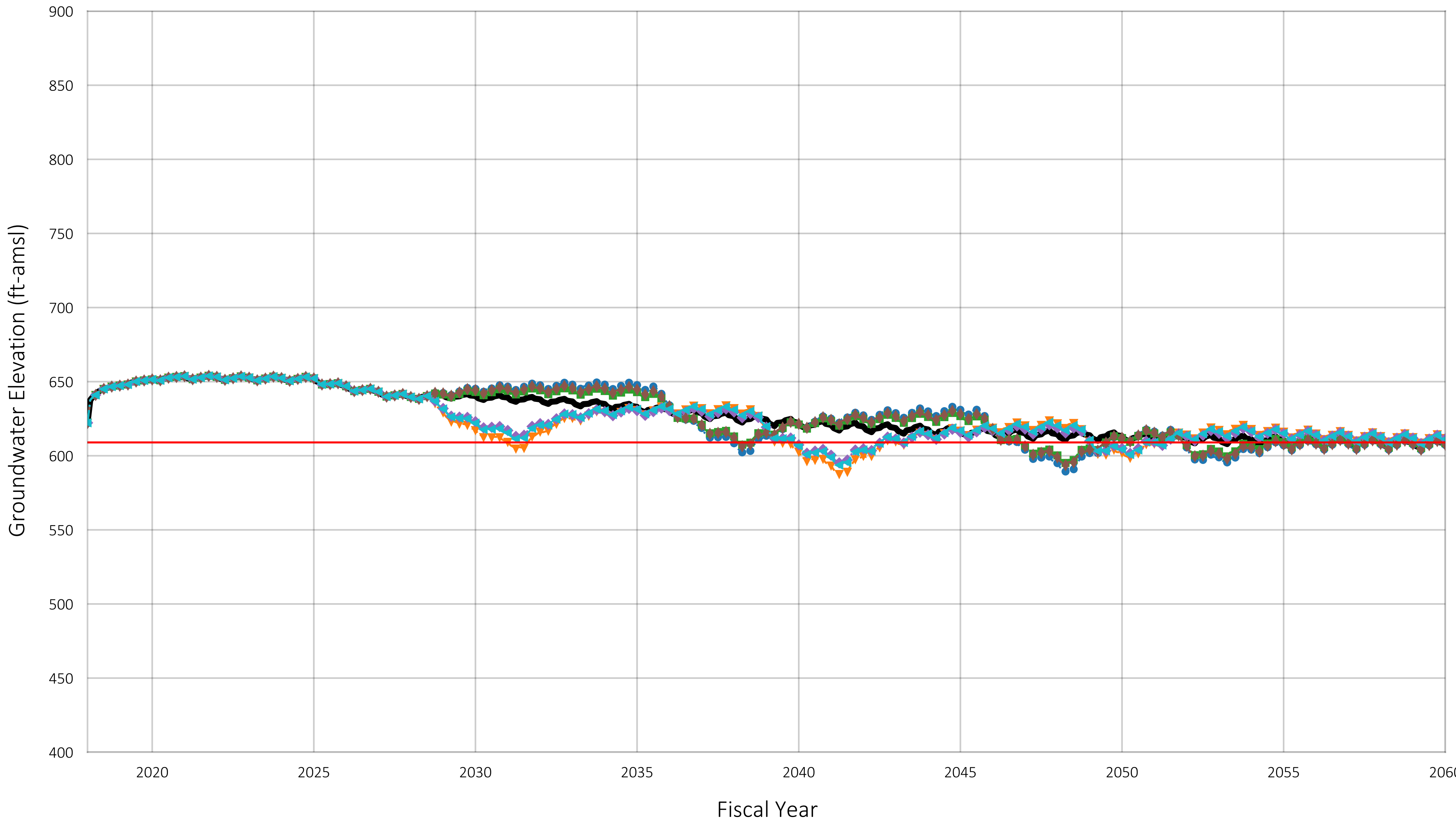
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002372
Owner: City of Ontario
Well Name: 36

Figure A-87



Location of Well in Chino Basin

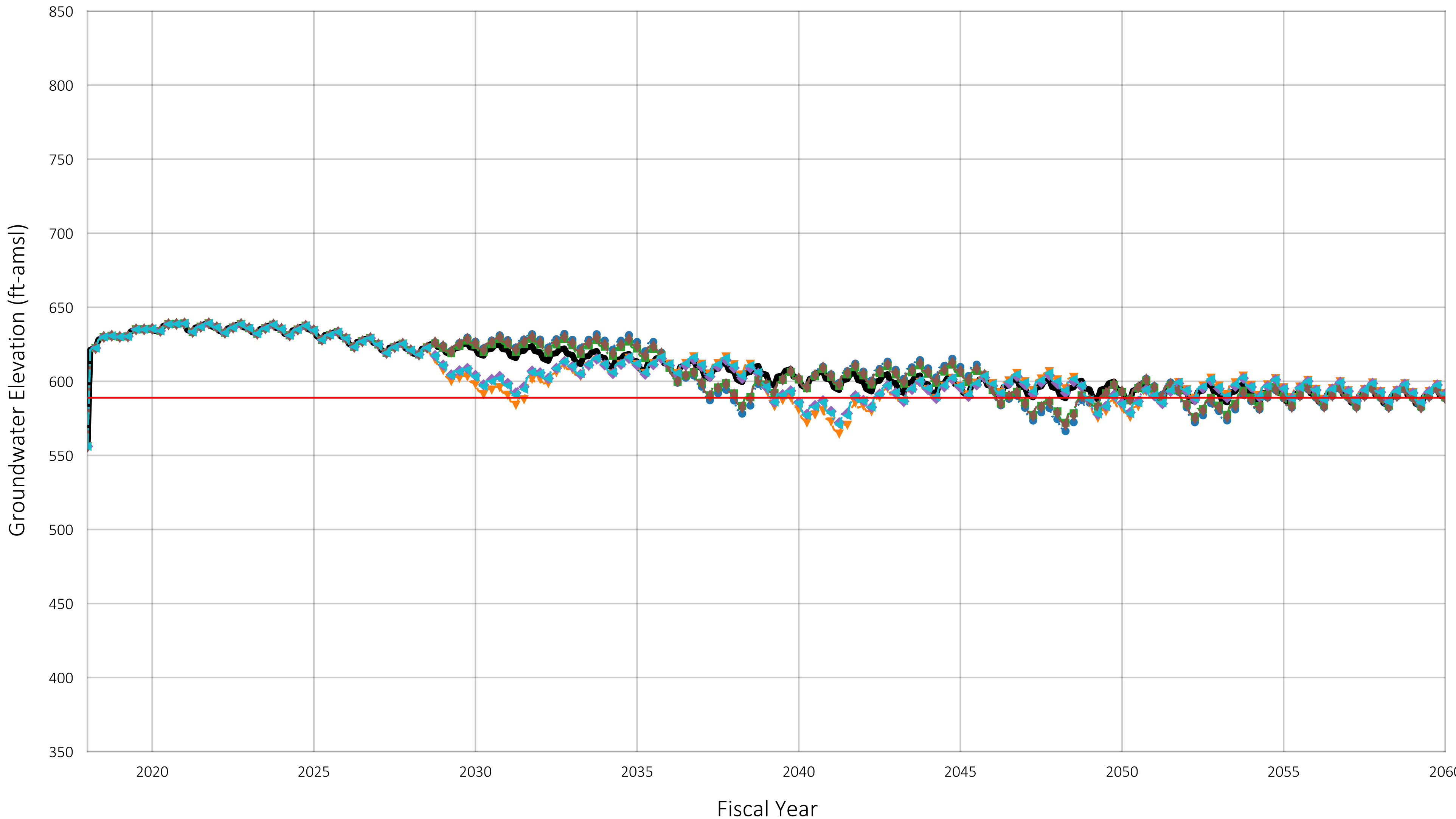
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002230
Owner: City of Ontario
Well Name: 37

Figure A-88



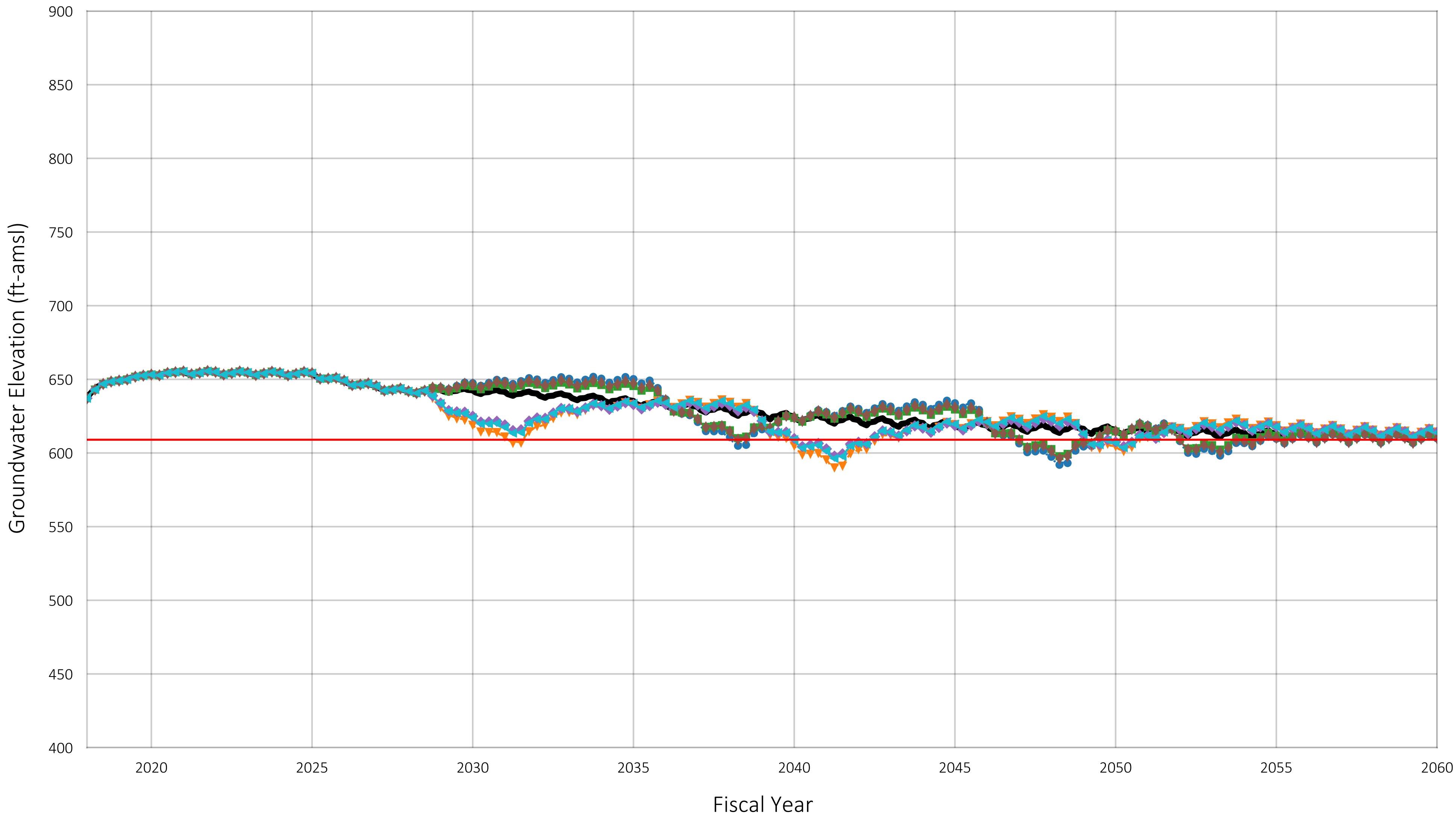
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1006998
Owner: City of Ontario
Well Name: 38

Figure A-89



Location of Well in Chino Basin

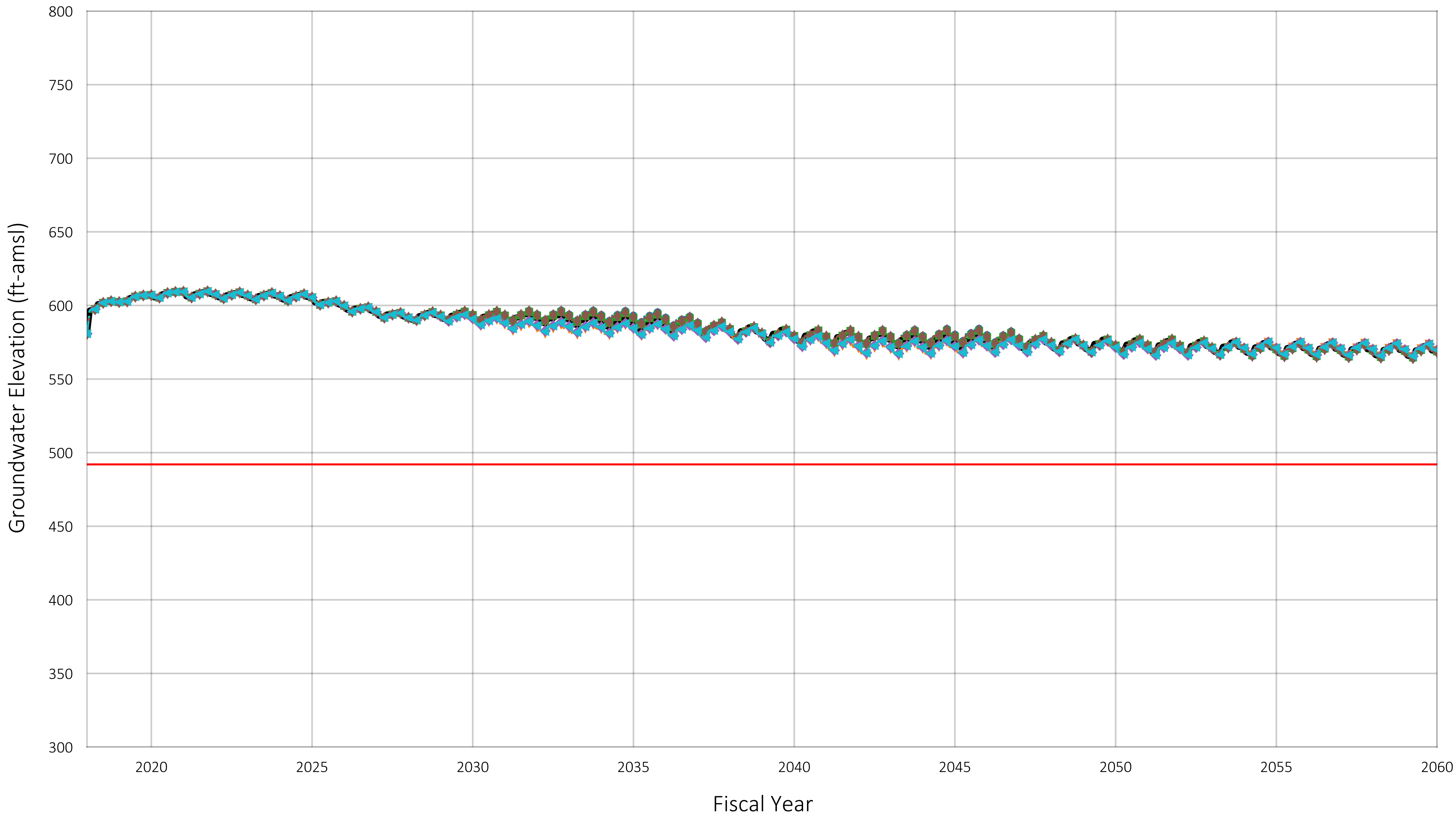
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206945
Owner: City of Ontario
Well Name: 39

Figure A-90



Location of Well in Chino Basin

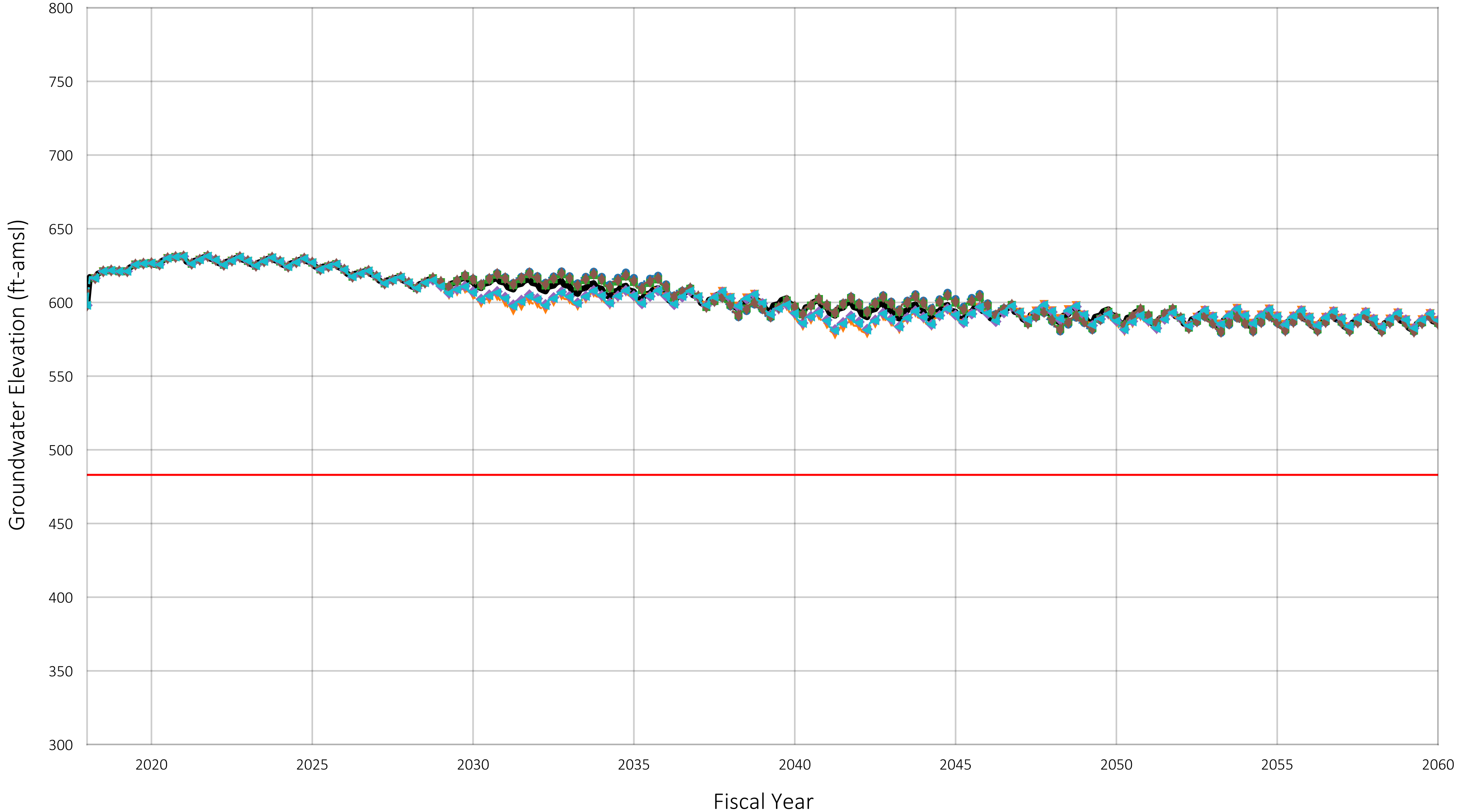
Baseline		Scenario 4	
Scenario 1		Scenario 5	
Scenario 2		Scenario 6	
Scenario 3		Pumping Sustainability Metric Elevation	

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207502
Owner: City of Ontario
Well Name: 40

Figure A-91



Location of Well in Chino Basin

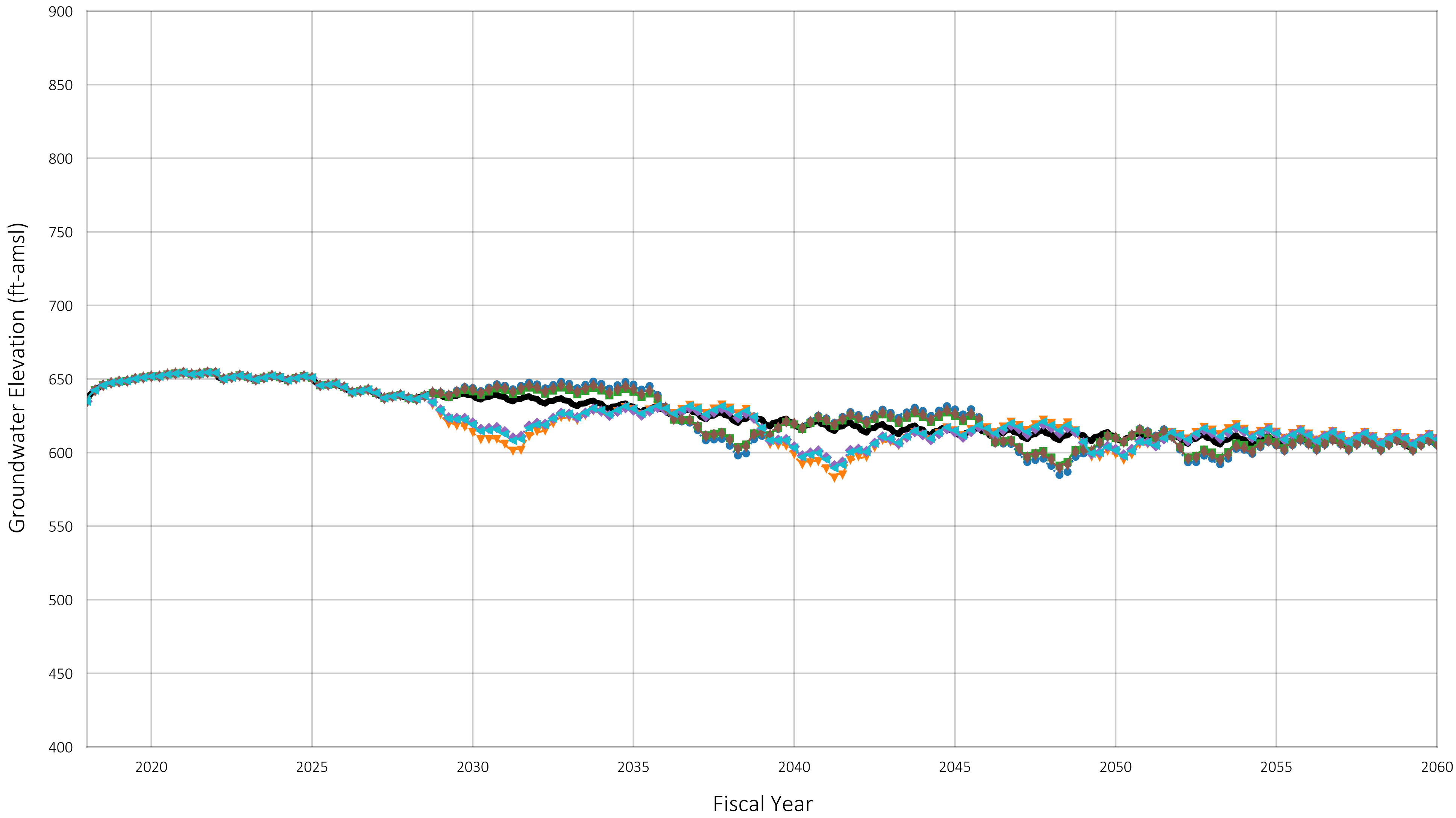
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207503
Owner: City of Ontario
Well Name: 41

Figure A-92



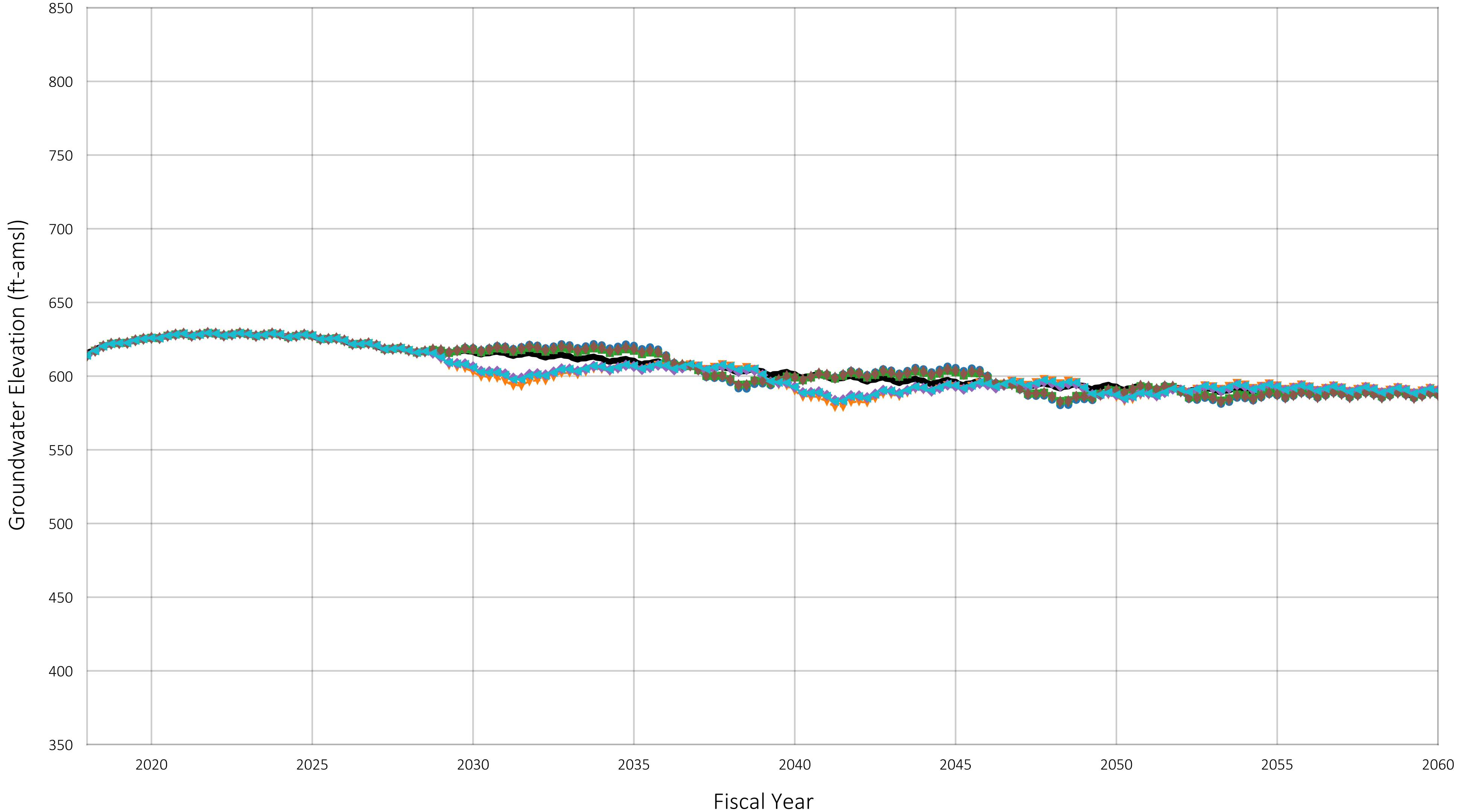
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220168
Owner: City of Ontario
Well Name: 42

Figure A-93



Location of Well in Chino Basin

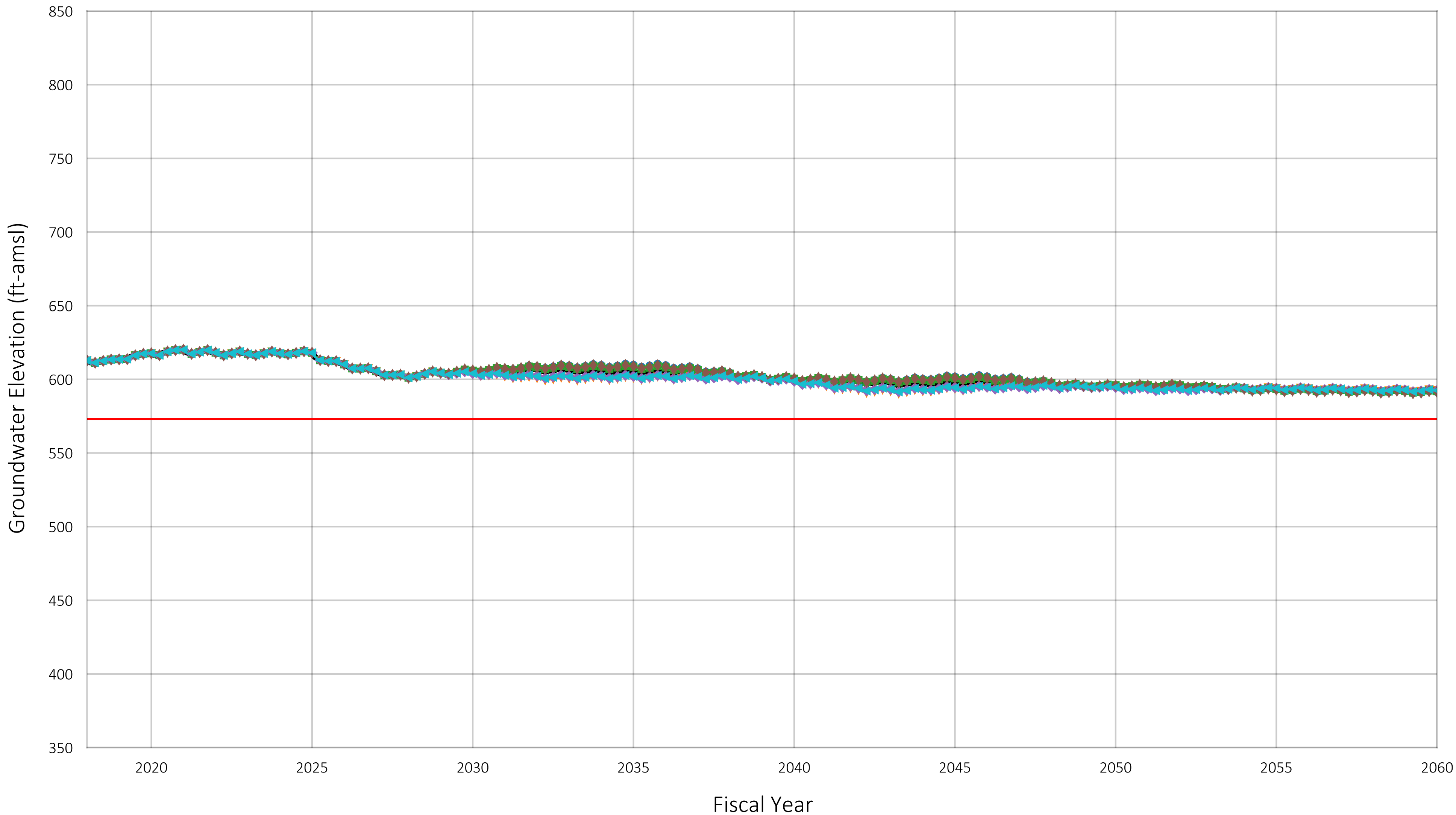
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220169
Owner: City of Ontario
Well Name: 43

Figure A-94



Location of Well in Chino Basin

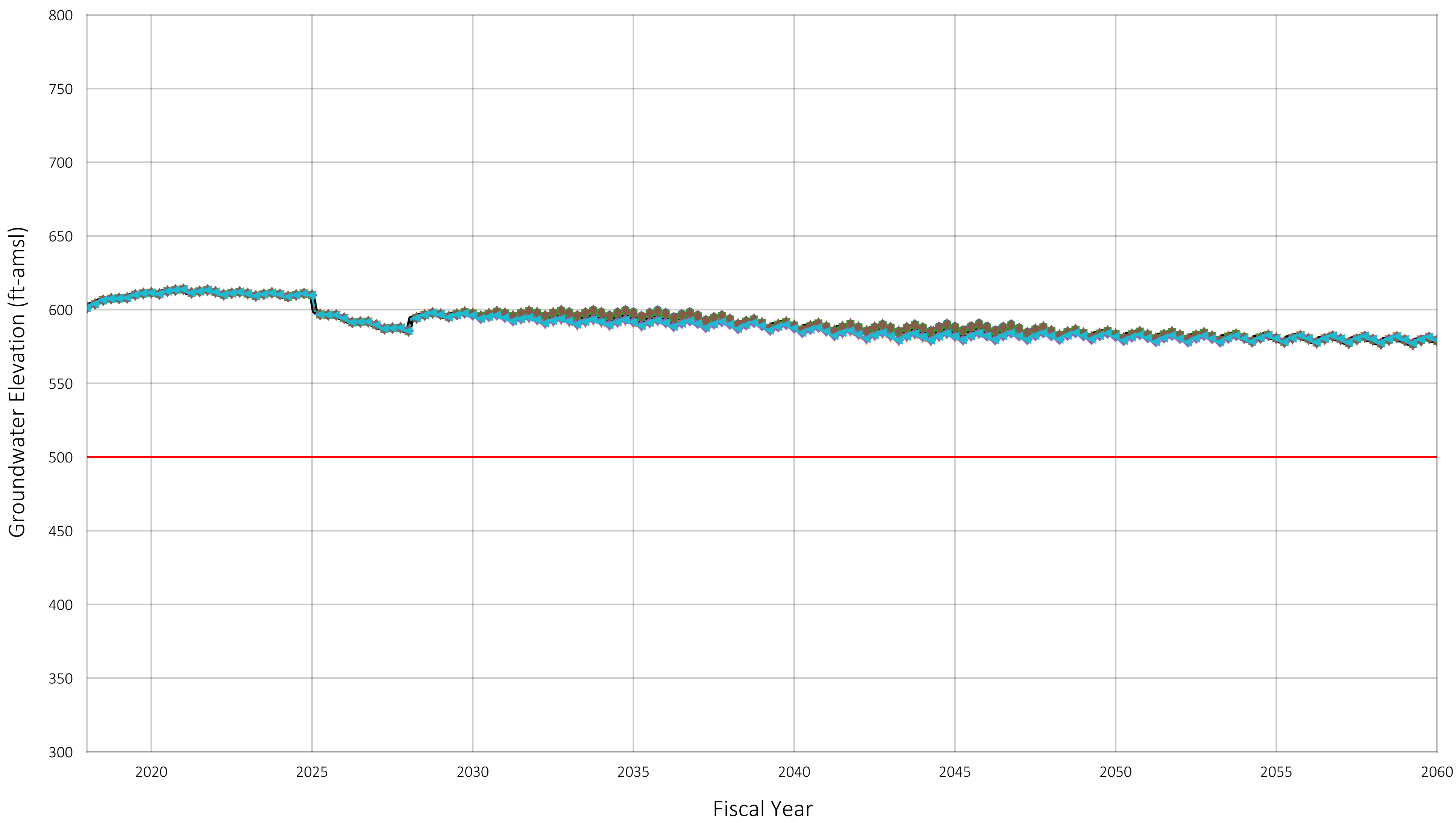
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220170
Owner: City of Ontario
Well Name: 44

Figure A-95



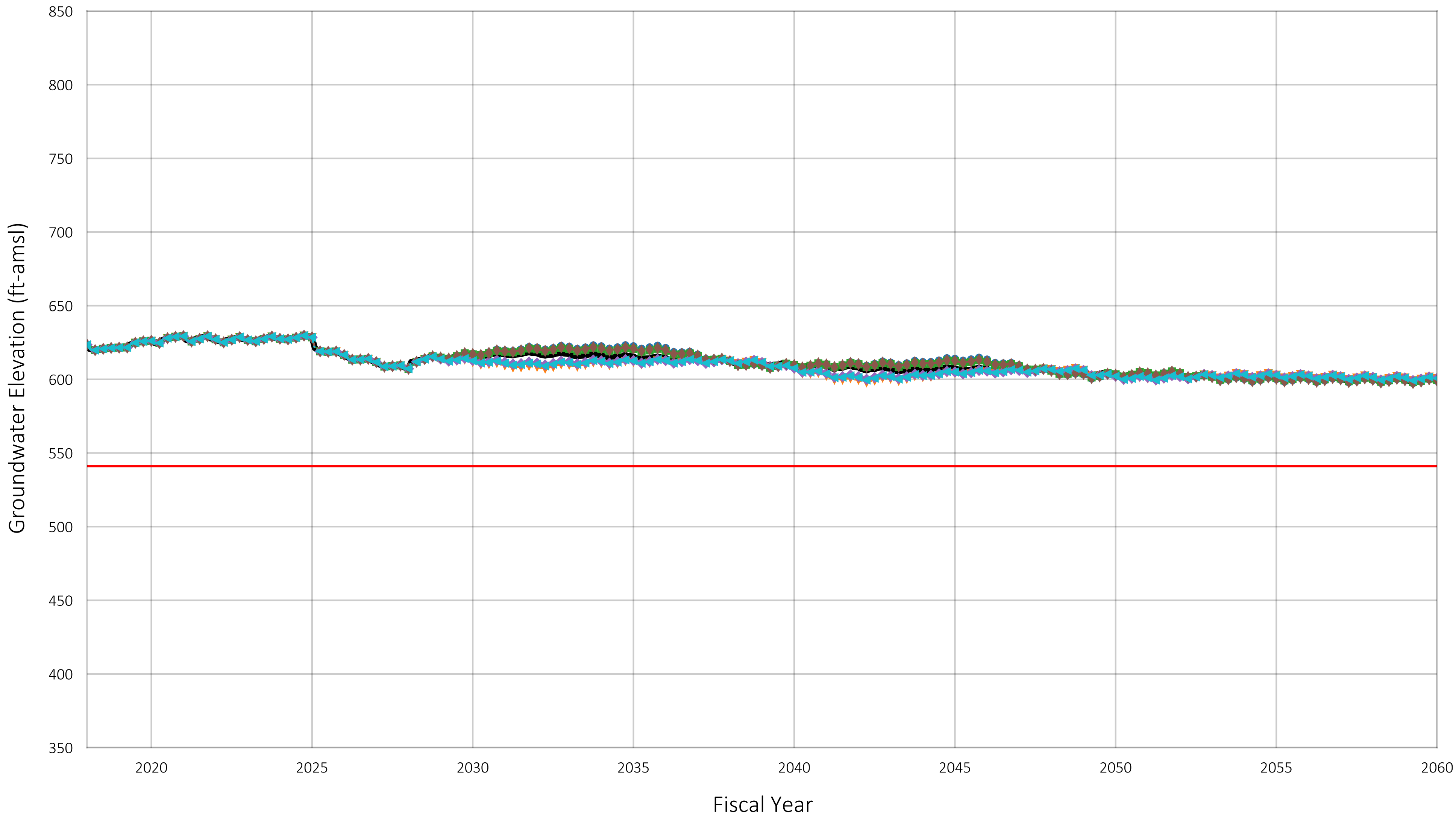
Location of Well in Chino Basin

Prepared by:

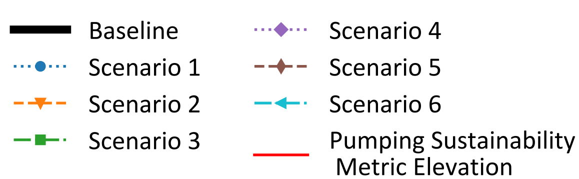
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207950
Owner: City of Ontario
Well Name: 45

Figure A-96



Location of Well in Chino Basin

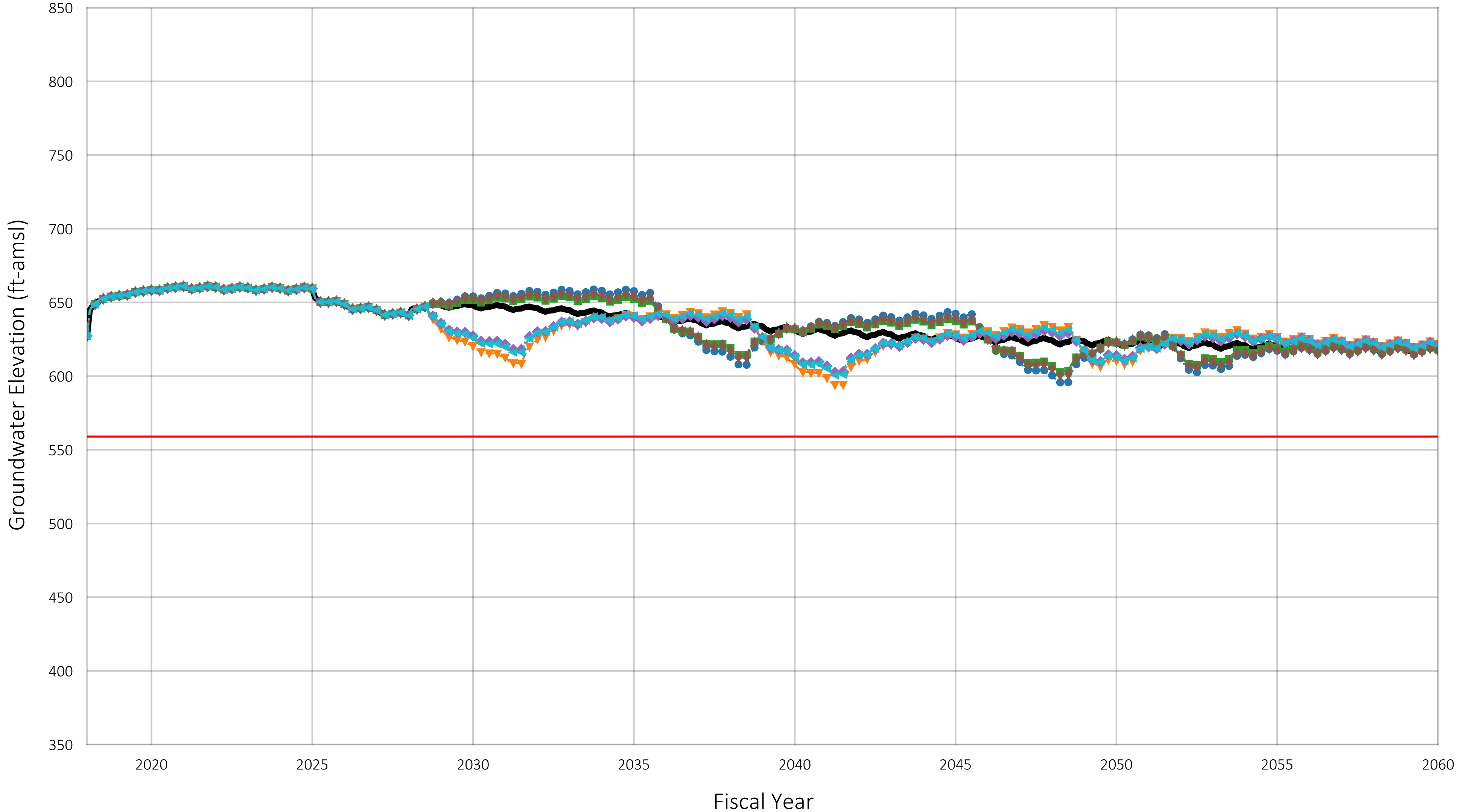


Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207946
Owner: City of Ontario
Well Name: 46

Figure A-97



Location of Well in Chino Basin

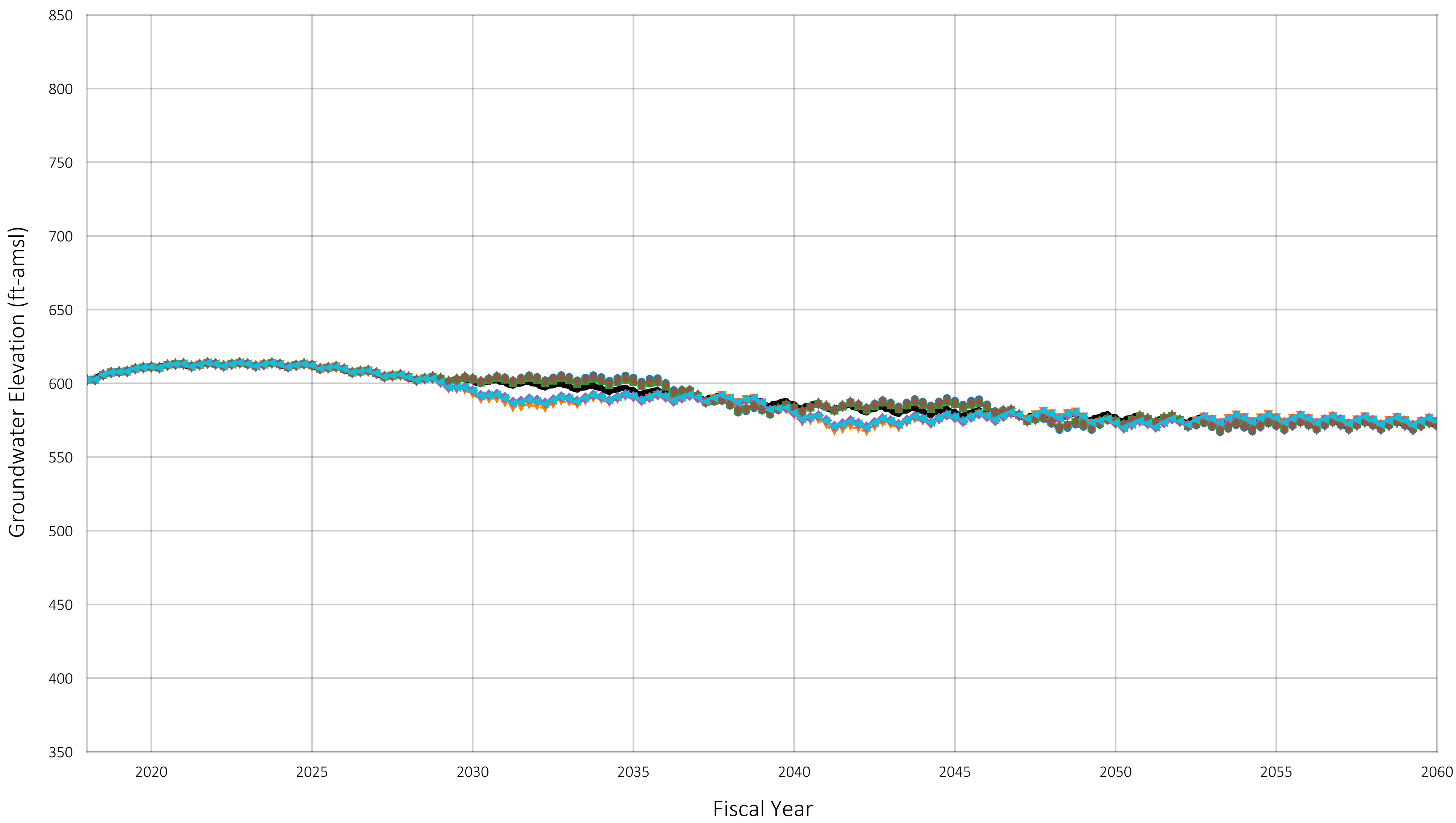
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1207948
Owner: City of Ontario
Well Name: 47

Figure A-98

Prepared by:

WEST YOST
Water. Engineered



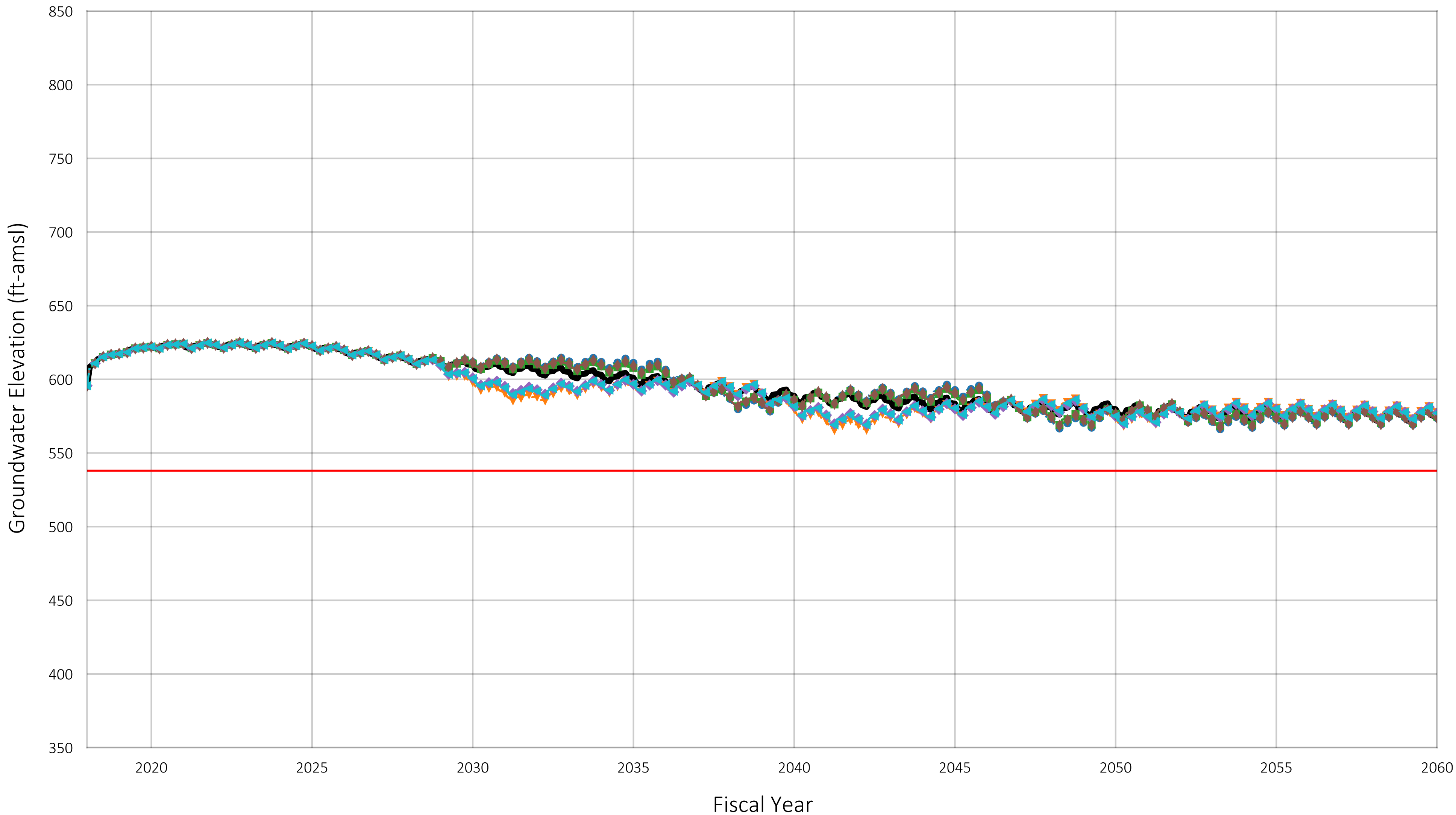
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220171
Owner: City of Ontario
Well Name: 48

Figure A-99



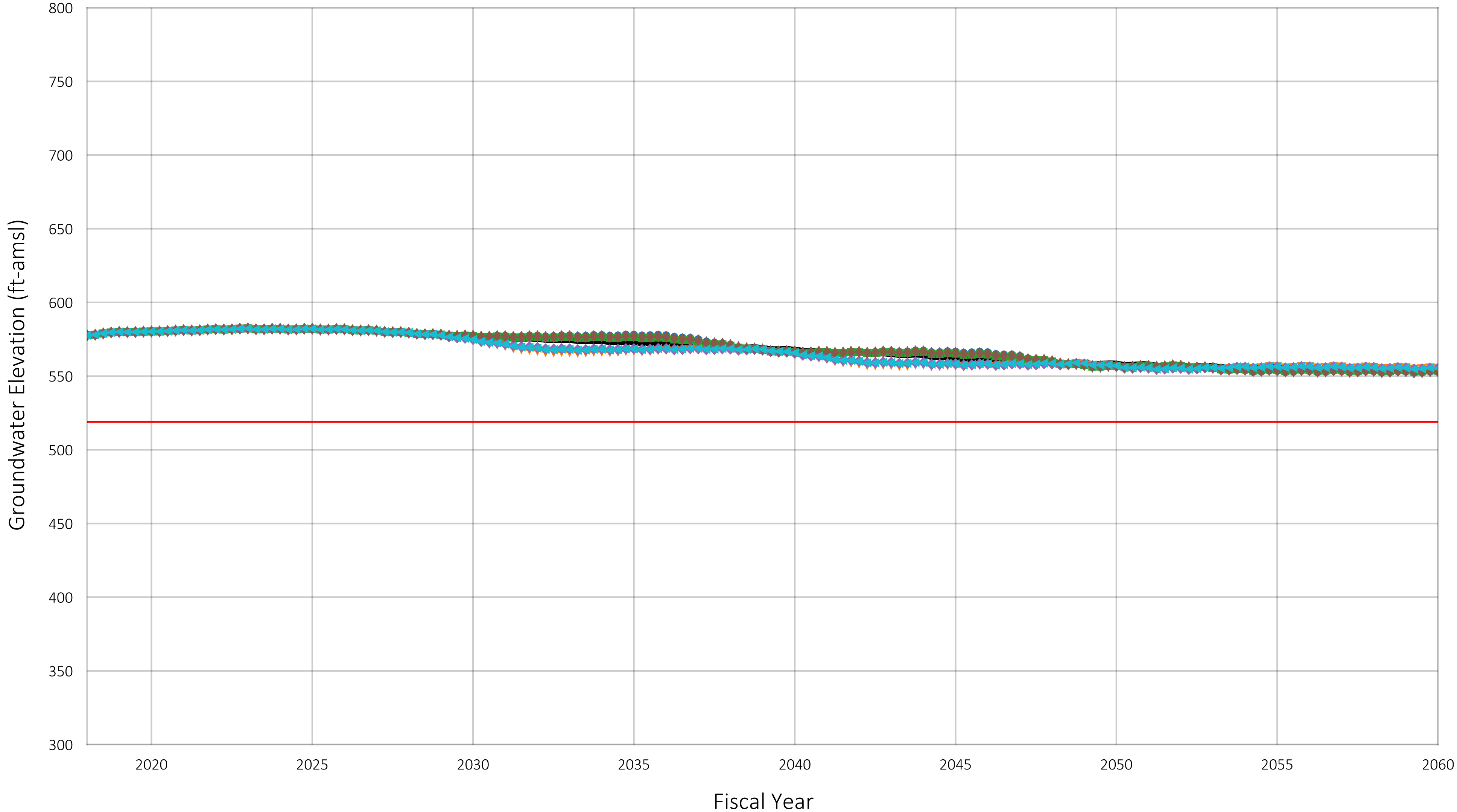
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207952
Owner: City of Ontario
Well Name: 49

Figure A-100



Location of Well in Chino Basin

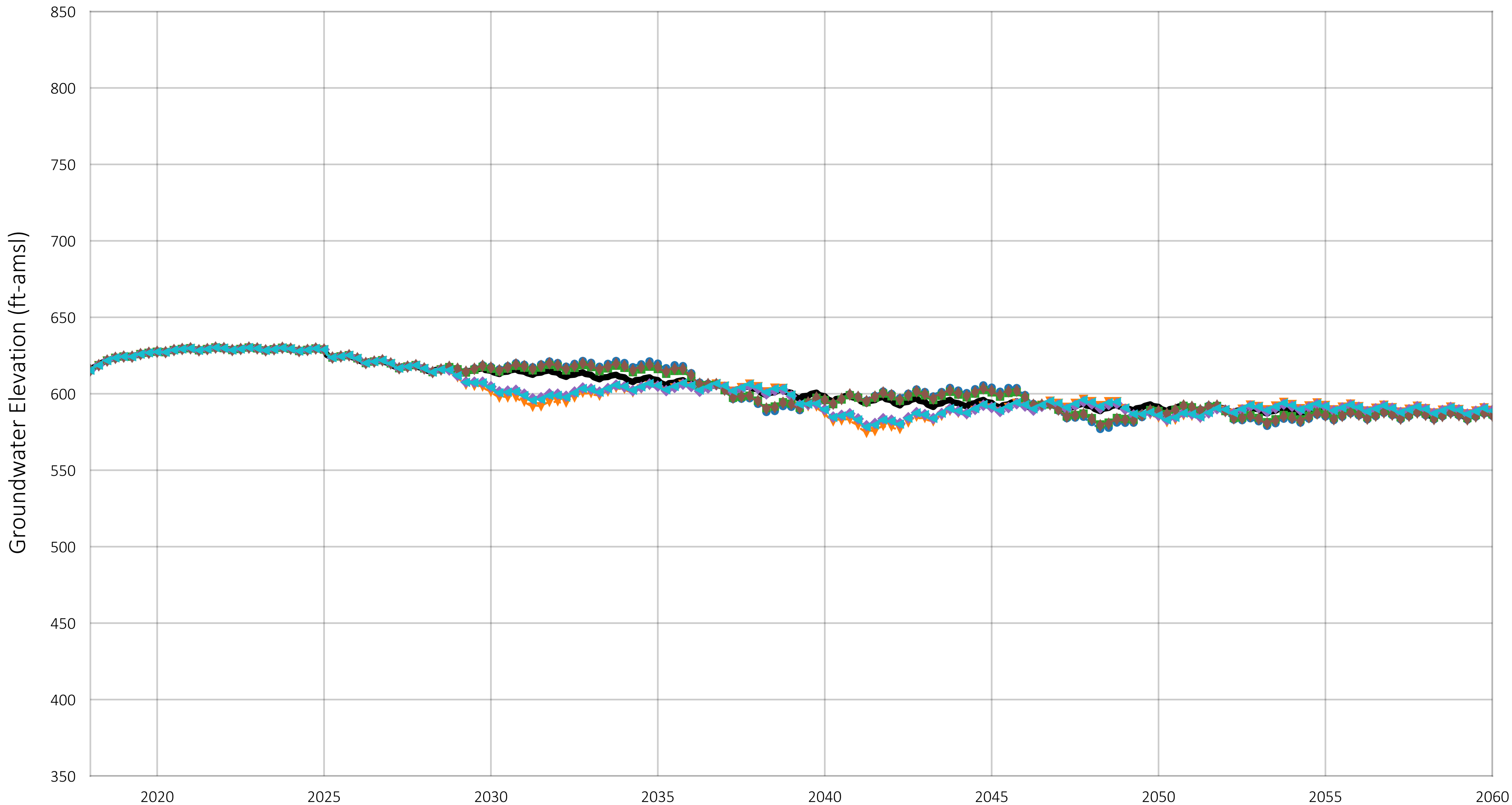
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1208387
Owner: City of Ontario
Well Name: 50

Figure A-101



Location of Well in Chino Basin

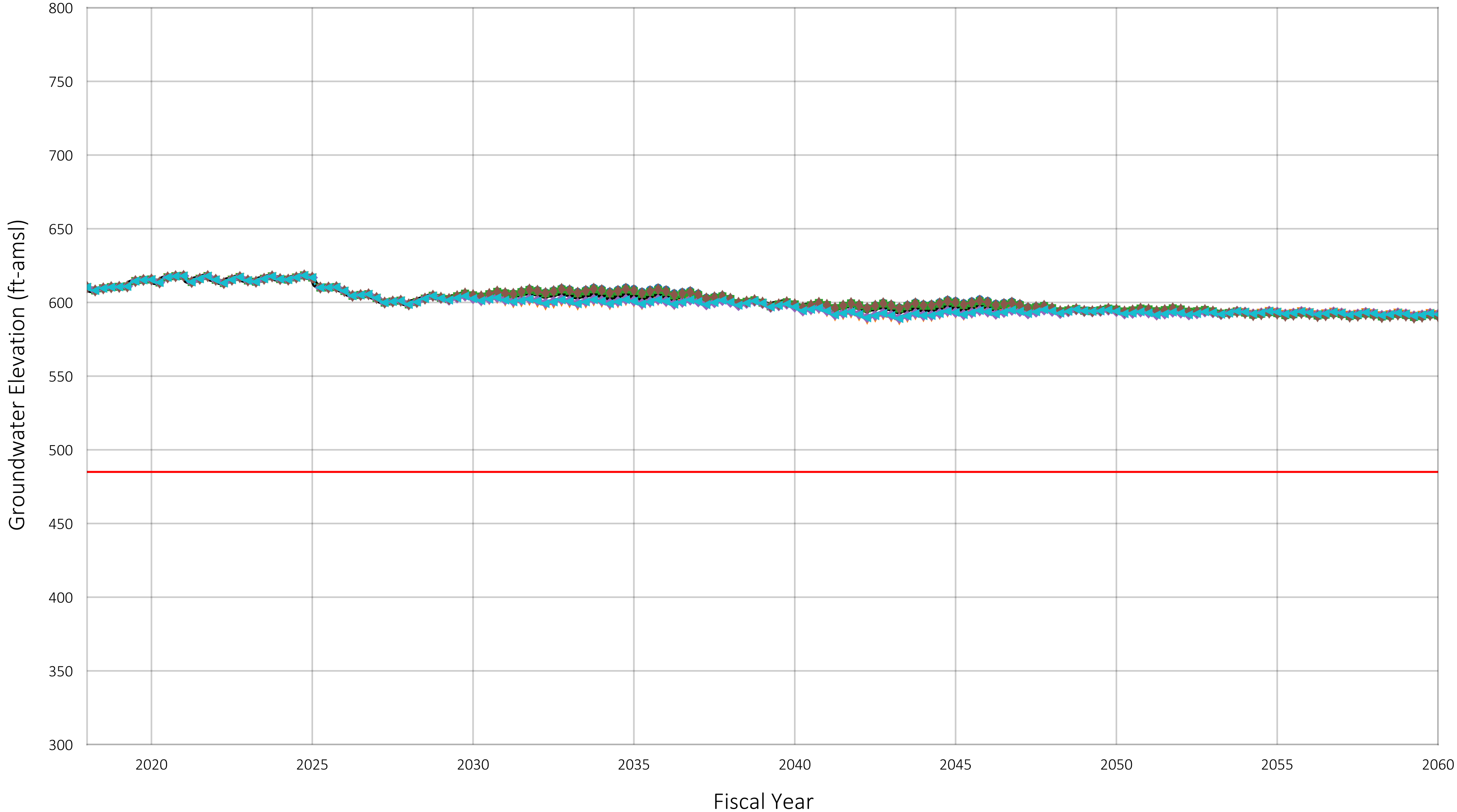
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1220172
Owner: City of Ontario
Well Name: 51

Figure A-102



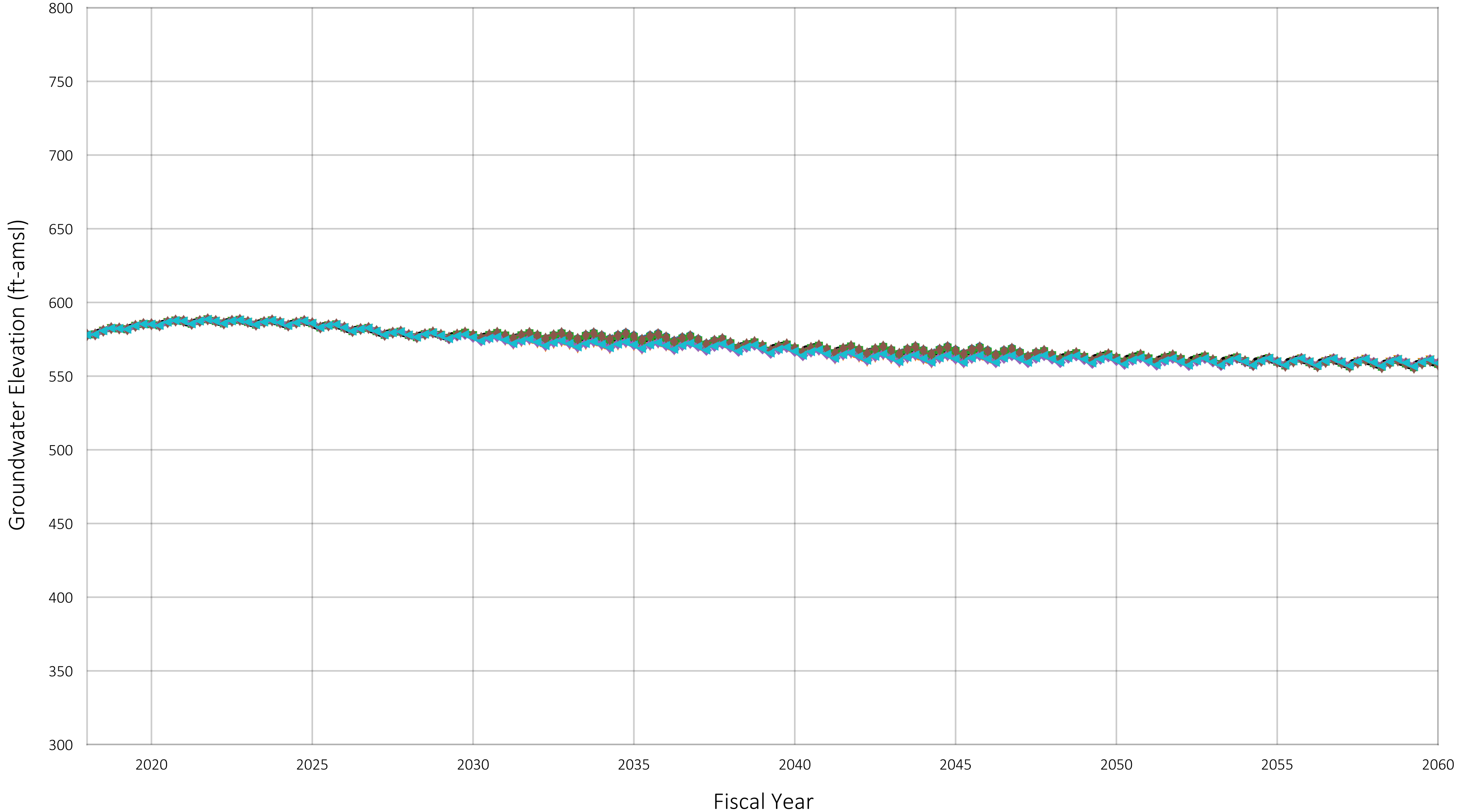
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1221753
Owner: City of Ontario
Well Name: 52

Figure A-103



Location of Well in Chino Basin

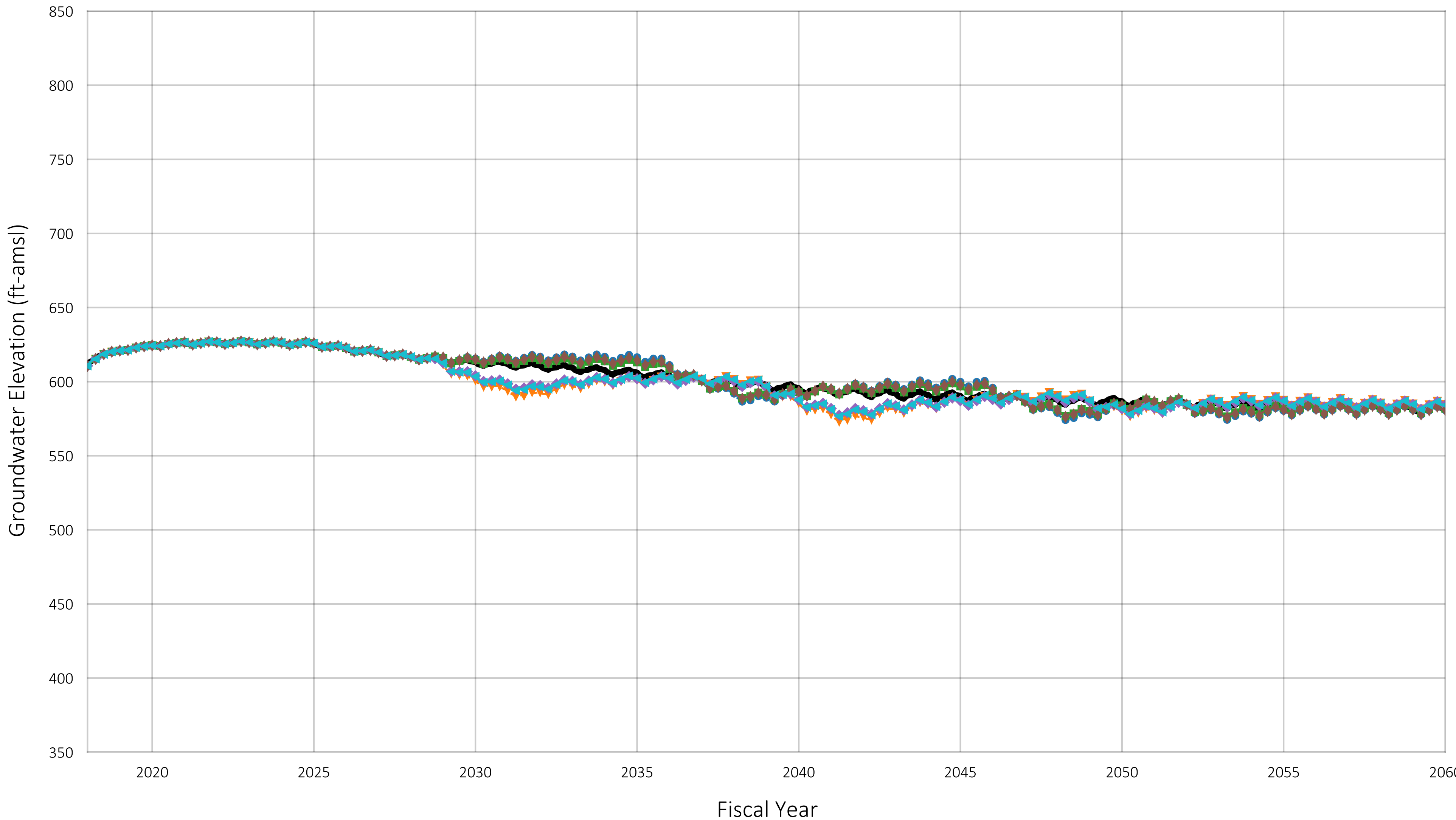
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 100
Owner: City of Ontario
Well Name: 100

Figure A-104



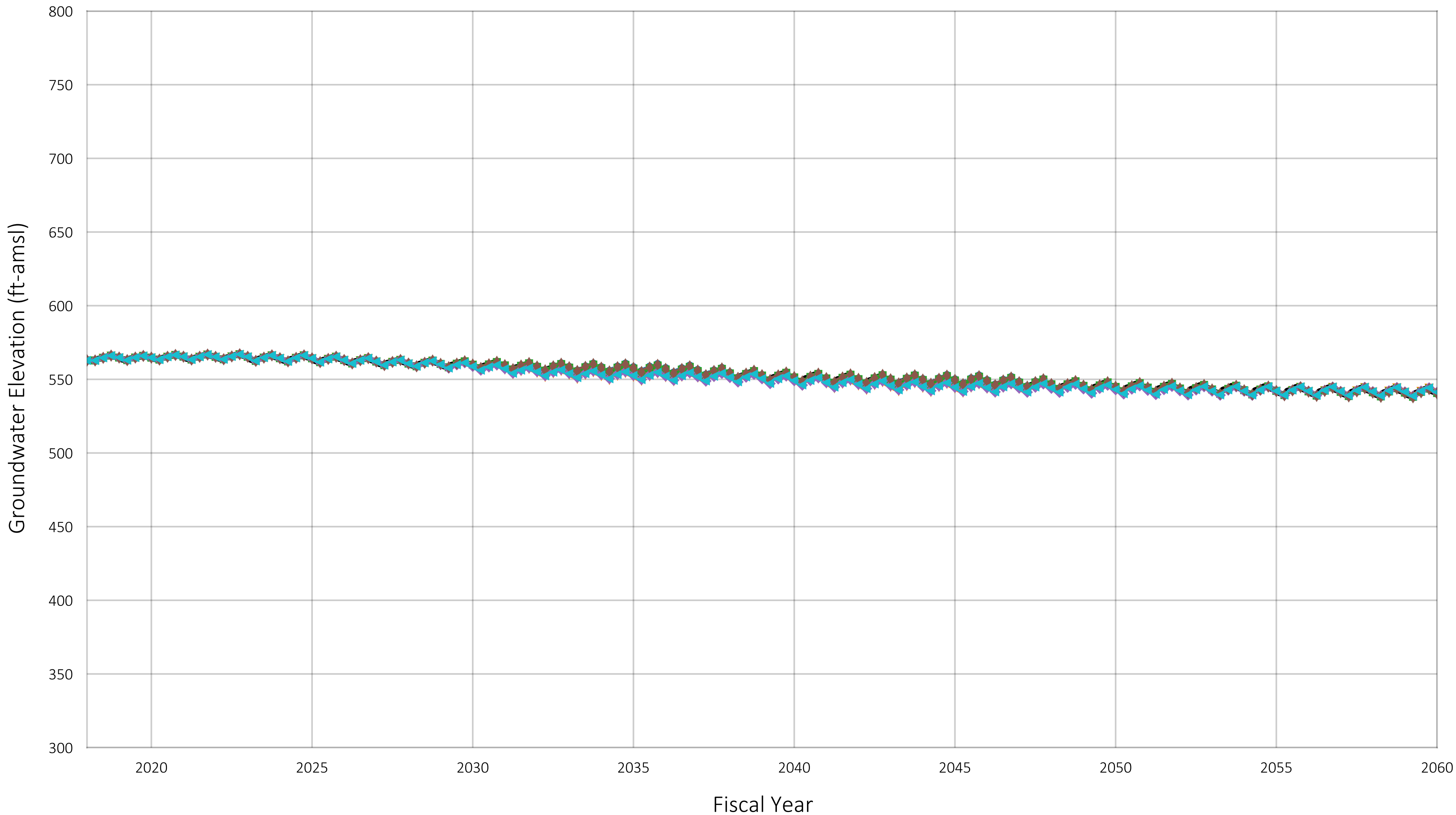
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 101
Owner: City of Ontario
Well Name: 101

Figure A-105



Location of Well in Chino Basin

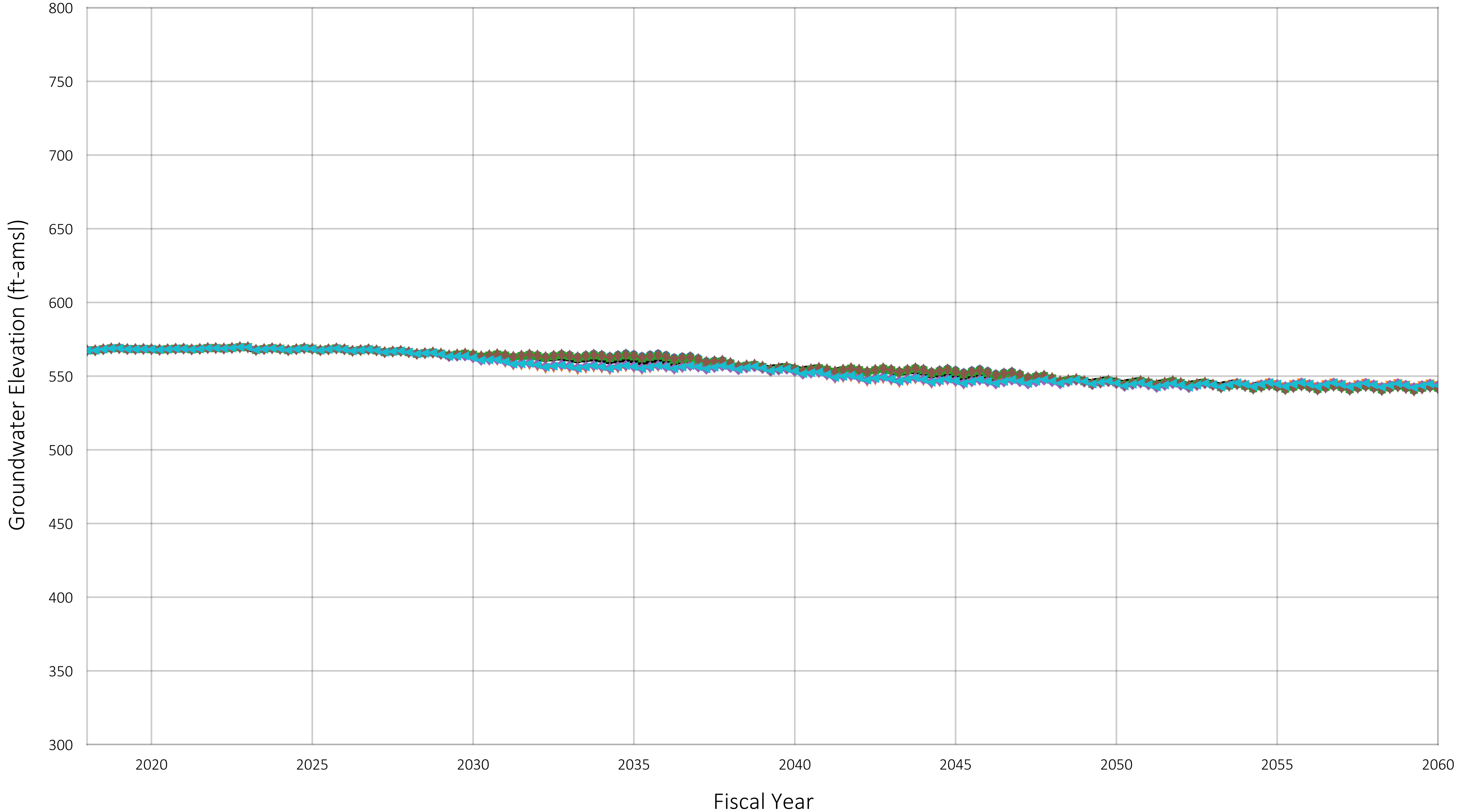
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 103
Owner: City of Ontario
Well Name: 103

Figure A-106



Location of Well in Chino Basin

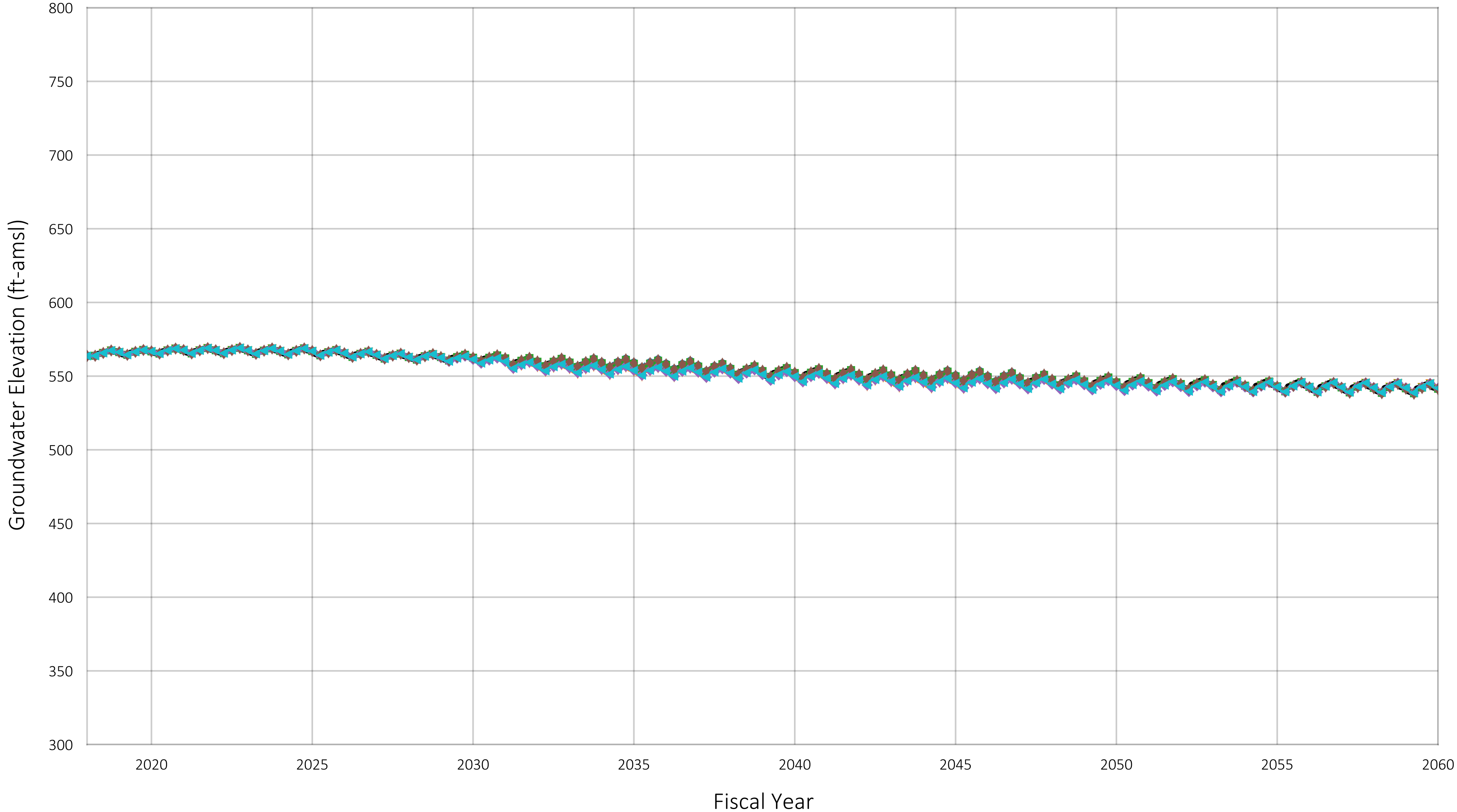
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

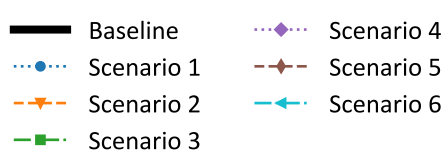
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 104
Owner: City of Ontario
Well Name: 104

Figure A-107



Location of Well in Chino Basin

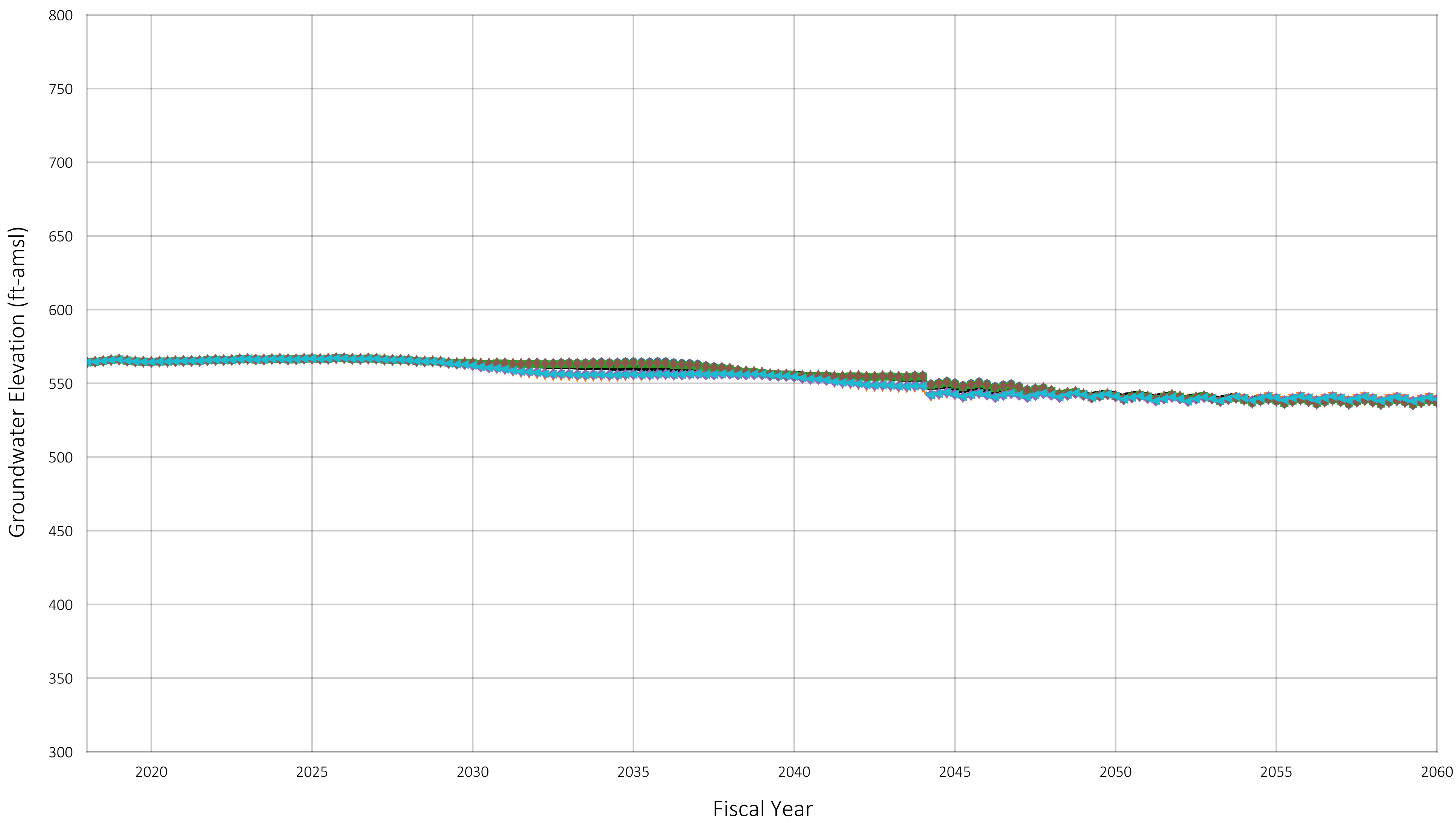


Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 105
Owner: City of Ontario
Well Name: 105

Figure A-108



Location of Well in Chino Basin

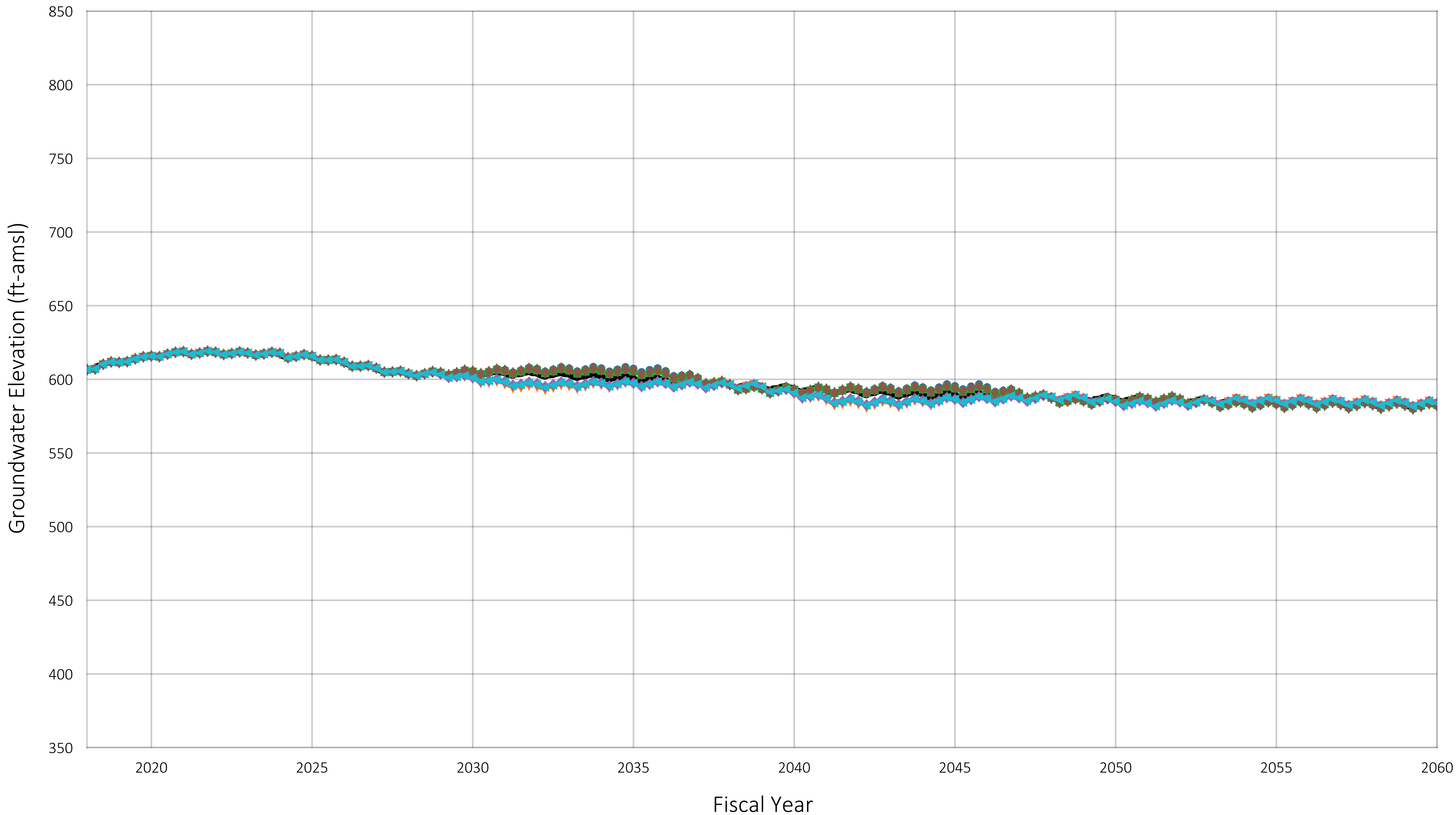
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

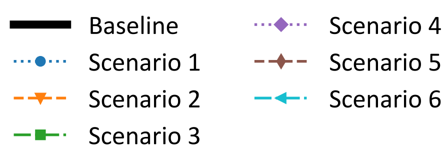
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 106
Owner: City of Ontario
Well Name: 106

Figure A-109



Location of Well in Chino Basin

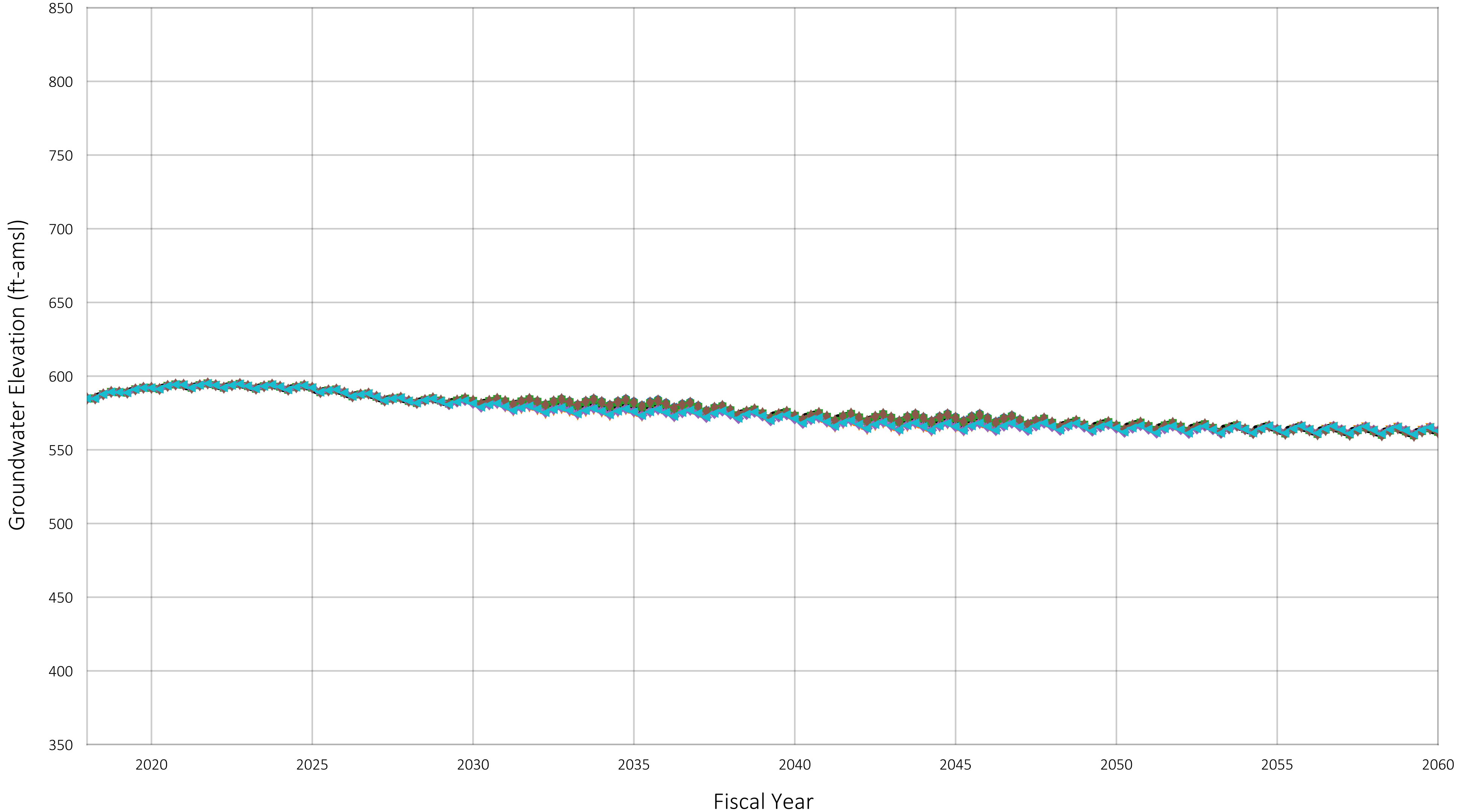


Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 109
Owner: City of Ontario
Well Name: 109

Figure A-110



Location of Well in Chino Basin

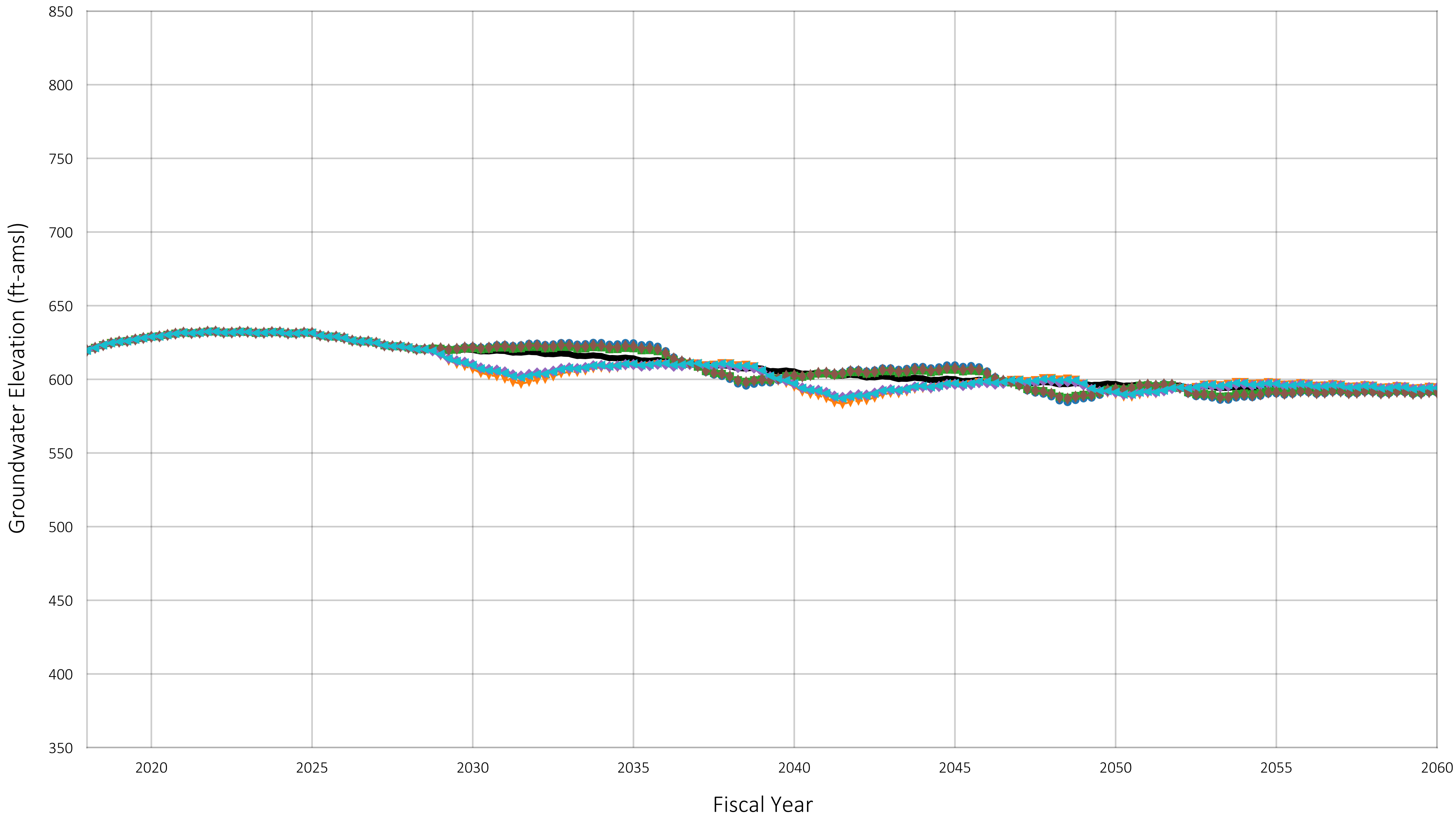
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 111
Owner: City of Ontario
Well Name: 111

Figure A-111



Location of Well in Chino Basin

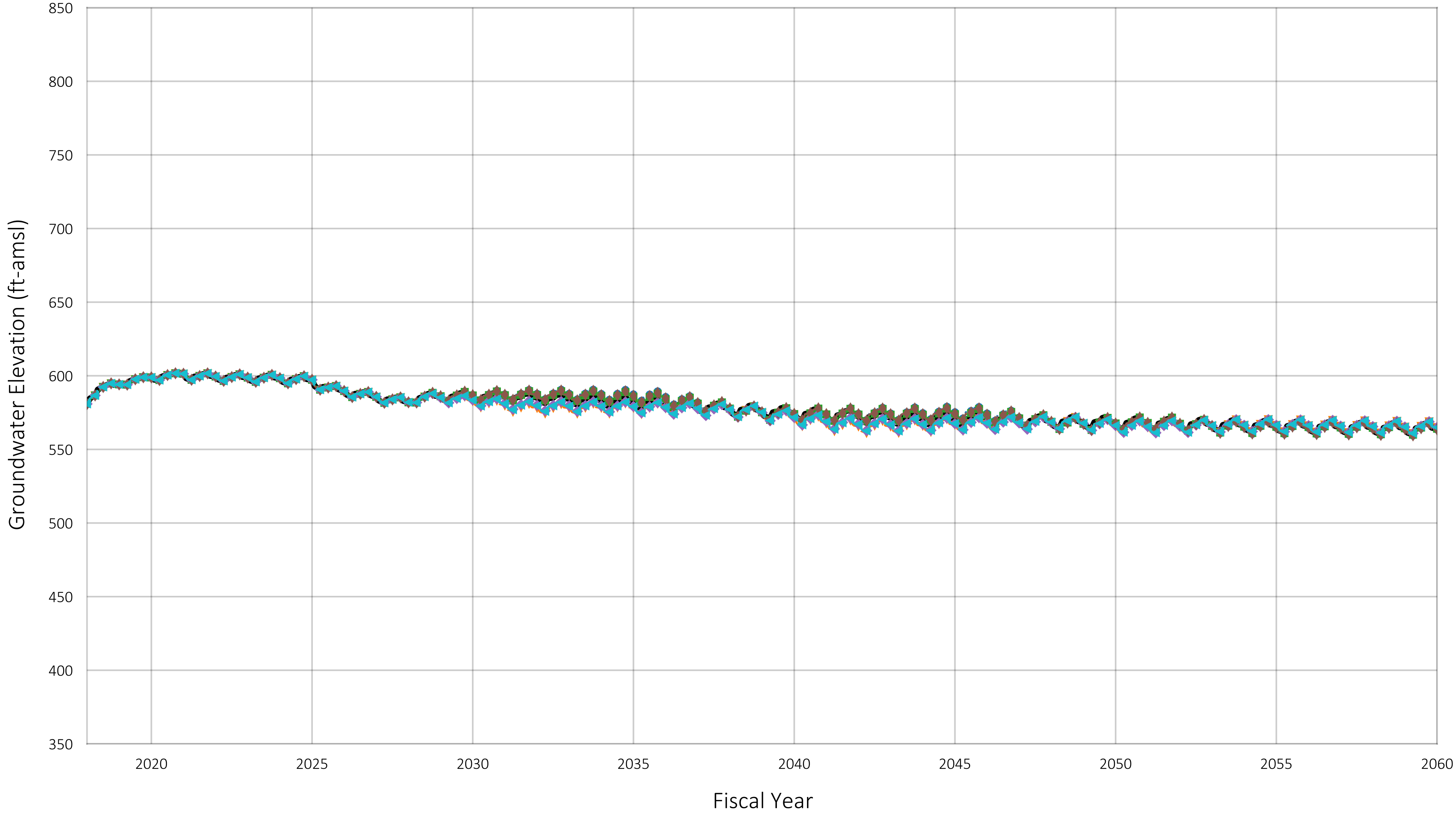
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 119
Owner: City of Ontario
Well Name: 119

Figure A-112



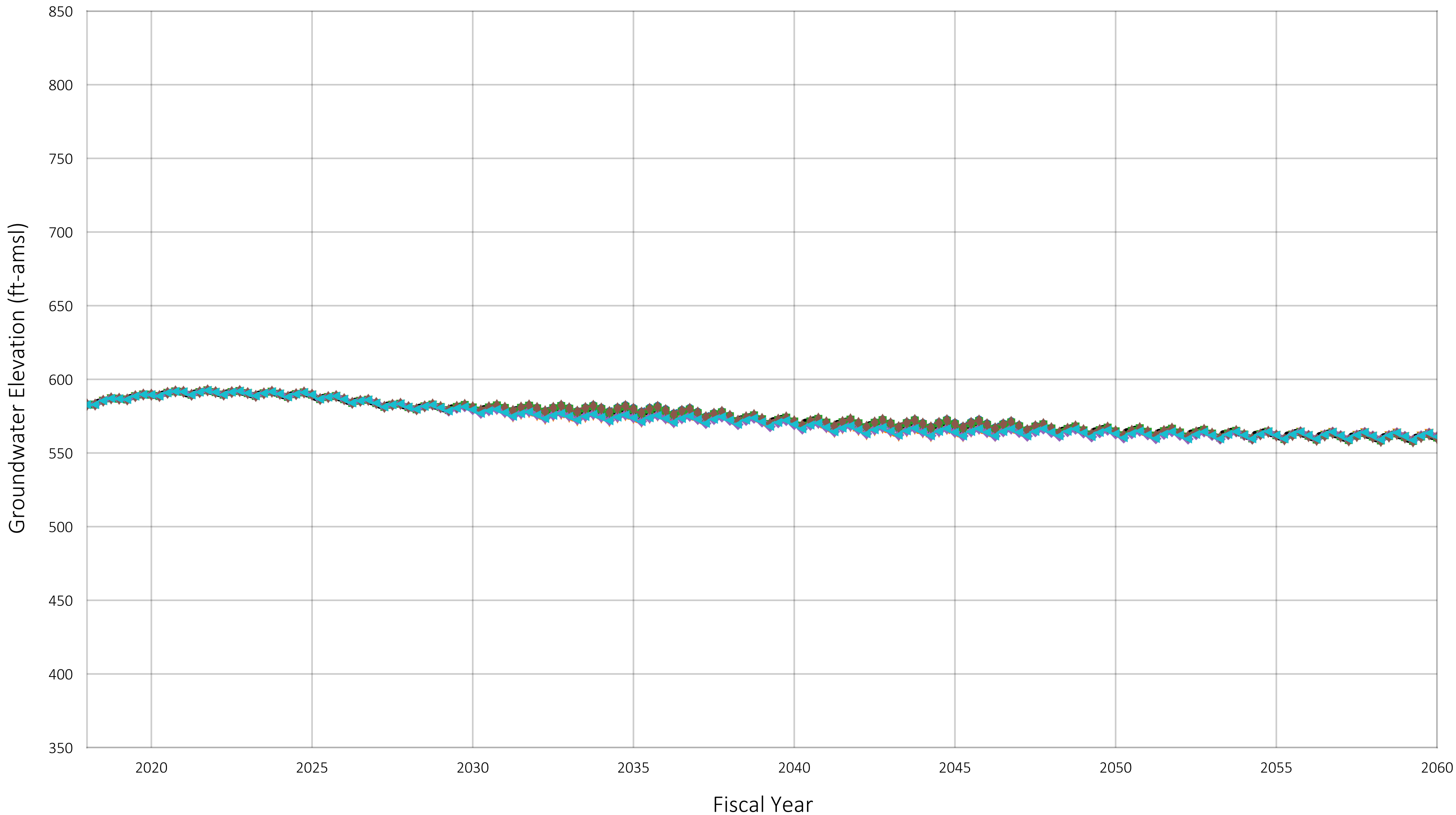
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 115
Owner: City of Ontario
Well Name: 115

Figure A-113



Location of Well in Chino Basin

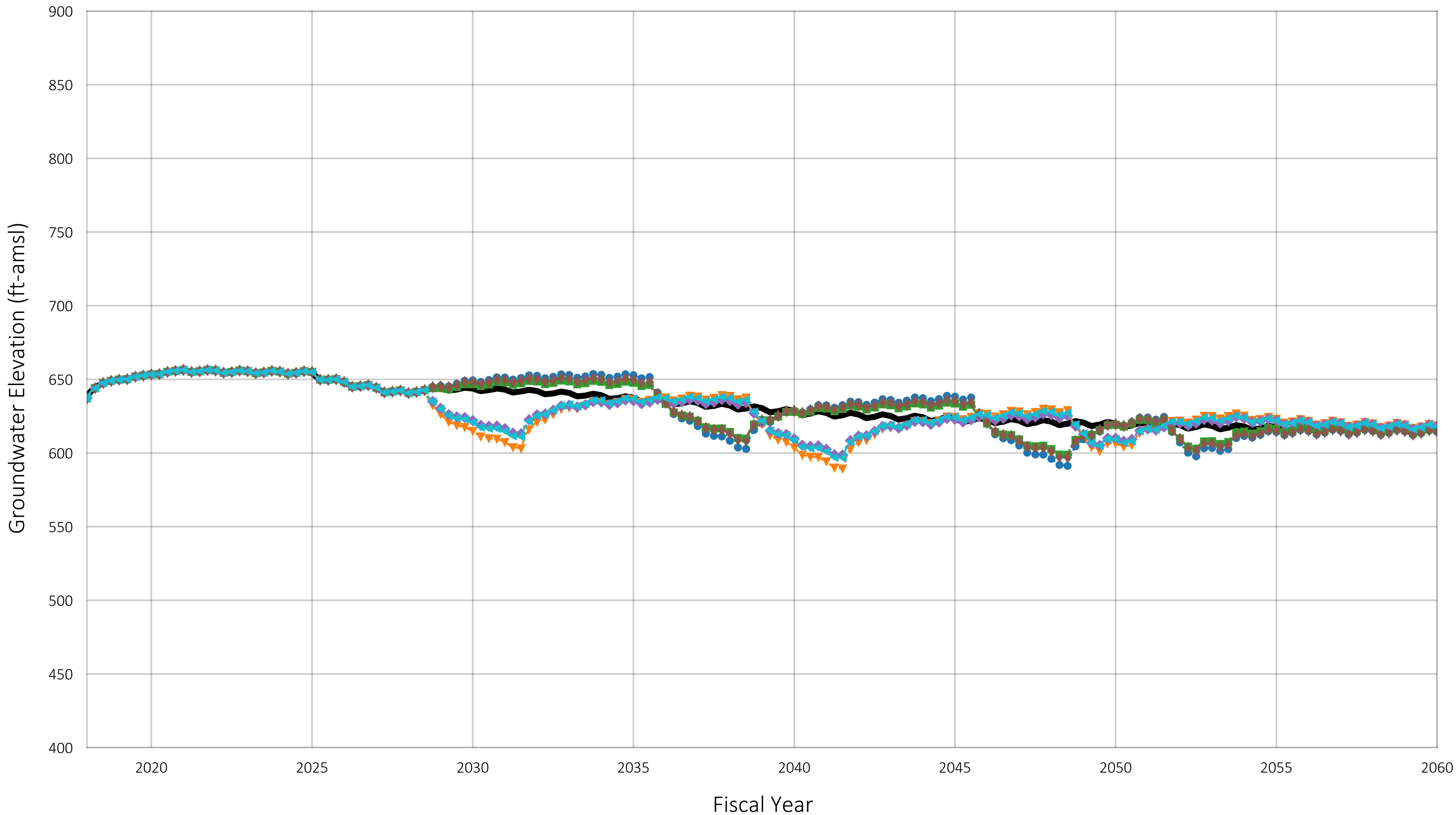
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 120
Owner: City of Ontario
Well Name: 120

Figure A-114



Location of Well in Chino Basin

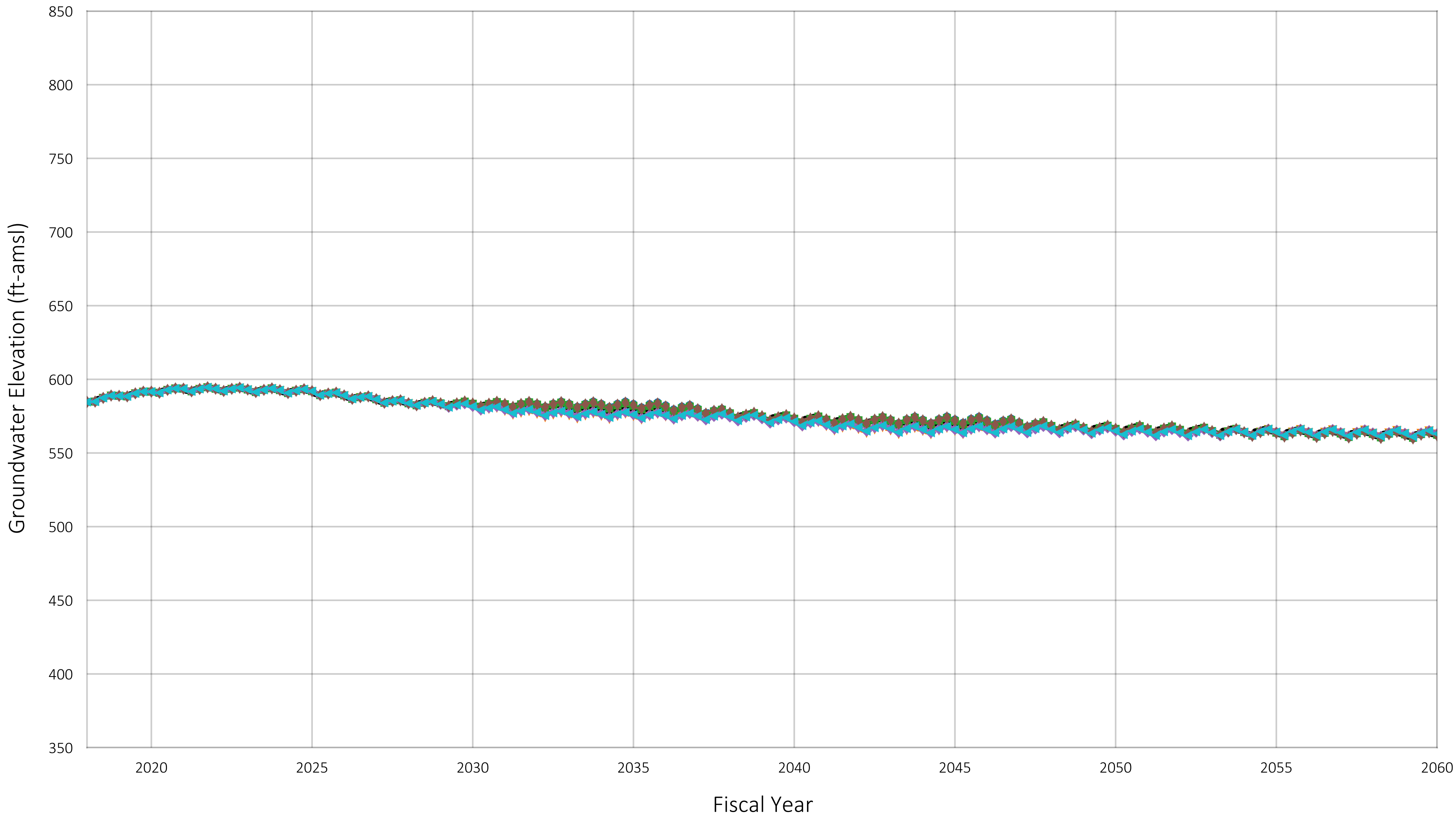
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 126
Owner: City of Ontario
Well Name: 126

Figure A-115



Location of Well in Chino Basin

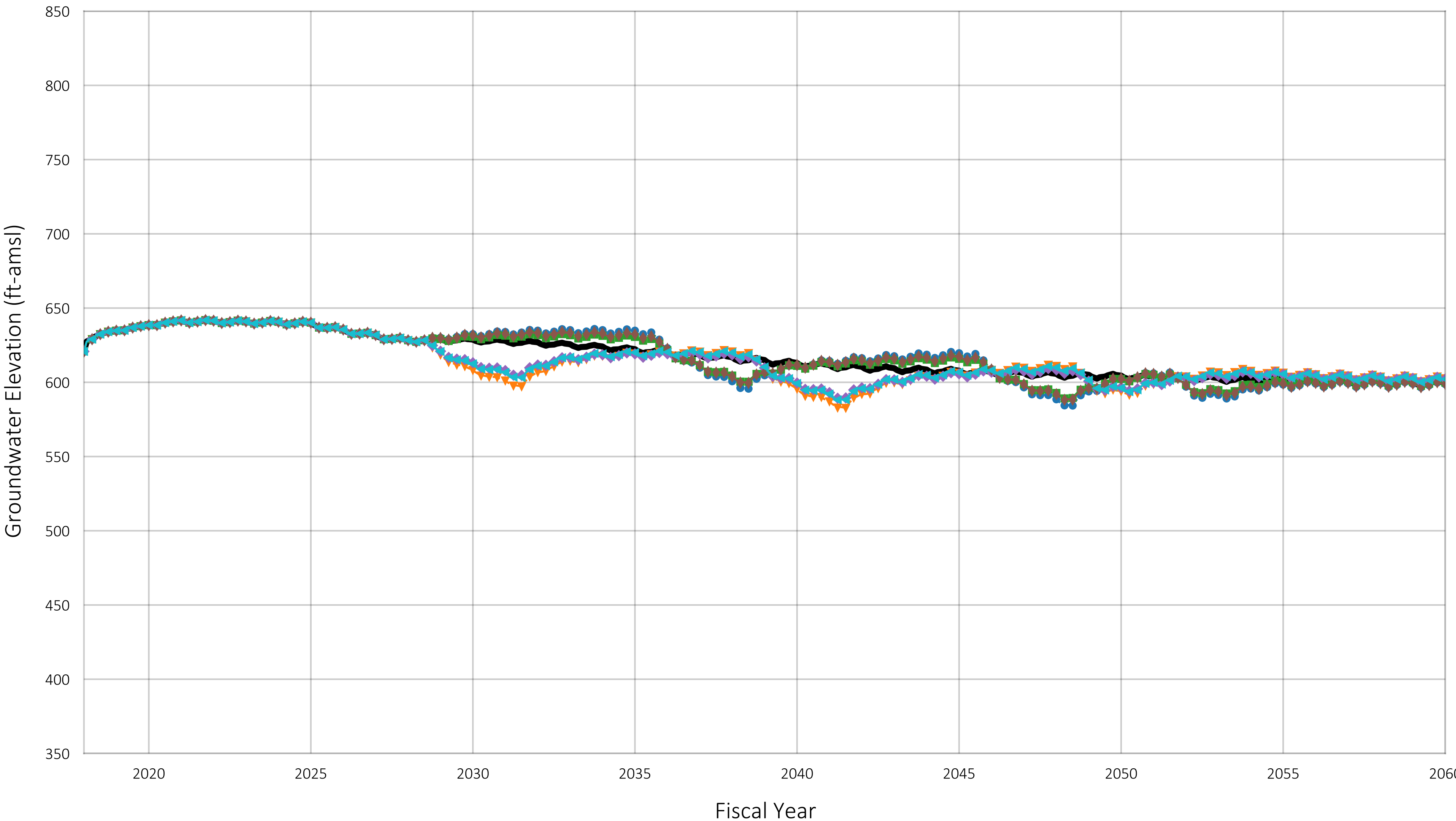
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

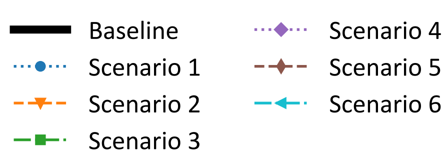
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 134
Owner: City of Ontario
Well Name: 134

Figure A-116



Location of Well in Chino Basin

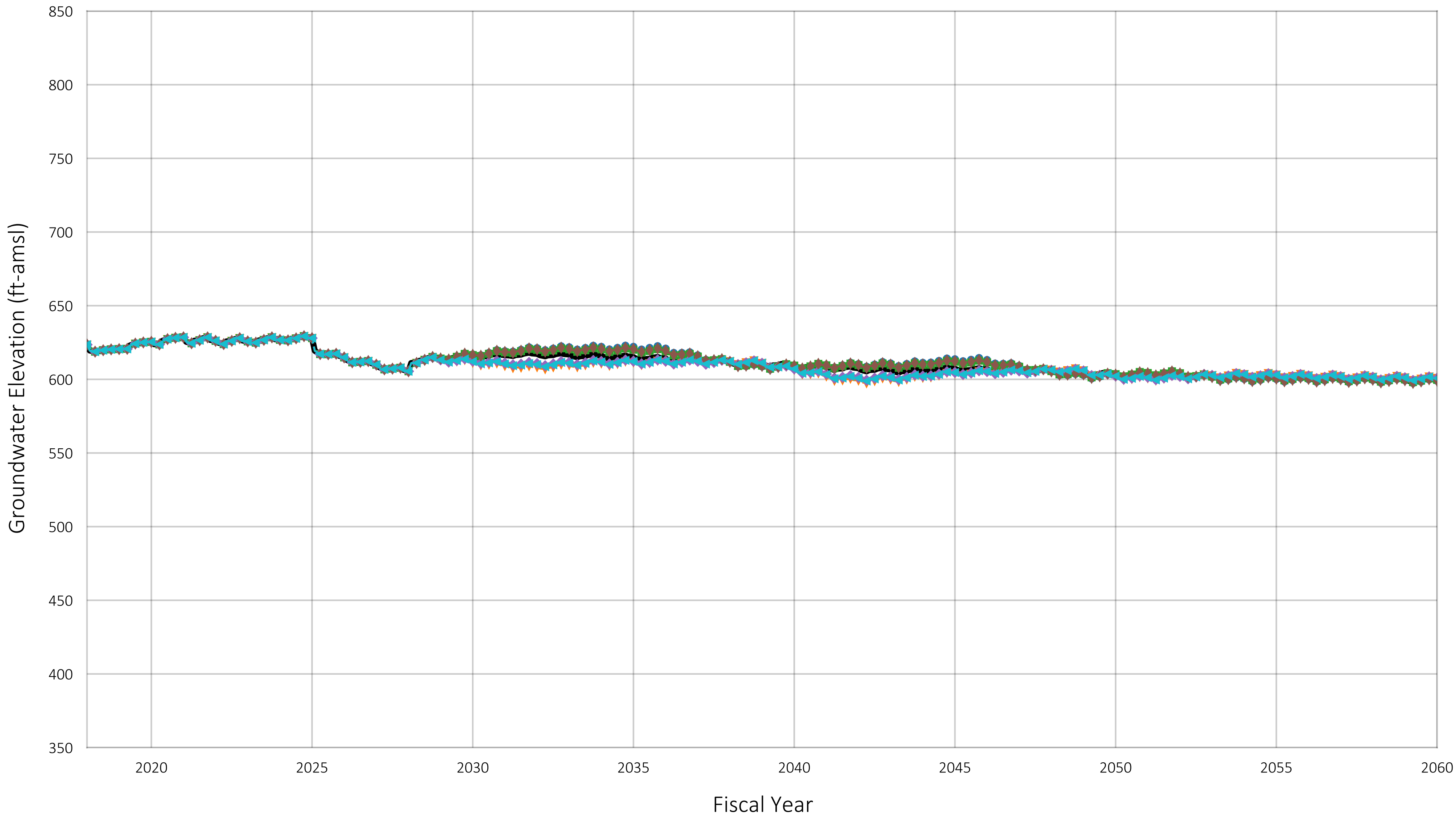


Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 136
Owner: City of Ontario
Well Name: 136

Figure A-117



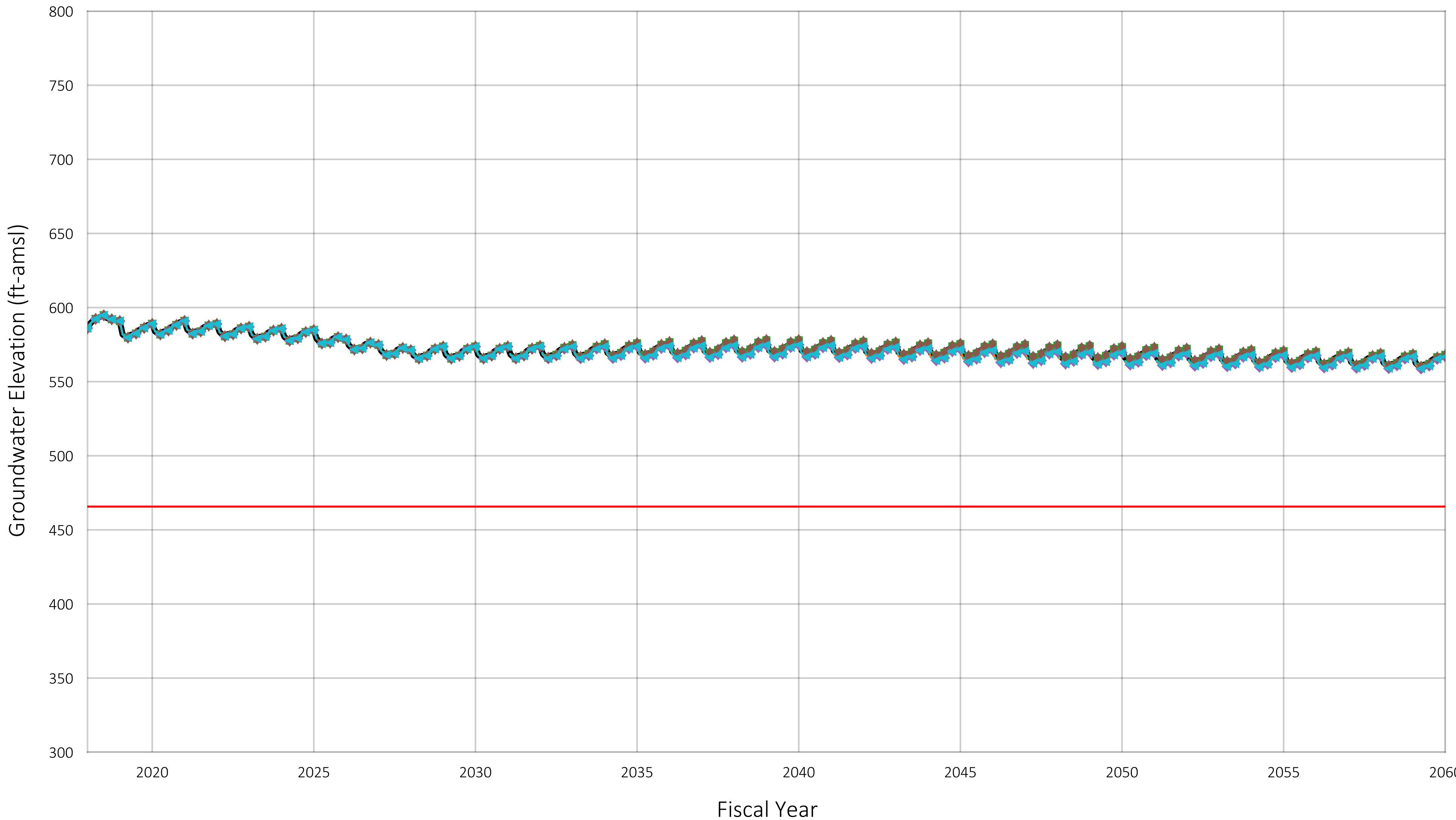
Location of Well in Chino Basin

Prepared by:

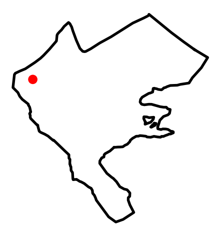
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 138
Owner: City of Ontario
Well Name: 138

Figure A-118



Location of Well in Chino Basin



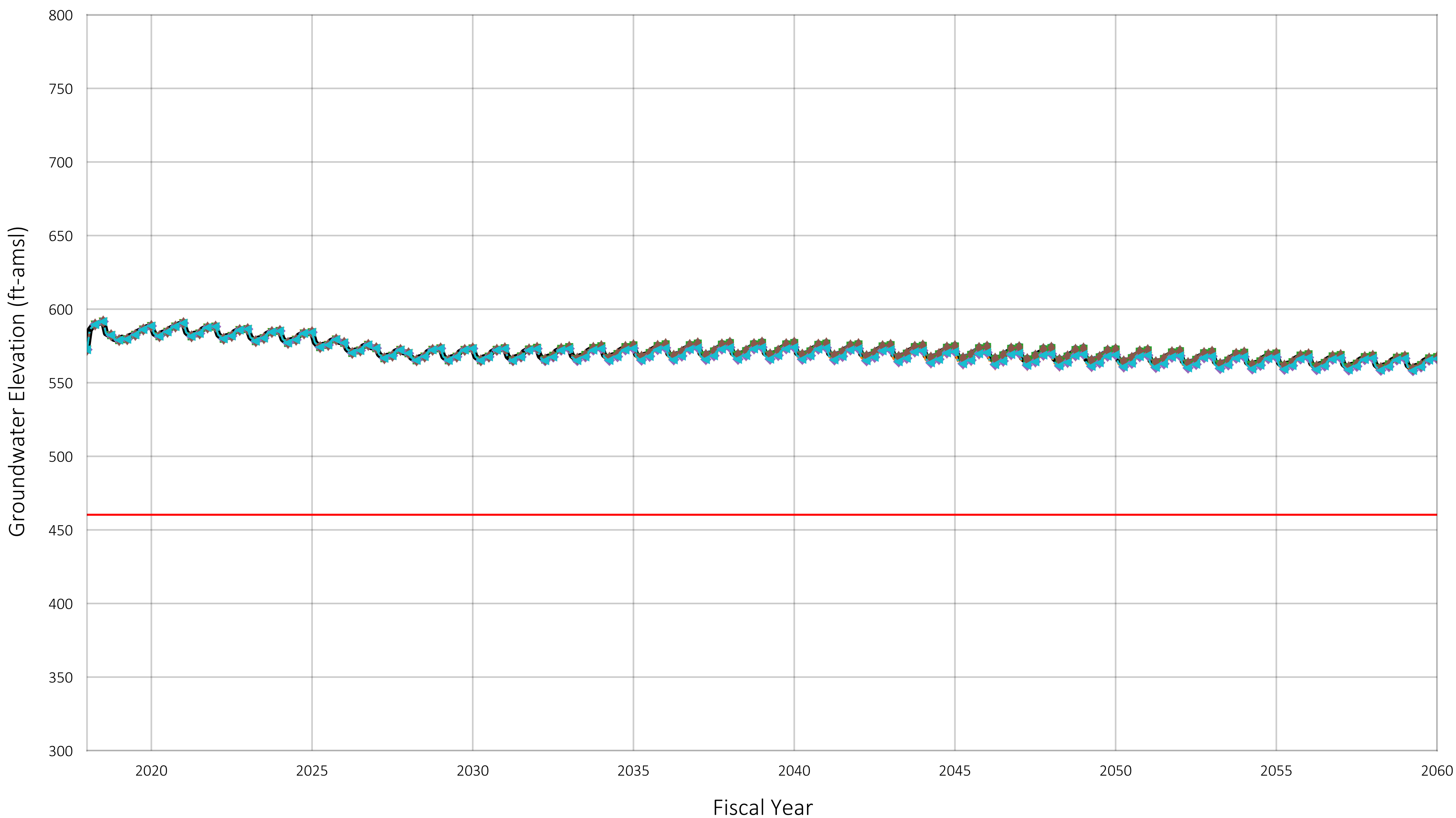
Prepared by:

WEST YOST
Water. Engineered

Baseline	Scenario 4
Scenario 1	Scenario 5
Scenario 2	Scenario 6
Scenario 3	Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1002653
Owner: City of Pomona
Well Name: 2

Figure A-119



Location of Well in Chino Basin

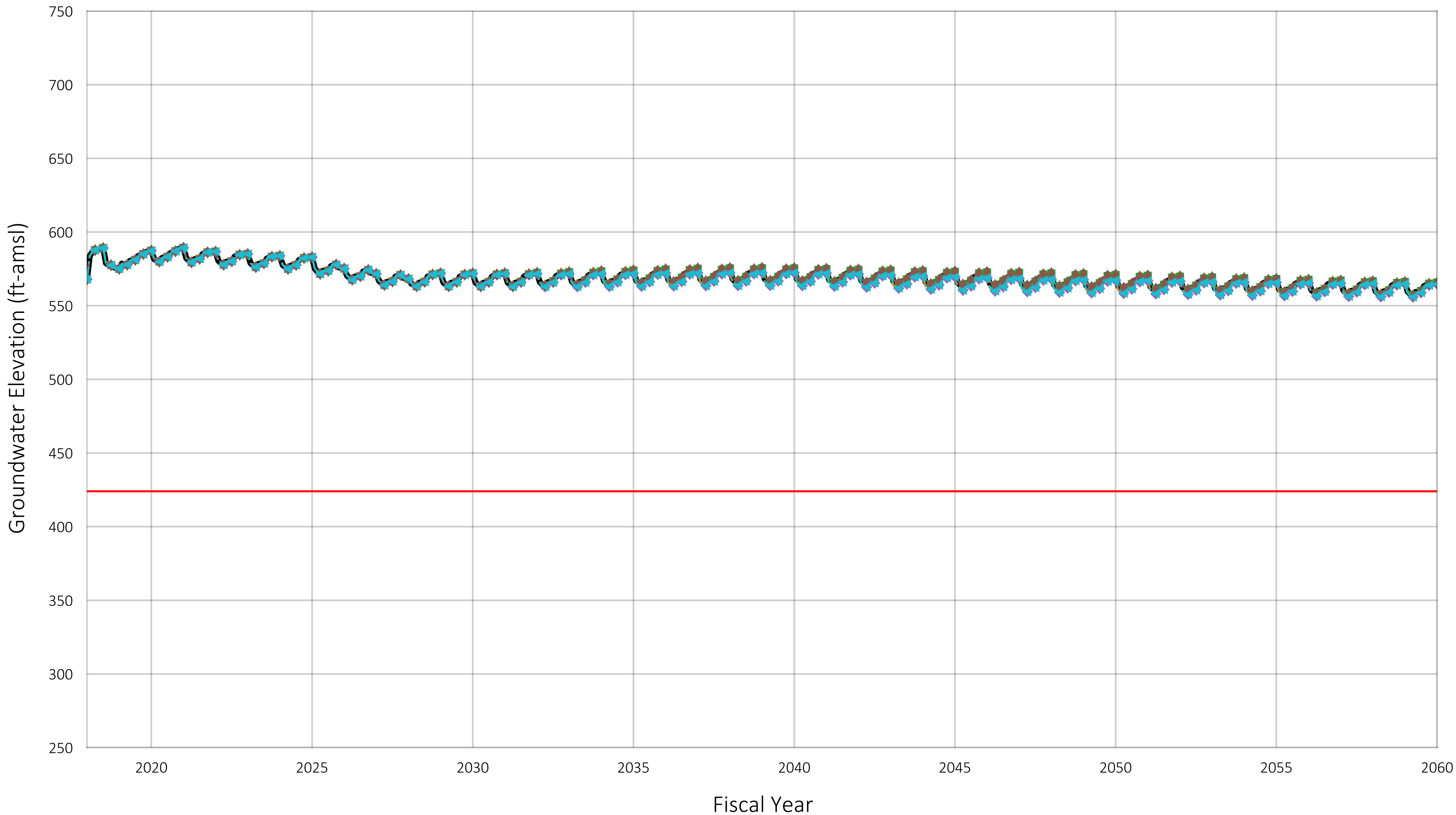
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1205314
Owner: City of Pomona
Well Name: 5B

Figure A-120



Location of Well in Chino Basin

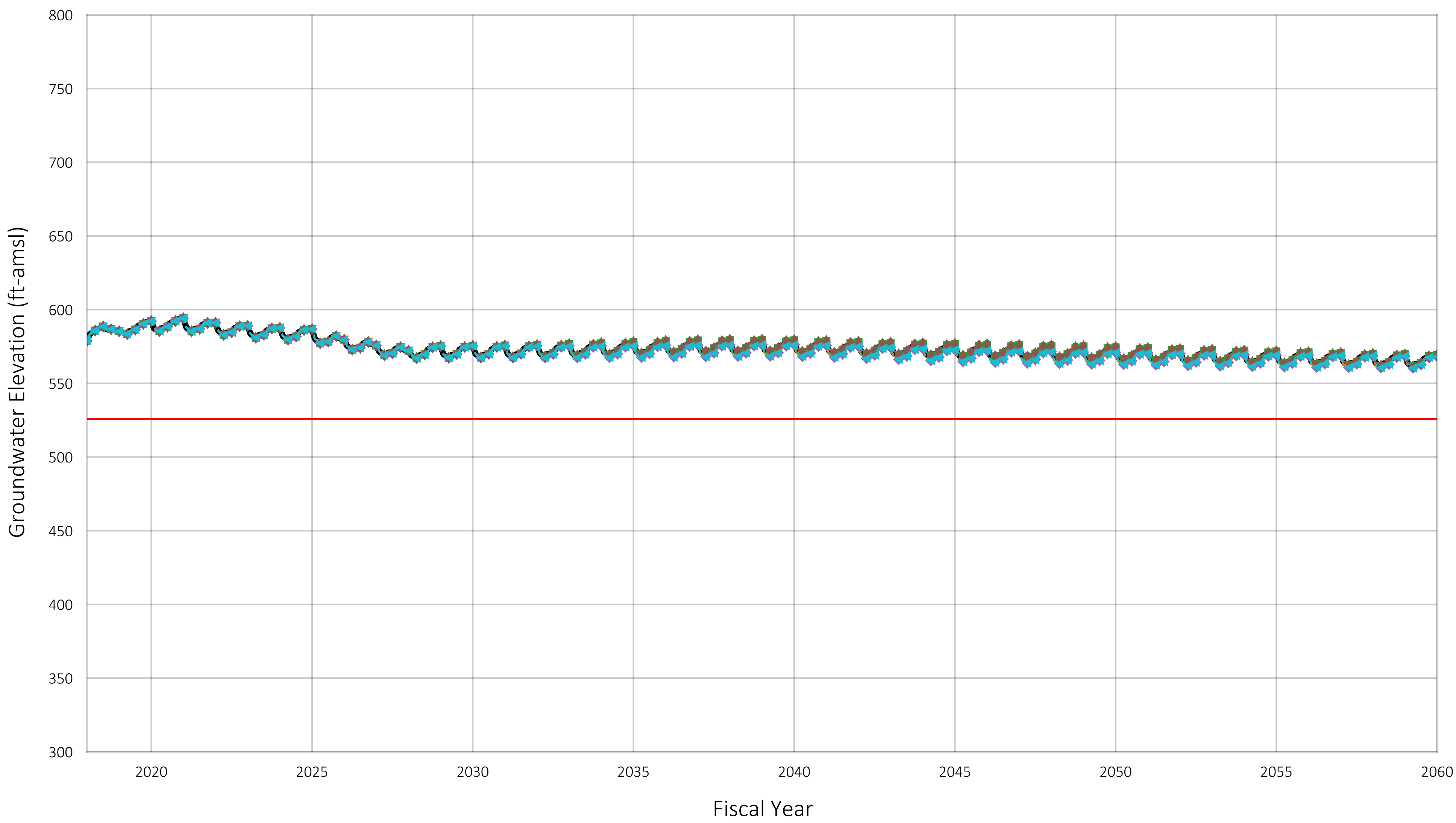
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002650
Owner: City of Pomona
Well Name: 6

Figure A-121



Location of Well in Chino Basin

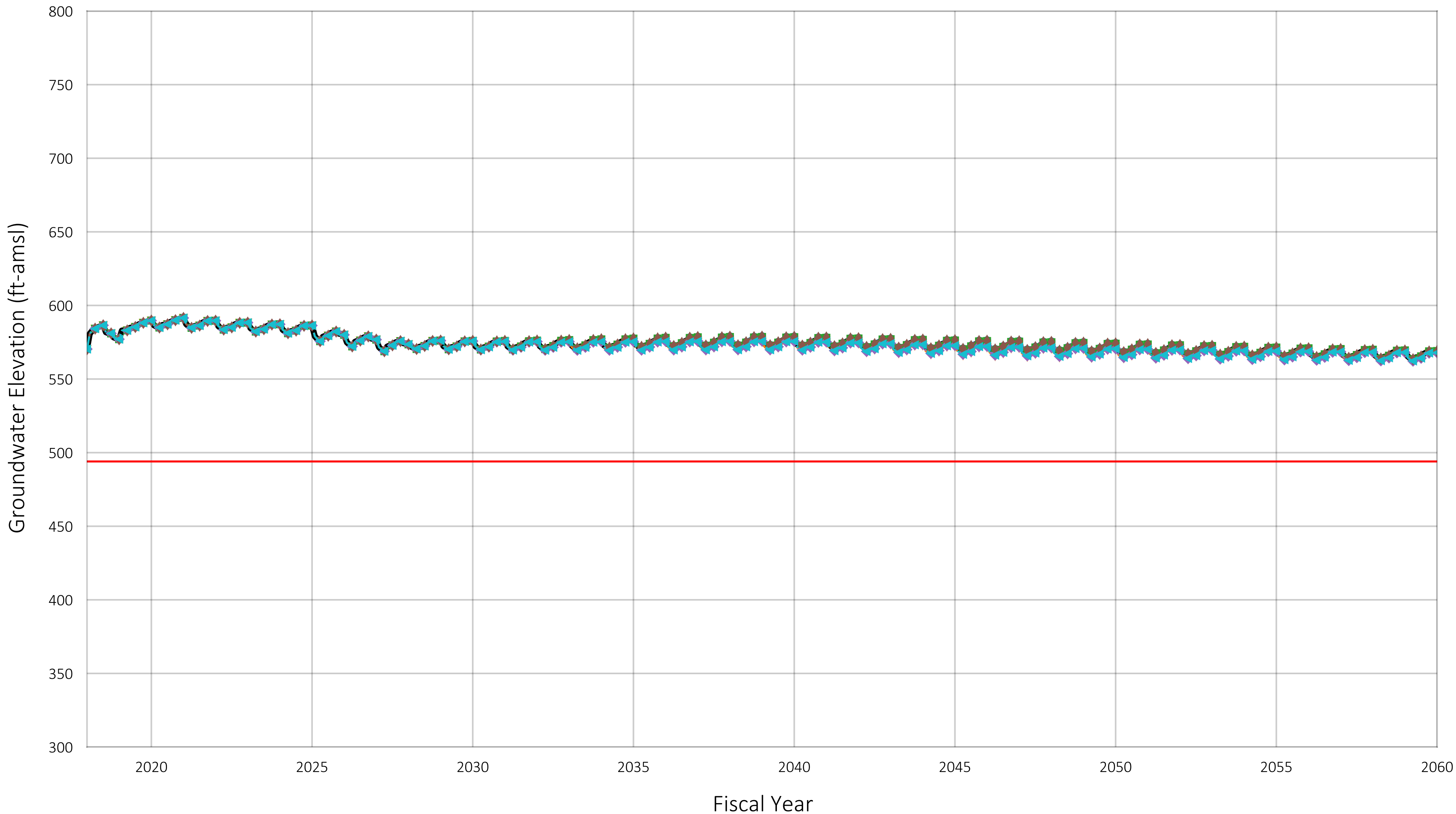
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002656
Owner: City of Pomona
Well Name: 10

Figure A-122



Location of Well in Chino Basin

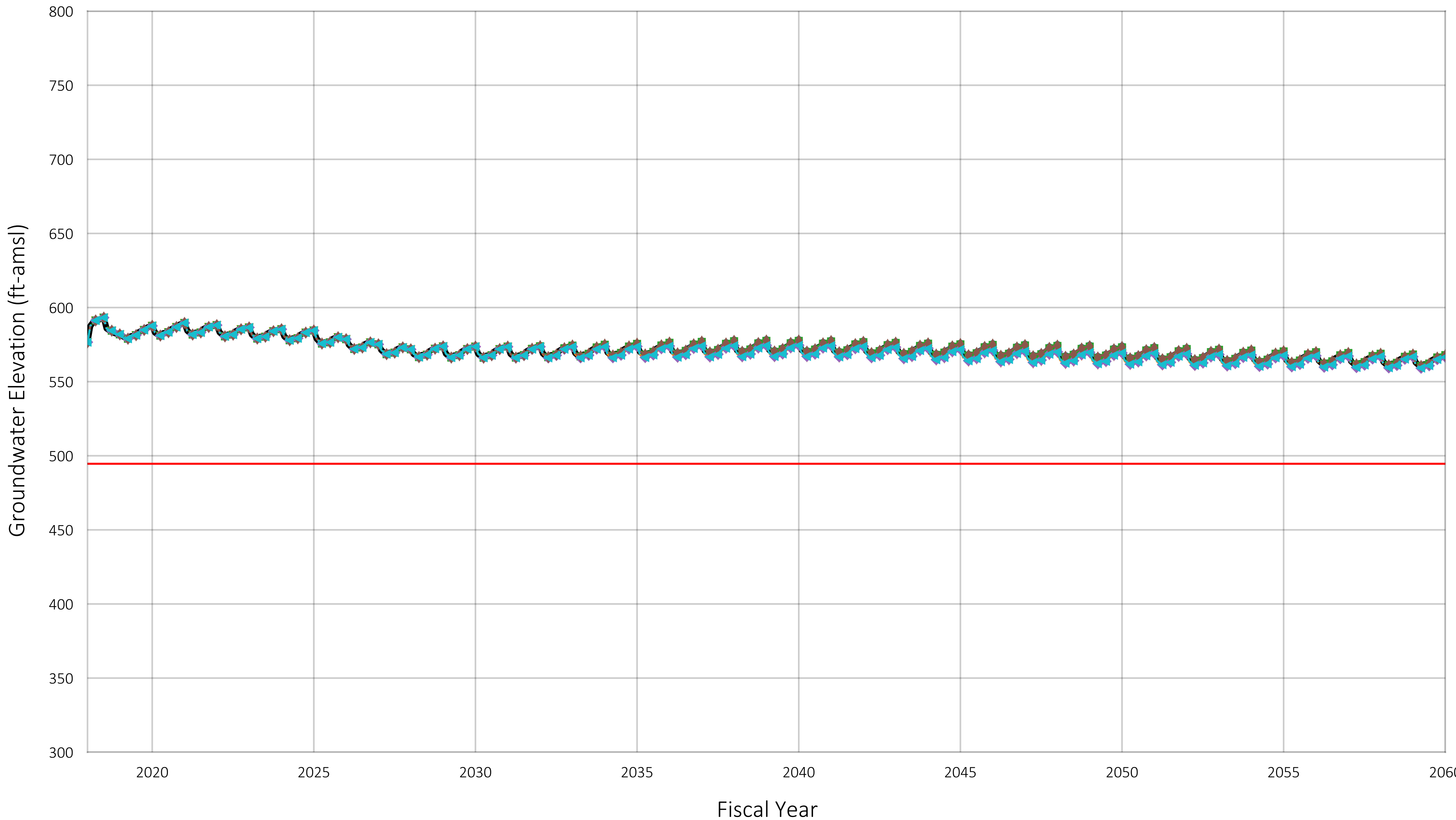
Prepared by:

WEST YOST Water. Engineered

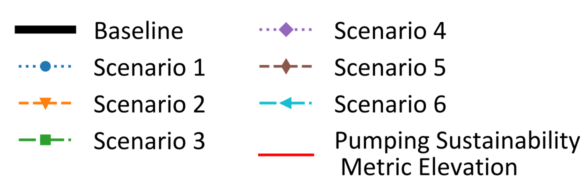
- Baseline
- Scenario 1
- Scenario 2
- Scenario 3
- Scenario 4
- Scenario 5
- Scenario 6
- Pumping Sustainability Metric Elevation

Projected Groundwater Elevation
Well ID#: 1002664
Owner: City of Pomona
Well Name: 15

Figure A-123



Location of Well in Chino Basin

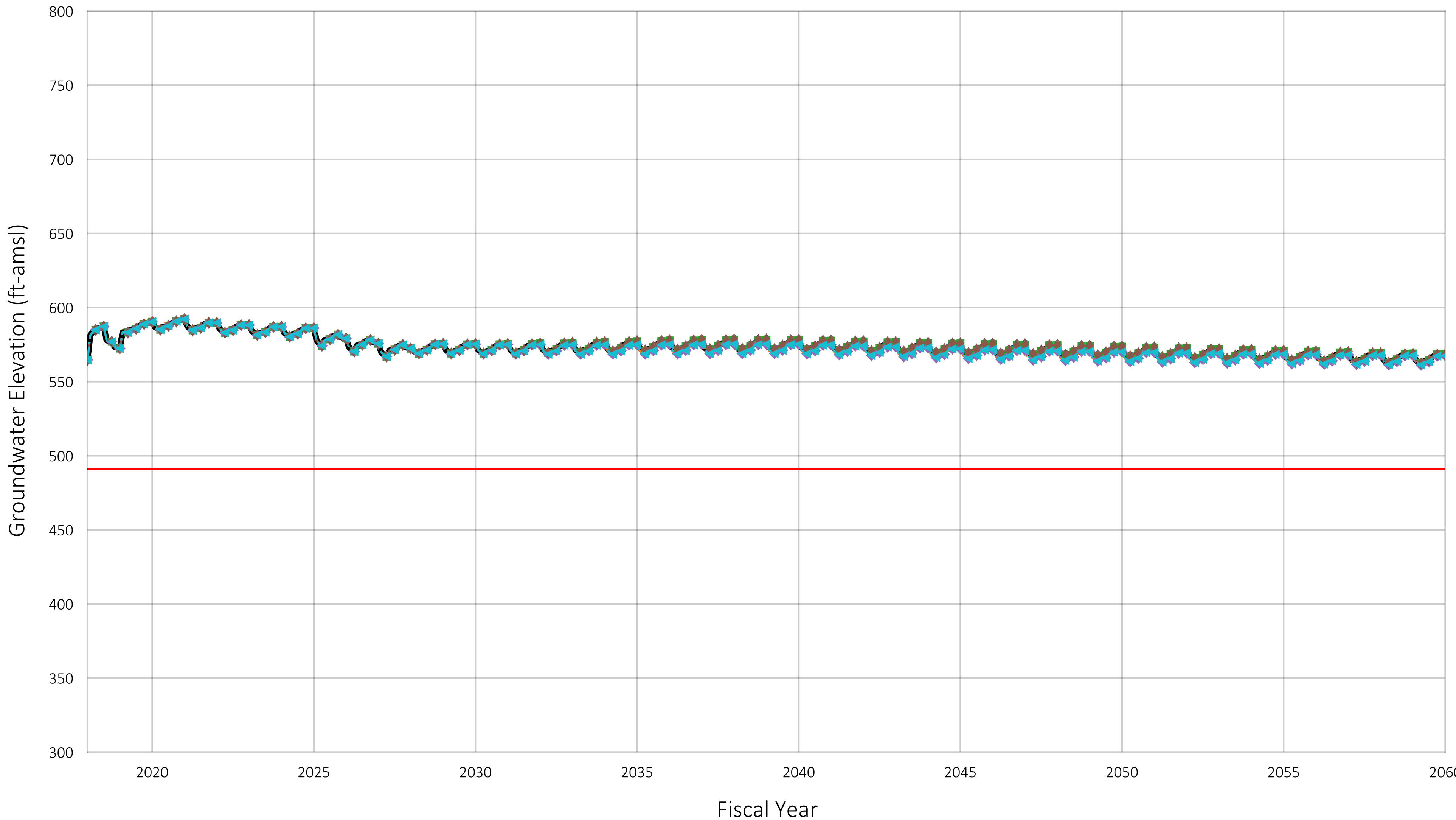


Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002654
Owner: City of Pomona
Well Name: 16

Figure A-124



Location of Well in Chino Basin

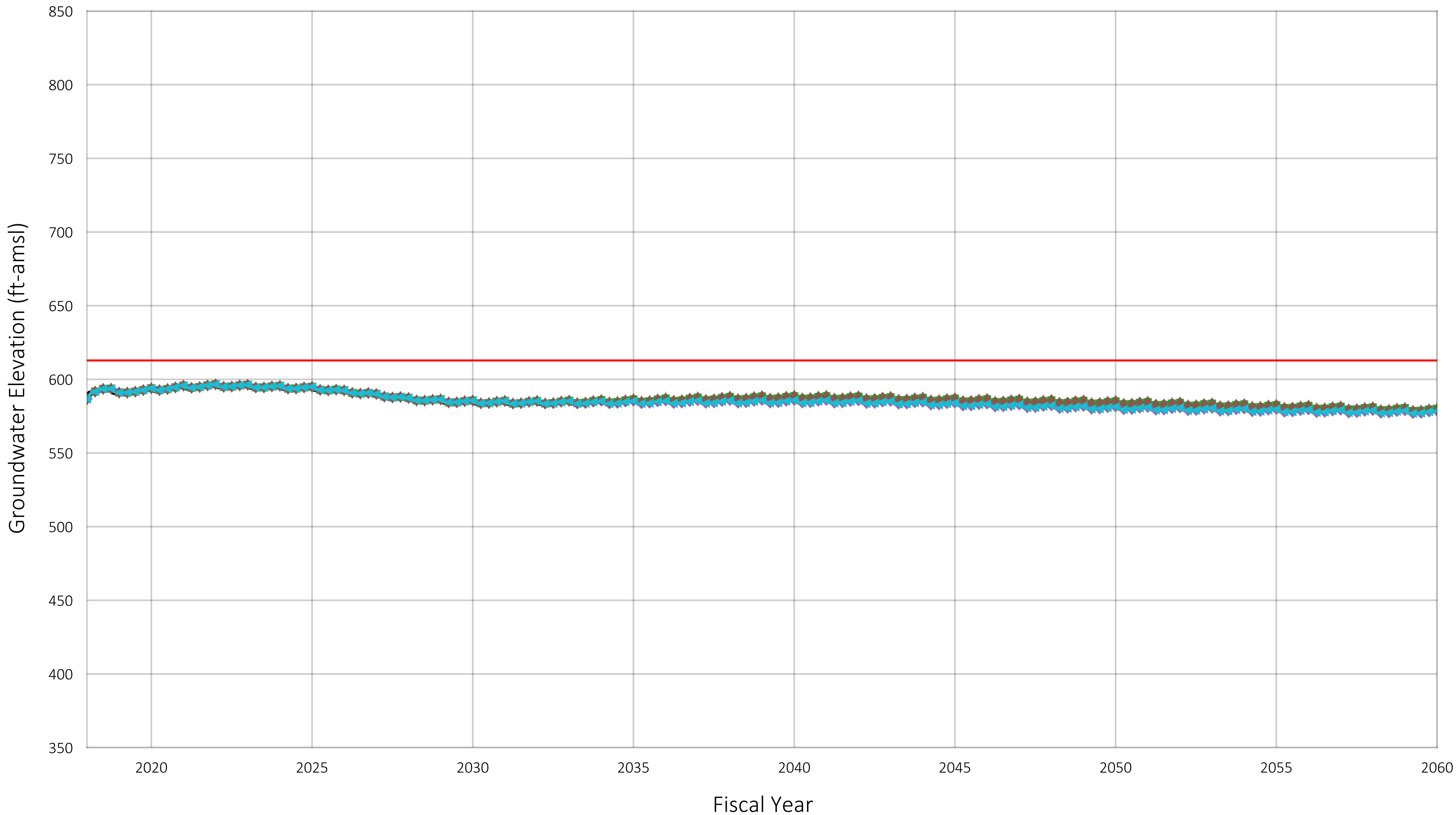
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002659
Owner: City of Pomona
Well Name: 17

Figure A-125



Location of Well in Chino Basin

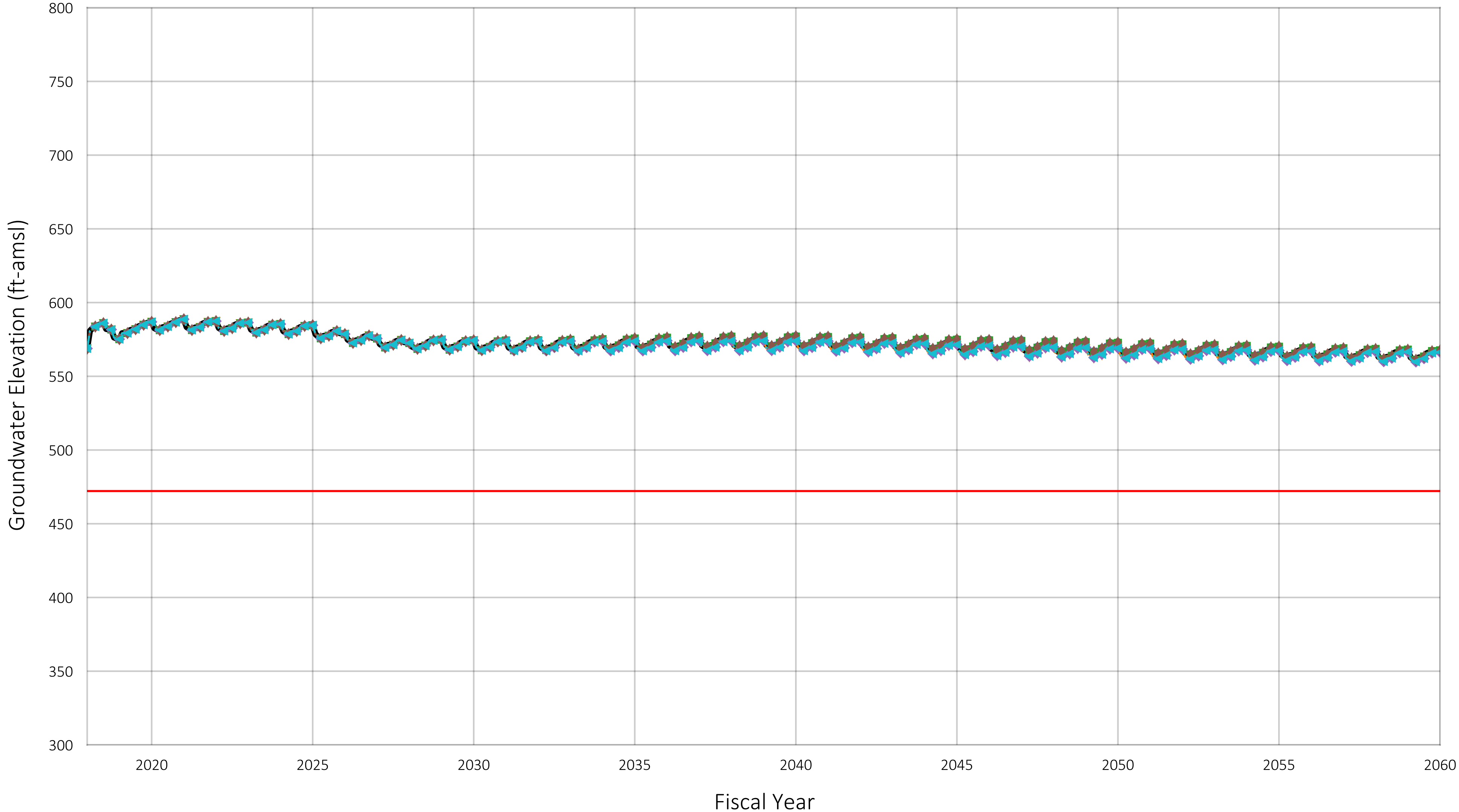
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002678
Owner: City of Pomona
Well Name: 21

Figure A-126



Location of Well in Chino Basin

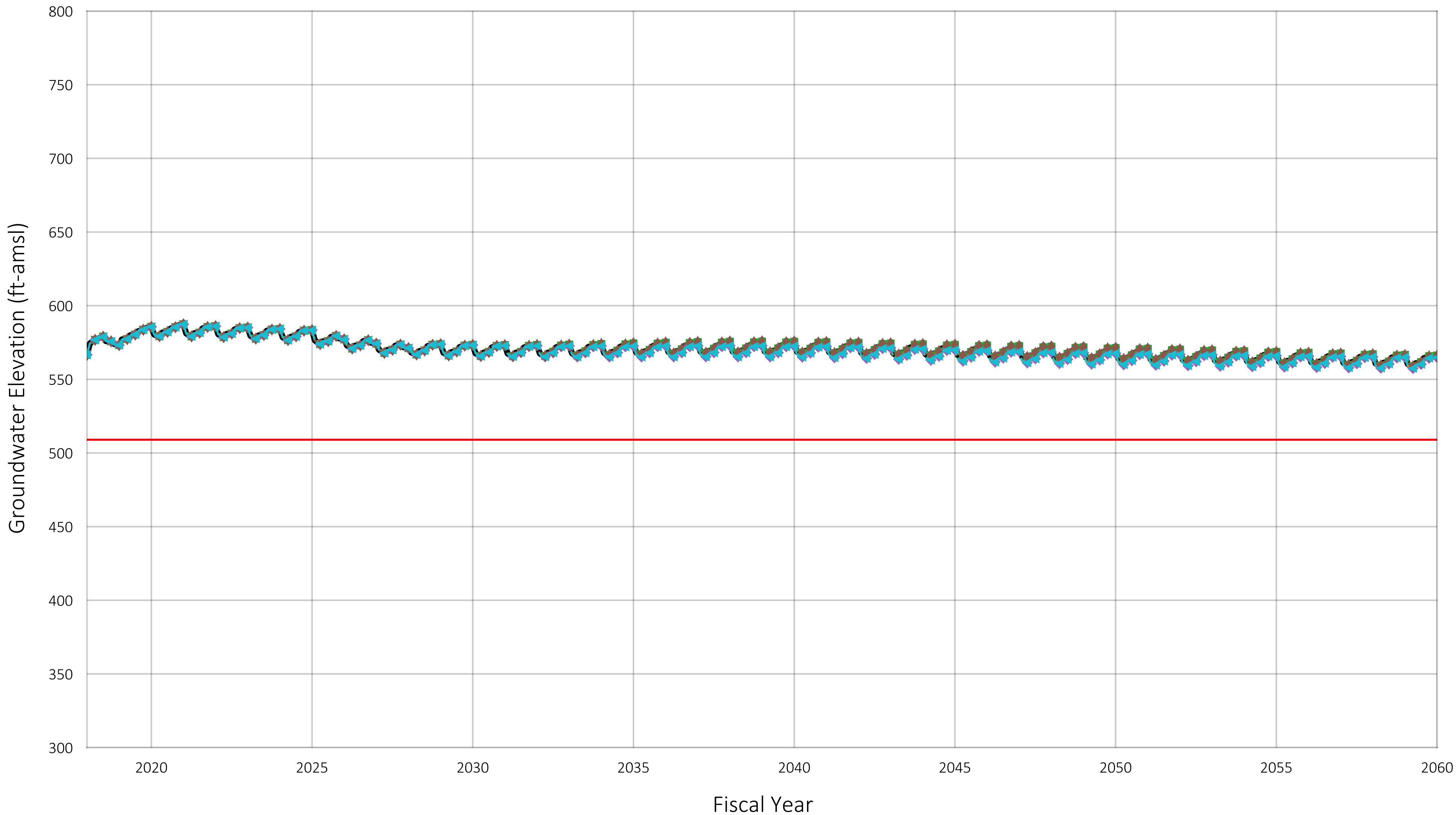
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

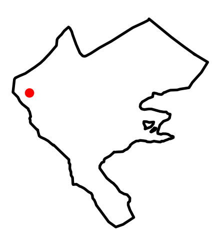
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002704
Owner: City of Pomona
Well Name: 23

Figure A-127



Location of Well in Chino Basin



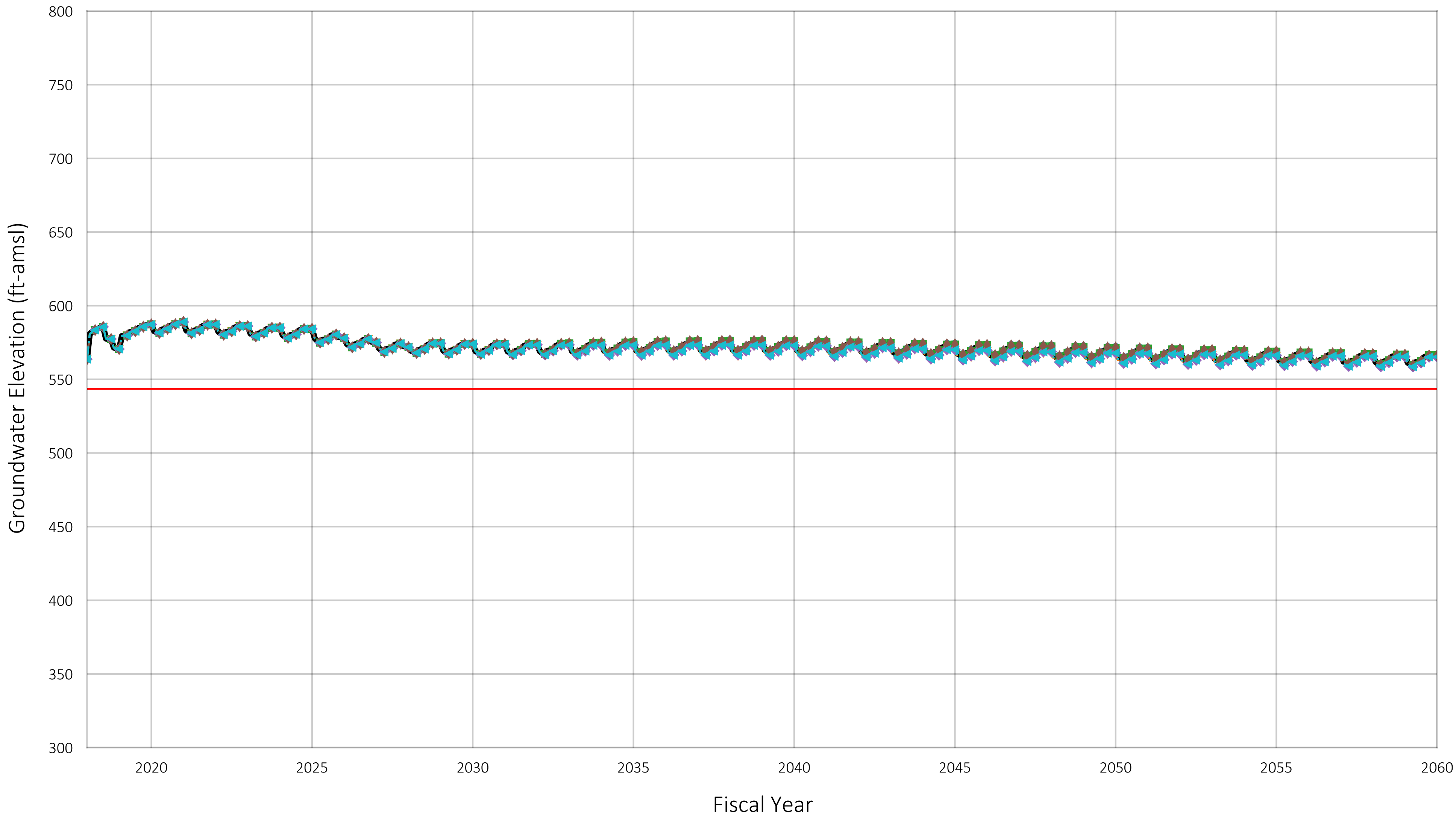
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002706
Owner: City of Pomona
Well Name: 25

Figure A-128



Location of Well in Chino Basin

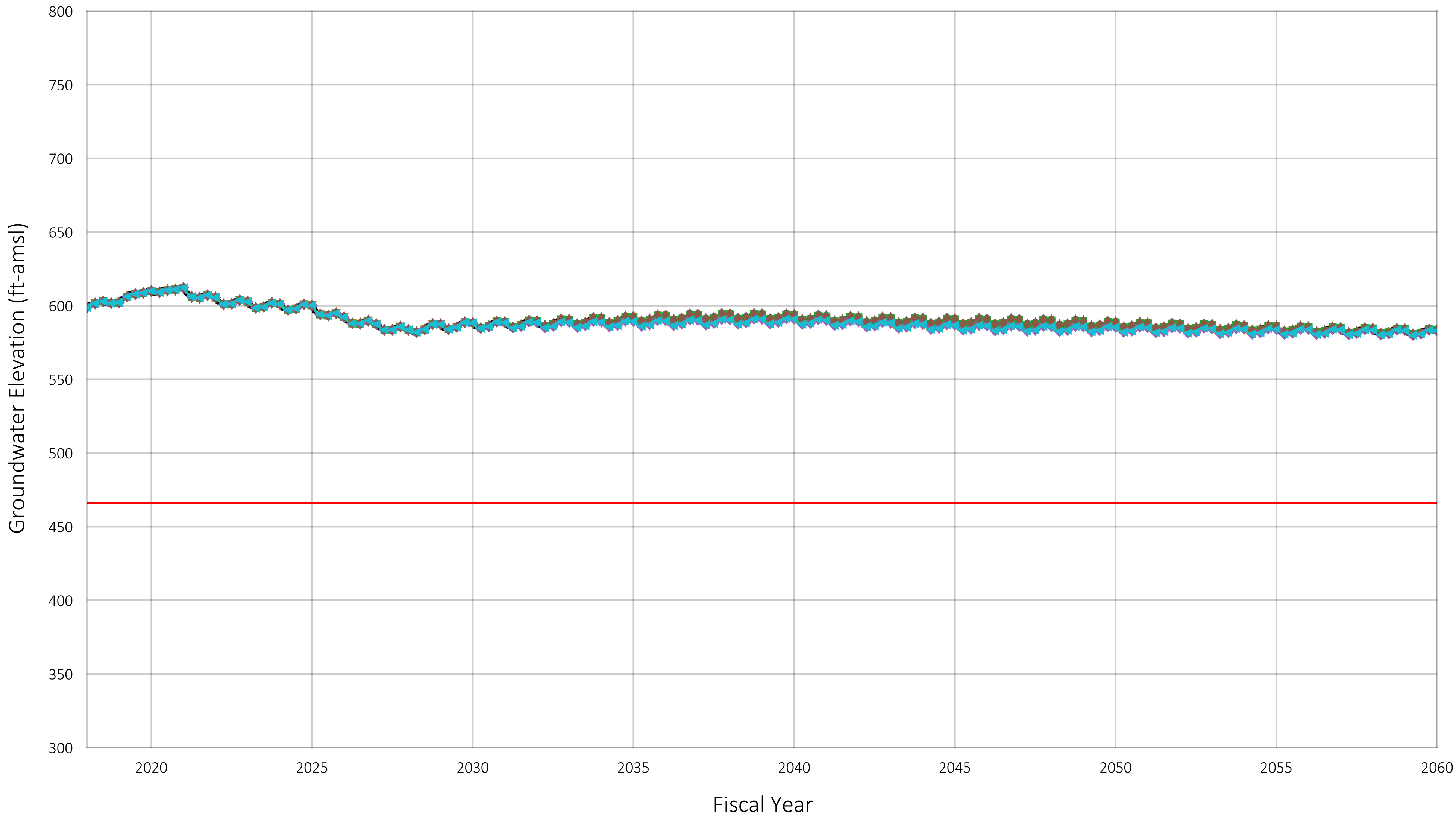
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002703
Owner: City of Pomona
Well Name: 26

Figure A-129



Location of Well in Chino Basin

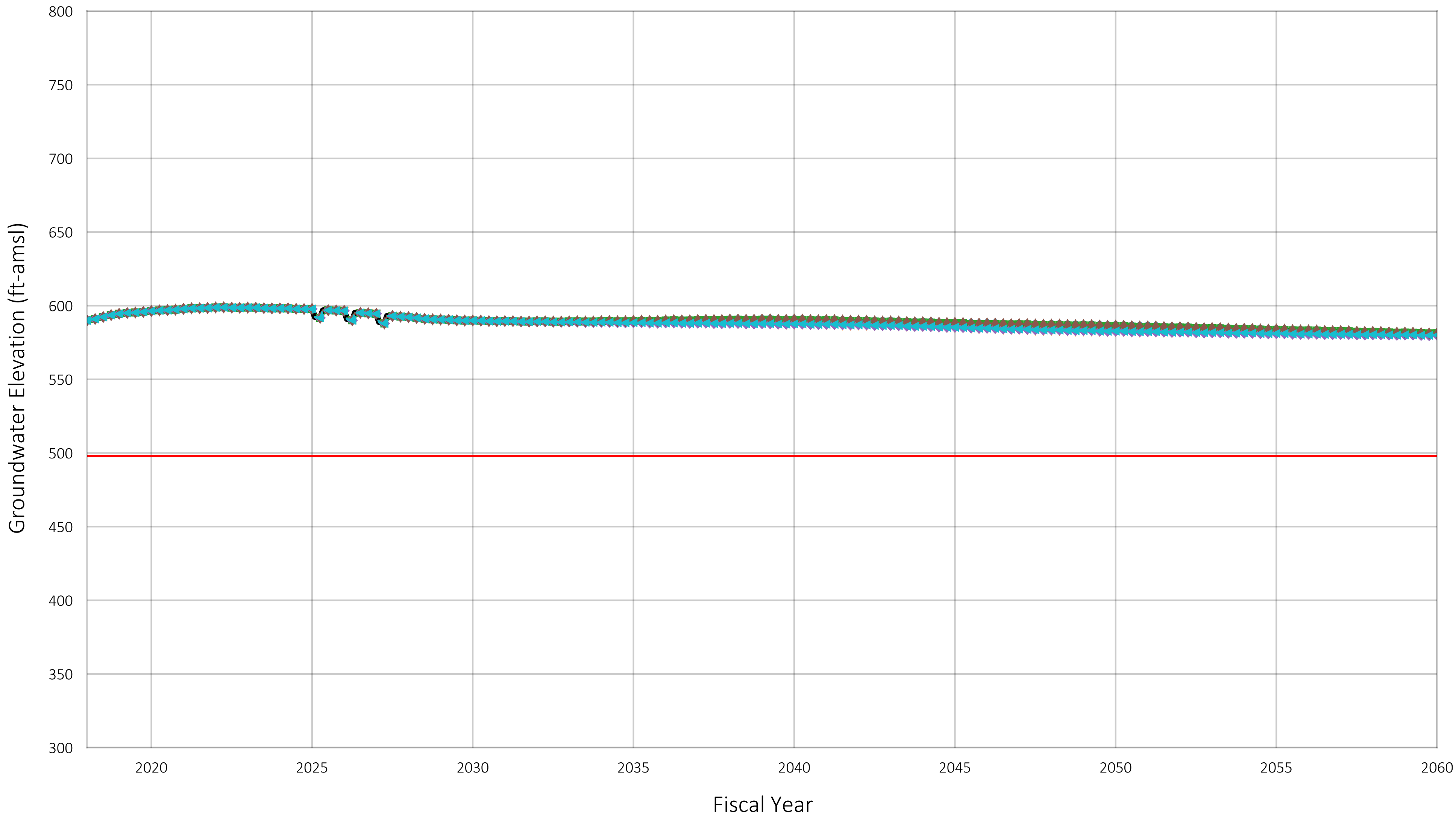
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1201236
Owner: City of Pomona
Well Name: 27

Figure A-130



Location of Well in Chino Basin

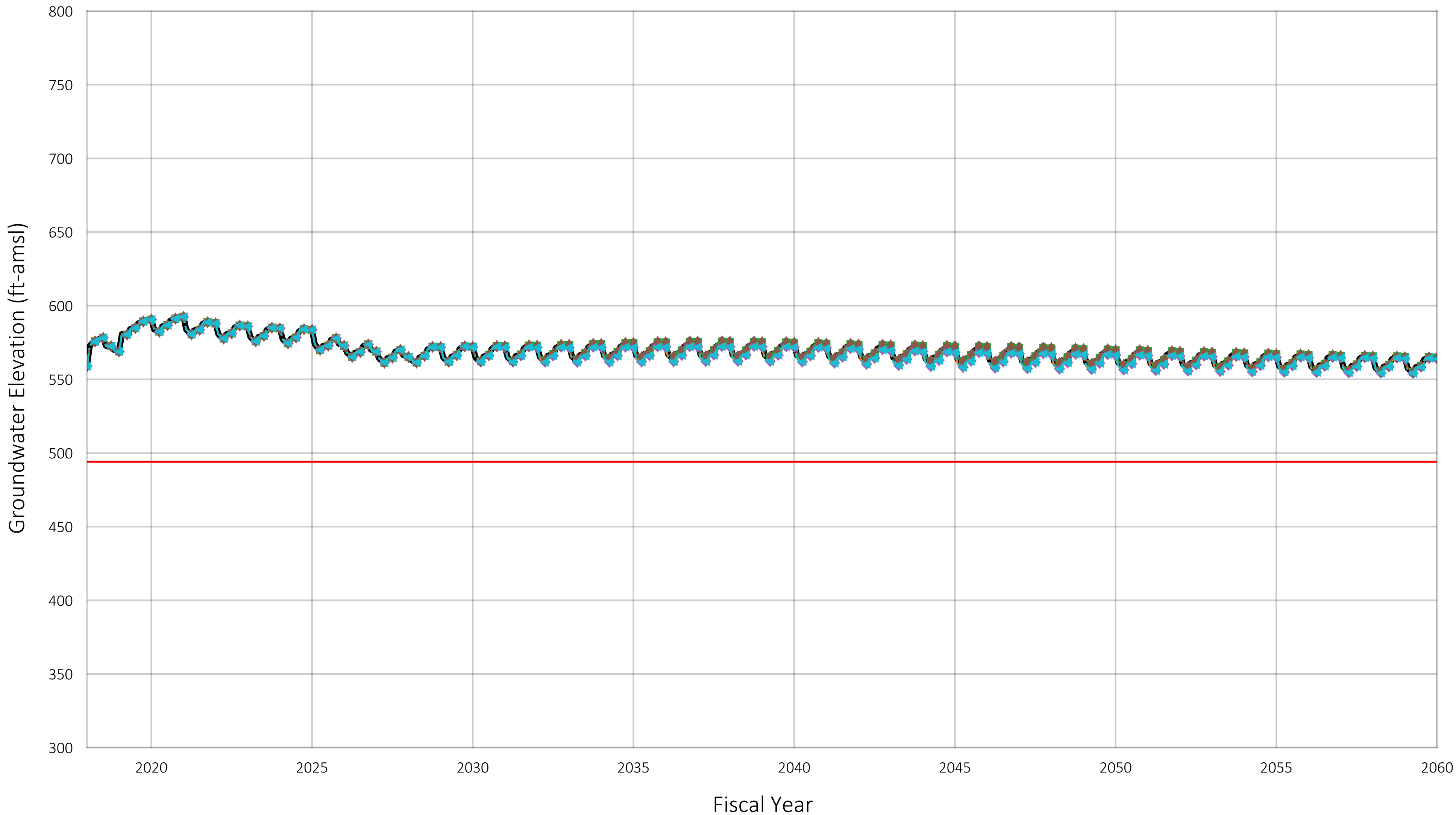
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1203062
Owner: City of Pomona
Well Name: 29

Figure A-131



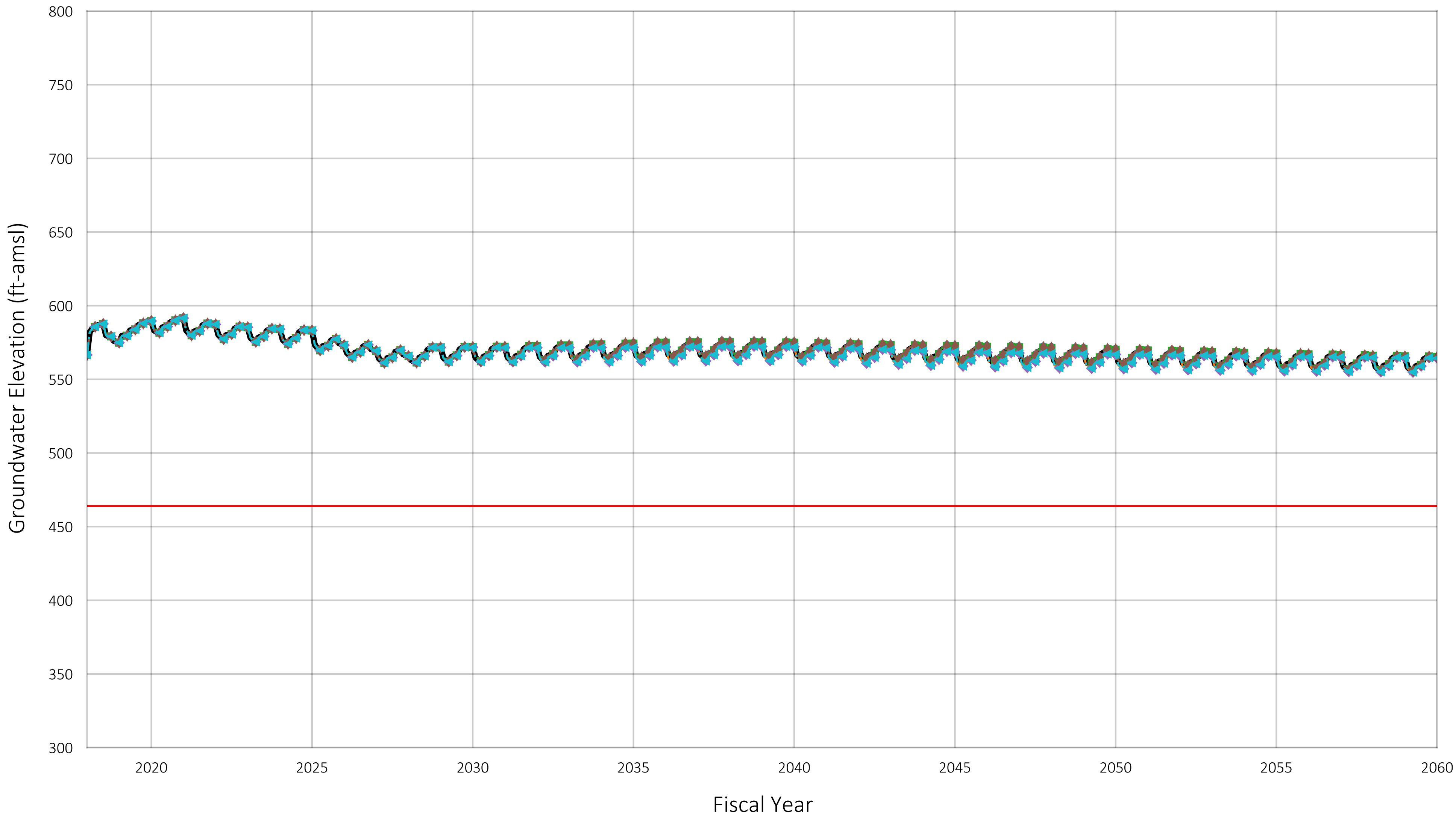
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1201247
Owner: City of Pomona
Well Name: 34

Figure A-132



Location of Well in Chino Basin

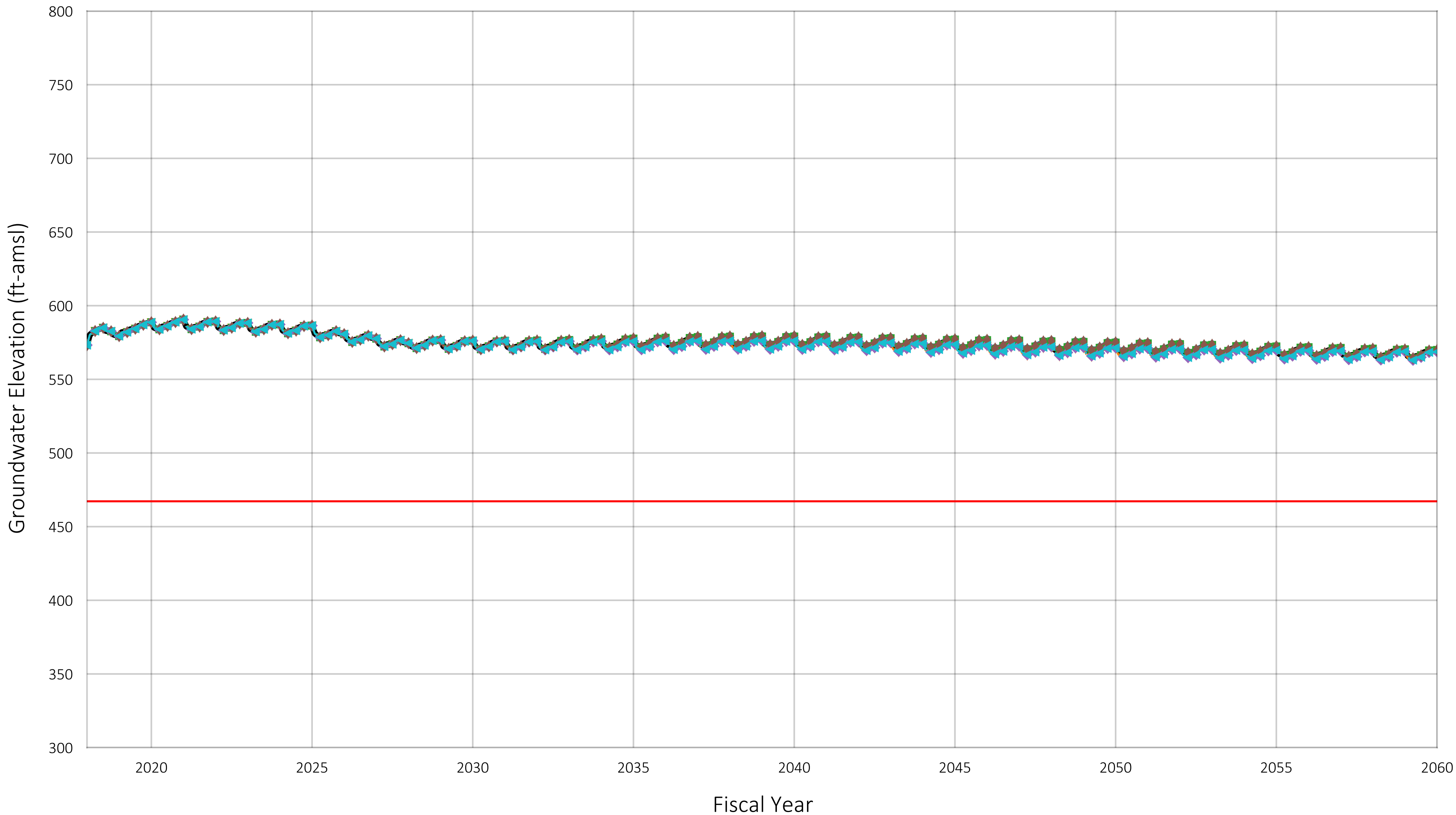
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

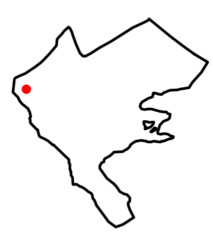
WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1201246
Owner: City of Pomona
Well Name: 35

Figure A-133



Location of Well in Chino Basin



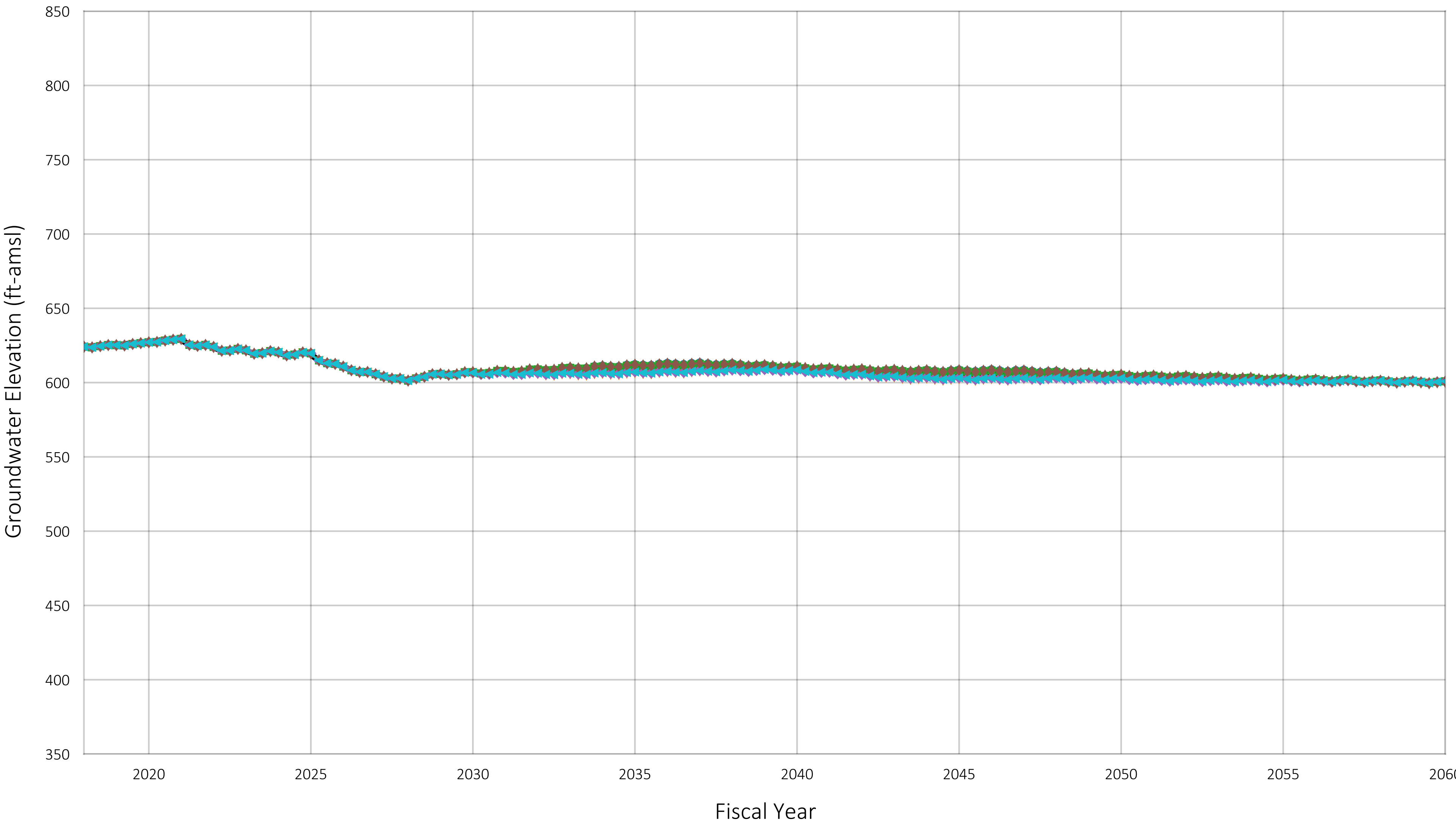
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

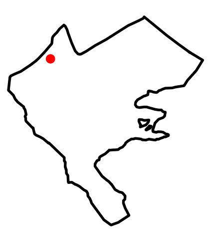
WEST YOST
Water. Engineered

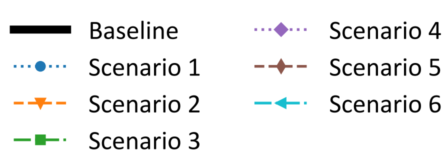
Projected Groundwater Elevation
Well ID#: 1205309
Owner: City of Pomona
Well Name: 36

Figure A-134



Location of Well in Chino Basin



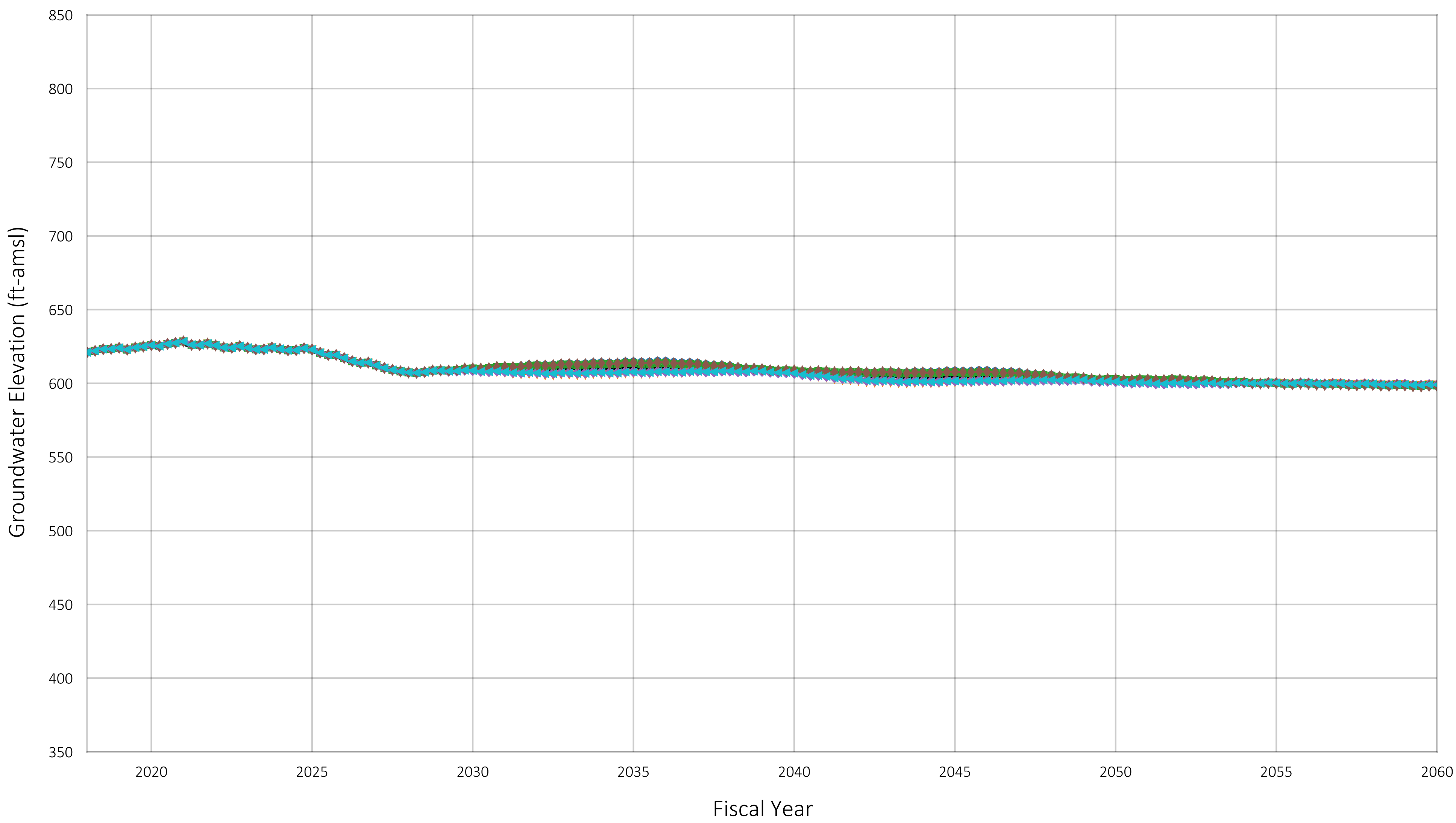


Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002535
Owner: City of Upland
Well Name: 3

Figure A-135



Location of Well in Chino Basin

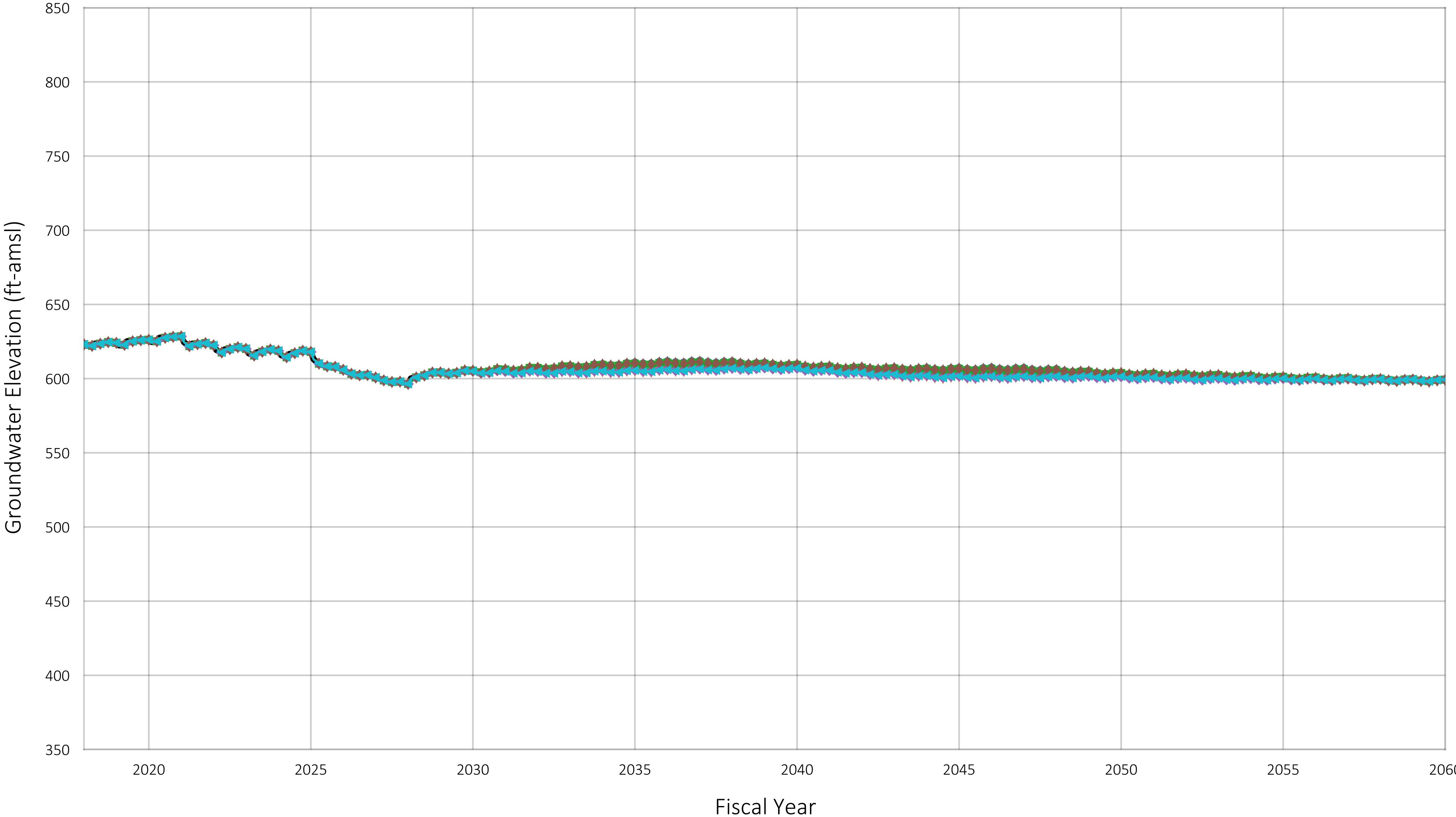
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1006997
Owner: City of Upland
Well Name: 7A

Figure A-136



Location of Well in Chino Basin

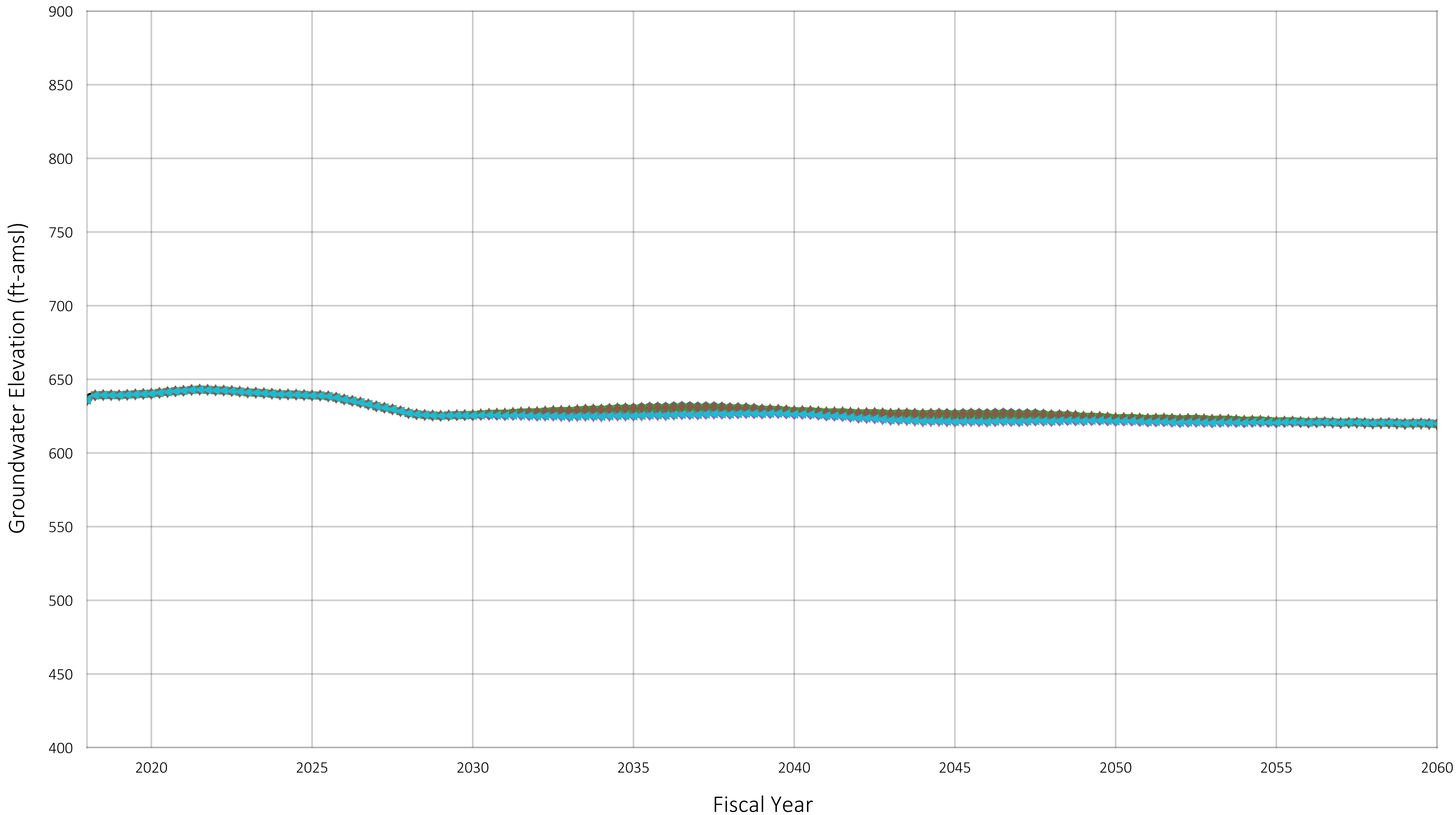
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

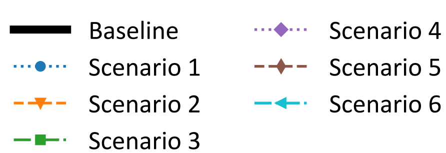
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1002531
Owner: City of Upland
Well Name: 8

Figure A-137



Location of Well in Chino Basin

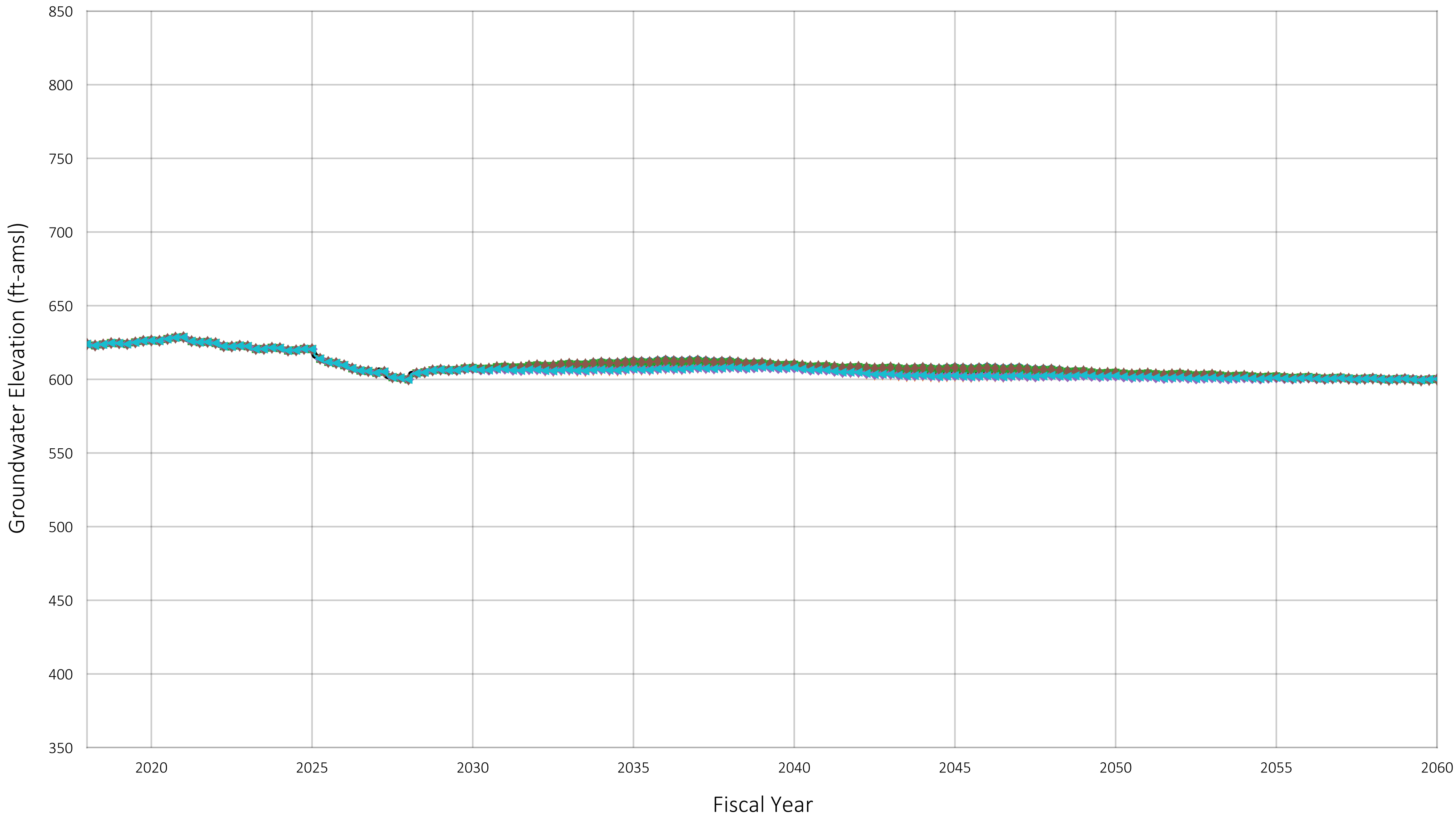


Prepared by:

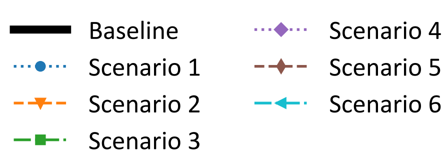
WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206654
Owner: City of Upland
Well Name: 20

Figure A-138



Location of Well in Chino Basin

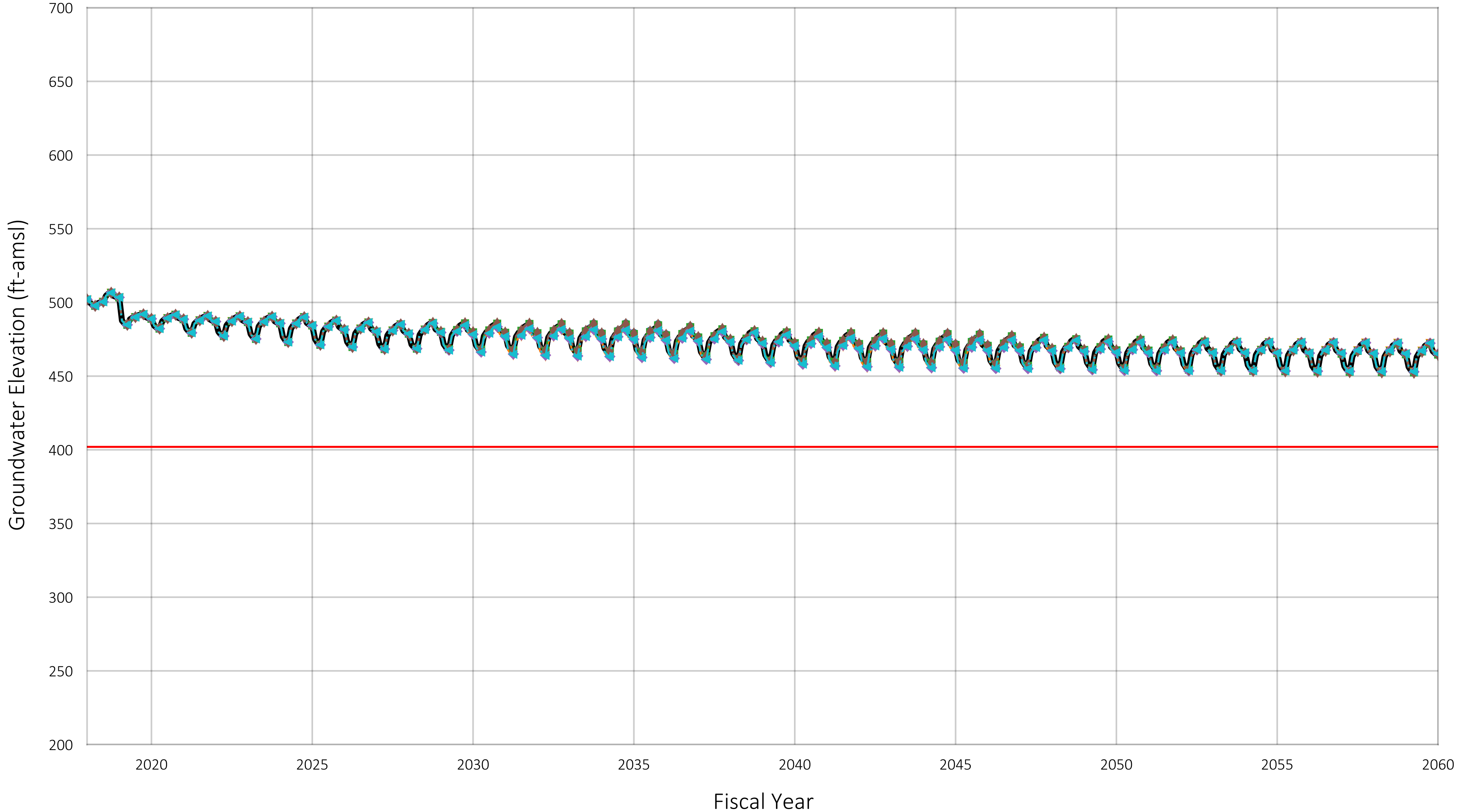


Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1207956
Owner: City of Upland
Well Name: 21A

Figure A-139



Location of Well in Chino Basin

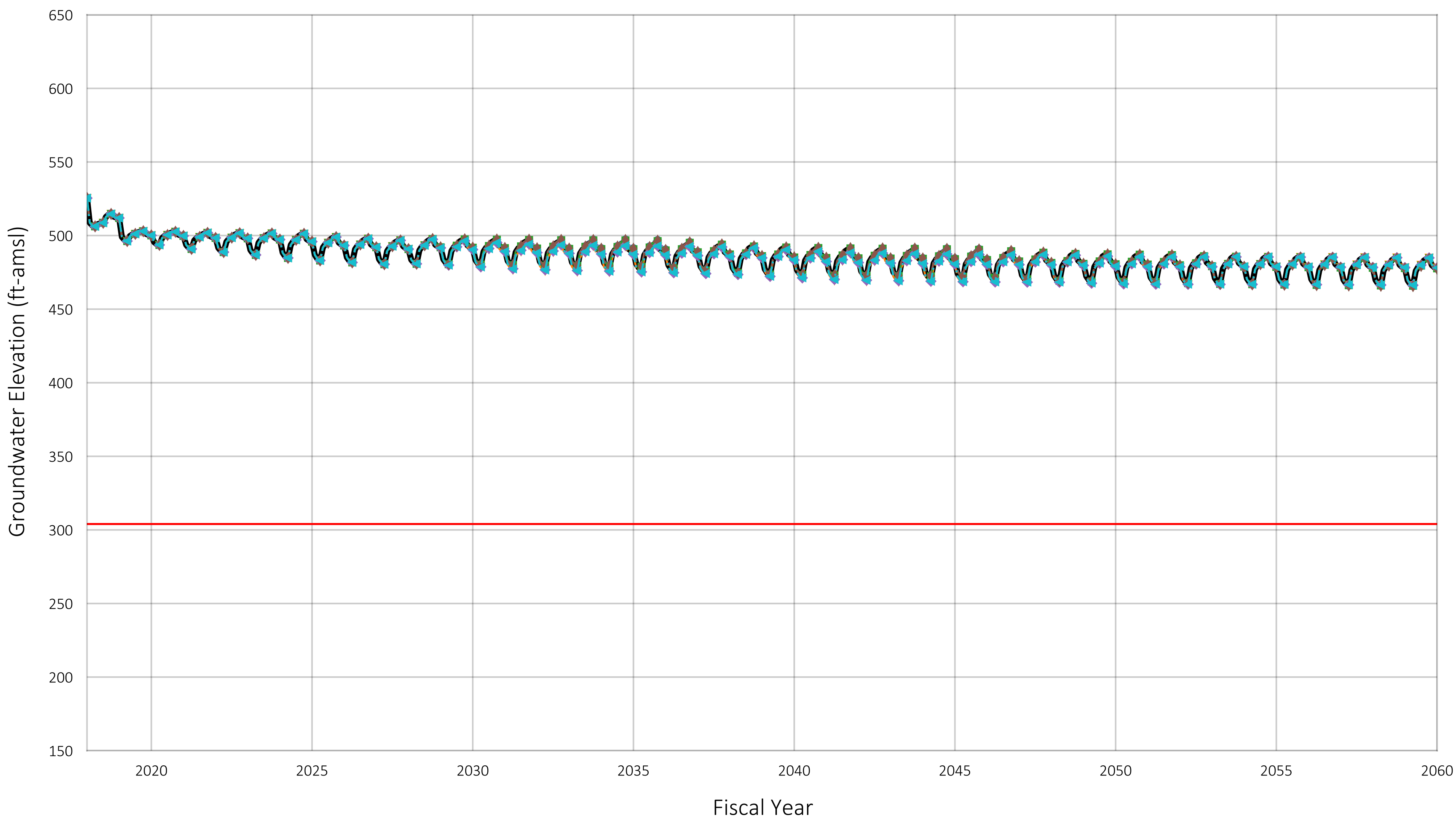
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206675
Owner: Chino Basin Desalter Authority
Well Name: I-1

Figure A-140



Location of Well in Chino Basin

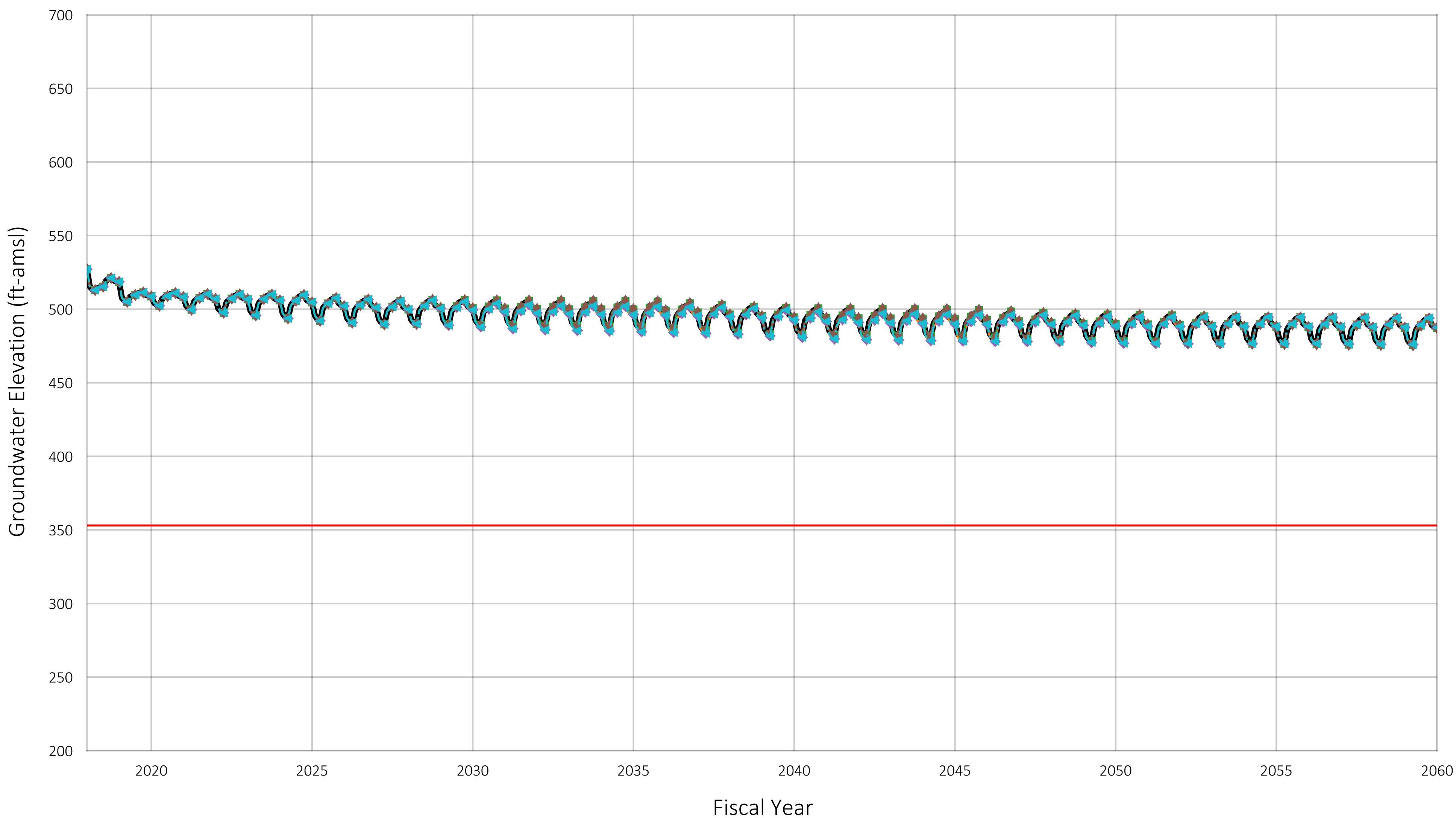
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206676
Owner: Chino Basin Desalter Authority
Well Name: I-2

Figure A-141



Location of Well in Chino Basin

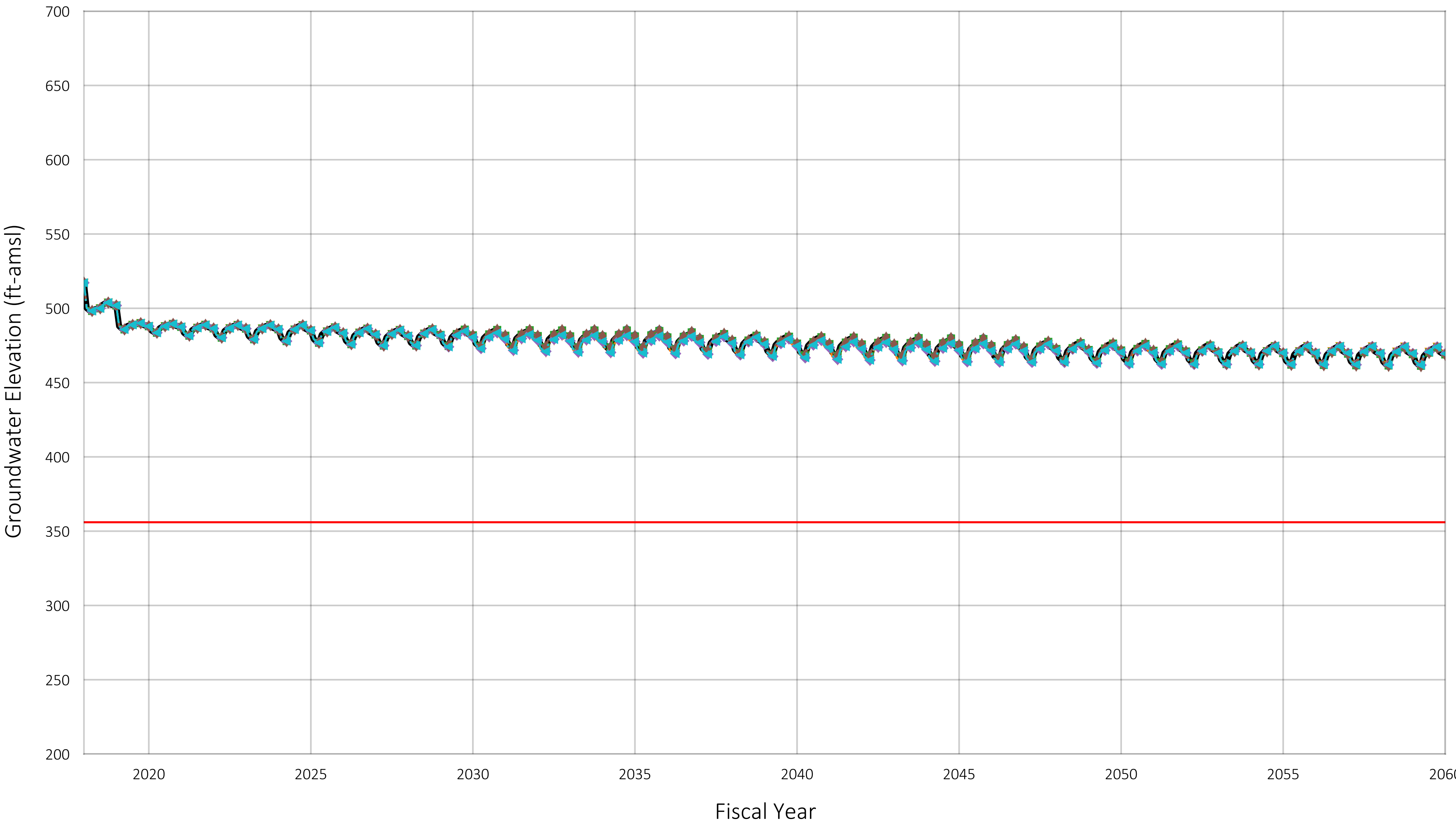
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206677
Owner: Chino Basin Desalter Authority
Well Name: I-3

Figure A-142



Location of Well in Chino Basin

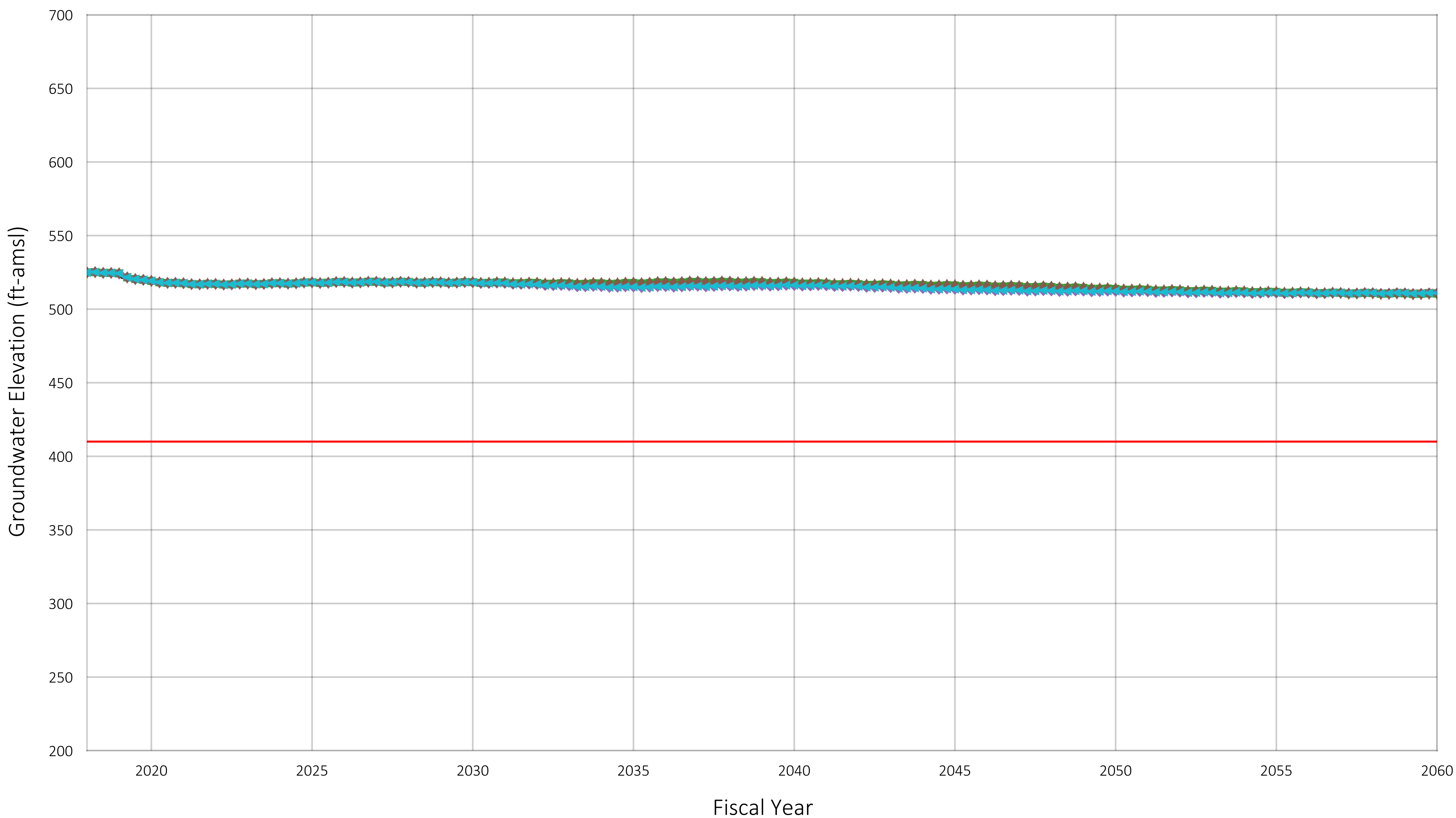
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206678
Owner: Chino Basin Desalter Authority
Well Name: I-4

Figure A-143



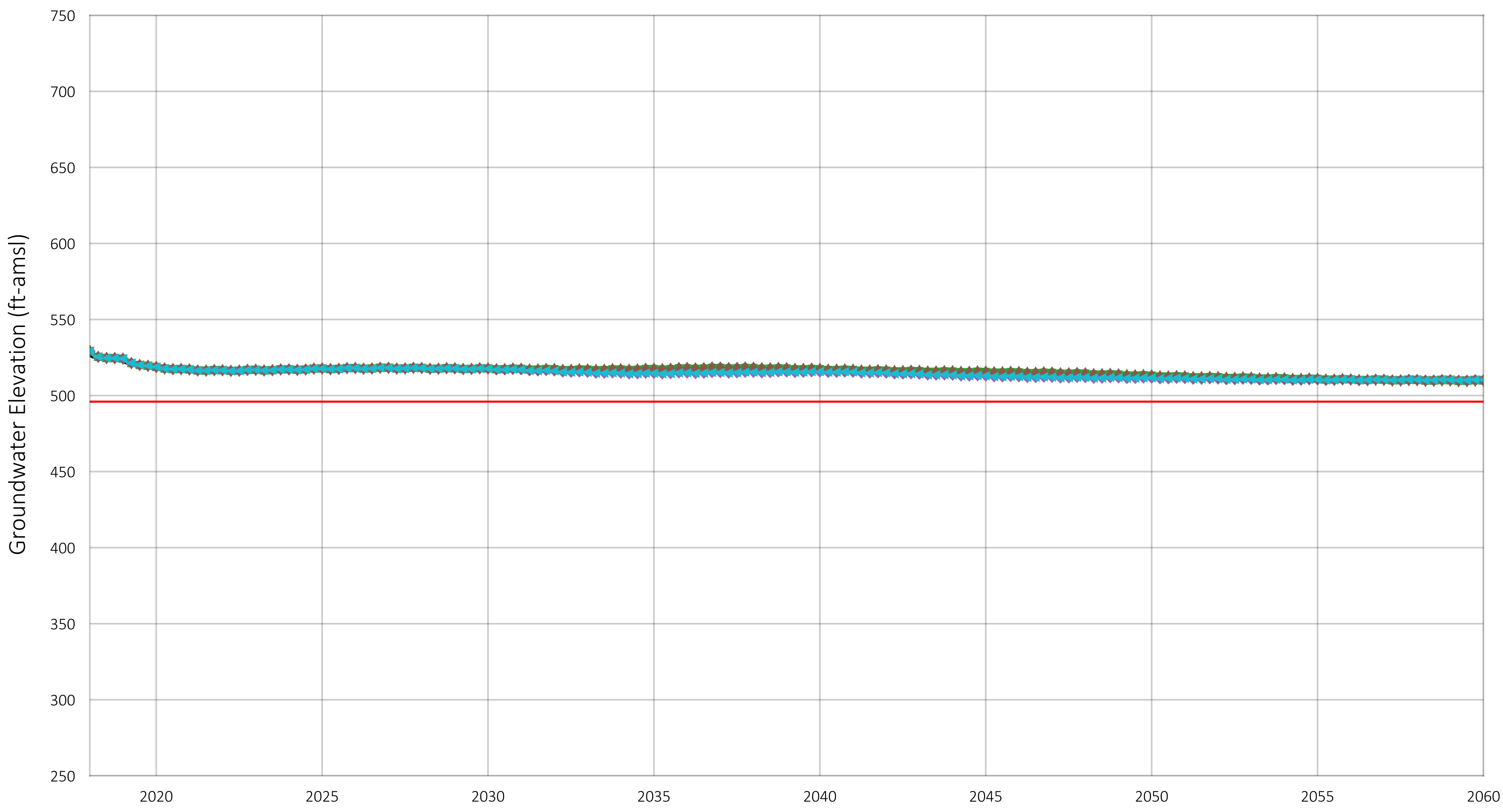
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206679
Owner: Chino Basin Desalter Authority
Well Name: I-5

Figure A-144



Location of Well in Chino Basin

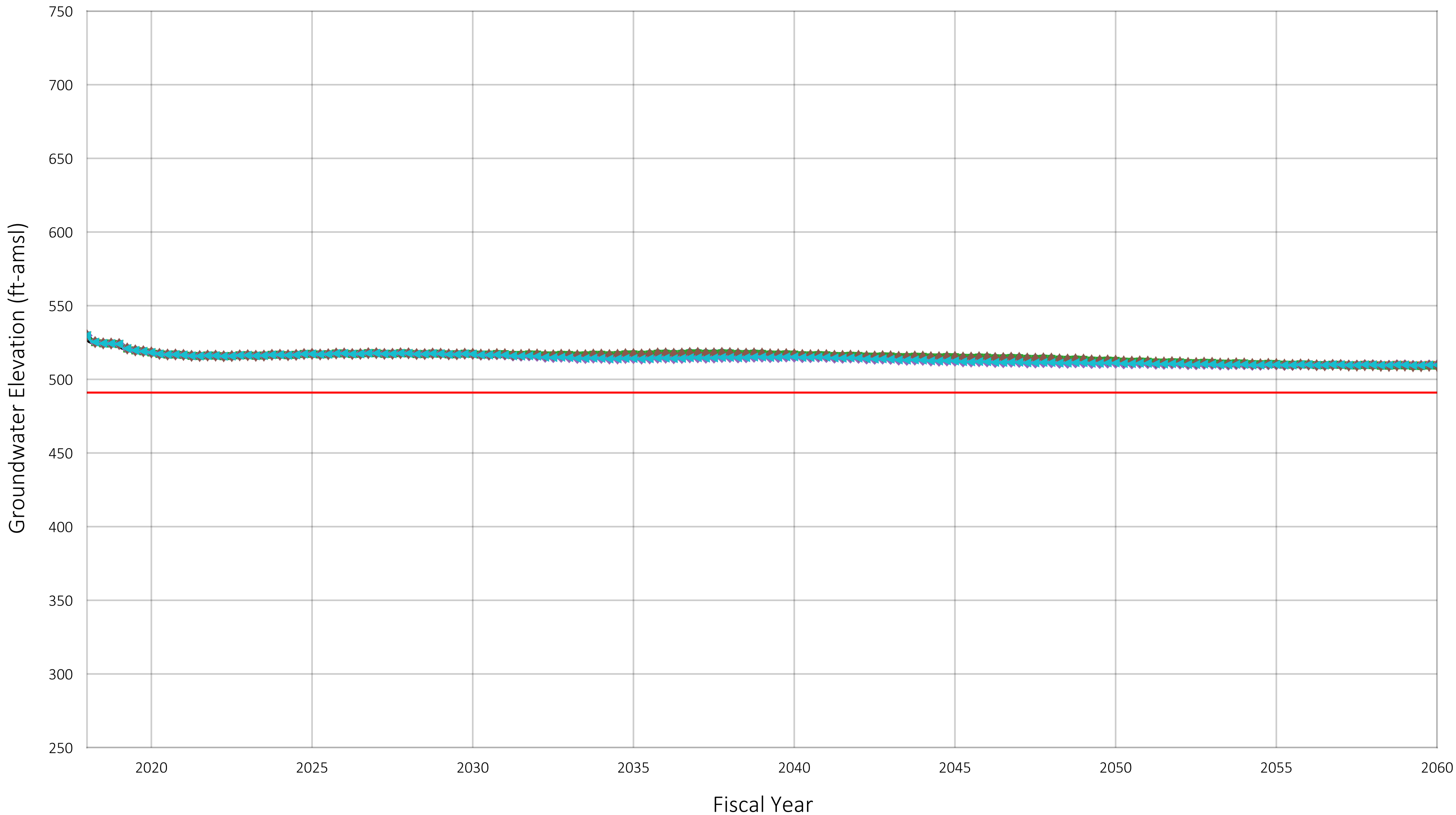
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206684
Owner: Chino Basin Desalter Authority
Well Name: I-6

Figure A-145



Location of Well in Chino Basin

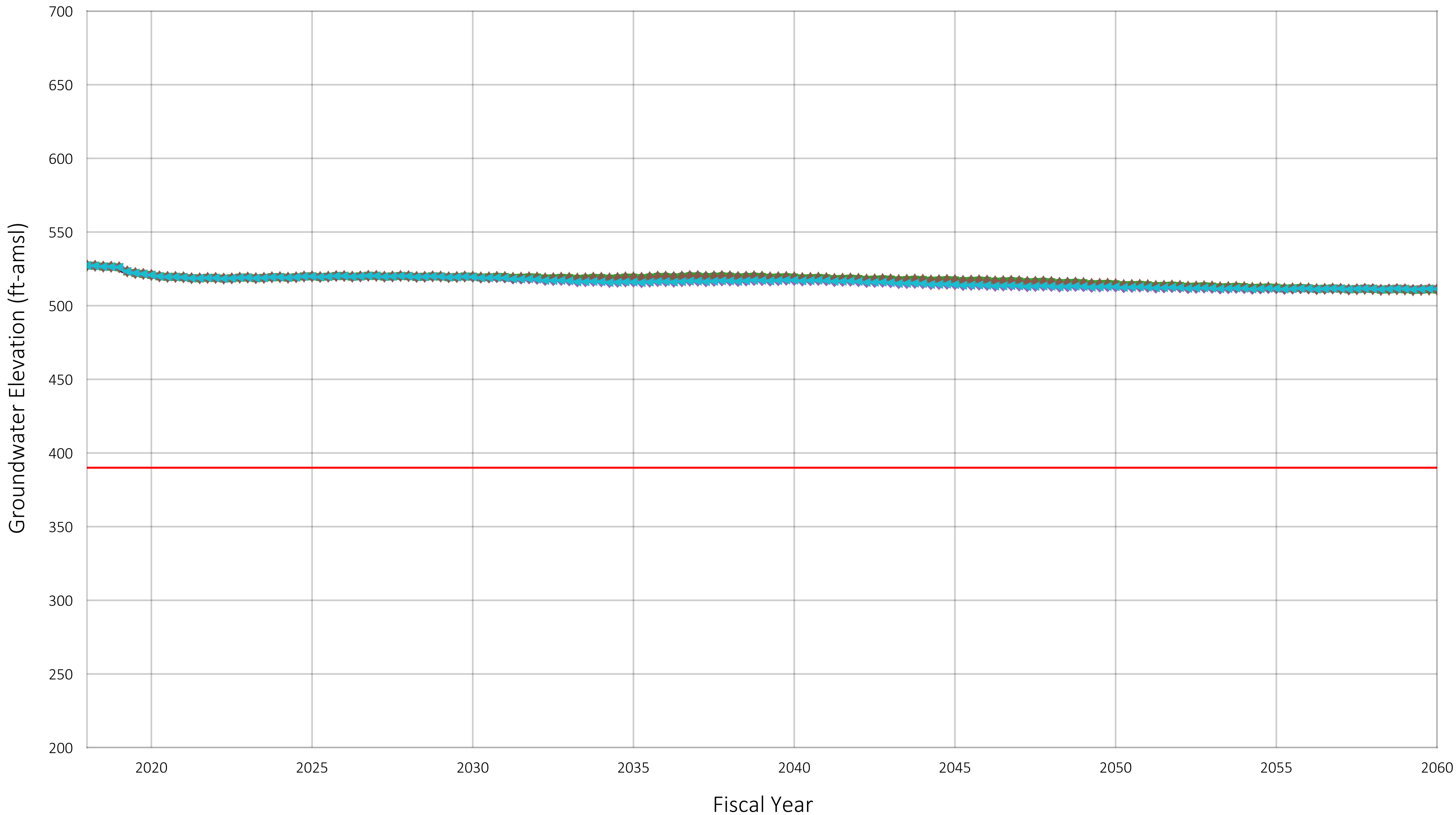
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206685
Owner: Chino Basin Desalter Authority
Well Name: I-7

Figure A-146



Location of Well in Chino Basin

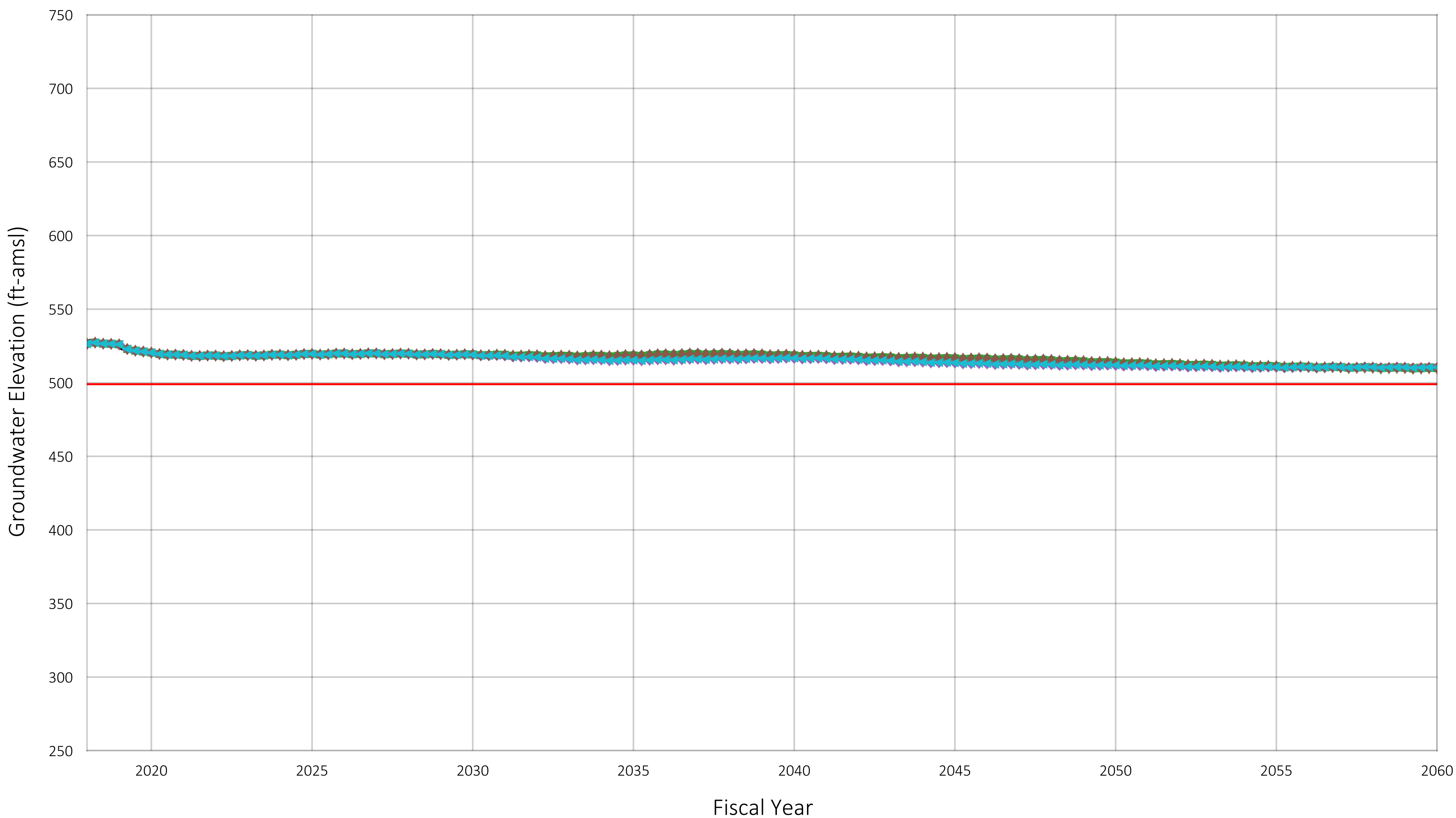
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206680
Owner: Chino Basin Desalter Authority
Well Name: I-8

Figure A-147



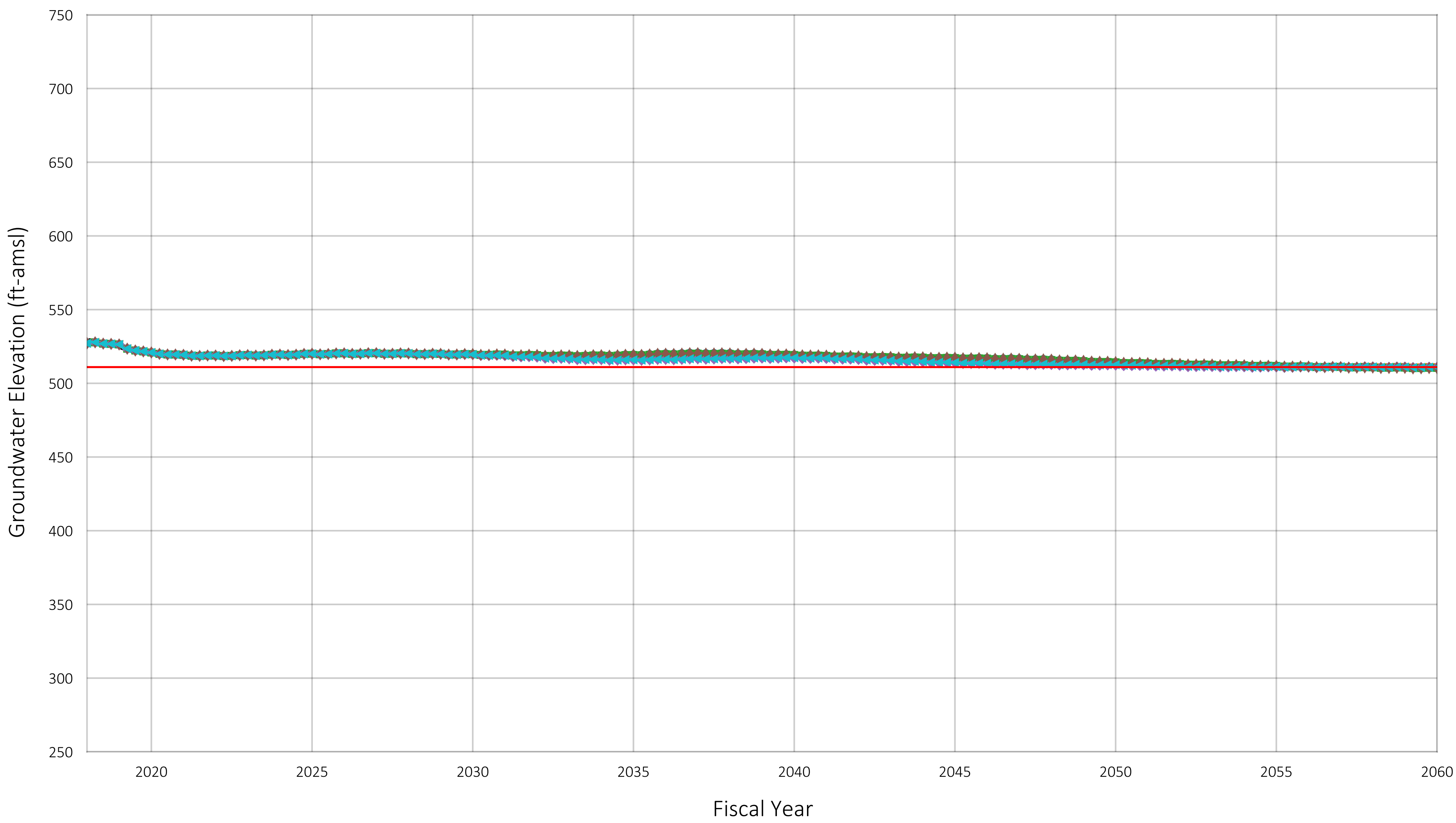
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206681
Owner: Chino Basin Desalter Authority
Well Name: I-9

Figure A-148



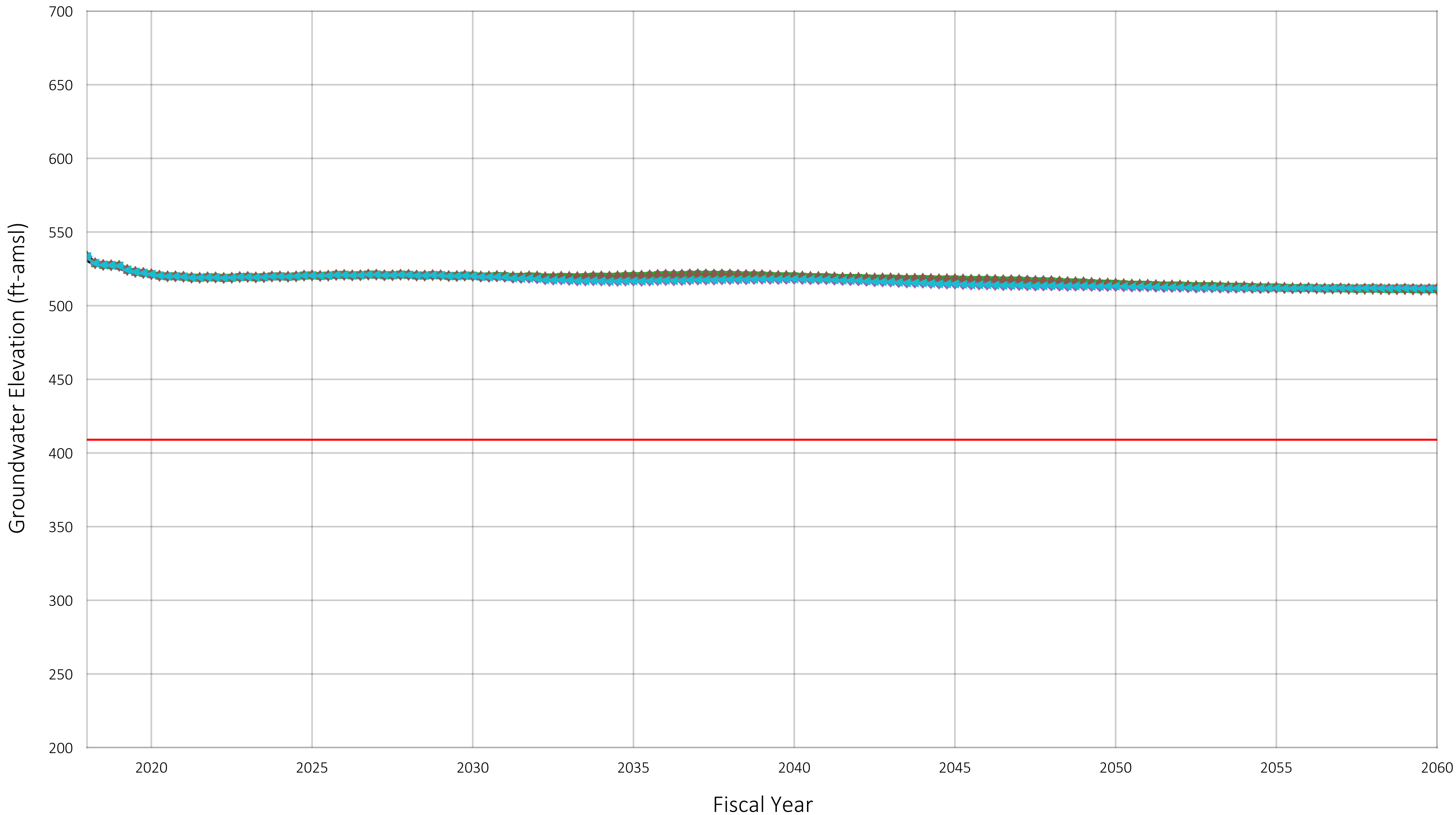
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206682
Owner: Chino Basin Desalter Authority
Well Name: I-10

Figure A-149



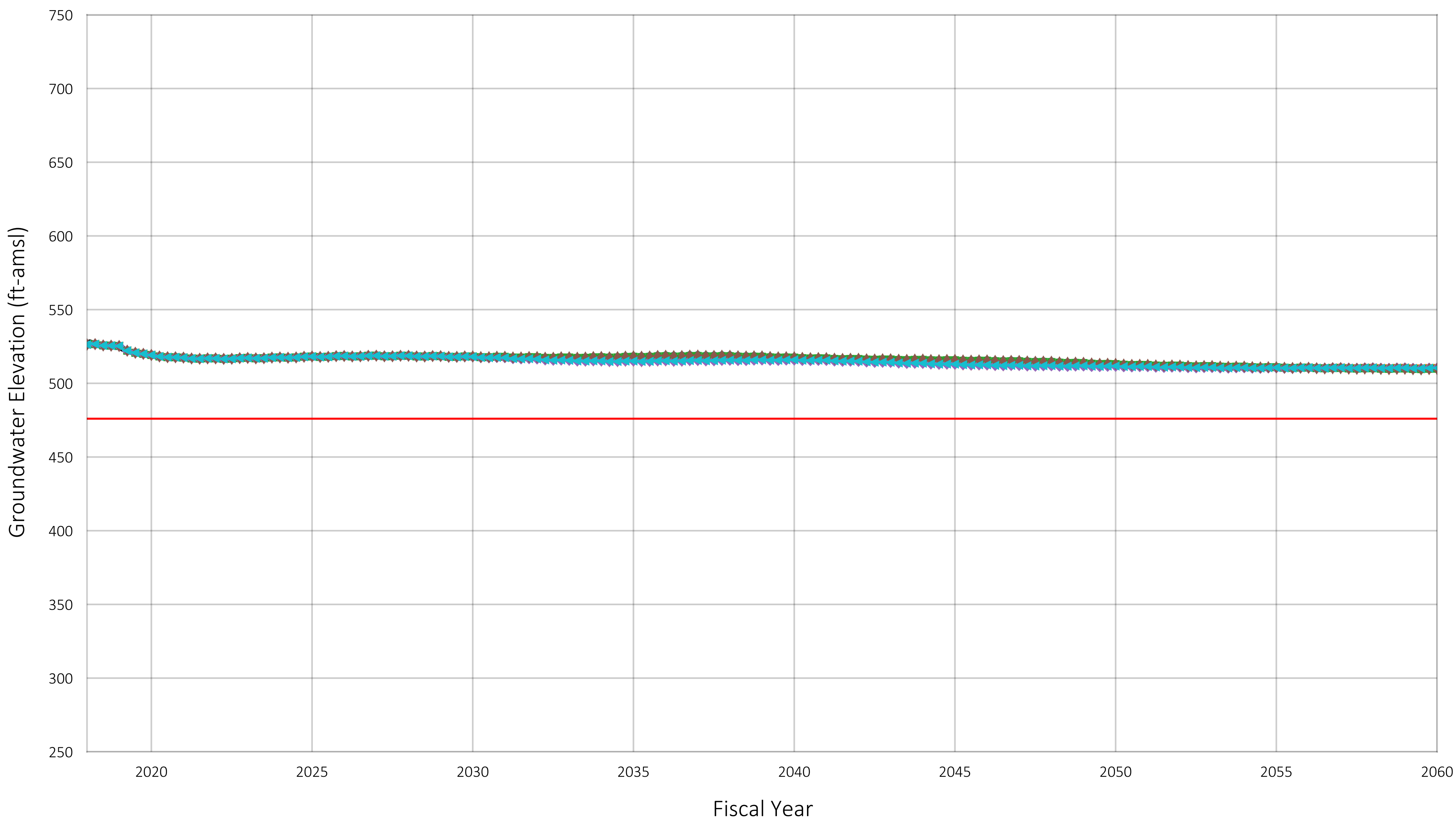
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206683
Owner: Chino Basin Desalter Authority
Well Name: I-11

Figure A-150



Location of Well in Chino Basin

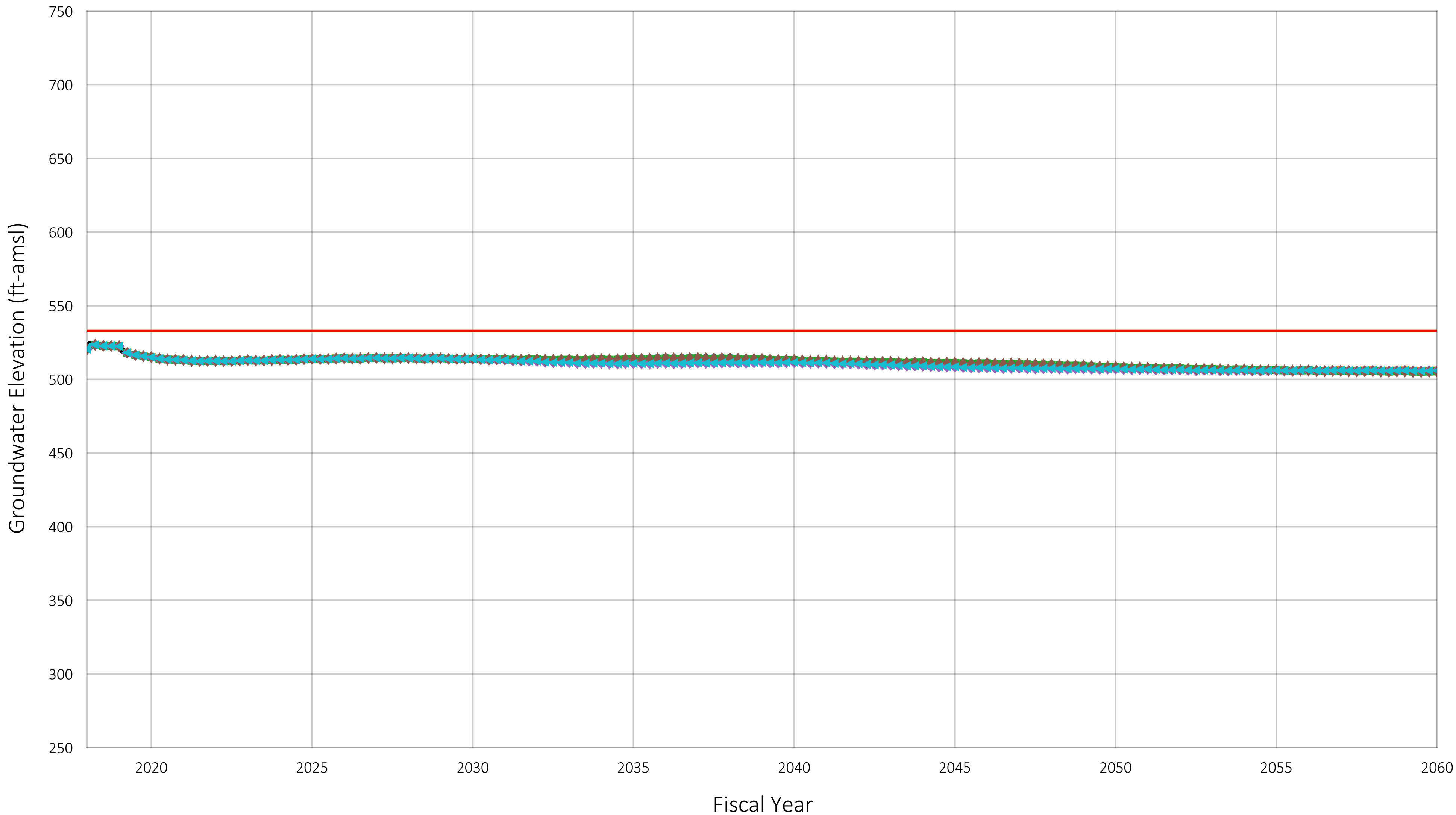
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206958
Owner: Chino Basin Desalter Authority
Well Name: I-13

Figure A-151



Location of Well in Chino Basin

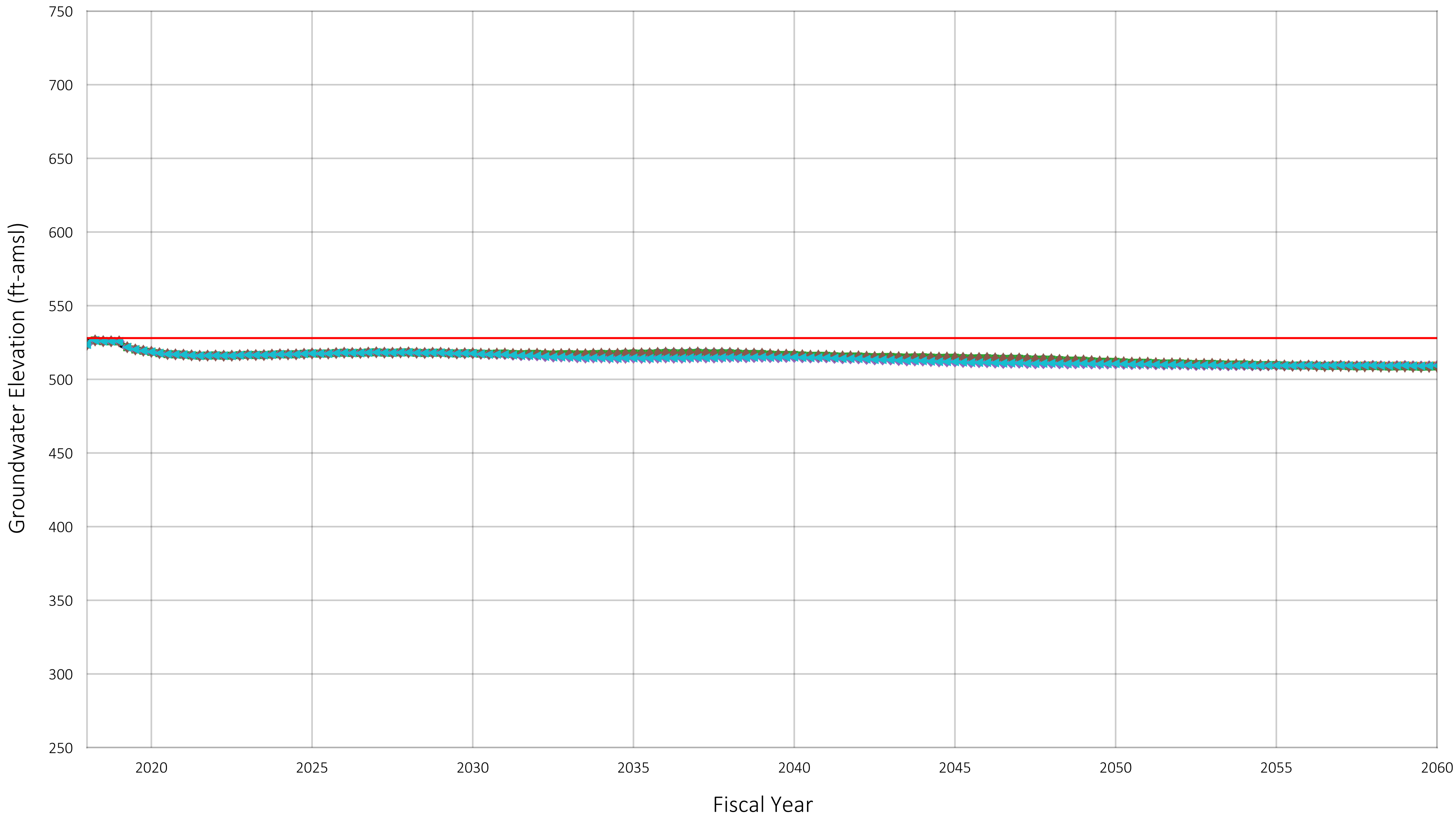
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206959
Owner: Chino Basin Desalter Authority
Well Name: I-14

Figure A-152



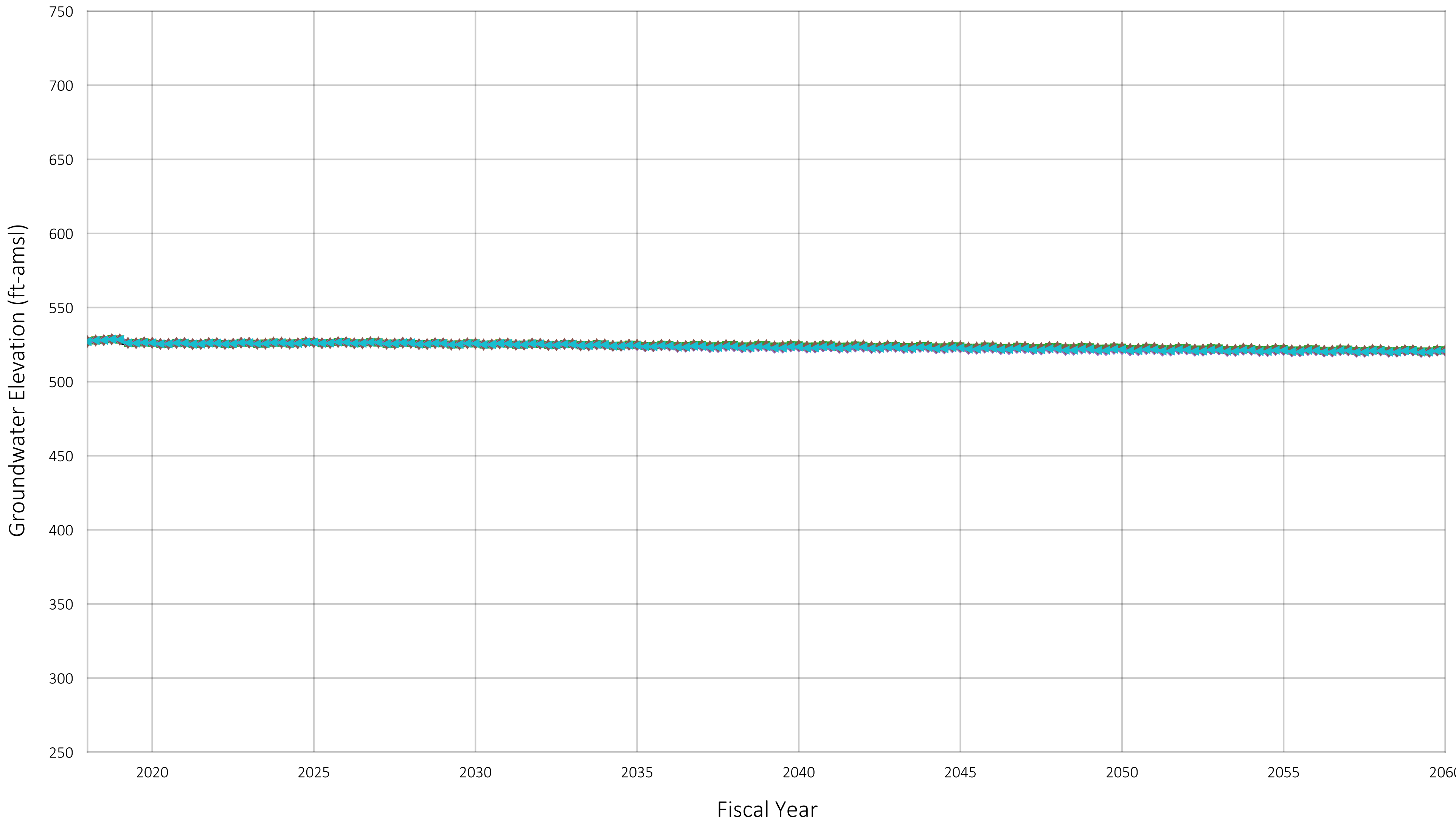
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206960
Owner: Chino Basin Desalter Authority
Well Name: I-15

Figure A-153



Location of Well in Chino Basin

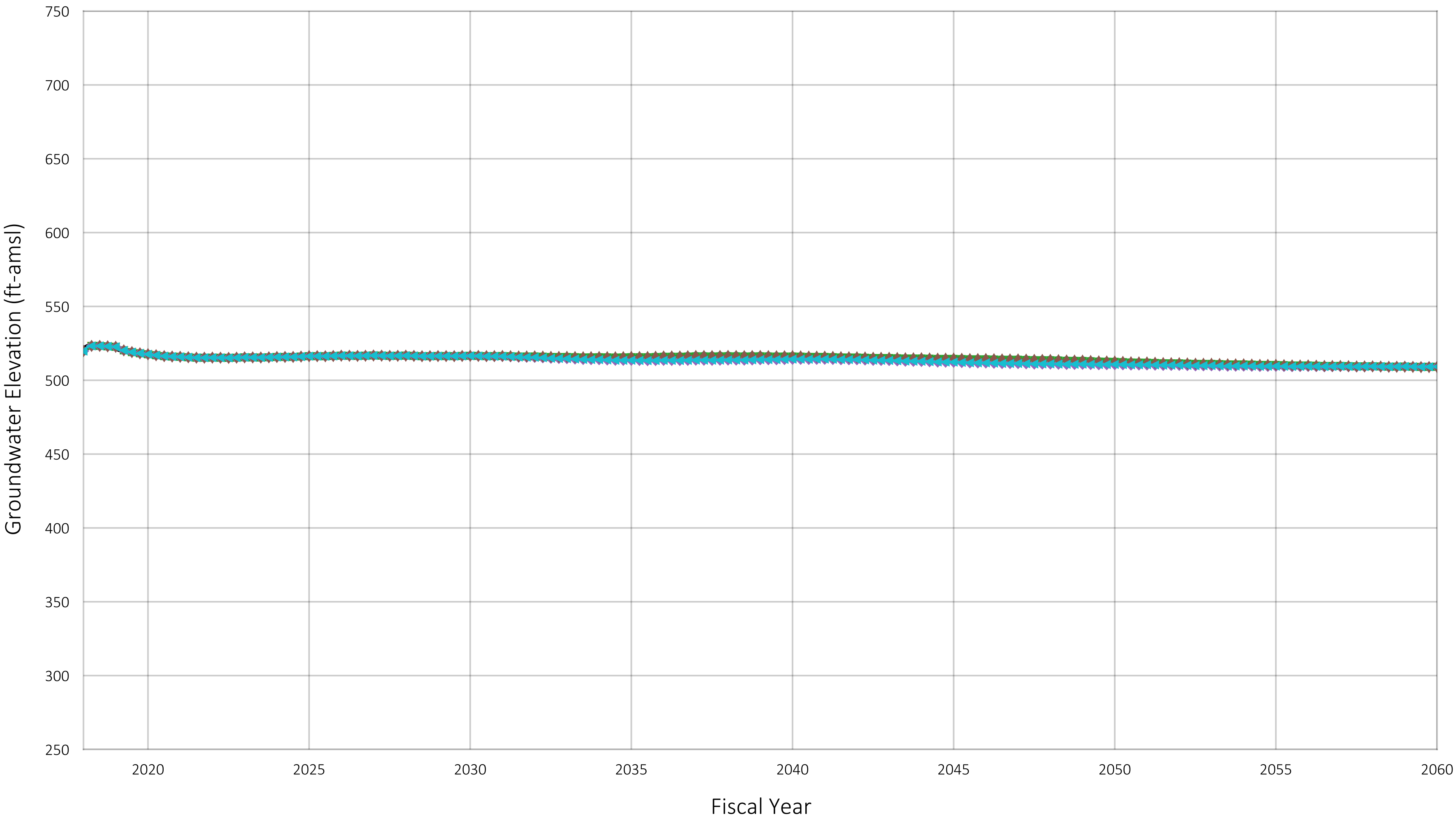
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1222970
Owner: Chino Basin Desalter Authority
Well Name: I-16

Figure A-154



Location of Well in Chino Basin

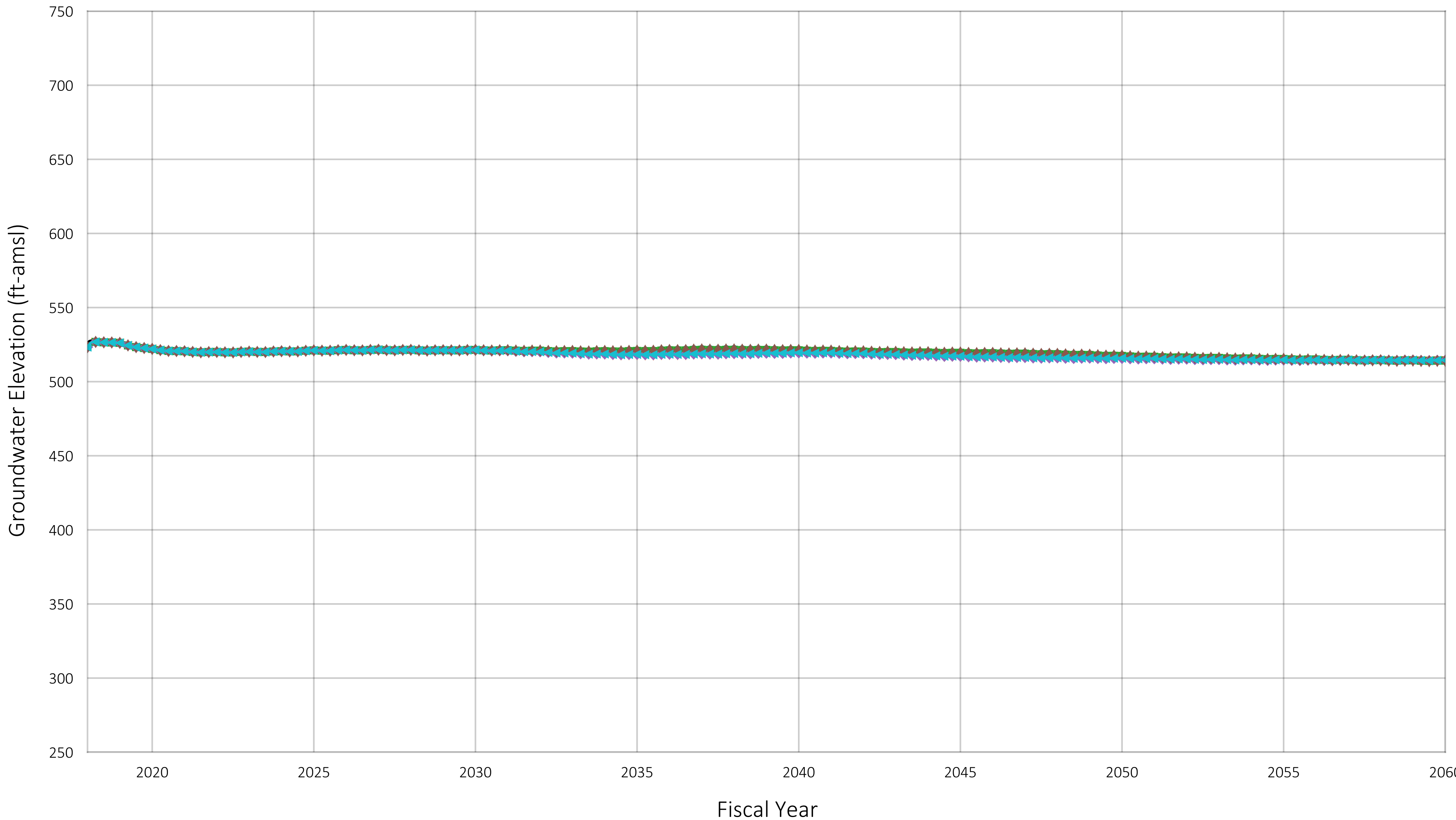
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1224801
Owner: Chino Basin Desalter Authority
Well Name: I-20

Figure A-155



Location of Well in Chino Basin

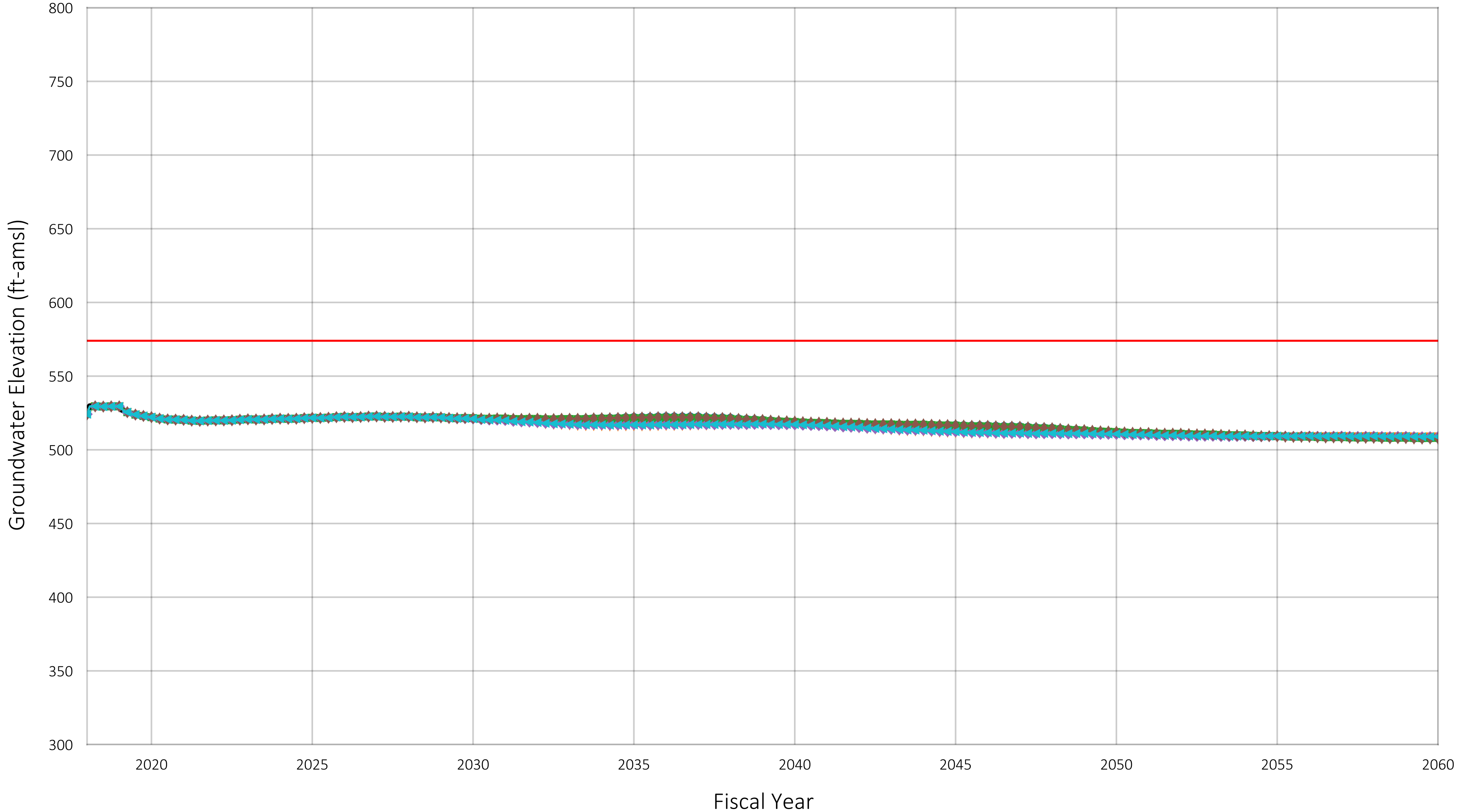
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1224812
Owner: Chino Basin Desalter Authority
Well Name: I-21

Figure A-156



Location of Well in Chino Basin

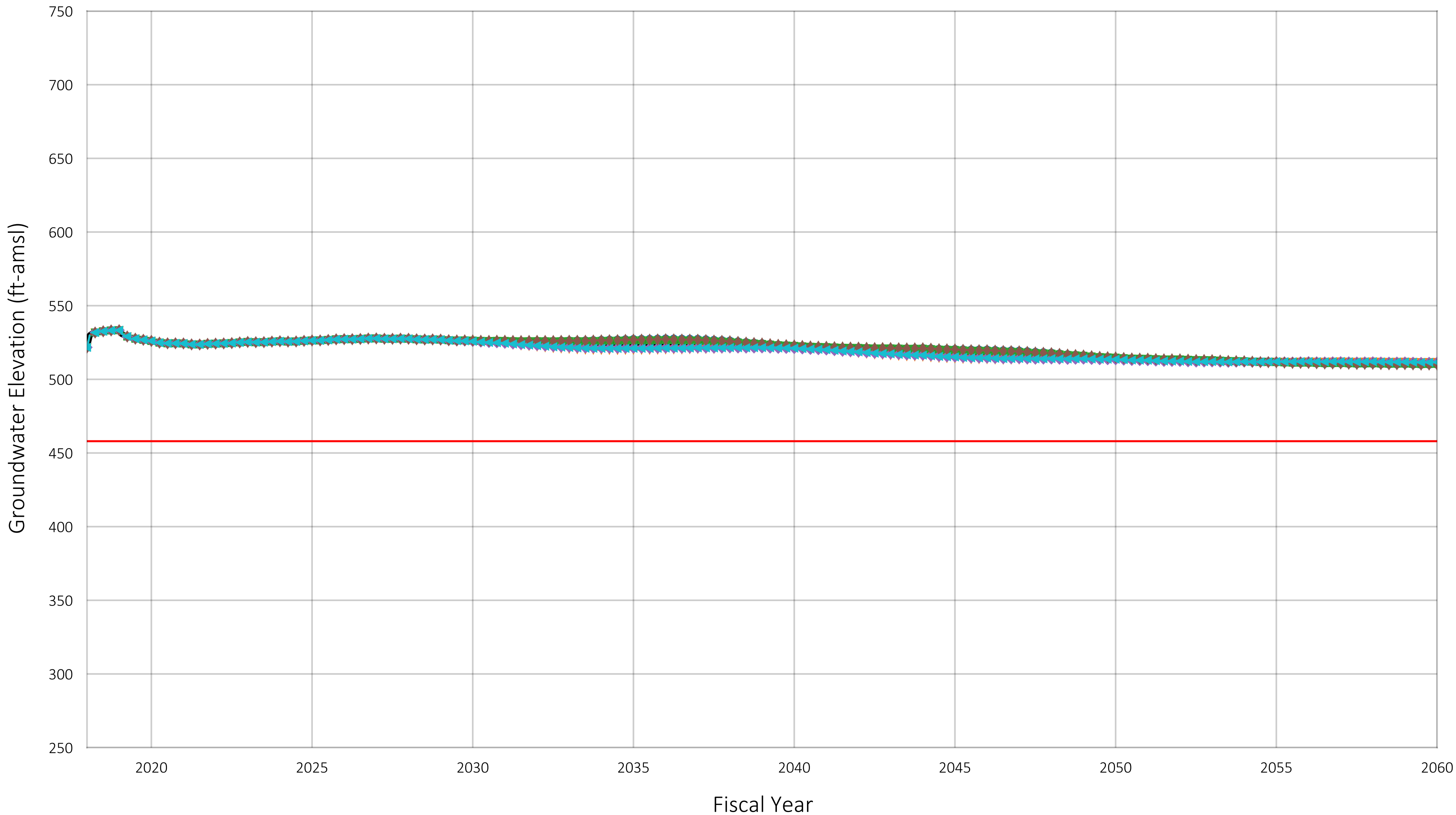
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206961
Owner: Chino Basin Desalter Authority
Well Name: II-1

Figure A-157



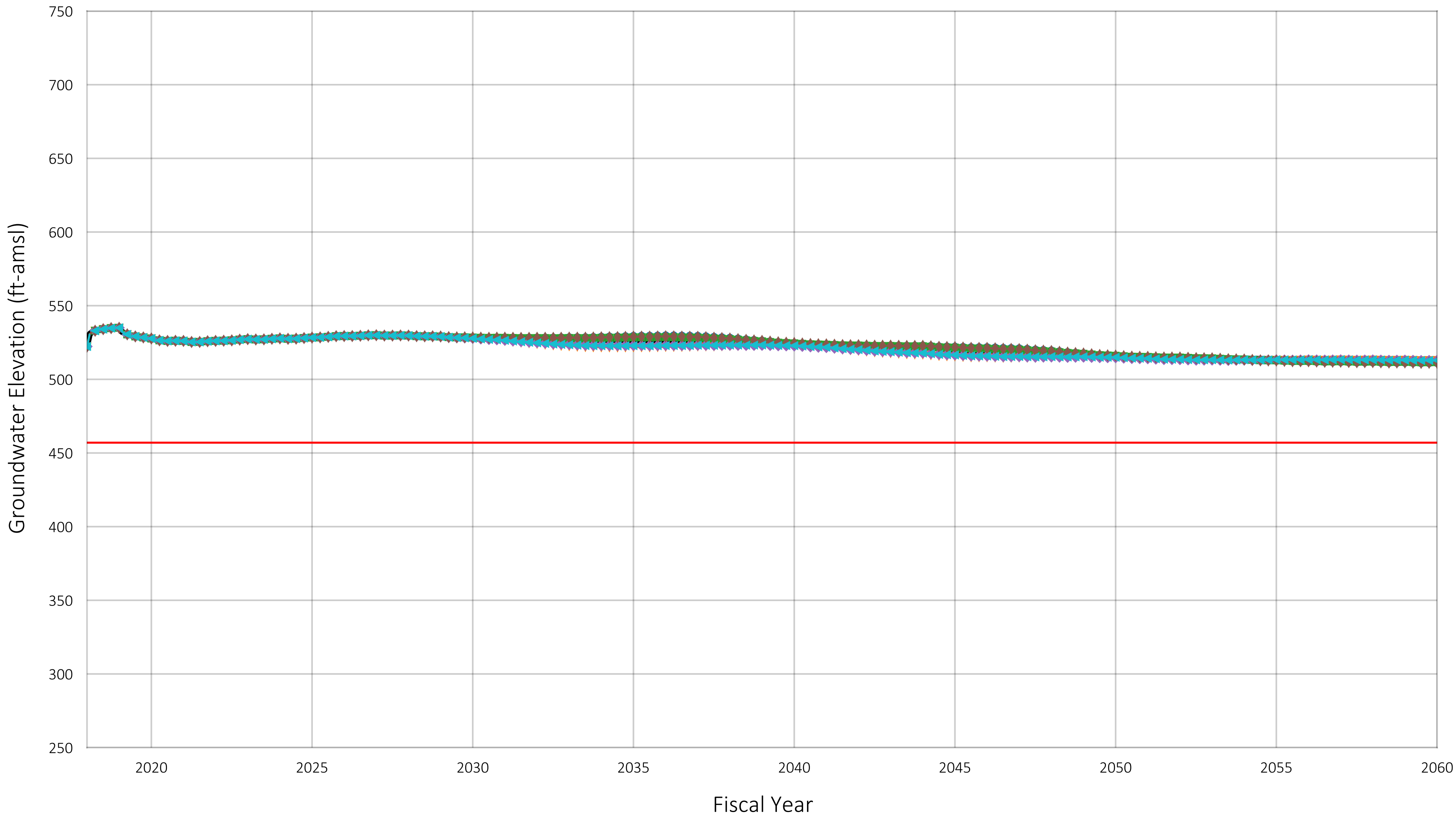
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206962
Owner: Chino Basin Desalter Authority
Well Name: II-2

Figure A-158



Location of Well in Chino Basin

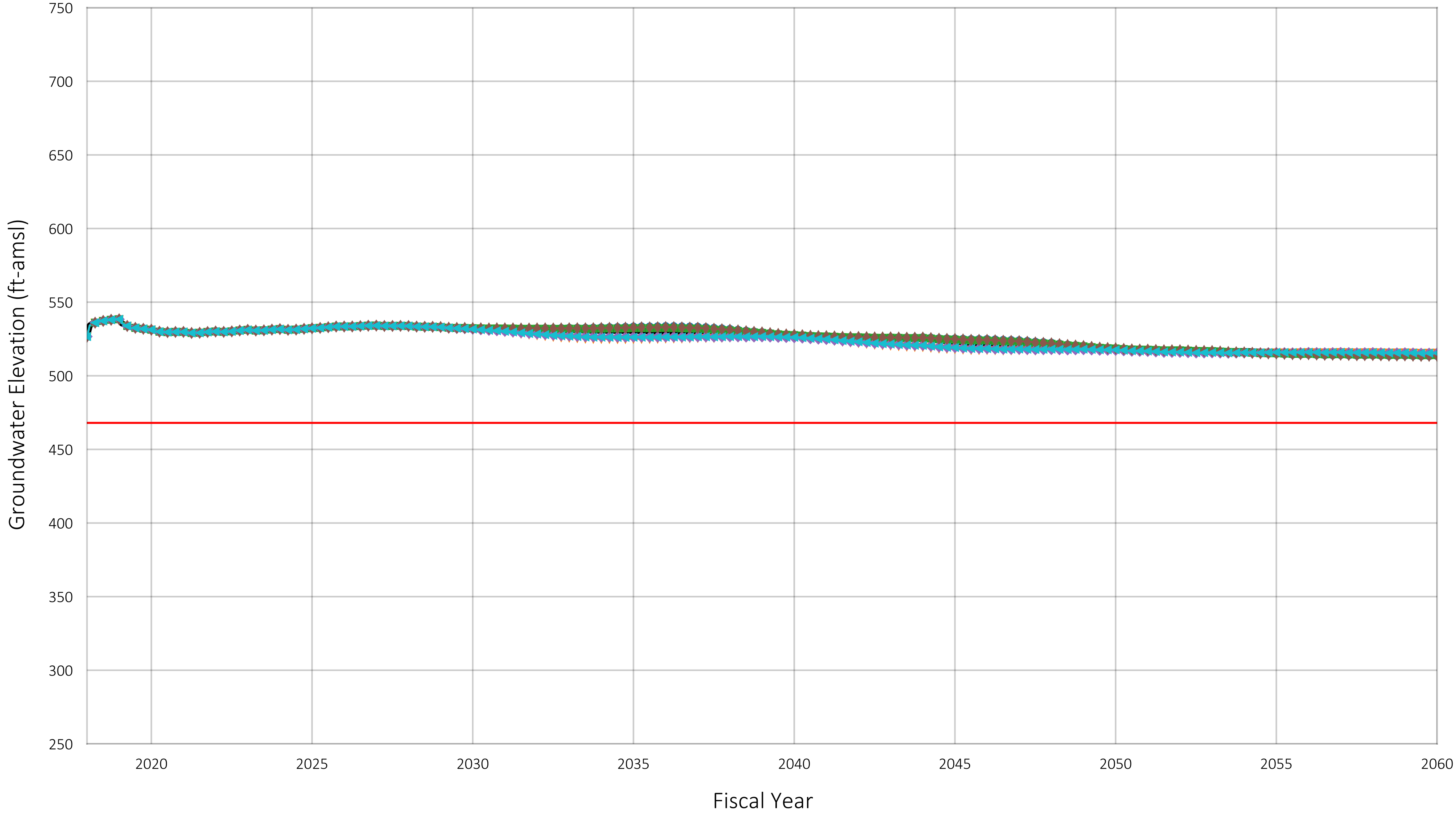
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206963
Owner: Chino Basin Desalter Authority
Well Name: II-3

Figure A-159



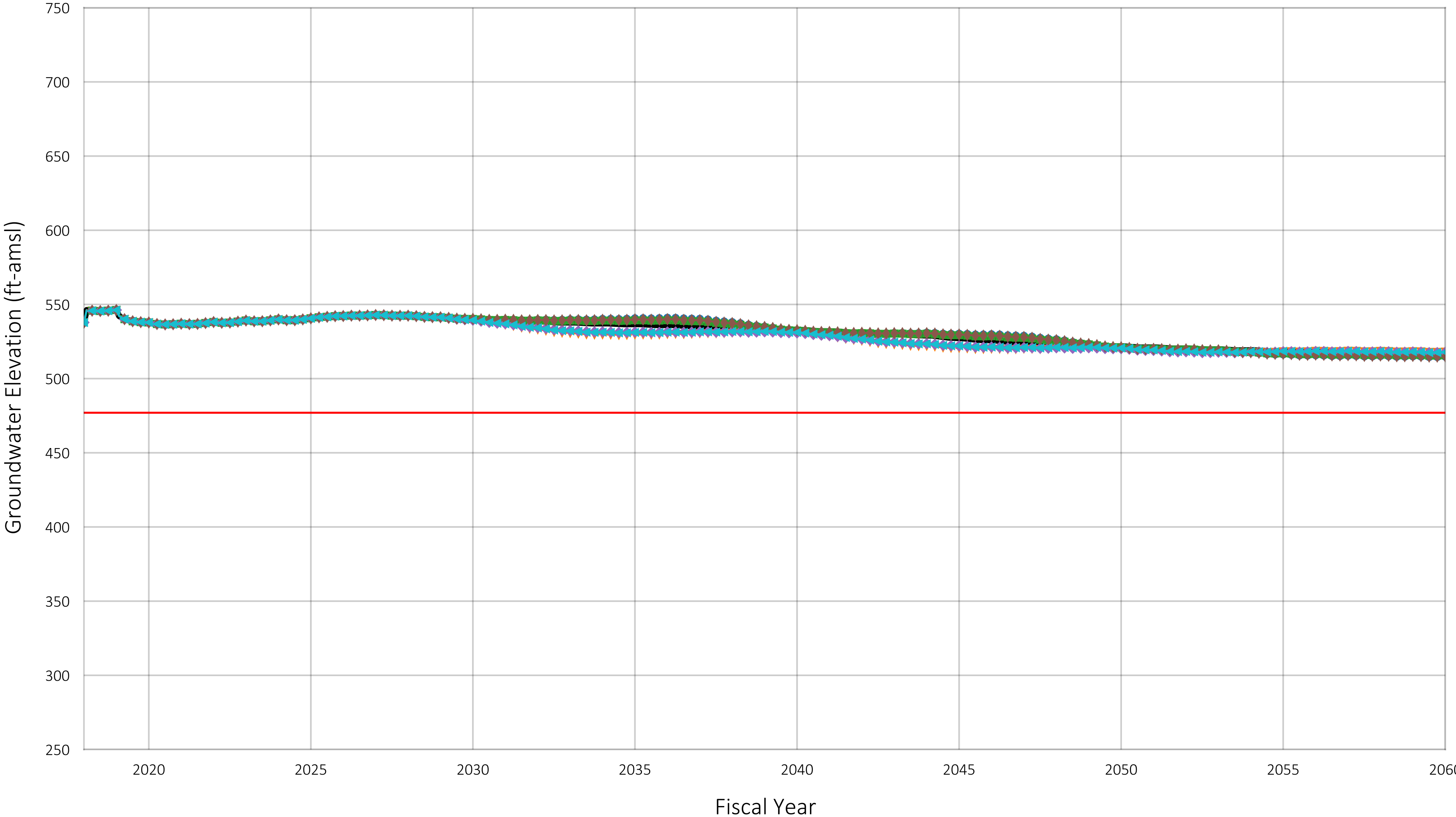
Location of Well in Chino Basin

Prepared by:

WEST YOST
Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206964
Owner: Chino Basin Desalter Authority
Well Name: II-4

Figure A-160



Location of Well in Chino Basin

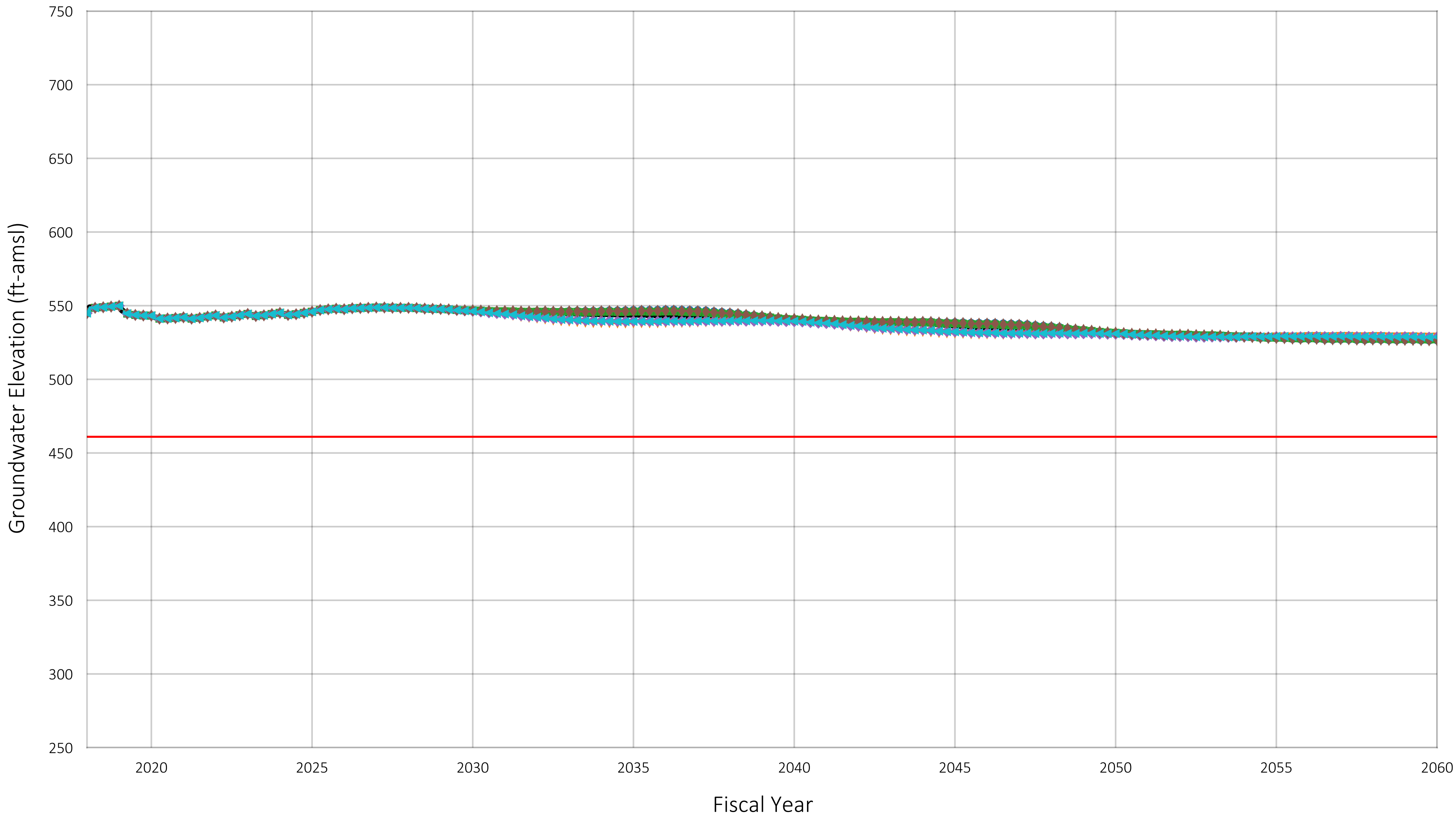
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206966
Owner: Chino Basin Desalter Authority
Well Name: II-6

Figure A-161



Location of Well in Chino Basin

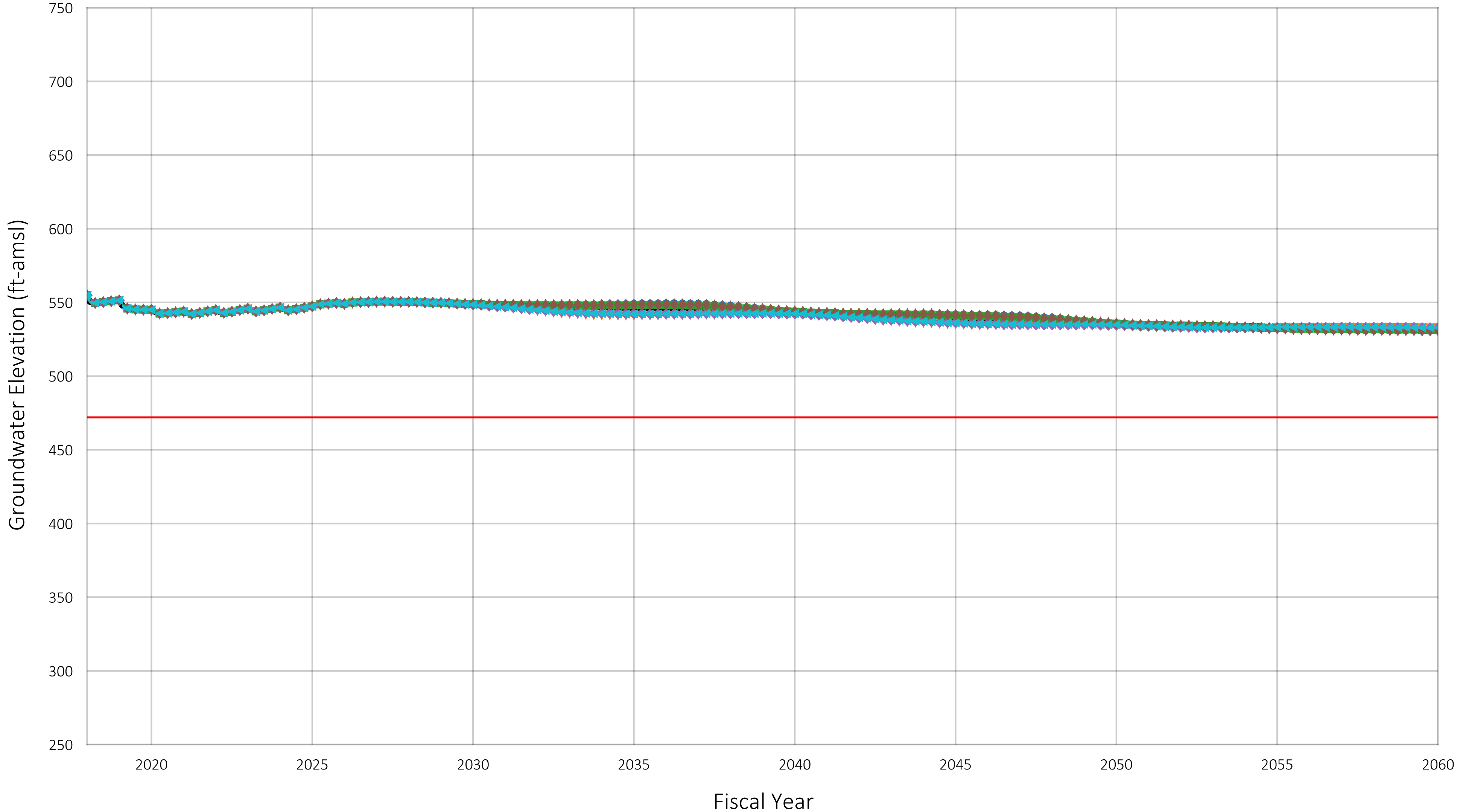
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206967
Owner: Chino Basin Desalter Authority
Well Name: II-7

Figure A-162



Location of Well in Chino Basin

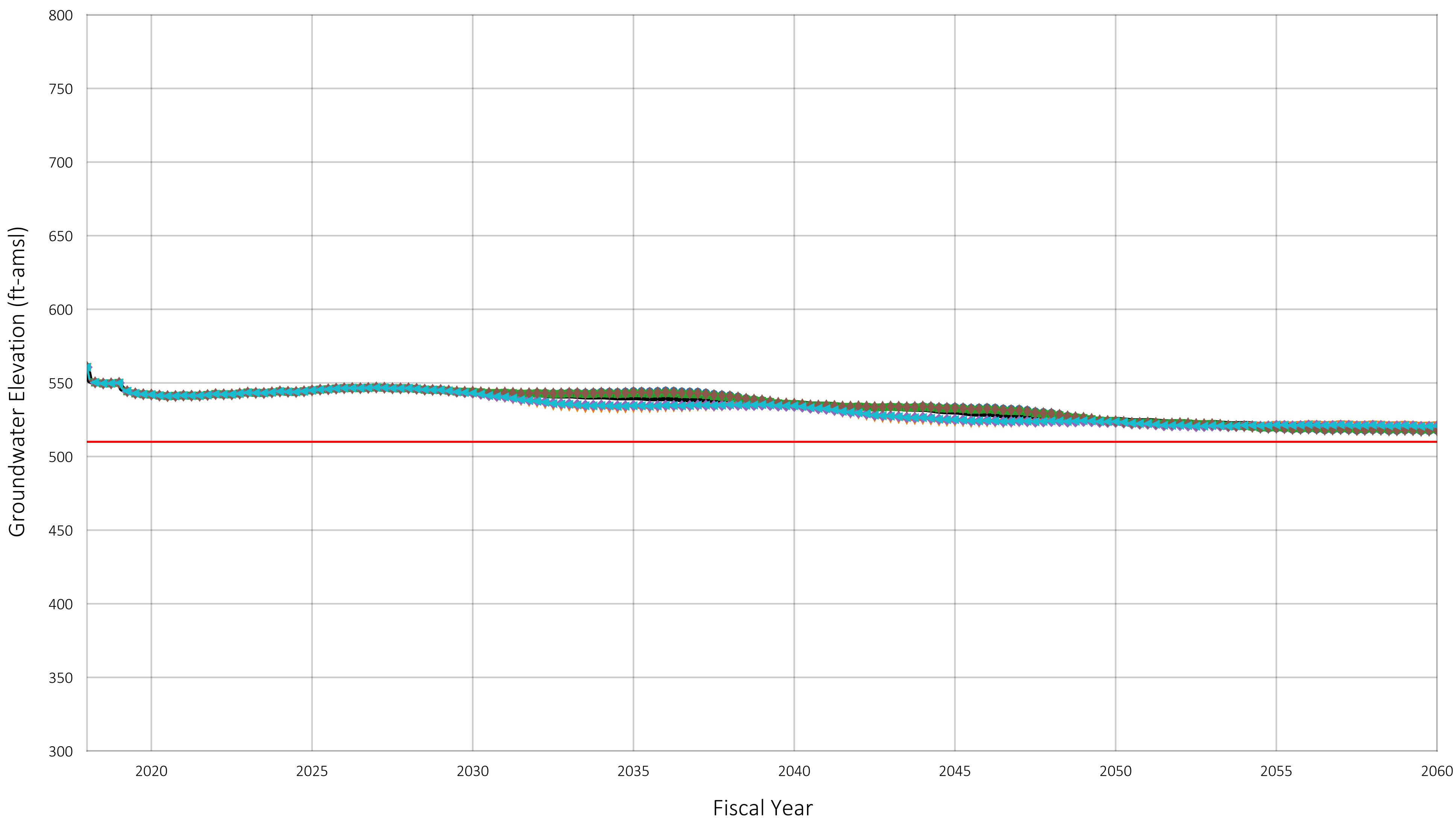
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206968
Owner: Chino Basin Desalter Authority
Well Name: II-8

Figure A-163



Location of Well in Chino Basin

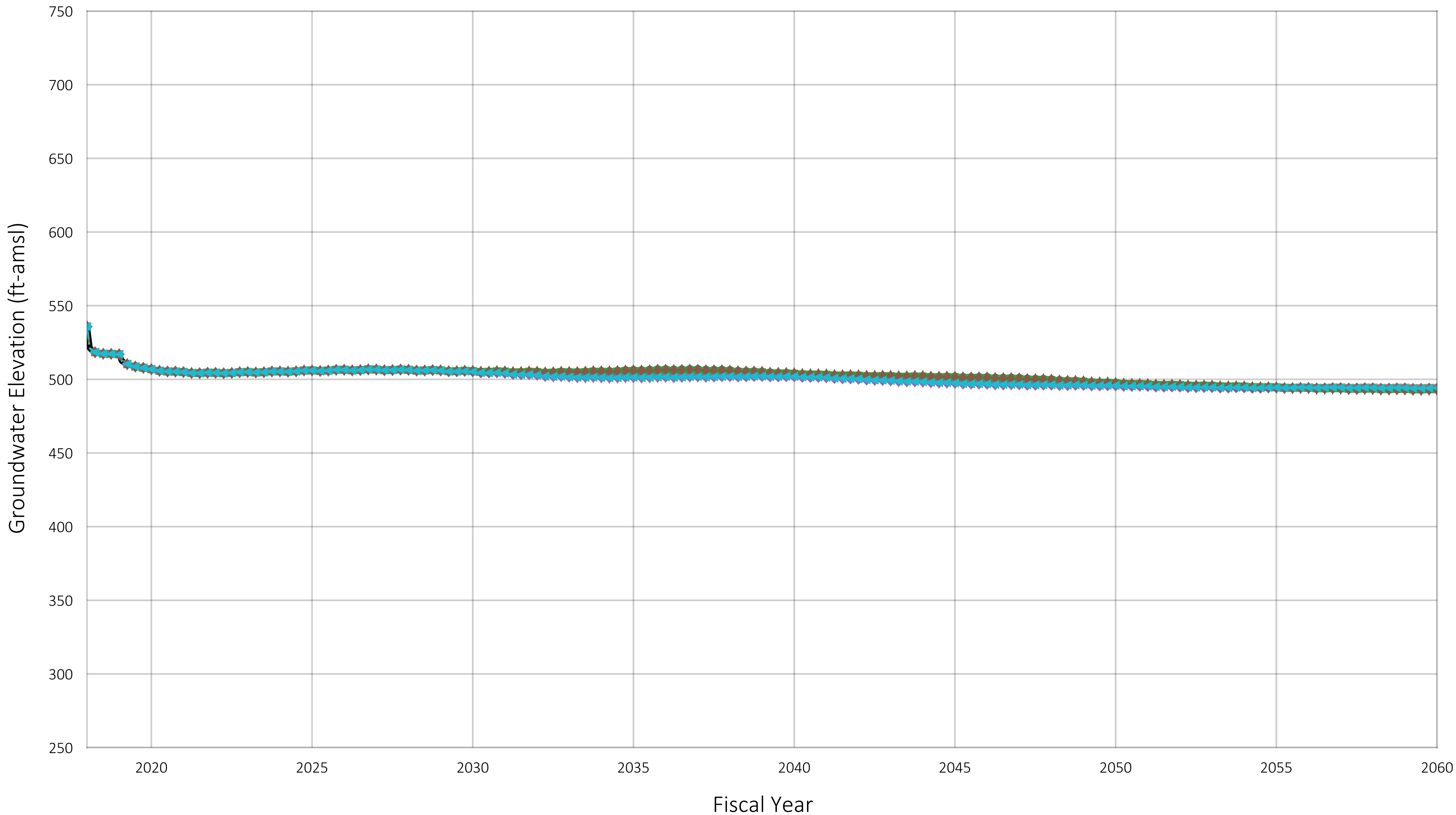
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Pumping Sustainability Metric Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206969
Owner: Chino Basin Desalter Authority
Well Name: II-9A

Figure A-164



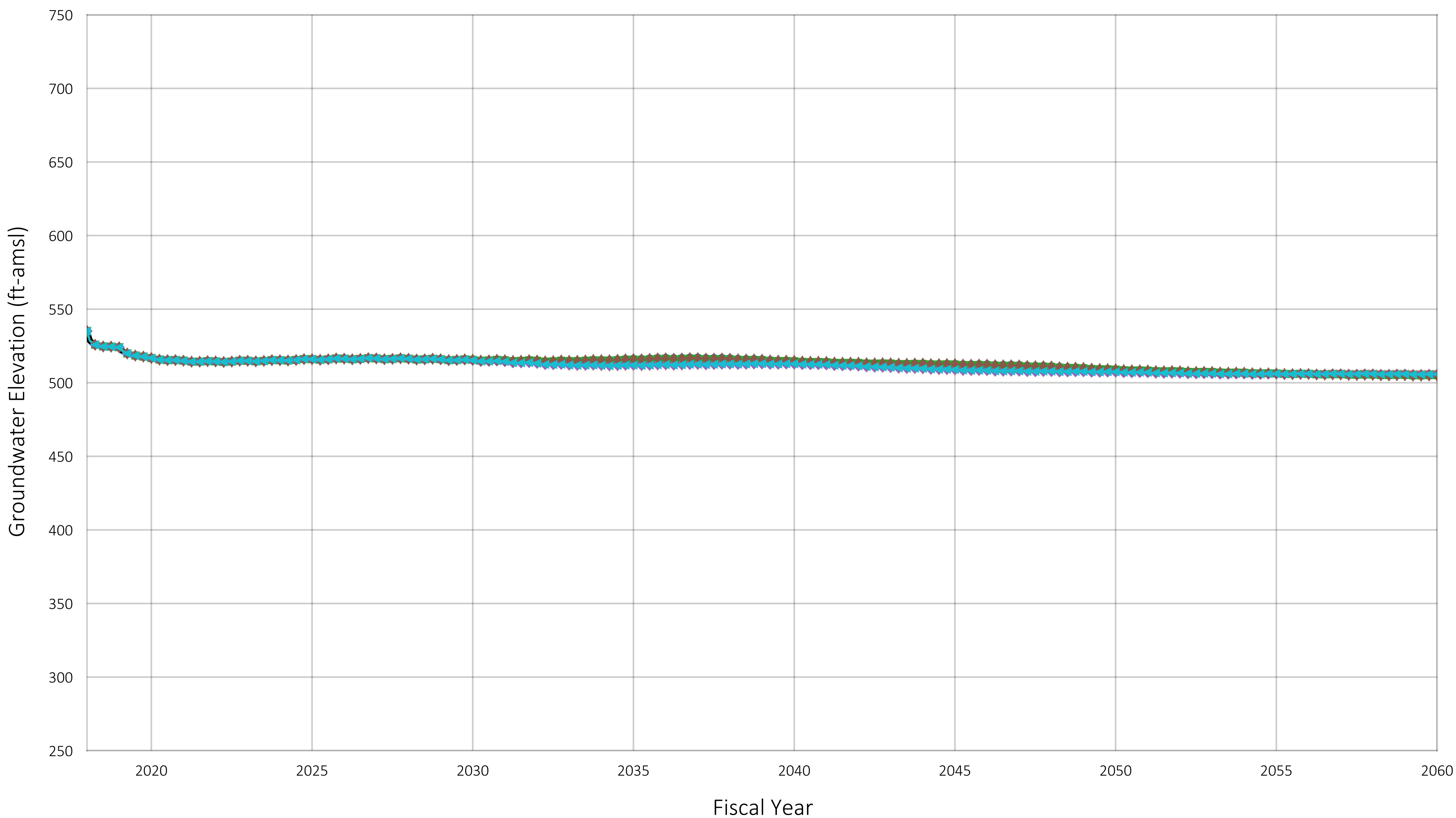
Location of Well in Chino Basin

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1234064
Owner: Chino Basin Desalter Authority
Well Name: II-10

Figure A-165



Location of Well in Chino Basin

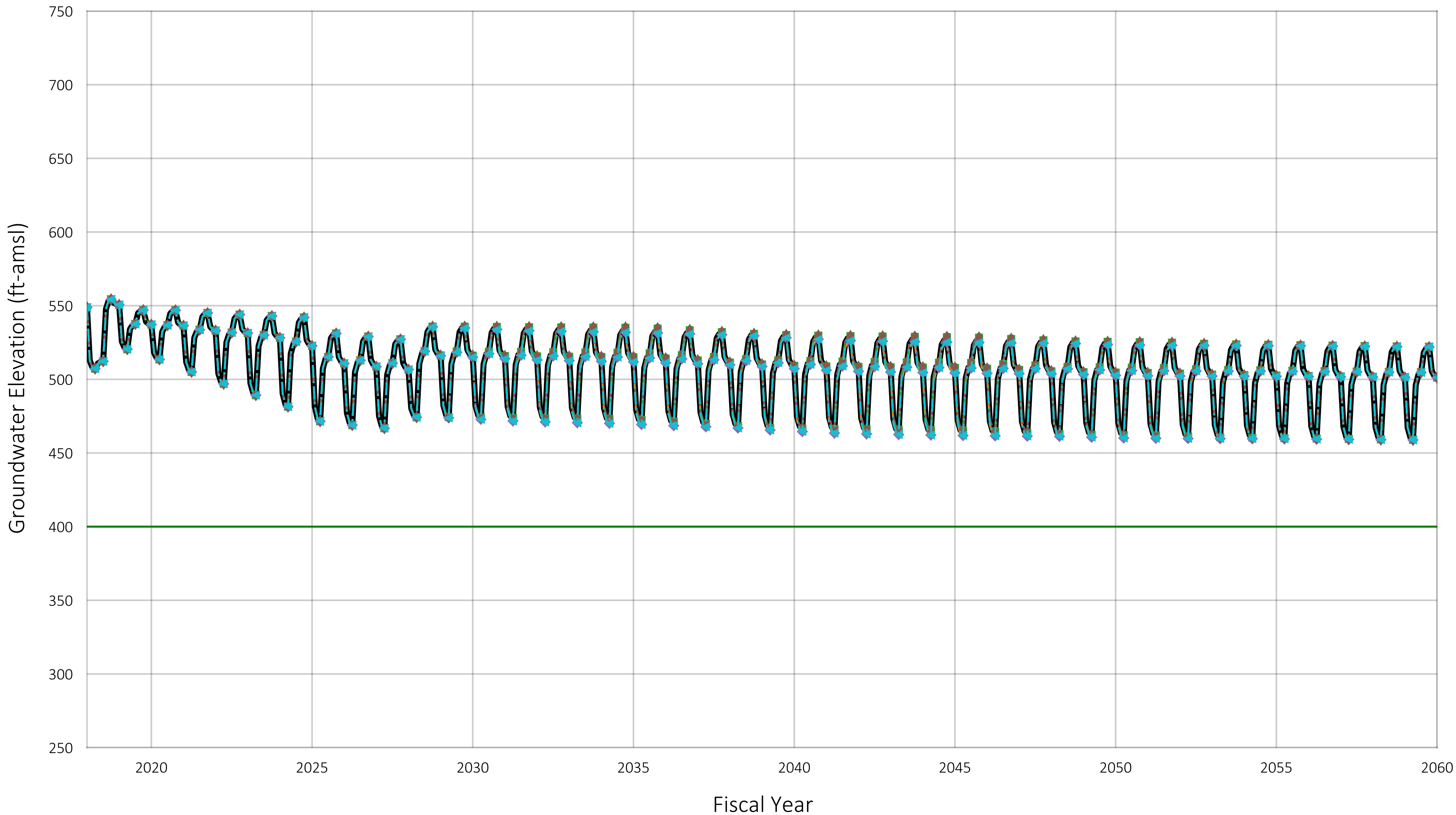
Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1234065
Owner: Chino Basin Desalter Authority
Well Name: II-11

Figure A-166



Location of Well in Chino Basin

Baseline
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
New Land Subsidence Elevation

Prepared by:

WEST YOST Water. Engineered

Projected Groundwater Elevation
Well ID#: 1206952
Owner: Chino Basin Water Master
Well Name: AP-PA/7

Figure A-167

23692 Birtcher Drive
Lake Forest CA 92630
949.420.3030 phone
530.756.5991 fax
westyost.com

October 15, 2021

Project No.: 941-80-21-69
SENT VIA: EMAIL

Liza Muñoz, PE
Senior Engineer
Inland Empire Utilities Agency
Chino, CA 91708

SUBJECT: Addendum to the Evaluation of the Chino Basin Program/ Water Storage Investment Program

Dear Ms. Muñoz:

West Yost performed a hydrologic evaluation of the Chino Basin Program (CBP) for the Inland Empire Utilities Agency (IEUA). The evaluation utilized model runs of the Chino Valley Model (CVM) and was documented in the technical memorandum (TM) *Evaluation of the Chino Basin Program/Water Storage Investment Program* (referenced herein as the Main TM).

Thereafter, IEUA requested that West Yost perform additional evaluations of certain hydrologic, biologic, and water-quality impacts that could be attributable to the diversion of wastewater discharge that would serve as the source water under CBP operations. The work included: (i) performing additional modeling of the CBP scenarios to characterize potential impacts on flow in the Santa Ana River (SAR) and the riparian habitat in Prado Basin; (ii) providing commentary on model uncertainty as it applies to the evaluation of the CBP; and (iii) estimating the impacts of the CBP scenarios on TDS concentrations in the SAR.

This letter documents the results of these additional evaluations, which will be used by the IEUA to assess the feasibility of the CBP and support its subsequent environmental review pursuant to the California Environmental Quality Act.

DESCRIPTION OF BASELINE AND DIVERSION SCENARIO ASSUMPTIONS

The impacts of the wastewater diversions necessary to facilitate the CBP are evaluated relative to a baseline scenario, which is identical to the baseline scenario described in the Main TM, except as noted below. The CBP is assumed to operate from January 1, 2029 through December 31, 2053 (referenced herein as the program period). During the program period, up to 17,000 acre-feet per year (afy) of wastewater is planned to be routed through an Advanced Water Purification Facility (AWPF), resulting in up to 15,000 afy of water for artificial recharge at CBP injection wells. The source of the wastewater is assumed to be effluent from multiple wastewater treatment plants that is currently discharged to the SAR or its tributaries or directly reused in the Chino Basin.

Figure 1 shows the boundary of the Chino Basin portion of the CVM, the modeled locations of wastewater discharge, and the boundary of the Prado Basin Groundwater Management Zone (PBMZ). The wastewater discharge locations shown in red are where the discharge is reduced in the CBP diversion scenarios. Table 1 below summarizes the assumptions for wastewater discharge under the baseline scenario and the CBP diversion scenarios for fiscal years (FYs) 2030 and 2040. The IEUA provided monthly estimates for the wastewater discharges in the CBP diversion scenarios. All wastewater discharges were assumed constant after 2040.

Table 1. Wastewater Discharge Assumptions for the CBP Diversion Baseline and CBP Diversion Scenarios[1], afy

Agency	Facility/ Discharge Point	Baseline		CBP Diversion Scenarios		Baseline minus CBP Diversion Scenarios	
		2030	2040	2030	2040	2030	2040
IEUA	001 (Prado)	1,569	1,569	1,151	1,151	418	418
IEUA	002 (Cucamonga Creek)	9,079	9,079	3,637	3,637	5,443	5,443
IEUA	RP-5 (Chino Creek)	2,802	2,802	1,519	1,519	1,283	1,283
IEUA	CCWRF (Chino Creek)	3,587	3,587	737	737	2,850	2,850
	Subtotal (IEUA)	17,038	17,038	7,043	7,043	9,995	9,995
SBMWD	RIX	20,275	20,625	20,275	20,625	0	0
City of Rialto	Rialto	10,137	13,115	6,637	9,615	3,500	3,500
City of Riverside	RWQCP	26,604	25,221	26,604	25,221	0	0
WRCRWA	WRCRWTP	2,500	2,500	0	0	2,500	2,500
City of Corona	WWTP #1	1,681	1,681	1,681	1,681	0	0
	Subtotal (Non-IEUA)	61,197	63,141	55,197	57,141	6,000	6,000
	Total	**78,235**	**80,179**	**62,240**	**64,185**	**15,995**	**15,995**

The only difference between the baseline scenario in the Main TM and for this evaluation is the increase of discharge at the Western Riverside County Recycled Water Treatment Plant (WRCRWTP) from zero to 2,500 afy (to accommodate the proposed diversions in this evaluation).

The CBP diversion scenarios are the six CBP planning scenarios documented in the Main TM but include the assumed wastewater diversions as shown in Table 1. The CBP diversion scenarios are called D1 through D6 and correspond to Scenarios 1 through 6 as documented in the Main TM. The CBP diversion scenarios will reduce wastewater discharges by about 16,000 afy compared to the baseline scenario throughout the program period. An additional 1,000 afy is necessary to facilitate the CBP and is assumed to come from reduced demand of wastewater for direct use.

[1] Acronyms are defined as follows: Recycling Plant No. 5 (RP-5); Carbon Canyon Water Recycling Facility (CCWRF); San Bernardino Municipal Water Department (SBMWD); Rapid Infiltration and Extraction Facility (RIX); Riverside Water Quality Control Plant (RWQCP); Western Riverside County Regional Wastewater Authority (WRCRWA); Western Riverside County Recycled Water Treatment Plant (WRCRWTP); Wastewater Treatment Plant (WWTP)

PROJECTED IMPACTS ON SAR DISCHARGE AND RIPARIAN HABITAT

This section describes the impacts of Scenarios D1 through D6 on the discharge of the SAR at below Prado Dam and the riparian vegetation in the PBMZ compared to the baseline scenario.

SAR Discharge at below Prado Dam

Figure 2 is a time series of the annual SAR discharge at below Prado Dam under the baseline scenario and CBP diversion scenarios D1 and D2. Of the six CBP diversion scenarios, D1 and D2 have the greatest and least discharge at below Prado Dam, respectively. The other four CBP diversion scenarios have discharges ranging between D1 and D2 and are omitted from Figure 2 for clarity. The average discharge at below Prado Dam during the program period under the baseline scenario is 167,400 afy, compared to 152,200 afy in D1 and 151,000 afy in D2.

The reductions in discharge of about 15,200 afy and 16,400 afy under scenarios D1 and D2, respectively, are caused by the reduced wastewater discharge and model-projected changes in groundwater/surface-water interactions in the PBMZ and the SAR. Scenario D1 includes the late call schedule for CBP operations, resulting in an increase in groundwater levels and reduced net recharge (see Scenario 1 in the Main TM). Most of this reduced net recharge is due higher groundwater levels that result in increased rising groundwater discharge to the SAR. This increase in rising groundwater offsets some of the reduced wastewater discharge—the reduced discharge in the SAR at below Prado Dam in scenario D1 (15,200 afy) is less than the average reduction in wastewater discharge (16,000 afy). Conversely, the early call schedule in scenario D2 results in lower groundwater levels and an increase in net recharge (see Scenario 2 in the Main TM). Scenario D2 results in a reduction in rising groundwater discharge to the SAR and a reduction in SAR discharge at Prado Dam (16,400 afy) that exceeds the average reduction in wastewater discharge (16,000 afy).

Pursuant to the SAR Judgment,[2] the IEUA and Western Municipal Water District (WMWD) are required to maintain a base flow[3] of 34,000 afy at Prado Dam for the foreseeable future. The discharges shown in Figure 2 represent the total of storm flow and base flow at Prado Dam. The differences in SAR discharge at below Prado Dam between the baseline scenario and the CBP diversion scenarios are almost entirely attributable to differences in base flow.

In addition to the wastewater discharges tributary to the SAR between Riverside Narrows and Prado Dam, the following sources of gain or loss influence the base flow in the SAR at Prado Dam:

- **Base Flow at Riverside Narrows**. The base flow at Riverside Narrows is determined by the SAR Watermaster each water year (WY) for the purpose of determining compliance with the SAR Judgment. SBMWD is required to maintain a base flow of 12,420 afy at Riverside Narrows for the foreseeable future. Over the period from WY 1971 through 2020, the average base flow at Riverside Narrows was about 43,000 afy. This base flow comprises

[2] Orange County Water District v. City of Chino, et al., Superior Court of the State of California for the County of Orange, 1969.

[3] Base Flow at Prado is defined in the SAR Judgment as "the portion of the total surface flow passing a point of measurement, which remains after deduction of Storm Flow, and … shall: (i) include any water caused to be delivered by [IEUA] or WMWD directly to OCWD, pursuant to its direction and control and not measured at the gages at Prado; (ii) exclude any nontributary water or reclaimed sewage water purchased by OCWD and delivered into the river upstream and which subsequently passes Prado, and (iii) exclude water salvaged from evapo-transpiration losses by OCWD on lands presently owned by it above Prado."

discharges from multiple wastewater treatment plants, including the City of Rialto's, which is planned to contribute about 3,500 afy to the CBP (see Table 1).

- **SAR Streambed Infiltration**. Downstream of the Riverside Narrows, streambed infiltration occurs in the SAR overlying the Chino Basin. Over the planning period, the CVM estimates streambed infiltration to fluctuate between 35,400 and 38,800 afy over all scenarios. This streambed infiltration comprises storm flow and base flow and causes reduced base flow in the SAR at Prado Dam.
- **Rising Groundwater Discharge**. Shallow groundwater can discharge to the SAR and its unlined tributaries in the southern Chino Basin and the northern Temescal Basin. This rising groundwater contributes to the base flow in the SAR at Prado Dam. Over the planning period, the CVM estimates the rising groundwater discharge to fluctuate between 14,100 and 16,400 afy over all scenarios.
- **Other minor sources of gains/losses**. This includes any wastewater discharges that infiltrate before reaching the SAR and dry-weather discharges tributary to the SAR.

MODFLOW-NWT (the groundwater and surface-water flow code used in the CVM) does not allow for the exact accounting of base flow and storm flow components. The planning hydrology used in the CVM is an expected-value monthly hydrology based on the period of 1950 through 2011 adjusted with climate change factors.[4] However, the simulated flows in the SAR at below Prado Dam in the summer months (July through September) can aid in understanding the impacts on the base flow under the conditions when wastewater allocated to direct use is maximized and the historical and planned discharges are generally at a minimum. This is consistent with the assumption used to determine compliance of the TDS water quality objectives in the Water Quality Control Plan for the Santa Ana River Basin[5] (Basin Plan), which assumes that August and September represent a base flow condition in the SAR. July is added to our analysis since the projected average discharge is almost identical to August and September, and some the projected wastewater discharges with the CBP diversions are zero in these months.

Figure 3 is a time series of the average projected discharge SAR discharge at below Prado Dam for July through September under the baseline scenario and CBP diversion scenarios D1 and D2. The average monthly discharge at below Prado Dam during the program period over the summer months under the baseline scenario is 5,200 acre-feet per month (afm), compared to 3,700 afm in D1 and 3,650 afm in D2. The minimum average summer discharge over all scenarios occurs in FY 2055 in D2, where the average monthly summer discharge is 3,570 afm. Extrapolated over the entire year, the minimum base flow would be 42,800 afy, 8,800 afy greater than the 34,000 afy base flow obligation. This suggests that the CBP diversions will not violate the base flow obligation under the assumptions incorporated into the CBP diversion scenario (e.g., expected-value hydrology, upstream wastewater discharges). Further analysis of the potential risk of the CBP diversion scenarios violating the SAR base flow obligation at Prado Dam would require simulating alternative hydrology and upstream wastewater discharges and is beyond the scope of this study.

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[4] See Section 7 of the *2020 Safe Yield Recalculation Final Report* (WEI, 2020) for more information on assumptions used in the CVM planning scenario: link

[5] California Regional Water Quality Control Board, Santa Ana Region. (2011). *Water Quality Control Plan, Santa Ana River Basin (8)*. January 24, 1995 (Updated February 2008 and June 2011).

Riparian Vegetation

The riparian vegetation in the Prado Basin is supported by a combination of shallow groundwater and streamflow. The reduction of discharge to the SAR and its tributaries in the CBP diversion scenarios can affect the extent and health of the riparian vegetation. The model-calculated evapotranspiration (ET) flux from groundwater in PBMZ[6] is used as a proxy for the health of the riparian habitat.

Figure 4 is a time series of the annual ET in the PBMZ for the baseline scenario and CBP diversion scenarios D1 and D2. Of the six CBP diversion scenarios, D1 and D2 have the greatest and least ET in the Prado Basin, respectively. The other four CBP diversion scenarios have ET ranging between D1 and D2 and are omitted from Figure 4 for clarity. The average ET in the PBMZ during the program period in the baseline scenario is 14,150 afy, compared to 14,110 afy in scenario D1 and 14,080 afy in scenario D2. The maximum difference in ET between the baseline and CBP scenarios is 70 afy, which is less than 0.5 percent of the average ET over the period. Therefore, the CBP diversion scenarios are projected to have a negligible impact on the riparian habitat in the PBMZ. Note that the CVM calculates ET as a function of the depth to saturated groundwater and therefore only simulates the effect of surface water changes on ET based on the effect of the surface water on groundwater. The CVM does not directly simulate the interaction of surface water and ET.

The IEUA participates in an existing monitoring and mitigation program for habitat in the Prado Basin[7] pursuant to the Peace II Agreement that is currently set to expire in 2030. The IEUA may consider a similar monitoring and mitigation program (or a continuation of the existing monitoring and mitigation program) to address any potential adverse impacts to riparian habitat due to the CBP.

Summary

The reductions in SAR discharge at below Prado Dam due to the CBP diversion scenarios range from 15,200 afy to 16,400 afy over the program period, a reduction of about 9.1 to 9.8 percent of total projected discharge under the baseline scenario. Based on the assumptions incorporated into the CBP diversion scenarios, the reductions in SAR discharge at below Prado Dam will not cause a violation of the base flow obligation at Prado.

Reductions in ET in the PBMZ due to the CBP diversion scenarios range from 40 to 70 afy, or less than 0.5 percent of the projected ET under the baseline scenario.

MODEL UNCERTAINTY IN THE CVM

The CVM was originally used to calculate the Safe Yield of the Chino Basin pursuant to the Court-ordered methodology (WEI, 2020). Two major types of uncertainty are inherent in the CVM: 1) uncertainty in the parameterization of the model domain developed through calibration and 2) uncertainty in the future cultural conditions used in the projection scenario, which serves as the foundation for the baseline scenario to which the CBP operations are compared.

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[6] See Section 5.2.6.5 of the *2020 Safe Yield Recalculation Final Report* for more information on ET in the CVM.

[7] The *2016 Adaptive Management Plan for the Prado Basin Habitat Sustainability Program* can be found here: link

As documented in the *2020 Safe Yield Recalculation Final Report* (WEI, 2020), the CVM is a well-calibrated model. The parameters and representation of the domain in the CVM are only one of multiple combinations of parameters that would result in a calibrated model. Given the high degree of calibration of the CVM, the independent peer-review process that supported the Court's approval of the CVM, and the Watermaster Engineer's extensive experience working in the Chino Basin, the Watermaster and the Watermaster Engineer have a high degree of confidence in the use of the CVM to estimate the Safe Yield and evaluate the potential for MPI and adverse impacts of proposed Storage and Recovery Programs including the CBP.

Predictive uncertainty in the CVM is primarily driven by estimates of future pumping, artificial recharge, and the deep infiltration of precipitation and applied water. The planning data used in the CVM is based on the best-available planning data when the CVM was developed. Pursuant to the April 28, 2017 Court Order, Watermaster is required to collect data annually to evaluate changes in cultural conditions. If the data indicate that changes in cultural conditions are significant, then Watermaster is required to update its model (i.e., the CVM) to project the response of the Chino Basin to update the Safe Yield. It is within this process that Watermaster will evaluate the Storage and Recovery Program application that the IEUA is required to submit prior to initiation of the construction and operations of the CBP.

PROJECTED IMPACTS ON TDS CONCENTRATION IN THE SAR

The water quality of the SAR is regulated pursuant to the Basin Plan. The Basin Plan contains TDS concentration objectives for the SAR and a plan to manage TDS concentrations to achieve these objectives. Figure 1 shows the location of the SAR, its regulatory reaches as specified in the Basin Plan, and wastewater discharge locations specifying where discharge is planned to be reduced to supply water for the CBP.

Reach 3 of the SAR runs from Mission Boulevard in Riverside to Prado Dam. The primary components of stream discharge in Reach 3 include storm discharge (i.e., runoff resulting from rainfall), non-tributary discharge (e.g., imported water or other water originating from outside the watershed), and base flow. Base flow comprises dry-weather runoff, rising groundwater, and wastewater discharge from Publicly Owned Treatment Works (POTWs).[8]

The Basin Plan specifies a TDS objective of 700 milligrams per liter (mgl) for the base flow in Reach 3 of the SAR. Compliance is determined based on the TDS concentration of the SAR at below Prado Dam in August and September. The influence of storm flow and non-tributary flow is at a minimum during these months, and the flow in the SAR is assumed to be entirely base flow.

The CVM does not simulate surface-water quality. To determine the potential impacts of the wastewater diversions for CBP operations on TDS in the SAR, a simple mass-balance analysis was conducted using historical TDS and discharge data. This analysis is documented below.

[8] See footnote 3 for the SAR Judgment definition of base flow at Prado.

Methodology

This analysis employed a mass-balance analysis like that conducted for the Basin Monitoring Program Task Force in 2015 to characterize the causes of TDS concentrations in Reach 3 that were exceeding the Reach 3 TDS objective.[9]

First, West Yost compiled available discharge and associated TDS data for the historical period from FY 2004 through FY 2020 at the POTW discharge points shown in Figure 1 and two of the stream gages operated by the United States Geological Survey: SAR at below Prado Dam and the SAR at MWD Crossing. Other inflows and outflows for Reach 3 of the SAR were either not measured (e.g., rising groundwater, streambed recharge, evapotranspiration) or have limited available data (e.g., data from the Reach 3 tributaries in the Chino Basin). These other inflows and outflows were aggregated into a residual term (Residual) and estimated from a mass-balance equation. To limit the influence of storm flow, only the summer months (July through September) were analyzed. The combined datasets from the POTW monitoring and the USGS stream gages were used to calculate the discharge and TDS concentration of the Residual by solving the following mass-balance equations:

$$Q_P = Q_X + Q_{RIV} + Q_{C1} + Q_{C3} + Q_{RC} + Q_{RP} + Q_{CC} + Q_{R5} + Q_{WR} + R_Q \quad (1)$$

$$Q_P * C_P = (Q_X * C_X) + (Q_{RIV} * C_{RIV}) + (Q_{C1} * C_{C1}) + (Q_{C3} * C_{C3}) + (Q_{RC} * C_{RC}) + (Q_{RP} * C_{RP}) + (Q_{CC} * C_{CC}) + (Q_{RP5} * C_{RP5}) + (Q_{WR} * C_{WR}) + (R_Q * R_C) \quad (2)$$

Where:

Q = discharge (acre-feet per month [afm])
C = TDS concentration (mgl)
R_Q = calculated Residual discharge (afm)
R_C = calculated TDS concentration of the Residual discharge (mgl)

The subscripts refer to the stream gages and POTW discharge locations as follows:

P = SAR below Prado Dam (USGS station 11074000)
X = Santa Ana River at MWD Crossing (USGS station 11066460)
RIV = Riverside Regional Water Quality Control Plant - DP-001
C1 = Corona Wastewater Treatment Plant No. 1B
C3 = Corona Wastewater Treatment Plant No. 3
RC = IEUA effluent from Regional Water Recycling Plant No. 1 to Cucamonga Creek
RP = IEUA effluent from Regional Water Recycling Plant No. 1 to Prado Basin
CC = IEUA effluent from Carbon Canyon Water Reclamation Facility (CCWRF) to Chino Creek
RP5 = IEUA effluent from Regional Water Recycling Plant No. 5 to Chino Creek
WR = Western Riverside County Regional Wastewater Treatment Plant - DP-001

[9] WEI, 2015. Investigation and Characterization of the Cause(s) of Recent Exceedances of the TDS Concentration Objective for Reach 3 of the Santa Ana River. Prepared for the Basin Monitoring Program Task Force.

The mass-balance equations were solved for each of the summer months over the period. At each measured discharge point in Equation 1, monthly discharge was estimated by averaging the daily discharges during days that had TDS measurements and applying the daily average across the days with nonzero discharge. The monthly volume-weighted TDS was calculated over the days with concurrent TDS and discharge measurements. 2011 was not evaluated due to the influence of the imported water discharged to San Antonio Creek at OC-59 for the Orange County Water District. The monthly discharge and TDS calculated at below Prado Dam based on historical data is meant to represent the baseline condition.

Second, to estimate the impacts of the CBP diversion scenarios on the TDS concentration of the SAR at below Prado Dam, the historical wastewater discharges were reduced to remove the projected monthly CBP diversions of wastewater (see Table 1). Table 2 below summarizes the projected monthly (July through September) wastewater discharges for the five discharge points where the discharge was assumed to be reduced due to implementation of the CBP. The projected wastewater discharge for the baseline and the CBP diversion scenario were provided by the IEUA.

Table 2. Recycled Water Discharge Assumptions for Baseline and CBP Diversion Scenarios - July, August, and September, af

Scenario	Month	IEUA RP1, Cucamonga	IEUA RP1, Prado	IEUA CCWRF	IEUA RP5[(a)]	WRCRWTP
Baseline Discharge (2030)	July	281	106	350	28	500
	August	237	119	238	26	500
	September	451	136	149	50	500
Discharge with Diversions (2030)	July	46	46	0	46	0
	August	46	46	0	46	0
	September	92	92	0	46	0
Baseline minus Discharge with Diversions	July	235	60	350	-18	500
	August	191	73	238	-20	500
	September	359	44	149	4	500

(a) The apparent increases in discharge at the RP5 outfall are due to a redistribution of discharge across months. As shown in Table 1, the annual RP5 discharge is projected to be reduced from 2,802 afy to 1,519 afy in 2030.

For July through September, the wastewater discharge at each of the five discharge locations listed in Table 1 was reduced using Equation 3:

$$Q_{reduced} = \min\left(Q_{hist}, \max[Q_{hist} - \Delta Q_{CBP}, Q_{div}]\right) \tag{3}$$

Where:

$Q_{reduced}$ = projected discharge after diversion

Q_{hist} = historical discharge

ΔQ_{CBP} = volume of projected diversion (Baseline minus CBP diversion scenario in Table 1)

Q_{div} = projected discharge in CBP diversion scenario

Equation 3 accommodates historical discharges that are far greater or less than what was assumed in the baseline scenario and results in reductions in historical discharge that are within the range of the assumptions in the modeled CBP diversion scenario. The monthly discharge and TDS calculated at below Prado Dam based on the projected discharge with diversions is meant to represent the CBP diversion scenario.

Results

Table 3 shows the mass-balance calculation of the discharge and TDS concentration Residuals for the historical data without diversions. The negative discharge Residuals (column 10), calculated by solving Equation 1, indicate that there is a cumulative loss of water between the measured discharge points upstream of the SAR below Prado Dam (columns 1 through 9) and at the SAR below Prado Dam (column 11). The TDS concentration Residuals were calculated by solving Equation 2 and are shown in column 21. Three months of data (July 2006, July and August 2016) were removed from the analysis due to anomalous Residual values.

Table 4 shows the mass-balance calculation of the discharge and TDS concentration in the SAR at below Prado Dam with the assumed diversions. The discharge and TDS concentration Residuals were held constant from those calculated in Table 3, and Equations 1 and 2 were used to solve for the SAR discharge at below Prado Dam (column 11) and the TDS concentration of the SAR at below Prado Dam (column 24). Column 12 shows the change in discharge in the SAR at below Prado Dam due to the diversions after Equation 3 is applied (i.e., column 11 in Table 4 minus column 11 in Table 3). The change in discharge due to the diversions ranges from 740 to 1,140 afm, averaging about 930 afm. Column 13 expresses this change as a percentage. The reductions in discharge range from 3 percent to 28 percent compared to the historical discharge without diversions.

Column 24 shows the change in TDS concentration due to diversions (i.e., column 24 in Table 4 minus column 22 in Table 3). The changes in TDS concentration due to diversions range from -14 to +74 mgl. The percent change in TDS concentration due to diversions (column 26) ranges from -3.2 percent to +10.3 percent.

Figure 5 shows an annual comparison of the monthly average discharges and the volume-weighted TDS concentrations with and without diversions. This is meant to indicate the potential effects of the diversions for the CBP on the TDS at below Prado Dam. For every year, the volume-weighted TDS concentration is greater with diversions than without diversions. In 2010, 2012, 2017, and 2019, the diversions are projected to result in an exceedance of the SAR Reach 3 TDS objective of 700 mgl (shown in red on Figure 5). As shown on Figure 5, the volume-weighted annual TDS without diversions fluctuates between 560 (2005) and 720 mgl (2018), and the volume-weighted annual TDS with diversions fluctuates between 560 (2005) and 760 mgl (2018). Over the 15 years of data analyzed, the volume-weighted TDS without and with diversions is 623 and 636 mgl, respectively, an increase of 13 mgl. Over the period from 2012 through 2019, when wastewater discharges were generally lower than before 2011, the volume-weighted TDS without and with diversions is 660 and 692 mgl, respectively, an increase of 32 mgl.

Summary

These results indicate that the diversions of wastewater for the CBP will, in most years, result in higher TDS concentrations in the SAR at below Prado Dam, potentially causing a violation of the Reach 3 TDS objective. In 4 out of the 15 years analyzed the diversions were projected to cause a violation of the Reach 3 TDS objective.

Assumptions were made to account for incomplete discharge and TDS data sets as discussed in the methodology. The calculated Residual is reported as one value in the mass-balance calculation. The Residual incorporates unknown and unmeasured gains or losses to the SAR between MWD Crossing and below Prado Dam that include rising groundwater, storm and dry-weather runoff, streambed infiltration and direct evaporation. Assuming that the discharge and TDS concentration Residuals are identical with and without diversions may overstate the impact of the diversions on the discharge and TDS concentrations in the SAR at below Prado Dam, since a reduction in wastewater discharge may reduce the amount of surface water losses (via streambed percolation or ET).

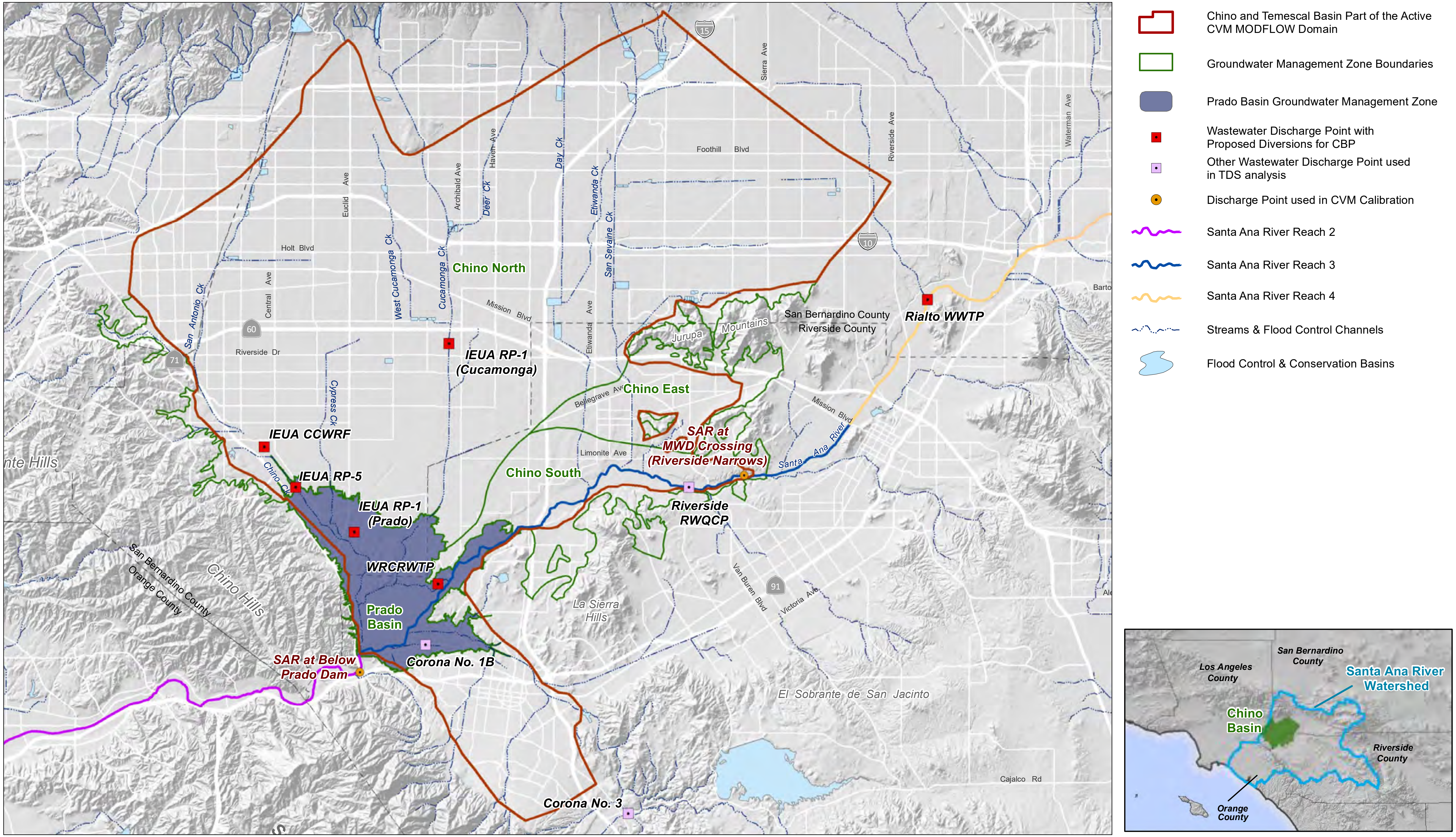
We appreciate the opportunity to assist the IEUA with this important work. Please contact me if you have any questions.

Sincerely,
WEST YOST

Garrett Rapp, PE
Associate Engineer II
RCE #86007

cc: Sylvie Lee, PE

Attachment(s): Figures 1 through 4; Tables 3 and 4



Prepared by:

WEST YOST

Author: GR
Date: 10/14/2021
File: Figure 1 Chino Basin.mxd

0 1 2 3 4 5 Miles
0 2 4 6 8 Km

Evaluation of the Chino Basin Program

Prepared for:

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Modeled Wastewater Discharge Points, Locations of Measured Discharge in the Santa Ana River, and Groundwater Management Zones in the Chino Basin

Figure 1

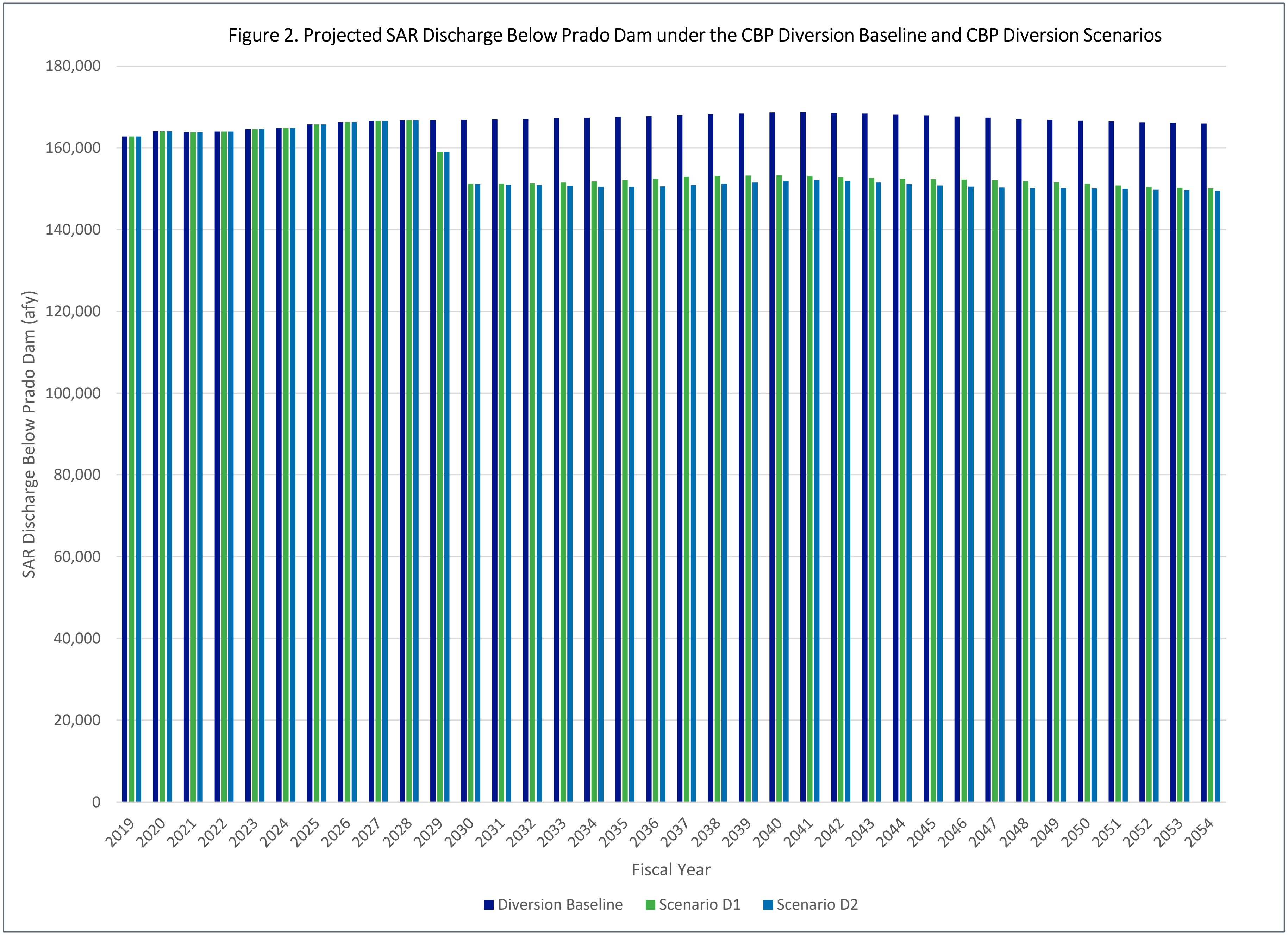
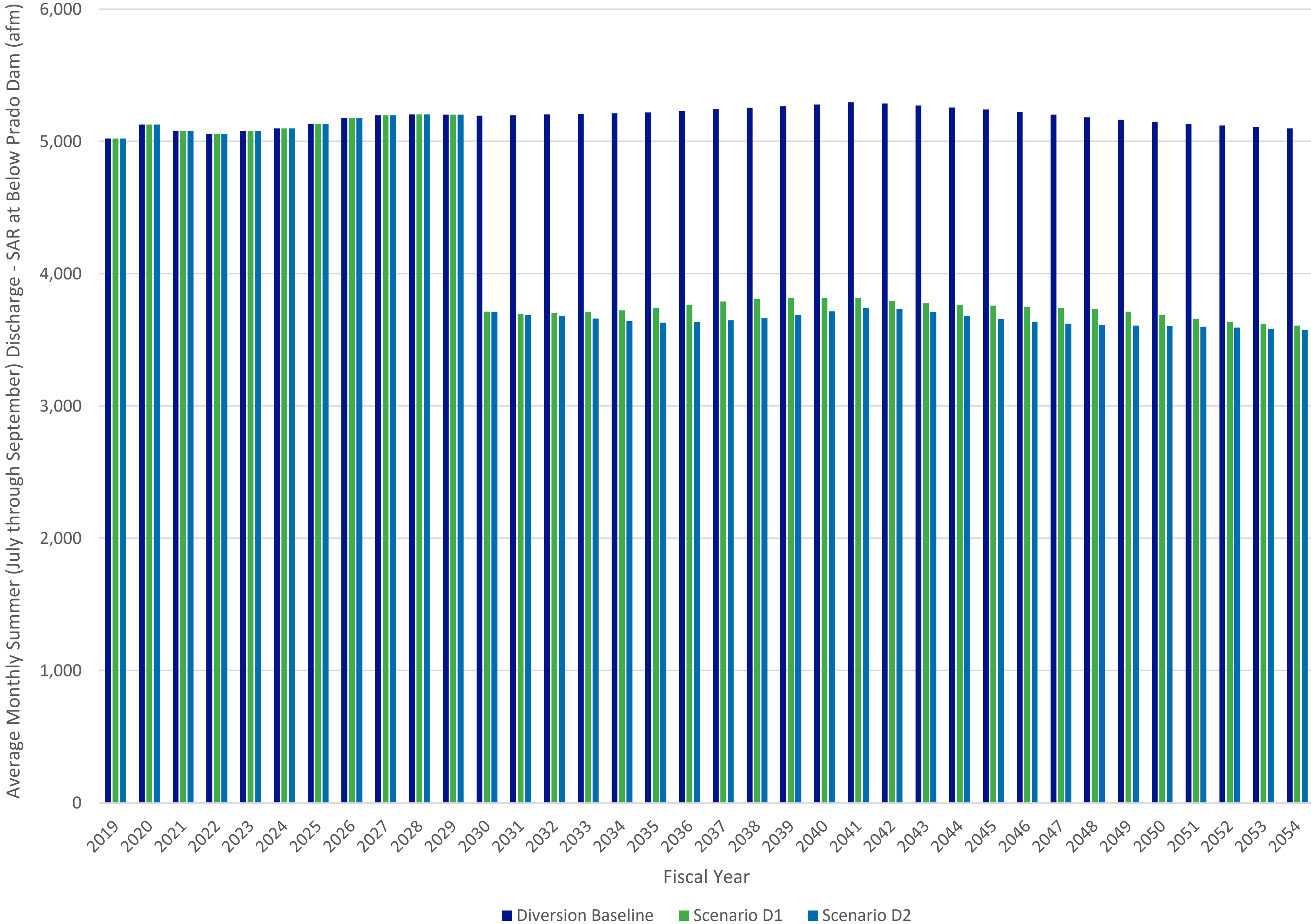


Figure 2. Projected SAR Discharge Below Prado Dam under the CBP Diversion Baseline and CBP Diversion Scenarios
SAR Discharge Below Prado Dam (afy)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Fiscal Year
Diversion Baseline
Scenario D1
Scenario D2

Figure 3. Projected Average Monthly Summer (July through September) SAR Discharge at Below Prado Dam under the CBP Diversion Baseline and CBP Diversion Scenarios



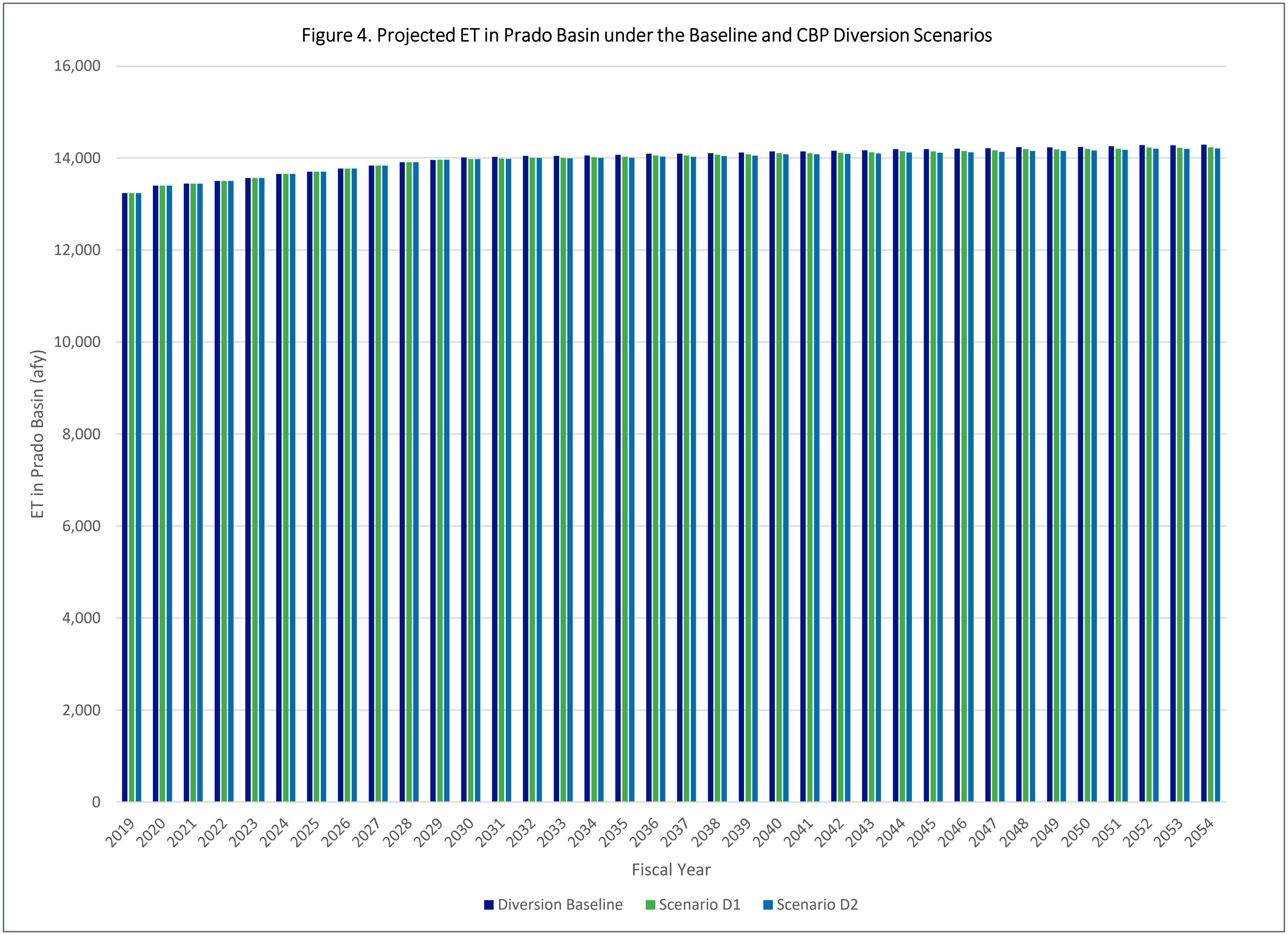


Figure 4. Projected ET in Prado Basin under the Baseline and CBP Diversion Scenarios
ET in Prado Basin (afy)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Fiscal Year
Diversion Baseline
Scenario D1
Scenario D2

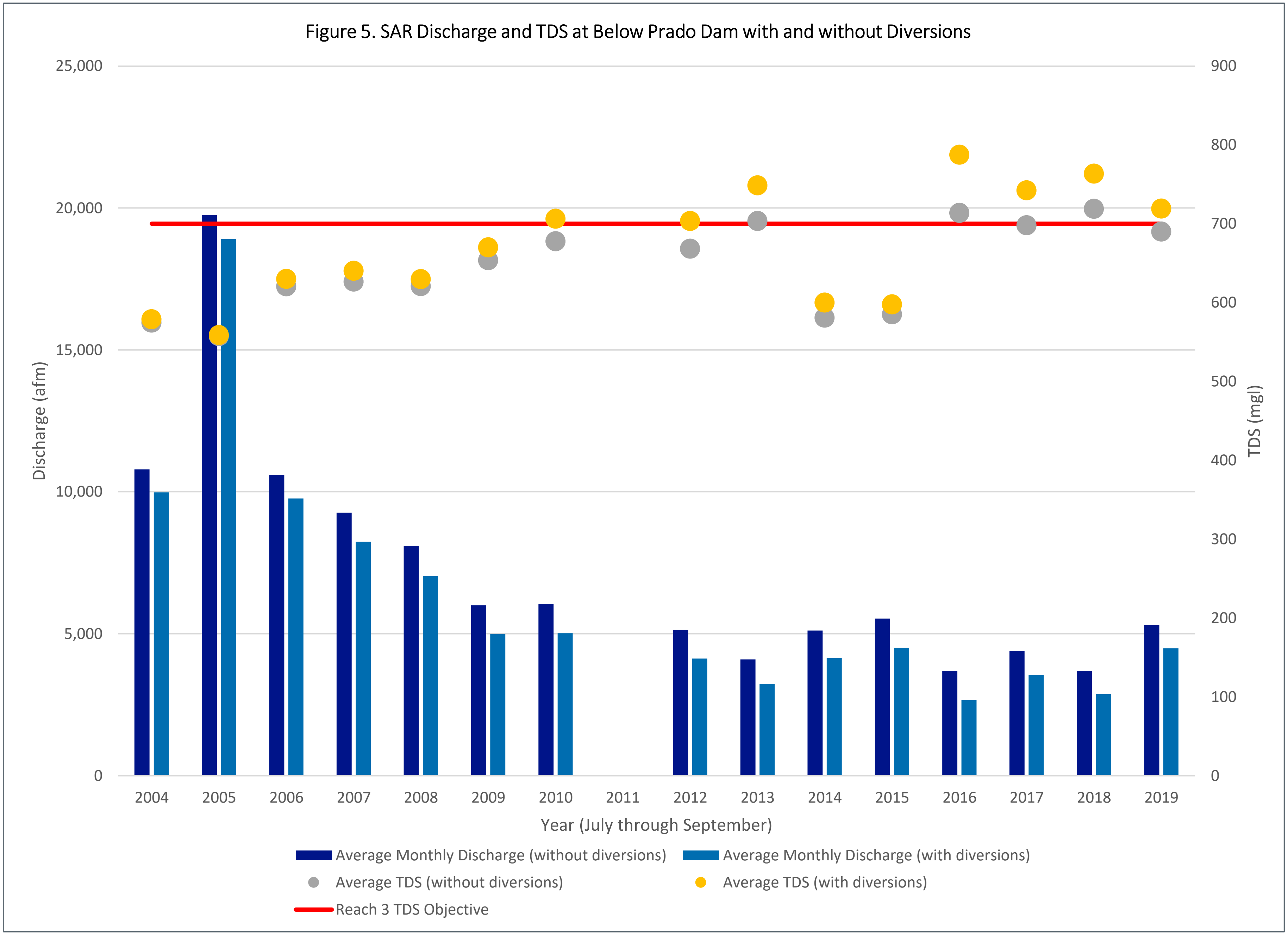


Figure 5. SAR Discharge and TDS at Below Prado Dam with and without Diversions
25,000
20,000
15,000
10,000
5,000
0
Discharge (afm)
900
800
700
600
500
400
300
200
100
0
TDS (mgl)
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year (July through September)
Average Monthly Discharge (without diversions)
Average Monthly Discharge (with diversions)
Average TDS (without diversions)
Average TDS (with diversions)
Reach 3 TDS Objective

Table 3. Mass-Balance Computation of the Discharge and TDS Computation of the Residual without Diversions[1]

Year	Month	Discharge (af)											TDS (mgl)										
		(1) SAR at MWD Xing	(2) RWQCP DP-001	(3) Corona WWTP No. 1B	(4) Corona WWTP No. 3	(5) IEUA RP1 (Cucamonga)	(6) IEUA RP1 (Prado)	(7) IEUA CCWRF	(8) IEUA RP5	(9) WRCRWTP	(10) Residual	(11) SAR Below Prado Dam	(12) SAR at MWD Xing	(13) RWQCP DP-001	(14) Corona WWTP No. 1B	(15) Corona WWTP No. 3	(16) IEUA RP1 (Cucamonga)	(17) IEUA RP1 (Prado)	(18) IEUA CCWRF	(19) IEUA RP5	(20) WRCRWTP	(21) Residual	(22) SAR Below Prado Dam
2004	July	3,853	3,043	199	0	5,756	645	478	773	247	-3,701	11,293	629	603	728	-	494	505	508	511	614	509	574
	August	3,837	3,073	278	0	5,994	727	531	713	238	-6,105	9,285	628	561	708	-	476	483	492	504	602	436	607
	September	3,749	3,032	264	0	5,984	592	611	721	246	-3,402	11,797	625	564	676	-	475	483	492	491	589	494	550
2005	July	9,551	3,234	470	0	15,150	965	626	662	285	-10,083	20,860	478	575	770	-	455	446	471	481	645	301	569
	August	12,617	3,143	465	0	18,494	820	599	622	288	-13,481	23,568	431	593	810	-	448	431	471	465	674	349	525
	September	5,088	3,045	538	0	7,964	916	630	596	280	-4,224	14,832	601	577	810	-	464	437	484	483	655	320	591
2006	July	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	August	5,595	3,089	681	0	8,029	479	561	874	310	-8,537	11,083	614	622	747	-	460	456	500	494	603	441	624
	September	4,076	2,966	621	0	6,015	299	555	1,058	298	-5,773	10,116	617	608	777	-	449	383	479	469	578	402	616
2007	July	3,782	2,837	377	5	5,851	575	351	984	452	-5,867	9,346	703	615	853	750	485	481	532	508	543	496	628
	August	4,284	2,991	288	18	6,850	528	444	1,047	451	-7,408	9,494	672	600	835	780	475	470	521	489	540	508	595
	September	4,641	2,938	321	25	7,826	492	569	995	465	-9,317	8,956	583	591	830	690	463	463	505	490	542	398	658
2008	July	3,167	2,892	249	0	4,693	410	343	828	533	-4,802	8,313	675	672	614	-	485	490	557	512	625	545	607
	August	3,382	2,918	359	18	5,328	401	394	852	512	-5,986	8,178	675	652	726	740	489	488	540	503	569	515	625
	September	3,719	2,902	207	0	5,938	388	267	1,015	500	-7,141	7,795	595	648	736	-	506	516	543	518	641	494	631
2009	July	3,136	2,821	172	0	4,995	362	197	797	487	-7,208	5,759	680	683	758	-	528	504	563	505	593	546	673
	August	2,890	2,813	239	22	4,376	337	321	909	562	-6,115	6,354	661	651	711	710	517	489	552	509	646	531	647
	September	2,460	2,833	108	0	3,452	400	181	667	606	-4,831	5,875	650	633	685	-	523	494	544	499	611	517	642
2010	July	3,597	2,855	5	12	8,245	320	228	863	530	-10,608	6,046	674	603	778	750	526	481	511	513	572	503	691
	August	3,136	2,795	164	0	4,757	285	271	70	619	-6,465	5,632	714	613	752	-	509	517	498	528	575	527	670
	September	3,312	2,711	373	9	5,202	368	534	0	527	-6,580	6,456	649	602	734	700	490	505	494	-	579	459	673
2012	July	2,244	2,556	273	0	3,330	165	248	51	521	-4,562	4,827	728	681	794	640	461	519	528	564	577	481	721
	August	2,398	2,616	246	0	3,710	238	177	30	511	-5,223	4,704	669	664	743	-	463	509	523	535	555	513	654
	September	4,046	2,734	173	0	5,156	259	153	0	520	-7,167	5,874	580	622	700	590	476	542	519	-	539	471	637
2013	July	2,367	2,752	143	0	3,496	162	138	71	578	-5,485	4,222	664	674	790	-	518	536	545	555	540	532	698
	August	3,197	2,696	143	0	2,521	145	0	157	576	-5,346	4,089	554	642	810	-	508	545	-	575	580	470	706
	September	2,112	2,794	177	0	3,130	192	0	173	558	-5,169	3,967	633	624	780	-	513	531	-	552	520	485	707
2014	July	1,845	2,475	143	0	2,806	182	81	36	620	-4,847	3,341	640	631	760	-	497	523	575	576	510	479	719
	August	13,404	2,651	143	0	12,201	257	205	0	628	-22,830	6,658	448	644	750	-	505	525	576	-	570	489	515
	September	5,474	2,552	184	0	5,303	209	163	0	557	-9,118	5,326	466	627	710	-	507	538	583	-	330	471	576
2015	July	12,082	2,478	143	0	6,992	269	245	0	580	-17,235	5,554	296	649	760	-	500	530	574	-	510	323	683
	August	2,152	2,460	143	0	3,539	185	331	0	613	-5,651	3,771	608	646	760	-	524	531	595	-	500	498	703
	September	5,593	2,436	138	0	3,522	295	262	107	571	-5,645	7,279	536	659	790	-	499	535	597	555	540	688	449
2016	July	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	August	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	September	1,749	2,392	601	0	2,617	239	127	0	643	-4,677	3,691	637	640	710	-	517	506	522	-	530	495	714
2017	July	1,934	2,482	143	0	2,218	191	143	46	428	-3,291	4,294	642	636	700	-	482	465	503	538	570	437	693
	August	2,171	2,484	143	0	2,733	196	0	0	624	-4,116	4,235	638	633	710	-	459	463	-	-	540	420	711
	September	2,187	2,466	138	0	3,381	361	0	56	600	-4,542	4,647	636	632	700	-	456	458	-	516	530	417	690
2018	July	1,888	2,396	500	0	2,867	291	0	0	610	-4,917	3,636	623	662	770	-	509	516	-	-	630	500	737
	August	1,906	2,485	55	0	2,899	359	0	0	578	-5,053	3,230	638	650	760	-	499	511	-	-	620	501	721
	September	1,824	2,425	138	0	2,764	354	0	218	609	-4,126	4,205	627	633	760	-	493	513	-	511	560	444	701
2019	July	2,238	2,346	143	0	3,565	155	0	388	622	-3,611	5,846	623	643	770	-	458	500	-	518	560	340	692
	August	2,260	2,409	143	0	3,613	124	0	699	646	-4,918	4,974	631	665	750	-	470	470	-	512	580	427	709
	September	1,931	2,312	140	0	2,995	166	0	720	661	-3,820	5,106	624	672	770	-	449	525	-	530	580	431	670

[1] 2011 was excluded from the analysis due to the influence of OCWD imported water at the OC-59 outfall. July 2006, July 2016, and August 2016 were removed from the analysis due to anomalous values.

Table 4. Mass-Balance Computation of the Discharge and TDS Computation of the Residual with Diversions[1]

		Discharge (af)													TDS (mgl)												
Year	Month	(1) SAR at MWD Xing	(2) RWQCP DP-001	(3) Corona WWTP No. 1B	(4) Corona WWTP No. 3	(5) **IEUA RP1 (Cucamonga)**	(6) **IEUA RP1 (Prado)**	(7) **IEUA CCWRF**	(8) **IEUA RP5**	(9) **WRCRWTP**	(10) Residual	(11) **SAR Below Prado Dam**	(12) **Change in discharge due to Diversions**	(13) **Percent change in discharge with diversions**	(14) SAR at MWD Xing	(15) RWQCP DP-001	(16) Corona WWTP No. 1B	(17) Corona WWTP No. 3	(18) IEUA RP1 (Cucamonga)	(19) IEUA RP1 (Prado)	(20) IEUA CCWRF	(21) IEUA RP5	(22) WRCRWTP	(23) Residual	(24) **SAR Below Prado Dam**	(25) **Change in TDS concentration due to Diversions**	(26) **Percent change in TDS concentration due to diversions**
2004	July	3,853	3,043	199	0	5,521	585	128	773	0	-3,701	10,401	-892	-7.9%	629	603	728	-	494	505	508	511	614	509	577	3	0.6%
	August	3,837	3,073	278	0	5,802	654	293	713	0	-6,105	8,544	-741	-8.0%	628	561	708	-	476	483	492	504	602	436	615	7	1.2%
	September	3,749	3,032	264	0	5,626	548	462	717	0	-3,402	10,995	-802	-6.8%	625	564	676	-	475	483	492	491	589	494	552	3	0.5%
2005	July	9,551	3,234	470	0	14,915	905	277	662	0	-10,083	19,931	-929	-4.5%	478	575	770	-	455	446	471	481	645	301	571	2	0.4%
	August	12,617	3,143	465	0	18,303	747	361	622	0	-13,481	22,777	-791	-3.4%	431	593	810	-	448	431	471	465	674	349	525	0	-0.1%
	September	5,088	3,045	538	0	7,605	871	480	592	0	-4,224	13,995	-836	-5.6%	601	577	810	-	464	437	484	483	655	320	595	4	0.6%
2006	July	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	August	5,595	3,089	681	0	7,838	406	323	874	0	-8,537	10,270	-813	-7.3%	614	622	747	-	460	456	500	494	603	441	632	8	1.2%
	September	4,076	2,966	621	0	5,656	255	406	1,054	0	-5,773	9,261	-855	-8.4%	617	608	777	-	449	383	479	469	578	402	627	11	1.8%
2007	July	3,782	2,837	377	5	5,616	515	1	984	0	-5,867	8,250	-1,096	-11.7%	703	615	853	750	485	481	532	508	543	496	641	14	2.2%
	August	4,284	2,991	288	18	6,659	455	206	1,047	0	-7,408	8,540	-954	-10.1%	672	600	835	780	475	470	521	489	540	508	604	9	1.5%
	September	4,641	2,938	321	25	7,467	448	420	991	0	-9,317	7,935	-1,021	-11.4%	583	591	830	690	463	463	505	490	542	398	678	20	3.0%
2008	July	3,167	2,892	249	0	4,458	350	0	828	33	-4,802	7,175	-1,138	-13.7%	675	672	614	-	485	490	557	512	625	545	613	6	1.0%
	August	3,382	2,918	359	18	5,137	327	156	852	12	-5,986	7,175	-1,003	-12.3%	675	652	726	740	489	488	540	503	569	515	637	12	1.9%
	September	3,719	2,902	207	0	5,580	343	118	1,011	0	-7,141	6,739	-1,056	-13.6%	595	648	736	-	506	516	543	518	641	494	639	9	1.4%
2009	July	3,136	2,821	172	0	4,760	302	0	797	0	-7,208	4,781	-979	-17.0%	680	683	758	-	528	504	563	505	593	546	695	22	3.3%
	August	2,890	2,813	239	22	4,185	263	83	909	62	-6,115	5,351	-1,003	-15.8%	661	651	711	710	517	489	552	509	646	531	658	11	1.7%
	September	2,460	2,833	108	0	3,094	355	32	663	106	-4,831	4,819	-1,056	-18.0%	650	633	685	-	523	494	544	499	611	517	658	17	2.6%
2010	July	3,597	2,855	5	12	8,010	260	0	863	30	-10,608	5,023	-1,023	-16.9%	674	603	778	750	526	481	511	513	572	503	721	30	4.4%
	August	3,136	2,795	164	0	4,566	212	33	70	119	-6,465	4,630	-1,003	-17.8%	714	613	752	-	509	517	498	528	575	527	698	28	4.2%
	September	3,312	2,711	373	9	4,843	324	385	0	27	-6,580	5,404	-1,052	-16.3%	649	602	734	700	490	505	494	-	579	459	700	27	4.0%
2012	July	2,244	2,556	273	0	3,095	105	0	51	21	-4,562	3,784	-1,043	-21.6%	728	681	794	640	461	519	528	564	577	481	771	51	7.1%
	August	2,398	2,616	246	0	3,519	164	0	30	11	-5,223	3,762	-942	-20.0%	669	664	743	-	463	509	523	535	555	513	685	32	4.9%
	September	4,046	2,734	173	0	4,797	215	3	0	20	-7,167	4,822	-1,052	-17.9%	580	622	700	590	476	542	519	-	539	471	664	27	4.2%
2013	July	2,367	2,752	143	0	3,261	102	0	71	78	-5,485	3,289	-933	-22.1%	664	674	790	-	518	536	545	555	540	532	745	46	6.6%
	August	3,197	2,696	143	0	2,330	72	0	157	76	-5,346	3,325	-764	-18.7%	554	642	810	-	508	545	-	575	580	470	740	34	4.8%
	September	2,112	2,794	177	0	2,772	148	0	169	58	-5,169	3,060	-907	-22.9%	633	624	780	-	513	531	-	552	520	485	763	56	7.9%
2014	July	1,845	2,475	143	0	2,572	122	0	36	120	-4,847	2,465	-876	-26.2%	640	631	760	-	497	523	575	576	510	479	792	73	10.2%
	August	13,404	2,651	143	0	12,010	184	0	0	128	-22,830	5,689	-969	-14.6%	448	644	750	-	505	525	576	-	570	489	509	-7	-1.3%
	September	5,474	2,552	184	0	4,944	165	14	0	57	-9,118	4,273	-1,052	-19.8%	466	627	710	-	507	538	583	-	330	471	611	35	6.0%
2015	July	12,082	2,478	143	0	6,757	209	0	0	80	-17,235	4,515	-1,040	-18.7%	296	649	760	-	500	530	574	-	510	323	720	37	5.4%
	August	2,152	2,460	143	0	3,348	111	93	0	113	-5,651	2,769	-1,003	-26.6%	608	646	760	-	524	531	595	-	500	498	765	63	8.9%
	September	5,593	2,436	138	0	3,163	250	113	103	71	-5,645	6,223	-1,056	-14.5%	536	659	790	-	499	535	597	555	540	688	434	-14	-3.2%
2016	July	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	August	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	September	1,749	2,392	601	0	2,258	195	0	0	143	-4,677	2,662	-1,029	-27.9%	637	640	710	-	517	506	522	-	530	495	787	74	10.3%
2017	July	1,934	2,482	143	0	1,983	131	0	46	0	-3,291	3,428	-866	-20.2%	642	636	700	-	482	465	503	538	570	437	735	42	6.0%
	August	2,171	2,484	143	0	2,542	122	0	0	124	-4,116	3,470	-764	-18.1%	638	633	710	-	459	463	-	-	540	420	755	44	6.2%
	September	2,187	2,466	138	0	3,023	317	0	52	100	-4,542	3,740	-907	-19.5%	636	632	700	-	456	458	-	516	530	417	737	47	6.8%
2018	July	1,888	2,396	500	0	2,632	231	0	0	110	-4,917	2,841	-795	-21.9%	623	662	770	-	509	516	-	-	630	500	780	42	5.8%
	August	1,906	2,485	55	0	2,708	286	0	0	78	-5,053	2,466	-764	-23.7%	638	650	760	-	499	511	-	-	620	501	765	44	6.1%
	September	1,824	2,425	138	0	2,405	309	0	214	109	-4,126	3,298	-907	-21.6%	627	633	760	-	493	513	-	511	560	444	748	47	6.7%
2019	July	2,238	2,346	143	0	3,330	95	0	388	122	-3,611	5,051	-795	-13.6%	623	643	770	-	458	500	-	518	560	340	718	26	3.8%
	August	2,260	2,409	143	0	3,422	50	0	699	146	-4,918	4,210	-764	-15.4%	631	665	750	-	470	470	-	512	580	427	739	30	4.3%
	September	1,931	2,312	140	0	2,637	121	0	716	161	-3,820	4,199	-907	-17.8%	624	672	770	-	449	525	-	530	580	431	701	31	4.7%

[1] 2011 was excluded from the analysis due to the influence of OCWD imported water at the OC-59 outfall. July 2006, July 2016, and August 2016 were removed from the analysis due to anomalous values.

APPENDIX 5

Air Quality Technical Report

WOODARD & CURRAN

AIR QUALITY TECHNICAL REPORT

October 2021

9665 Chesapeake Drive Suite 320
San Diego, CA 92123
858.875.7400

woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

Inland Empire Utilities Agency
Chino Basin Program

TABLE OF CONTENTS

SECTION PAGE NO.

ATTACHMENTS

1. INTRODUCTION

This report describes environmental and regulatory setting related to air quality for Inland Empire Utility Agency's (IEUA) proposed Chino Basin Program (CBP, or Proposed Project) area. The report then describes the methodology and thresholds relied upon to assess the impacts of the Proposed Project. Finally, it identifies the impacts of the Proposed Project. This report discusses the Proposed Project impacts associated with criteria and toxic air pollutants and odors.

2. PROJECT DESCRIPTION

The CBP consists of an advanced water purification facility (AWPF), injection wells, extraction wells, groundwater treatment facilities, and a pipeline distribution network connecting the proposed facilities to local agencies and Metropolitan Water District of Southern California (MWD) for a water exchange with the State Water Project (SWP). The CBP AWPF and groundwater injection facilities would allow for the recharge/storage of up to 15,000 acre-feet per year (AFY) of recycled water in the Chino Basin, creating a new local supply. The AWPF would process 17,000 AFY of recycled water, which includes currently unused recycled water and 6,000 AFY of external supplies; 2,000 AFY of water will be lost through the AWPF process each year. The CBP would connect CBP potable water facilities to the region, as well as connections to MWD with the ability to pump CBP potable supplies into MWD's water distribution system. This connection would allow the CBP to make 50,000 AFY available to MWD in dry or critically dry years in exchange for the same amount of supply from the SWP. In return, 50,000 AFY that would otherwise have been exported to MWD would be stored in Lake Oroville and used to enhance instream flows in the Feather River. Figure 1 shows a proposed conceptual layout of the key facilities.

The CBP will provide for an exchange of new water supplies in the Chino Basin for SWP supplies in Lake Oroville in northern California that would otherwise be delivered to southern California. The additional Lake Oroville water would subsequently be released in the form of pulse flows in the Feather River to improve habitat conditions for native salmonids and achieve environmental benefits. The 15,000 AFY of new water supply would be produced for a period of 25 years to provide for the State exchange, to be used in blocks of up to 50,000 AFY in dry and critical years when pulse flows in the Feather River would provide the most ecosystem benefit. The term for this exchange will be fixed at 25 years for a total volume of 375,000 acre-feet, after which time the CBP will be devoted to meeting local water management needs while fulfilling commitments to improve water quality in the Chino Basin and provide a source of emergency water supply. The program would be administered through agreements with California Department of Water Resources (DWR), California Department of Fish and Wildlife (CDFW), MWD, and other project partners. For every acre-foot (AF) of water requested for north of the Delta ecosystem benefits, IEUA would pump locally stored groundwater and deliver it to MWD or use the water locally instead of taking raw imported water from MWD. MWD would then leave behind an equivalent amount of water in Lake Oroville to be dedicated and released for the requested ecosystem benefit. The 375,000 AF would be recharged over 25 years and the same amount would be extracted over 25 years.

Figure 1: Conceptual Chino Basin Program Infrastructure

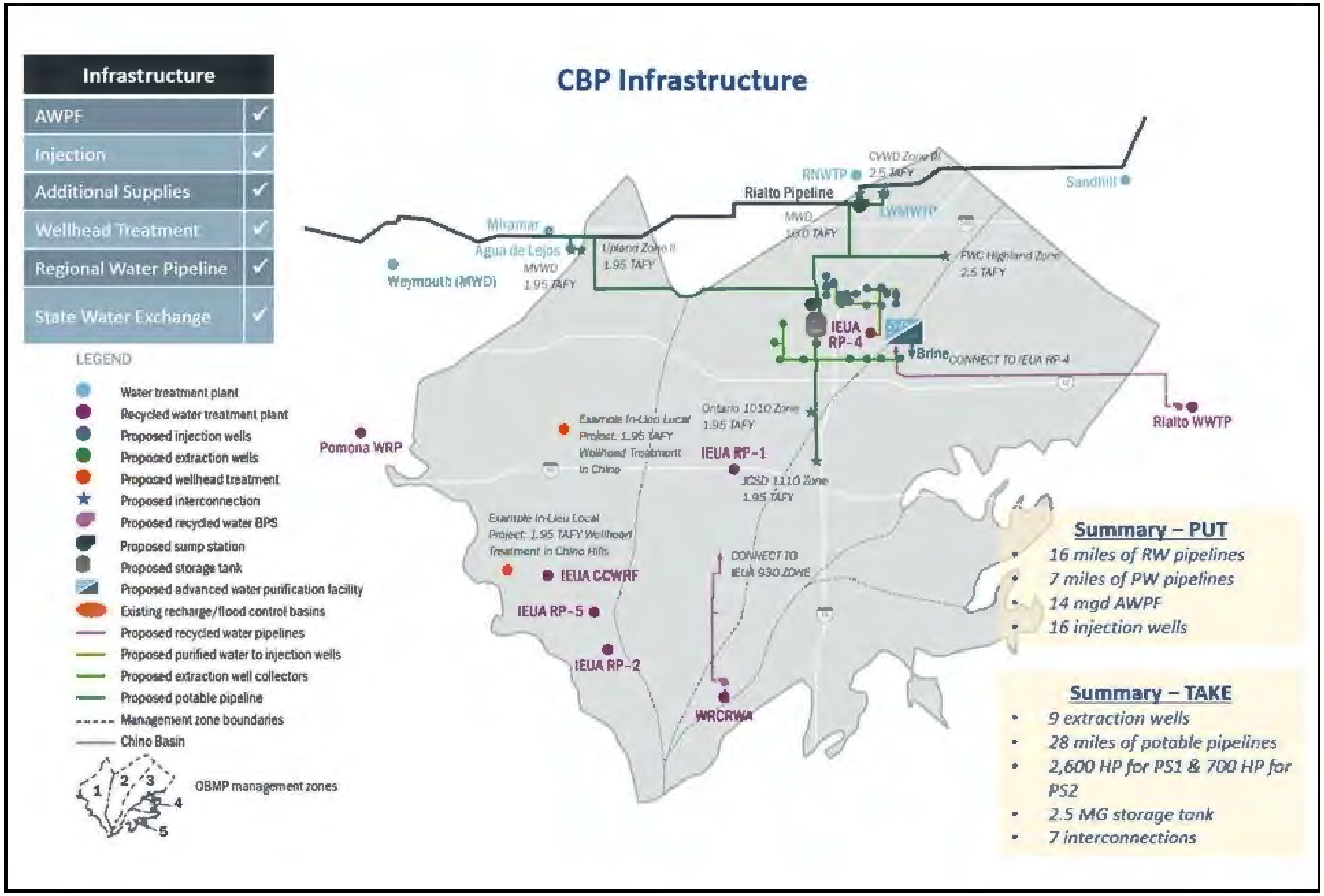


FIGURE 1

Tom Dodson & Associates *Environmental Consultants*	**CBP Infrastructure**

The Proposed Project includes two main categories of facilities: “Put” and “Take” components. The “Put” facilities include the components to recharge purified water to the Chino Basin, while the “Take” facilities include the components to extract groundwater and convey potable water supply from the Chino Basin. These components are summarized in Table 1 and described in detail in Table 2.

Table 1: **Summary of “Put” and “Take” Components of the Chino Basin Program**

“Put” Components	**“Take”** Components
• Tertiary recycled water supply and conveyance • AWPF • Purified water pumping and conveyance • Groundwater recharge (injection wells and/or use of existing recharge basins)	• Groundwater extraction and treatment • Potable water pumping and conveyance • Potable water usage (MWD pump back or in-lieu)

Table 2: Detail of Chino Basin Program Infrastructure

Project Category	Infrastructure
Project Category 1: Well Development	16 injection wells (maximum) with max operational capacity of 830 gpm each 17 extraction wells (maximum) with max operational capacity of 2,000 gpm each 4 monitoring wells (maximum) Use of existing wells including a mix of up to 4 of the following: • Use of existing Rialto Pipeline • Use of existing member agency wells • Use of existing Agua de Lejos Water Treatment Plant (WTP) Clearwell • Use of existing Lloyd Michael WTP Clearwell
Project Category 2: Conveyance Facilities and Ancillary Facilities	<u>Pipeline</u>: The CBP would ultimately install a total of about 30 miles or 158,400 linear feet (LF) of various types of pipeline. Potential alignments include a mix of the following: • TAKE 1: 9 miles of 12- to 36-inch collector pipelines • TAKE 1: 5 miles of 54-inch potable northern pipeline • TAKE 3: 9 miles of 12- to 42-inch collector pipelines • TAKE 3: 8 miles of 16- through 48-in potable northern pipeline • TAKE 3: 4 miles of 12- through 24-inch potable southern pipeline • TAKE 3: In lieu Brine Disposal Inland Empire Brine Line (IEBL) 6,800 ft 8” pipeline, possible jack and bore across 300 ft under Hwy 71 and Chino Creek • TAKE 7: 7 miles of 36- to 72-inch e/w Water Facilities Authority (WFA) pipeline • TAKE 7: 4.5 miles 24-inch e/w Fontana Water Company (FWC) pipeline • TAKE 7: 4.5 miles 54- to 72-inch & 36-inch Cucamonga Valley Water District (CVWD)/ MWD pipeline • TAKE 7: 0.3 miles 54- to 72-inch MWD pipeline • TAKE 8: 6.3 miles of 48-inch CVWD pipeline • TAKE 8: 7 miles of 24-inch FWC-1 pipeline • TAKE 8: 0.7 miles of 24-inch FWC-2 pipeline • TAKE 8: 0.8 miles of 24-inch MWD pipeline • TAKE 8: 36-inch Jurupa Community Services District (JCSD) 2 miles • PUT 5: 7.1 miles of 8- to 30-inch pipeline for purified water conveyance • PUT 5: 1,400 ft (8-foot pipeline) Non-Reclaimable Wastewater System (NRWS) brine conveyance; NRWS Capacity Units required: 2,603 <u>Reservoir</u>: The CBP would install a storage tank with a maximum capacity of 5 MG with possible and in-conduit hydropower facility. <u>Pump Stations</u>: The CBP would install 4 pump stations serving various PUT and TAKE facilities. One pump station would serve PUT facilities, while up to 3 pump stations would

Project Category	Infrastructure
	support TAKE facilities. The breakdown of the types of pump stations and boosters include a mix of the following: • PUT 5: Pump station at Regional Water Recycling Plant No. 4 (RP-4) 1,500 HP • TAKE 1: Pump Station with a max 9,300 HP, and a max of 31,100 gpm, 823 ft total dynamic head (TDH) • TAKE 3: Potable Water Pump Station #1 with a max 7,000 HP, 23,300 gpm firm capacity, 823 ft TDH • TAKE 7: WFA Booster at 1,700 HP • TAKE 7: FWC Booster at 300 HP • TAKE 7: CVWD/MWD Booster at 4,800 HP • TAKE 8: Booster Station #1 at 5,300 HP • TAKE 8: MWD Booster at 650 HP • An additional TAKE pump station would have a max 650 HP Turnouts: The CBP would install a maximum of 6 turn-outs that would be between 12" and 72" in size to support TAKE facilities at various member agency locations throughout the Chino Basin
Project Category 3: Groundwater Storage Increase	The CBP contemplates a permanent increase in Safe Storage Capacity of 850,000 AF
Project Category 4: Advanced Water Purification Facility and Other Water Treatment Facilities	AWPF: The CBP would install an AWPF at RP-4, which will ultimately have a capacity of 15,000 AFY. The intake of recycled water at this facility will total 17,000 AFY, with a resulting 15,000 AFY of purified water derived from the AWPF processes. Wellhead Treatment: The CBP may install up to 3 wellhead treatment facilities at locations that have yet to be selected but would be sited at existing member agency offline wells. These wellhead treatment systems would be capable of treating up to 3,000 AFY per wellhead treatment system. Each of the 3 wellhead treatment systems would be connected to 3 existing member agency wells (total of 9 existing extraction wells used for the CBP). Wellhead treatment also includes the following brine conveyance and disposal: • Disposal Capacity: 4,900 gpd per wellhead treatment system • Pipeline Length: up to 6,800 LF (8-inch) • Disposal System: Assumed utilization of IEBL

2.1 Construction

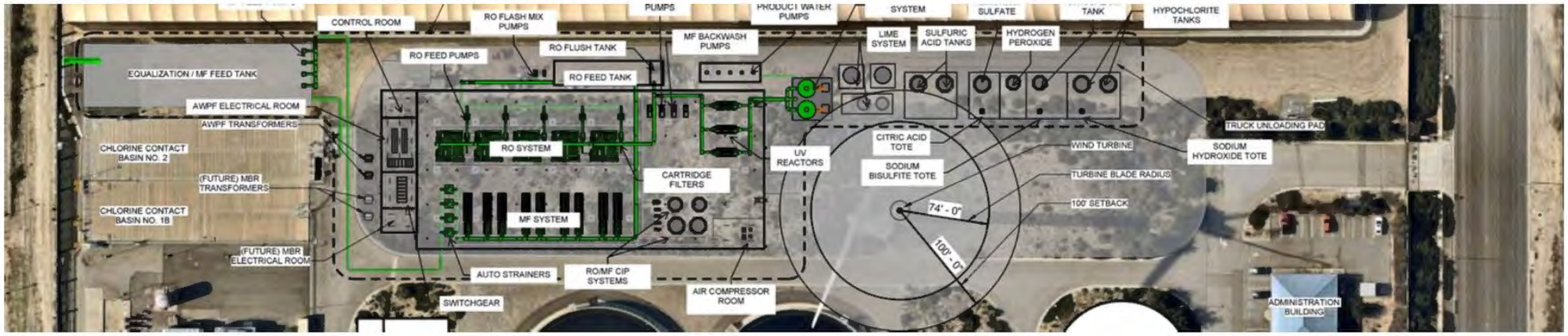
The following section summarizes the construction activity details for each Proposed Project component. The overall assumed construction vehicle fleet can be found in Table 3.

2.1.1 AWPF

The installation of the AWPF at IEUA's existing RP-4, located in the City of Rancho Cucamonga, would require approximately 12 months to construct. It is anticipated that the AWPF would be operational by 2028. The construction of the AWPF would consist of site clearing, grading, construction of facilities, installation of equipment, and site completion. Construction equipment would include the following: one bulldozer or motor grader, backhoes, loaders, dump trucks, crew trucks, concrete trucks, cranes, personal vehicles, compactor, delivery trucks, and a water truck. It is anticipated that the maximum number of construction personnel at a site on any given day will be 20 persons. The maximum number of truck deliveries is forecasted at 15 per day at 40-miles round-trip per day of construction. Materials and equipment would be delivered to the site including piping, building materials, concrete forms, roofing materials, HVAC equipment, pumps, diffusers, screens, belt presses, and screw presses. The site of the proposed AWPF is currently vacant (see Figure 2). No demolition is anticipated to be required to construct the AWPF.

Figure 2: AWPF Site

Regional Water Recycling Plant No. 4 Advanced Water Purification Facility Site Layout



Google Street view of Regional Water Recycling Plant No. 4 Advanced Water Purification Facility Site

2.1.2 Pipelines and Turnouts

With rare exceptions, all proposed pipelines would be aligned through the public right-of-way (ROW) and properties owned or to-be acquired by IEUA. Typically, pavement removal would occur, followed by excavation of the pipeline trench, installation of the pipe, then backfilling and compaction, and finally ground surface restoration or pavement reinstallation. Trenchless technologies would be required at freeway, flood channel, and railroad crossings: jack and bore for lengths less than 500 feet; and horizontal directional drilling (HDD) for lengths exceeding 500 feet. HDD involves establishing entry and exit pits, using a drill rig to create an underground bore hole, and then stringing the pipeline through the hole. Jack and bore also employs entry and exit pits but uses an auger to remove material and push a casing forward, then the pipeline is inserted in the casing. Most of the pipe would range from 10-inch to 48-inch diameter. Depending on the pipe size, the trenches may vary in depth and width. Roughly half an acre of land would be actively excavated on a given day.

An estimated 30 miles or 158,400 LF of conveyance pipeline would be installed in support of the CBP. The rate of pipeline installation would depend on whether the pipeline installation is in undeveloped areas or developed roadways. Installation of 158,400 LF of pipeline was assumed to occur over a period of 3 years, with 53,000 LF being installed each year to coincide with the opening year (2028) of the AWPF. For the purposes of analysis, it is assumed that an underground utility installation team can install an average of 200-400 LF of pipeline per day and that three teams will be installing pipelines at any given time for a maximum total of 1,200 LF per day (400 LF/team/day x 3 teams = 1,200 LF per day). It is assumed that the proposed pipeline installation will occur for a maximum of 260 days in one calendar year.

In addition to conveyance pipeline, a maximum of six turnout structures would be provided to deliver water from the main canal to the water users via a pipeline or other means. The type of turnout structure and its design requirements would depend on location. Installation of the six turnouts would occur over a period of two years, with three turnouts being installed each year to coincide with the opening year (2028) of the AWPF. For the turnouts, roughly a quarter acre of land would be actively excavated on a given day.

The daily construction fleet required to install the average 200-400 LF/day of conveyance pipelines or for each turnout consists of a pavement cutter, grinder, backhoe, crane, two dump trucks, roller/vibrator, and traffic control signage and devices operating 6 hours per day; a water truck and excavator operating 4 hours per day; and a paving machine and compacter operating 2 hours per day. In addition, the contractor may occasionally use a portable generator and welder for equipment repairs or incidental uses. Installation of pipeline in unpaved locations would require the same equipment as in paved locations, without the paving equipment (cutter, grinder, paving machine). In general, trenches would have vertical side walls to minimize the amount of soil excavated. Soils excavated from the trenches, if of suitable quality, would be stockpiled alongside the trench or in staging areas for later reuse in backfilling the trench. If not reusable, the soil would be hauled off site for disposal. Engineered backfill material would be imported to stockpiles near the trenching. During the installation of the pipelines, there would be a surplus of native soil requiring off-site export. Pipeline and turnout installation would require an estimated 10 dump/delivery trucks (40 miles round trip distance) per day, and a crew of 14 members per team (40-mile round-trip commute). For the purposes of analysis, it is assumed that each phase of pipeline construction would be occurring simultaneously at some location in the basin (i.e., one segment would be in the repaving phase while another segment begins trenching).

2.1.3 Pump Stations

Pump stations are required to pump water from areas at a lower elevation within the Basin, to areas located at a higher elevation. A total of four pump stations are anticipated to be constructed as part of the CBP. At each site, no more than 0.5 acre would be actively graded on a given day for site preparation of each pump station. Grading activities would occur over a five-day period and this phase of construction would require up to six truck trips with an average round

trip distance of 20 miles to deliver construction materials and equipment (concrete, steel, pipe, etc.). Installation of the pump station would require the use of a crane, forklift, backhoe and front loader operating four hours per day. Five workers would each commute 40 miles round-trip to the work site.

Each pump station would be housed within a block building and would require a transformer to be installed to deliver electric power to the pumps. The proposed pump station building would include a pump room, electric control room, odor control facilities, chemical tanks, and storage room. Construction of the pump station would involve installation of piping and electrical equipment, excavation and structural foundation installation, pump house construction, pump and motor installation, and final site completion.

The proposed pump stations are anticipated to be located at sites that have permanent power available for construction, as such a generator is not anticipated to be required for welding required to construct the pump stations.

2.1.4 Injection, Extraction, and Monitoring Wells

The CBP would install up to 37 new wells, (16 injection wells [12 duty, 4 stand-by], 17 extraction wells, and 4 monitoring wells). Installation of the 37 new wells would occur over a period of three years, with 12 wells being installed each year to coincide with the opening year of the AWPF, 2028. Production well, injection well, and monitoring well development have essentially the same construction impacts.

The drilling and development of each well would require drilling to—in most cases—between 250 and 1,500 feet below ground surface (bgs). The proposed schedule for constructing each well would be as follows: drilling, construction, and testing of each well would require approximately six weeks to complete (about 45 days, of which 15 to 20 days would include 24-hour, 7-day a week drill activity). For planning purposes, a construction and testing schedule duration of 60 days per well is assumed to account for unforeseen circumstances (e.g., extreme weather, equipment break downs, etc.) that could affect the drilling and testing schedule. The well casings would be welded and well development and installation would require a two week use of a diesel generator.

Development of up to 12 new wells during a given year would require the delivery and set up of the drilling rig at each site. It is anticipated the wells would be drilled at different times and the drilling equipment transported to and from the sites on separate occasions. For the purposes of this evaluation, it is assumed that delivery of the drilling equipment 12 times in a year would result in 12 50-mile round-trips for the drill rigs. It is anticipated that a crew of five persons would be on a given well site at any one time to support drilling a well: three drillers, the hydrologist inspector, and a foreman. Daily trips to complete the well would average approximately 15 round trips per day, which at various points of construction would include: two round trips for drill rigs; between six and 12 round trips for cement trucks; five trips to deliver pipe; and 10 trips per day for employees.

The average area of disturbance of each well site is estimated to be 0.5 acre or less to allow for construction, periodic well rehabilitation, and the drilling of a new well should the original well fail and need to be replaced. For analysis purposes, it is assumed that each well would be drilled using the direct rotary or fluid reverse circulation rotary drilling methods. Access to the drilling site for the drilling rig and support vehicles would be from adjacent roadways. Typically, well drilling requires only minimal earth movement or grading.

2.1.5 Wellhead Treatment Facilities

Several existing wells would require wellhead treatment in order to become operational in support of the CBP. The CBP would construct up to three wellhead treatment facilities at existing member agency wells. Two are shown in Figure 1, and a third could be constructed in the vicinity of the AWPF. The area expected to be disturbed by the construction of the proposed treatment facilities would be less than three acres for each site. A regional groundwater treatment facility would range from about one acre to two acres in size per facility. Construction of water treatment

facilities would involve site demolition; site paving; site prep/grading; excavation and installation of yard pipes; installation of treatment facilities; site finishing (landscaping, misc. curb/cutter, etc.); and site drainage (above and below grade). Construction equipment would include the following: one bulldozer or motor grader, backhoes, loaders, dump trucks, crew trucks, concrete trucks, cranes, personal vehicles, compactor, delivery trucks, and a water truck. It is anticipated that the maximum number of construction personnel at a site on any given day would be 10 persons. The maximum number of construction material truck deliveries would be approximately 10 per day at 40 miles round trip per day. Each wellhead treatment facility would require about six months to construct, with construction of two treatment systems assumed to occur simultaneously. The operational year is anticipated to coincide with the opening year of the AWPF, 2028.

2.1.6 Storage Reservoir

One 5 million gallon (MG) storage tank is anticipated to be required in support of the CBP. Overall, reservoir construction is anticipated to require about three months from start to finish. During mass grading of the site, an assumed 5,000 cubic yards (CY) of material would be imported as engineered backfill. The amount of material that would need to be exported is unspecified, but conservatively assumed to be roughly the same quantity (5,000 CY). This material would be delivered by trucks to the site in the amount of about 300 trips, assuming 50 trips maximum per day to and from the site, with a roundtrip length of no more than 50 miles. Fine grading of the site will be completed after the reservoir and piping are installed. A maximum of five to 12 workers would be on the site during grading, which would take place for about 10 days. Following mass excavation, the tank foundation would be installed. The foundation would consist of concrete, steel, and aggregate. It is assumed that a maximum of five to 12 workers would be on the site during foundation construction for a maximum of about 25 days. The new 5 MG storage tank would be constructed in the following fashion: floor; walls and columns; roof; prestressing; and appurtenances. It is assumed that a maximum of 12 employees would be on the site during reservoir construction for a maximum of about 50 days total (grading and construction).

Table 3 summarizes the overall construction vehicle fleet that has been assumed to be necessary for the purposes of estimating construction-related air pollutant emissions.

Table 3: Estimated Construction Equipment Fleet by Phase

Construction Phase	Modeled Daily Equipment Fleet	Unit Amount	Hours per Day	Hp	Load Factor
Well Development (assume mobilization, drilling, and construction and testing occurs simultaneously at some location in area)	Rubber Tired Dozers	4	6	247	0.4
	Tractors/Loaders/Backhoes	12	6	97	0.37
	Bore/Drill Rigs	1	24	221	0.5025
	Cranes	4	6	231	0.2881
	Welders	4	4	46	0.45
Pipelines (assume pavement cutting, excavation, install, and paving occurs simultaneously at some location in area)	Excavators	3	4	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	6	6	247	0.4
	Tractors/Loaders/Backhoes	3	6	97	0.37
	Crushing/Proc. Equipment	6	6	85	0.78
	Cranes	3	6	231	0.2881
	Rollers	3	6	80	0.3752
	Sweepers/Scrubbers	3	4	64	0.4556
	Paving Equipment	3	2	132	0.3551
	Generator Sets	3	1	84	0.74
Storage Reservoir – Grading phase	Excavators	1	8	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4
	Tractors/Loaders/Backhoes	3	8	97	0.37
Storage Reservoir – Construction phase	Cranes	1	7	231	0.29
	Forklifts	3	8	89	0.2

Construction Phase	Modeled Daily Equipment Fleet	Unit Amount	Hours per Day	Hp	Load Factor
	Generator Sets	1	8	84	0.74
	Tractors/Loaders/Backhoes	3	7	97	0.37
	Welders	1	8	46	0.45
Storage Reservoir – Site finishing phase	Cement and Mortar Mixers	2	6	9	0.56
	Pavers	1	8	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38
	Tractors/Loaders/Backhoes	1	8	97	0.37
Pump Stations - Grading	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4
	Tractors/Loaders/Backhoes	2	7	97	0.37
Pump Stations - Construction	Cranes	1	4	231	0.29
	Forklifts	1	4	89	0.2
	Tractors/Loaders/Backhoes	2	4	97	0.37
	Welders	1	4	46	0.45
Turnouts (assume excavation, install, and resurfacing occurs simultaneously at some location in area)	Excavators	3	4	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	6	6	247	0.4
	Tractors/Loaders/Backhoes	3	6	97	0.37
	Crushing/Proc. Equipment	6	6	85	0.78
	Cranes	3	6	231	0.2881
	Rollers	3	6	80	0.3752
	Sweepers/Scrubbers	3	4	64	0.4556
	Paving Equipment	3	2	132	0.3551
	Generator Sets	3	1	84	0.74
AWPF – Site preparation	Rubber Tired Dozers	3	8	247	0.4
	Tractors/Loaders/Backhoes	4	8	97	0.37
AWPF - Grading	Excavators	1	8	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4
	Tractors/Loaders/Backhoes	3	8	97	0.37
AWPF – Construction	Cranes	1	7	231	0.29
	Forklifts	3	8	89	0.2
	Generator Sets	1	8	84	0.74
	Tractors/Loaders/Backhoes	3	7	97	0.37
	Welders	1	8	46	0.45
AWPF - Paving	Cement and Mortar Mixers	2	6	9	0.56
	Pavers	1	8	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38
	Tractors/Loaders/Backhoes	1	8	97	0.37
Wellhead Treatment – Demolition	Concrete/Industrial Saws	2	6	81	0.73
	Rubber Tired Dozers	2	6	247	0.4
Wellhead Treatment – Grading	Graders	2	6	187	0.41
	Tractors/Loaders/Backhoes	4	6	97	0.37
Wellhead Treatment – Construction	Cranes	2	4	231	0.29
	Forklifts	2	6	89	0.2
	Generator Sets	2	4	84	0.74
	Tractors/Loaders/Backhoes	4	6	97	0.37
	Welders	2	4	46	0.45
Wellhead Treatment – Paving	Pavers	2	6	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38

2.1.7 Construction Schedule

Construction is expected to begin in 2025 and extend to the opening of the AWPF in 2028. Construction would be limited to daytime, with the exception of well drilling for injection and extraction wells, which would last up to 20 days per well at 24 hours per day to prevent bore hole collapse. Trenchless drilling methods (HDD and jack-and-bore) would also require round-the-clock construction to prevent borehole collapse. Construction of the wells and pipelines would occur over three years from 2025-2027; construction of the turnouts would occur over two years from 2026-2027; construction of the wellhead treatment, AWPF and the pump stations would occur over one year, 2027; and the storage reservoir would be constructed at the end of 2027.

2.1.8 Construction Best Management Practices

The Proposed Project would comply with applicable State regulations including:

- All portable diesel-powered construction equipment shall be registered with the state's portable equipment registration program or shall obtain a South Coast Air Quality Management District (SCAQMD) permit.
- Fleet owners of mobile construction equipment are subject to the California Air Resource Board (CARB) Regulation for In-Use Off-Road Diesel Vehicles (Title 13, California Code of Regulations (CCR), §2449), the purpose of which is to reduce oxides of nitrogen (NO_x), diesel particulate matter (DPM), and other criteria pollutant emissions from in-use off-road diesel-fueled vehicles. Off-road heavy-duty trucks shall comply with the State Off-Road Regulation.
- Fleet owners of mobile construction equipment are subject to the CARB Regulation for In-Use (On-Road) Heavy-Duty Diesel-Fueled Vehicles (Title 13, CCR, §2025), the purpose of which is to reduce DPM, NO_x and other criteria pollutants from in-use (on-road) diesel-fueled vehicles. On-road heavy-duty trucks shall comply with the State On-Road Regulation.
- All commercial off-road and on-road diesel vehicles are subject, respectively, to Title 13, CCR, §2449(d)(3) and §2485, limiting engine idling time. Idling of heavy-duty diesel construction equipment and trucks during loading and unloading shall be limited to five minutes; electric auxiliary power units should be used whenever possible.

The Project would be subject to SCAQMD Rule 403, Fugitive Dust. Rule 403 requires the implementation of best available dust control measures during activities capable of generating fugitive dust. Rule 403 includes requirements such as:

- No person shall cause or allow the emissions of fugitive dust from any…disturbed surface area such that the dust remains visible in the atmosphere beyond the property line of the emission source.
- No person shall allow track-out to extend 25 feet or more in cumulative length from the point of origin from an active operation. Notwithstanding the preceding, all track-out from an active operation shall be removed at the conclusion of each workday or evening shift.
- No person shall conduct an active operation with a disturbed surface area of five or more acres, or with a daily import or export of 100 cubic yards or more of bulk material without utilizing at least one of the following measures: Install a pad consisting of washed gravel (minimum-size: one inch) maintained in a clean condition to a depth of at least six inches and extending at least 30 feet wide and at least 50 feet long; Pave the surface extending at least 100 feet and at least 20 feet wide; Utilize a wheel shaker/wheel spreading device consisting of raised dividers (rails, pipe, or grates) at least 24 feet long and 10 feet wide to remove bulk material from tires and vehicle undercarriages before vehicles exit the site; install and utilize a wheel washing system to remove bulk material from tires and vehicle undercarriages before vehicles exit the site.

- No person shall conduct active operations without utilizing the applicable best available control measures included in Table 1 of Rule 403 to minimize fugitive dust emissions from each fugitive dust source type. Table 1 lists around 50 dust control measures for 20 different source categories and can be found at: https://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-403.pdf?sfvrsn=4.

2.2 Operation

Operations and maintenance (O&M) for each of the Proposed Project's key facilities is briefly described below.

Wells: The injection wells would recharge up to 15,000 AFY per year, while the new extraction wells would pump up to 50,000 AFY of water from the Basin in call years, or 10,000 AFY in non-call years (only 7.5 call years are anticipated over a 25-year period). After the 25-year period in which the CBP would be active, IEUA member agencies could utilize the water purified at the AWPF in the amount of 15,000 AFY. The 16 injection wells would have a maximum operational capacity of 830 gpm each. The 17 extraction wells would have a maximum operational capacity of 2,000 gpm each. All energy demands would be met by electricity supplied by Southern California Edison. The four monitoring wells would be visited by a field technician on a monthly to quarterly frequency. There would be negligible energy consumption in obtaining groundwater levels from the monitoring wells. Ongoing operation and maintenance of the wells may involve periodic backwash and inspection.

AWPF: The AWPF would include various processes and facilities, including an MF System, RO System, Equalization Tank, UV-AOP System, Chemical Facilities, Post Treatment, and CIP Systems. It is assumed that the AWPF would involve daily inspections and maintenance of treatment processes, daily backflush and maintenance cleans, more rigorous weekly to monthly cleans, and weekly deliveries of chemicals and supplies to the AWPF. The Reverse Osmosis (RO) system would require chemical cleaning and inspection monthly and membranes would be replaced every five years. All energy demands would be met by electricity supplied by Southern California Edison or from onsite sources at the RP-4; the Proposed Project would not consume natural gas.

Other Well Treatment Facilities: The CBP may install up to three wellhead treatment facilities at locations that have yet to be selected but would be sited at existing member agency offline wells. These wellhead treatment systems would be capable of treating up to 3,000 AFY per wellhead treatment system. Each of the three wellhead treatment systems would be connected to three existing member agency wells (total of nine existing extraction wells used for the CBP). The Wellhead treatment facilities would require routine inspection and maintenance of the treatment processes. Wellhead treatment would also include the following brine conveyance and disposal:

- Disposal Capacity: 4,900 gpd per wellhead treatment system
- Pipeline Length: up to 6,800 LF (8-inch)
- Disposal System: Assumed utilization of IEBL

Brine Disposal: The additional brine stream flow from the AWPF at RP-4 would be 1,027,300 gpd. The brine stream flow from the AWPF would ultimately need to be treated by the Los Angeles County Sanitation District (LACSD) through the Joint Outfall System (JOS) or by the Orange County Sanitation District (OCSD).

Pipelines and Turnouts: Once a pipeline or turnout is installed, operations would not require any operations and maintenance visits unless unforeseen circumstances arise that would require maintenance or repair of the pipelines. In the event of routine maintenance, one vehicle trip per maintenance event would be required.

Pump Stations: A total of four pump stations will be installed. It is assumed that the three TAKE Pump stations would range between 650 HP to 9,300 HP, with the booster pumps averaging 4,200 HP each. The PUT pump station would operate at 1,500 HP. All energy demands would be met by electricity supplied by Southern California Edison. The pump stations would require routine inspection and maintenance.

Water Storage Tank: Once the reservoirs are installed, operation of the reservoir would not require any shifts or employees as it would be monitored and controlled remotely. Scheduled maintenance visits would occur in the future with one trip per maintenance event. Reservoirs typically do not directly consume energy as water or recycled water is pumped into reservoirs directly from wells or through booster pump stations.

Renewable Energy: In-conduit hydropower facilities may be considered in locations of the potable water distribution system where the system pressure needs to be reduced and energy can be produced. Current renewable on-site generation at RP-4, which shares the same SCE meter with the Inland Empire Regional Composting Facility (IERCF), is about 20%. In addition to the 1 MW wind turbine and 1.5 MW battery at RP-4, additionally, there is a potential for use of a 2.5 MW solar at the IERCF. As the Proposed Project has not undergone site specific design, at this time, alternative energy options would be explored when design has been further specified.

According to the IEUA Facilities Management Plan, over the course of the next 15 years, IEUA intends to procure 100 percent of its electricity needs from carbon neutral sources, so in that period of time, IEUA will slowly begin to use less carbon sourced energy for greater operational demands. Additionally, the Proposed Project would create a source of local water supply within the Chino Basin, which would offset the energy required to transfer water from MWD from the Sacramento-San Joaquin Delta to IEUA's service area.

3. ENVIRONMENTAL SETTING

3.1 South Coast Air Basin

The environmental setting provides a baseline against which to measure a Project's impact. The Project site is located in the South Coast Air Basin (SCAB) within the jurisdiction of SCAQMD. The SCAQMD was created by the 1977 Lewis-Presley Air Quality Management Act, which merged four county air pollution control bodies into one regional district. Under the Act, the SCAQMD is responsible for bringing air quality in areas under its jurisdiction into conformity with federal and state air quality standards. The SCAB is a 6,745-square mile subregion of the SCAQMD, which includes portions of Los Angeles, Riverside, and San Bernardino Counties, and all of Orange County. The SCAB is bounded by the Pacific Ocean to the west and the San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east.

3.2 Regional Climate and Wind Patterns

The regional climate has a substantial influence on air quality in the SCAB. In addition, the temperature, wind, humidity, precipitation, and amount of sunshine influence the air quality. The annual average temperatures vary throughout the SCAB, ranging from the low 60s to the high 80s. The eastern portion of the SCAB shows greater variability in average annual minimum and maximum temperatures. January is the coldest month throughout the SCAB, with average minimum temperatures of 47°F in downtown Los Angeles and 36°F in San Bernardino. All portions of the SCAB have recorded maximum temperatures above 100°F.

Although the climate of the SCAB can be characterized as semi-arid, the air near the land surface is quite moist on most days because of the presence of a marine layer. This shallow layer of sea air is an important modifier of SCAB climate. Humidity restricts visibility in the SCAB, and the conversion of sulfur dioxide (SO_2) to sulfates (SO_4) is heightened in air with high relative humidity. The marine layer provides an environment for that conversion process, especially during the spring and summer months. The annual average relative humidity within the SCAB is 71 percent along the coast and 59 percent inland. Since the ocean effect is dominant, periods of heavy early morning fog are frequent and low stratus clouds are a characteristic feature. These effects decrease with distance from the coast.

More than 90 percent of the SCAB's rainfall occurs from November through April. The annual average rainfall varies from approximately nine inches in Riverside to 14- inches in downtown Los Angeles. Monthly and yearly rainfall totals are extremely variable. Summer rainfall usually consists of widely scattered thunderstorms near the coast and slightly heavier shower activity in the eastern portion of the SCAB with frequency being higher near the coast.

Due to its generally clear weather, about three-quarters of available sunshine is received in the SCAB. The remaining one-quarter is absorbed by clouds. The ultraviolet portion of this abundant radiation is a key factor in photochemical reactions. On the shortest day of the year there are approximately 10 hours of possible sunshine, and on the longest day of the year there are approximately 14.5 hours of possible sunshine.

During the late autumn to early spring rainy season, the SCAB is subjected to wind flows associated with the traveling storms moving through the region from the northwest. This period also brings five to ten periods of strong, dry offshore winds, locally termed "Santa Anas" each year. During the dry season, which coincides with the months of maximum photochemical smog concentrations, the wind flow is bimodal, typified by a daytime onshore sea breeze and a nighttime offshore drainage wind. Summer wind flows are created by the pressure differences between the relatively cold ocean and the unevenly heated and cooled land surfaces that modify the general northwesterly wind circulation over southern California. Nighttime drainage begins with the radiational cooling of the mountain slopes. Heavy, cool air descends the slopes and flows through the mountain passes and canyons as it follows the lowering terrain toward the ocean. Another characteristic wind regime in the SCAB is the "Catalina Eddy," a low level cyclonic (counterclockwise) flow centered over Santa Catalina Island which results in an offshore flow to the southwest. On most spring and summer days, some indication of an eddy is apparent in coastal sections.

In the SCAB, there are two distinct temperature inversion structures that control vertical mixing of air pollution. During the summer, warm high-pressure descending (subsiding) air is undercut by a shallow layer of cool marine air. The boundary between these two layers of air is a persistent marine subsidence/inversion. This boundary prevents vertical mixing which effectively acts as an impervious lid to pollutants over the entire SCAB. The mixing height for the inversion structure is normally situated 1,000 to 1,500 feet above mean sea level.

A second inversion-type forms in conjunction with the drainage of cool air off the surrounding mountains at night followed by the seaward drift of this pool of cool air. The top of this layer forms a sharp boundary with the warmer air aloft and creates nocturnal radiation inversions. These inversions occur primarily in the winter, when nights are longer and onshore flow is weakest. They are typically only a few hundred feet above mean sea level. These inversions effectively trap pollutants, such as nitrogen oxides (NO_X) and carbon monoxide (CO) from vehicles, as the pool of cool air drifts seaward. Winter is therefore a period of high levels of primary pollutants along the coastline.

The distinctive climate of the SCAB is determined by its terrain and geographical location. The SCAB is located in a coastal plain with connecting broad valleys and low hills, bounded by the Pacific Ocean in the southwest quadrant with high mountains forming the remainder of the perimeter.

Wind patterns across the south coastal region are characterized by westerly and southwesterly onshore winds during the day and easterly or northeasterly breezes at night. Winds are characteristically light although the speed is somewhat greater during the dry summer months than during the rainy winter season.

3.3 Current Air Pollution and Criteria Pollutant Conditions

Air quality is determined by measuring ambient concentrations of air pollutants, which are known to have adverse health effects. For regulatory purposes, criteria have been set for some of these air pollutants, and they are referred to as "criteria pollutants." The six criteria pollutants for which the US Environmental Protection Agency (EPA) has set standards are: particulate matter, ozone, nitrogen oxides, sulfur oxides, carbon monoxide, and lead. CARB has set standards for the same six pollutants, as well as for four additional pollutants - hydrogen sulfide, sulfate, vinyl chloride, and visibility reducing particles - and for about 200 toxic air contaminants. For most criteria pollutants, regulations and standards have been in effect, in varying degrees, for more than 25 years, and control strategies are designed to ensure that the ambient concentrations do no exceed certain thresholds.

Another class of air pollutants that is subject to regulatory requirements is hazardous air pollutants (HAPs) or air toxics. Substances that are especially harmful to health, such as those considered under the EPA hazardous air pollutant program or California's AB 1807 and/or AB 2588 air toxics programs, are considered to be air toxics. There are 186 federal hazardous air pollutants. Toxic air contaminants (TACs) are air pollutants that may cause acute (immediate) or chronic (cumulative) adverse health effects, such as cancer or reproductive harm. Many companies have reduced their toxic air emissions, either voluntarily or as a result of the implementation of the Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588), or the air toxics control measures (ATCMs) developed and implemented by the CARB. The Clean Communities Plan was designed to examine the overall direction of the SCAQMD's air toxics control program. It includes control strategies aimed to reduce toxic emissions and risk from both mobile and stationary sources. Regulatory air quality standards are based on scientific and medical research and these standards establish minimum concentrations of an air pollutant in the ambient air that could initiate adverse health effects. For air toxics emissions, however, the regulatory process usually assesses the potential impacts to public health in terms of "risk," such as the Air Toxics "Hot Spots" Program, or the emissions may be controlled by prescribed technologies, as in the Federal Clean Air Act approach for controlling hazardous air pollutants.

The degree of air quality degradation for criteria pollutants is determined by comparing the ambient pollutant concentrations to health-based standards developed by government agencies. Criteria pollutants, their typical sources, and relevant health effects are summarized in Table 4.

Table 4: Criteria and Common Air Pollutant Effects and Sources

Criteria Pollutant	Description	Sources	Health Effects
CO	CO is a colorless, odorless gas produced by the incomplete combustion of carbon-containing fuels, such as gasoline or wood. CO concentrations tend to be the highest during the winter morning, when little to no wind and surface-based inversions trap the pollutant at ground levels. Because CO is emitted directly from internal combustion engines, unlike ozone (O_3), motor vehicles operating at slow speeds are the primary source of CO in the SCAB. The highest ambient CO concentrations are generally found near congested transportation corridors and intersections.	Any source that burns fuel such as automobiles, trucks, heavy construction equipment, farming equipment and residential heating.	Individuals with a deficient blood supply to the heart are the most susceptible to the adverse effects of CO exposure. The effects observed include earlier onset of chest pain with exercise, and electrocardiograph changes indicative of decreased oxygen (O_2) supply to the heart. Inhaled CO has no direct toxic effect on the lungs but exerts its effect on tissues by interfering with O_2 transport and competing with O_2 to combine with hemoglobin present in the blood to form carboxyhemoglobin (COHb). Hence, conditions with an increased demand for O_2 supply can be adversely affected by exposure to CO. Individuals most at risk include fetuses, patients with diseases involving heart and blood vessels, and patients with chronic hypoxemia (O_2 deficiency) as seen at high altitudes.

Criteria Pollutant	Description	Sources	Health Effects
SO_2	SO_2 is a colorless, extremely irritating gas or liquid. It enters the atmosphere as a pollutant mainly as a result of burning high sulfur-content fuel oils and coal and from chemical processes occurring at chemical plants and refineries. When SO_2 oxidizes in the atmosphere, it forms SO_4. Collectively, these pollutants are referred to as sulfur oxides (SO_X).	Coal or oil burning power plants and industries, refineries, diesel engines	A few minutes of exposure to low levels of SO_2 can result in airway constriction in some asthmatics, all of whom are sensitive to its effects. In asthmatics, increase in resistance to air flow, as well as reduction in breathing capacity leading to severe breathing difficulties, are observed after acute exposure to SO_2. In contrast, healthy individuals do not exhibit similar acute responses even after exposure to higher concentrations of SO_2. Animal studies suggest that despite SO_2 being a respiratory irritant, it does not cause substantial lung injury at ambient concentrations. However, very high levels of exposure can cause lung edema (fluid accumulation), lung tissue damage, and sloughing off of cells lining the respiratory tract. Some population-based studies indicate that the mortality and morbidity effects associated with fine particles show a similar association with ambient SO_2 levels. In these studies, efforts to separate the effects of SO_2 from those of fine particles have not been successful. It is not clear whether the two pollutants act synergistically, or one pollutant alone is the predominant factor.
NO_X	NO_X consist of nitric oxide (NO), nitrogen dioxide (NO_2) and nitrous oxide (N_2O) and are formed when nitrogen (N_2) combines with O_2. Their lifespan in the atmosphere ranges from one to seven days for NO and N_2O, to 170 years for nitrous oxide. NO_X is typically created during combustion processes and are major contributors to smog formation and acid deposition. NO_2 is a criteria air pollutant and may result in numerous adverse health effects; it absorbs blue light, resulting in a brownish-red cast to the atmosphere and reduced visibility. Of the seven types of nitrogen oxide compounds, NO_2 is the most abundant in the atmosphere. As ambient concentrations of NO_2 are related to traffic density, commuters in heavy traffic may be exposed to higher concentrations of	Any source that burns fuel such as automobiles, trucks, heavy construction equipment, farming equipment and residential heating.	Population-based studies suggest that an increase in acute respiratory illness, including infections and respiratory symptoms in children (not infants), is associated with long-term exposure to NO_2 at levels found in homes with gas stoves, which are higher than ambient levels found in Southern California. Increase in resistance to air flow and airway contraction is observed after short-term exposure to NO_2 in healthy subjects. Larger decreases in lung functions are observed in individuals with asthma or chronic obstructive pulmonary disease (e.g., chronic bronchitis, emphysema) than in healthy individuals, indicating a greater

Criteria Pollutant	Description	Sources	Health Effects
	NO_2 than those indicated by regional monitoring station.		susceptibility of these sub-groups. In animals, exposure to levels of NO_2 considerably higher than ambient concentrations result in increased susceptibility to infections, possibly due to the observed changes in cells involved in maintaining immune functions. The severity of lung tissue damage associated with high levels of O_3 exposure increases when animals are exposed to a combination of O_3 and NO_2.
O_3	O_3 is a highly reactive and unstable gas that is formed when VOCs and NO_X, both byproducts of internal combustion engine exhaust, undergo slow photochemical reactions in the presence of sunlight. O_3 concentrations are generally highest during the summer months when direct sunlight, light wind, and warm temperature conditions are favorable to the formation of this pollutant.	Formed when reactive organic gases (ROG) and NO_X react in the presence of sunlight. ROG sources include any source that burns fuels, (e.g., gasoline, natural gas, wood, oil) solvents, petroleum processing and storage and pesticides.	Individuals exercising outdoors, children, and people with preexisting lung disease, such as asthma and chronic pulmonary lung disease, are considered to be the most susceptible sub-groups for O_3 effects. Short-term exposure (lasting for a few hours) to O_3 at levels typically observed in Southern California can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. Elevated O_3 levels are associated with increased school absences. In recent years, a correlation between elevated ambient O_3 levels and increases in daily hospital admission rates, as well as mortality, has also been reported. An increased risk for asthma has been found in children who participate in multiple outdoor sports and live in communities with high O_3 levels. O_3 exposure under exercising conditions is known to increase the severity of the responses described above. Animal studies suggest that exposure to a combination of pollutants that includes O_3 may be more toxic than exposure to O_3 alone. Although lung volume and resistance changes observed after a single exposure diminish with repeated exposures, biochemical and cellular changes

Criteria Pollutant	Description	Sources	Health Effects
			appear to persist, which can lead to subsequent lung structural changes.
Particulate Matter	PM_{10}: A major air pollutant consisting of tiny solid or liquid particles of soot, dust, smoke, fumes, and aerosols. Particulate matter pollution is a major cause of reduce visibility (haze) which is caused by the scattering of light and consequently the significant reduction air clarity. The size of the particles (10 microns or smaller, about 0.0004 inches or less) allows them to easily enter the lungs where they may be deposited, resulting in adverse health effects. Additionally, it should be noted that PM_{10} is considered a criteria air pollutant. $PM_{2.5}$: A similar air pollutant to PM_{10} consisting of tiny solid or liquid particles which are 2.5 microns or smaller (which is often referred to as fine particles). These particles are formed in the atmosphere from primary gaseous emissions that include SO_4 formed from SO_2 release from power plants and industrial facilities and nitrates that are formed from NO_X release from power plants, automobiles and other types of combustion sources. The chemical composition of fine particles highly depends on location, time of year, and weather conditions. $PM_{2.5}$ is a criteria air pollutant.	Sources of PM_{10} include road dust, windblown dust and construction. Also formed from other pollutants (acid rain, NO_X, SO_X, organics). Incomplete combustion of any fuel. $PM_{2.5}$ comes from fuel combustion in motor vehicles, equipment and industrial sources, residential and agricultural burning. Also formed from reaction of other pollutants (acid rain, NO_X, SO_X, organics).	A consistent correlation between elevated ambient fine particulate matter (PM_{10} and $PM_{2.5}$) levels and an increase in mortality rates, respiratory infections, number and severity of asthma attacks and the number of hospital admissions has been observed in different parts of the United States and various areas around the world. In recent years, some studies have reported an association between long-term exposure to air pollution dominated by fine particles and increased mortality, reduction in lifespan, and an increased mortality from lung cancer. Daily fluctuations in $PM_{2.5}$ concentration levels have also been related to hospital admissions for acute respiratory conditions in children, to school and kindergarten absences, to a decrease in respiratory lung volumes in normal children, and to increased medication use in children and adults with asthma. Recent studies show lung function growth in children is reduced with long term exposure to particulate matter. The elderly, people with pre-existing respiratory or cardiovascular disease, and children appear to be more susceptible to the effects of high levels of PM_{10} and $PM_{2.5}$.
VOC	VOCs are hydrocarbon compounds (any compound containing various combinations of hydrogen and carbon atoms) that exist in the ambient air. VOCs contribute to the formation of smog through atmospheric photochemical reactions and/or may be toxic. Compounds of carbon (also known as organic compounds) have different levels of reactivity; that is, they do not react at the same speed or do not form O_3 to the same extent when exposed to photochemical processes.	Organic chemicals are widely used as ingredients in household products. Paints, varnishes and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic, degreasing and hobby products. Fuels are made up of organic chemicals. All of these products can release	Breathing VOCs can irritate the eyes, nose and throat, can cause difficulty breathing and nausea, and can damage the central nervous system as well as other organs. Some VOCs can cause cancer. Not all VOCs have all these health effects, though many have several.

Criteria Pollutant	Description	Sources	Health Effects
	VOCs often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints. Exceptions to the VOC designation include CO, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. VOCs are a criteria pollutant since they are a precursor to O_3, which is a criteria pollutant. The terms VOC and ROG (see below) interchangeably.	organic compounds while you are using them, and, to some degree, when they are stored.	
ROG	Similar to VOC, ROGs are also precursors in forming O_3 and consist of compounds containing methane, ethane, propane, butane, and longer chain hydrocarbons, which are typically the result of some type of combustion/decomposition process. Smog is formed when ROG and NO_X react in the presence of sunlight. ROGs are a criteria pollutant since they are a precursor to O_3, which is a criteria pollutant. The terms ROG and VOC (see previous) interchangeably.	Sources similar to VOCs.	Health effects similar to VOCs.
Lead (Pb)	Pb is a heavy metal that is highly persistent in the environment and is considered a criteria pollutant. In the past, the primary source of Pb in the air was emissions from vehicles burning leaded gasoline. The major sources of Pb emissions are ore and metals processing, particularly Pb smelters, and piston-engine aircraft operating on leaded aviation gasoline. Other stationary sources include waste incinerators, utilities, and lead-acid battery manufacturers. It should be noted that the Project does not include operational activities such as metal processing or Pb acid battery manufacturing. As such, the Project is not anticipated to generate a quantifiable amount of Pb emissions.	Metal smelters, resource recovery, leaded gasoline, deterioration of Pb paint.	Fetuses, infants, and children are more sensitive than others to the adverse effects of Pb exposure. Exposure to low levels of Pb can adversely affect the development and function of the central nervous system, leading to learning disorders, distractibility, inability to follow simple commands, and lower intelligence quotient. In adults, increased Pb levels are associated with increased blood pressure. Pb poisoning can cause anemia, lethargy, seizures, and death; although it appears that there are no direct effects of Pb on the respiratory system. Pb can be stored in the bone from early age environmental exposure, and elevated blood Pb levels can occur due to breakdown of bone tissue during pregnancy, hyperthyroidism (increased secretion of hormones from the thyroid gland) and osteoporosis (breakdown of bony tissue). Fetuses and breast-fed babies can be exposed to higher levels of Pb because of previous environmental Pb exposure of their mothers.

Criteria Pollutant	Description	Sources	Health Effects
Odor	Odor means the perception experienced by a person when one or more chemical substances in the air come into contact with the human olfactory nerve.	Odors can come from many sources including animals, human activities, industry, natures, and vehicles.	Offensive odors can potentially affect human health in several ways. First, odorant compounds can irritate the eye, nose, and throat, which can reduce respiratory volume. Second, studies have shown that the VOCs that cause odors can stimulate sensory nerves to cause neurochemical changes that might influence health, for instance, by compromising the immune system. Finally, unpleasant odors can trigger memories or attitudes linked to unpleasant odors, causing cognitive and emotional effects such as stress.

3.4 Existing Air Quality Standards

Existing air quality is measured at established SCAQMD air quality monitoring stations. Monitored air quality is evaluated in the context of ambient air quality standards. These standards are the levels of air quality that are considered safe, with an adequate margin of safety, to protect the public health and welfare. National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) currently in effect for the SCAB are shown in Table 5.

The determination of whether a region's air quality is healthful or unhealthful is determined by comparing contaminant levels in ambient air samples to the state and federal standards

The air quality in a region is considered to be in attainment if the measured ambient air pollutant levels for O_3, CO, SO_2 (1 and 24 hour), NO_2, PM_{10}, and $PM_{2.5}$ are not to be exceeded. All other pollutants are not to be equaled or exceeded to be in attainment. Attainment status for a pollutant means that the SCAQMD meets the standards set by the EPA or the California EPA (CalEPA). Conversely, nonattainment means that an area has monitored air quality that does not meet the NAAQS or CAAQS standards. In order to improve air quality in nonattainment areas, a State Implementation Plan (SIP) is drafted by CARB. The SIP outlines the measures that the state will take to improve air quality. Once nonattainment areas meet the standards and additional redesignation requirements, the EPA will designate the area as a maintenance area.

Table 5: Ambient Air Quality Standards

Pollutant	Average Time	California Standards	National Standards
		Concentration	Concentration
Ozone (O_3)	1 Hour	0.09 ppm	--
	8 Hour	0.070 ppm	0.070 ppm
Respirable Particulate Matter (PM_{10})[9]	24 Hour	50 µg/m^3	150 µg/m^3
	Annual	20 µg/m^3	
Fine Particulate Matter ($PM_{2.5}$)[9]	24 Hour	–	35 µg/m^3
	Annual	12 µg/m^3	12.0 µg/m^3
Carbon Monoxide (CO)	1 Hour	20 ppm	35 ppm
	8 Hour	9 ppm	9 ppm
Nitrogen Dioxide (NO_2)	1 Hour	0.18 ppm	0.010 ppm
	Annual	0.030 ppm	0.053 ppm
Sulfur Dioxide (SO_2)	1 Hour	0.25 ppm	75 ppb
	24 Hour	0.04 ppm	0.14 ppm
	Annual Arithmetic Mean	–	0.030 ppm
Lead (Pb)	30-Day Average	1.5 µg/m^3	–
	Calendar Quarter	–	–
	Rolling 3-Month Avg	–	0.15 µg/m^3
Sulfates	24 Hour	25 µg/m^3	No Federal Standards
Hydrogen Sulfide (H_2S)	1 Hour	0.03 ppm	

Source: SCAQMD 2017.

3.4.1 Regional Air Quality

Air pollution contributes to a wide variety of adverse health effects. The EPA has established NAAQS for six of the most common air pollutants: CO, Pb, O_3, particulate matter (PM_{10} and $PM_{2.5}$), NO_2, and SO_2 which are known as criteria pollutants. The SCAQMD monitors levels of various criteria pollutants at 37 permanent monitoring stations and 5 single-pollutant source Pb air monitoring sites throughout the air district. On February 21, 2019, CARB posted the 2018 amendments to the state and national area designations. Table 6 attainment designations of the SCAB.

Table 6: Attainment Status of Criteria Pollutants in the SCAB

Criteria Pollutant	State Designation	Federal Designation
O_3 – 1-hour standard	Nonattainment	Nonattainment (Extreme)
O_3 – 8-hour standard	Nonattainment	Nonattainment (Extreme)
PM_{10}	Nonattainment	Attainment (Maintenance)
$PM_{2.5}$	Nonattainment	Nonattainment (Serious)
CO	Attainment	Attainment (Maintenance)
NO_2	Attainment	Attainment (Maintenance)
SO_2	Attainment	Designations Pending (expect Unclassifiable/Attainment)
Pb	Attainment	Nonattainment (Partial) (Attainment determination to be requested)
Hydrogen Sulfide (H_2S)	Attainment	--
Sulfates	Attainment	--

Note: The national 1-hour O_3 standard was revoked effective June 15, 2005; however, the Basin has not attained this standard based on 2008-2010 data and is still subject to anti-backsliding requirements

3.4.2 Local Air Quality

Ambient air quality monitoring for criteria pollutants is conducted at numerous sites throughout the state. The most recent three years of high or average concentration data available for criteria pollutants within the SCAB monitoring station network are shown in Table 7. Data for O_3, CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ for 2018 through 2020 were obtained from the SCAQMD Air Quality Data Tables or California Air Resources Board iAdam Air Quality Statistics.

As summarized in the table, O_3, PM_{10}, and $PM_{2.5}$ levels frequently exceed standards. At monitoring stations within Northwestern San Bernardino and Northwestern Riverside County between 2018 and 2020, O_3 exceedances of the Federal standard ranged from 52 days at Source Receptor Area (SRA) 32 in Northwest San Bernadino Valley to 128 days at SRA 34 in Central San Bernadino Valley, exceedances of the State 1-hour standard ranged from 21 days (at SRA 23 in Metropolitan Riverside County) to 89 days (at SRA 34 in Central San Bernadino Valley), and exceedances of the State 8-hour standard ranged from 52 days (at SRA 32 in Northwest San Bernadino Valley) to 128 days (at SRA 34 in Central San Bernadino Valley). For the same area, PM_{10} had no exceedances of the Federal 24-hour or annual average standards, but the larger South Coast Air Basin had 1 to 2 days of exceedance of the 24-hour standard per year in the three-year period and the annual average for the basin exceeded the Federal annual average standard. The State 24-hour PM_{10} standard ranged from 3 days of exceedance or 5% of samples (at SRAs 24 in Corona/Norco Area and Perris Valley) to 130 days of exceedance or 36% of samples (at SRA 23 in Metropolitan Riverside County) in the three-year period and the State annual average was exceeded at least once at all monitoring stations. The Federal $PM_{2.5}$ 24-hour standard was exceeded The Federal 24-hour $PM_{2.5}$ standard ranged from 2 days or 0.6% of samples (at SRA 23 in Metropolitan Riverside County and SRA 34 in Ventral San Bernadino Valley) exceeding the standard to 9 days or 2.5% of samples (also at SRA 23 in Metropolitan Riverside County) exceeding the standard and both the State and Federal annual standards were exceeded at 3 of the 5 monitoring stations in both sites that took $PM_{2.5}$ measurements. The State Annual standard for NO_2 was also exceeded in 2018 and 2019 within the SCAB but was not exceeded within the SRA areas of the two counties except for in 2018 at SRA 33 at CA-60 with a value of 0.0304 ppm.[1]

[1] SRA and exceedance data obtained from SCAQMD Air Quality Data Tables for 2018-2020.

Table 7: Project Area Air Quality Monitoring Summary 2018-2020

Pollutant	Standard		2018 Max Monitored Value	2018 # Days Exceeded	2019 Maximum Monitored Value	2019 # Days Exceeded	2020 Maximum Monitored Value	2020 # Days Exceeded
Ozone (O_3)	State 1-hour	>0.090 ppm	0.142 ppm	84	0.137 ppm	82	0.185 ppm	133
	State 8-hour	>0.070 ppm	0.125 ppm	141	0.117 ppm	129	0.139 ppm	160
	Federal 8-hour	>0.070 ppm	0.125 ppm	141	0.118 ppm	126	0.140 ppm	157
Respirable Particulate Matter (PM_{10})	State 24-hour	>50 µg/m^3	126.0 µg/m^3	127	34.8 µg/m^3	110	35.8 µg/m^3	115
	State Annual	>20 µg/m^3	44.6 µg/m^3	Exceeded	40.9 µg/m^3	Exceeded	33.9 µg/m^3	Exceeded
	Federal 24-hour	>150 µg/m^3	230.2 µg/m^3	1	283.5 µg/m^3	2	324.7 µg/m^3	2
	Federal Annual*	>150 µg/m^3	53.5 µg/m^3	Exceeded	47.5 µg/m^3	Not Exceeded	55.5 µg/m^3	Exceeded
Fine Particulate Matter ($PM_{2.5}$)	State Annual	>12 µg/m^3	16.0 µg/m^3	16	15.5 µg/m^3	15.5	16.5 µg/m^3	16.5
	Federal 24-hour	>35 µg/m^3	103.8 µg/m^3	17	81.3 µg/m^3	12	175.0 µg/m^3	28
	Federal Annual	>12 µg/m^3	14.5 µg/m^3	Exceeded	12.8 µg/m^3	Exceeded	15.1 µg/m^3	Exceeded
Carbon Monoxide (CO)	State 1-hour	>20 ppm	1.9 ppm	0	2.7 ppm	0	1.72 ppm	0
	Federal 1-hour	>35 ppm		0		0		0
	State 8-Hour	>9 ppm	1.3 ppm	0	1.1 ppm	0	1.4 ppm	0
	Federal 8-Hour	>9 ppm		0		0		0
Nitrogen Dioxide (NO_2)	State 1-hour	>0.180 ppm	0.100 ppm	0	0.100 ppm	0	0.100 ppm	0
	State Annual	>0.030 ppm	0.032 ppm	Exceeded	0.032 ppm	Exceeded	0.030 ppm	Not Exceeded
	Federal 1-hour	>0.100 ppm	0.079 ppm	0	0.080 ppm	0	0.081 ppm	1
	Federal Annual	>0.053 ppm	0.030 ppm	Not Exceeded	0.029 ppm	Not Exceeded	0.029 ppm	Not Exceeded
Sulfur Dioxide (SO_2)	State 1-hour	>0.25 ppm	0.029 ppm	0	0.024 ppm	0	0.025 ppm	0
	Federal 1-hour	>0.075 ppm		0		0		0
Sulfates	24-Hour Max	>25 µg/m^3	3.9 µg/m^3	0	5.2 µg/m^3	0	3.0 µg/m^3	0

Sources: Data for 8-hour and 1-hour O_3, PM_{10}, $PM_{2.5}$, and NO_2 based on CARB iAdam: Air Quality Statistics for the SCAB; data for Sulfates, SO_2, and CO based on data from SCAQMD Air Quality Data Tables. No monitoring data for lead or hydrogen sulfide available for the project area on iAdam or in the SCAQMD Air Quality Data Tables.
Notes: *Revoked; Bolded values exceeded the NAAQS or CAAQS standard.

3.5 Regulatory Setting

This section discusses applicable federal, state, regional, and local rules and regulations, including emission standards and ambient air quality standards.

3.5.1 Federal Regulations

The EPA is responsible for setting and enforcing the NAAQS for O_3, CO, NO_X, SO_2, PM_{10}, and Pb. The EPA has jurisdiction over emissions sources that are under the authority of the federal government including aircraft, locomotives, and emissions sources outside state waters (Outer Continental Shelf). The EPA also establishes emission standards for vehicles sold in states other than California. Automobiles sold in California must meet the stricter emission requirements of the CARB.

The Federal Clean Air Act (CAA) was first enacted in 1955 and has been amended numerous times in subsequent years (1963, 1965, 1967, 1970, 1977, and 1990). The CAA establishes the federal air quality standards, the NAAQS, and specifies future dates for achieving compliance. The CAA also mandates that states submit and implement SIPs for local areas not meeting these standards. These plans must include pollution control measures that demonstrate how the standards will be met.

The 1990 amendments to the CAA that identify specific emission reduction goals for areas not meeting the NAAQS require a demonstration of reasonable further progress toward attainment and incorporate additional sanctions for failure to attain or to meet interim milestones. The sections of the CAA most directly applicable to the development of the Project site include Title I (Non-Attainment Provisions) and Title II (Mobile Source Provisions). Title I provisions were established with the goal of attaining the NAAQS for the following criteria pollutants $O_{3,}$ NO_2, SO_2, PM_{10}, CO, $PM_{2.5}$, and Pb. The NAAQS were amended in July 1997 to include an additional standard for O_3 and to adopt a NAAQS for $PM_{2.5}$. Table 5 (previously presented) provides the NAAQS within the SCAB.

Mobile source emissions are regulated in accordance with Title II provisions. These provisions require the use of cleaner burning gasoline and other cleaner burning fuels such as methanol and natural gas. Automobile manufacturers are also required to reduce tailpipe emissions of hydrocarbons and NO_X. NO_X is a collective term that includes all forms of NO_X which are emitted as byproducts of the combustion process.

3.5.2 California Regulations

3.5.2.1 CARB

The CARB, which became part of the CalEPA in 1991, is responsible for ensuring implementation of the California Clean Air Act (AB 2595), responding to the federal CAA, and for regulating emissions from consumer products and motor vehicles. AB 2595 mandates achievement of the maximum degree of emissions reductions possible from vehicular and other mobile sources in order to attain the CAAQS by the earliest practical date. The CARB established the CAAQS for all pollutants for which the federal government has NAAQS and, in addition, establishes standards for SO4, visibility, hydrogen sulfide (H_2S), and vinyl chloride (C_2H_3Cl). However, at this time, H_2S and C_2H_3Cl are not measured at any monitoring stations in the SCAB because they are not considered to be a regional air quality problem. Generally, the CAAQS are more stringent than the NAAQS.

Local air quality management districts, such as the SCAQMD, regulate air emissions from stationary sources such as commercial and industrial facilities. All air pollution control districts have been formally designated as attainment or non-attainment for each CAAQS. Serious non-attainment areas are required to prepare an Air Quality Management Plan (AQMP) that includes specified emission reduction strategies in an effort to meet clean air goals. The latest SCAQMD AQMP was adopted in March 2017. AQMPs are required to include:

- Application of Best Available Retrofit Control Technology to existing sources;
- Developing control programs for area sources (e.g., architectural coatings and solvents) and indirect sources (e.g. motor vehicle use generated by residential and commercial development);
- A District permitting system designed to allow no net increase in emissions from any new or modified permitted sources of emissions;
- Implementing reasonably available transportation control measures and assuring a substantial reduction in growth rate of vehicle trips and miles traveled;
- Significant use of low emissions vehicles by fleet operators; and
- Sufficient control strategies to achieve a 5 percent or more annual reduction in emissions or 15 percent or more in a period of three years for ROGs, NO_X, CO and PM_{10}. However, air basins may use an alternative emission reduction strategy that achieves a reduction of less than 5 percent per year under certain circumstances.

3.5.2.2 In-Use Off-Road Diesel Vehicle Regulation

In 2007, CARB adopted a regulation to reduce diesel particulate matter and NOx emissions from in-use (existing) off-road heavy-duty diesel vehicles in California. The regulation imposes limits on unnecessary vehicle idling to five minutes and requires fleets to reduce emissions by retiring, replacing, repowering, or installing exhaust retrofits to older engines. The restrictions on adding older vehicles into fleets vary by fleet size. Heavy-duty diesel vehicle fleets may not add a vehicle with a Tier 0 or Tier 1 engine. For large and medium fleets, and in January 2023 for small fleets, a fleet may not add a vehicle with a Tier 2 engine, rather the engine must be Tier 3 or higher. By 2029, all fleets' vehicles must have Tier 2 or higher engines. This regulation would apply to vehicles used in construction of the Proposed Project.

3.5.2.3 Truck and Bus Regulation

On December 12, 2008, CARB approved a new regulation to substantially reduce emissions of diesel particulate matter, NOx, and other pollutants from existing on-road diesel vehicles operating in California. The regulation requires affected trucks and buses to meet performance standards and requirements between 2011 and 2023. By January 1, 2023, nearly all trucks and buses will be required to have 2010 or newer model year engines. Affected vehicles included on-road, heavy-duty, diesel-fueled vehicles with a gross vehicle weight rating greater than 14,000 pounds. The regulation was updated in 2011, with revisions that provide more compliance flexibility and reflect the impact of the economic recession on vehicle activity and emissions. Heavy-duty trucks used in Proposed Project activities would have to comply with this regulation.

3.5.2.4 Commercial Vehicle Idling Regulation

The Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling was initially adopted by CARB in 2004 and subsequently amended in 2005, 2009, and 2013. requires that drivers of diesel-fueled commercial motor vehicles with gross vehicle weight ratings greater than 10,000 pounds, including buses and sleeper berth equipped trucks, not idle the vehicle's primary diesel engine longer than five minutes at any location. There are exceptions if a truck engine meets the optional low-NO_x idling emission standard, and the truck is located more than 100 feet from any restricted area (clean idle label required), which include: housing units, schools, hotels, motels, hospitals, senior care facilities, or childcare facilities. Trucks used for vendor delivery and material hauling for Proposed Project activities would be required to comply with the commercial vehicle idling regulatory requirements.

3.5.2.5 Heavy-Duty On-Board Diagnostic System Regulations

In 2016, CARB approved the latest version of the Heavy-Duty On-Board Diagnostic systems regulations to reduce emissions by establishing standards and other requirements for onboard diagnostic systems that are installed on 2010 and subsequent model-year engines. The systems, through the use of an onboard computer, monitor emission systems in-use for the actual life of the engine and must be capable of detecting malfunctions of the monitored emission systems, illuminating a malfunction indicator light to notify the vehicle operator of detected malfunctions, and storing fault codes identifying the detected malfunctions. The use and operation of On-Board Diagnostic systems reduces in-use motor vehicle and motor vehicle engine emissions through improvements of emission system durability and performance. Heavy-duty trucks used for Proposed Project activities would be required to comply with the On-Board Diagnostic systems regulatory requirements.

3.5.2.6 Heavy-Duty Diesel Vehicle Enforcement

The CARB's Heavy-Duty Vehicle Inspection Program requires heavy-duty trucks and buses to be inspected for excessive smoke and tampering, and engine certification label compliance. Any heavy-duty vehicle (i.e., vehicles with a gross vehicle weight rating greater than 6,000 pounds) traveling in California, including vehicles registered in other states and foreign countries, may be tested. Tests are performed by CARB inspection teams at border crossings, California Highway Patrol weigh stations, fleet facilities, and randomly selected roadside locations. The related Periodic Smoke Inspection Program requires that diesel fleet owners conduct annual smoke opacity inspections of their vehicles and repair those with excessive smoke emissions to ensure compliance. CARB randomly audits fleets, maintenance and inspection records and tests a representative sample of vehicles. All vehicles that do not pass the test must be repaired and retested. In July 2018, CARB approved amendments to the regulations, which require heavy-duty vehicles to meet a more stringent opacity limit of 5 percent opacity for most vehicles. The new opacity limit went into effect July 1, 2019. In addition, each vehicle operating in California - including those in transit from Mexico, Canada, or any other state - must be equipped with engines that meet California and/or EPA or equivalent emission standards and must maintain an Emission Control Label. Heavy-duty trucks used for Proposed Project activities would be subject to these inspection programs.

3.5.2.7 California Diesel Fuel Program

The California diesel fuel program set stringent standards for California diesel that produced cost-effective emission reductions from diesel-powered vehicles. The diesel fuel program set specifications for aromatic hydrocarbons and sulfur and also established a lubricity standard.

3.5.2.8 Portable Engine Airborne Toxic Control Measure

The California Portable Engine Airborne Toxic Control Measure is designed to reduce the PM emissions from portable diesel-fueled engines rated at 50 brake horsepower or larger. Any electric or gas-powered backpack sprayer engines, or vehicle-mounted pump engines, such as dewatering pumps, that are smaller than 50 brake horsepower, would be exempt from this program. Portable diesel-fueled engines rated at 50 brake horsepower or larger are not expected to be used during Proposed Project activities.

3.5.2.9 Portable Equipment Registration Program

The statewide Portable Equipment Registration Program establishes a system to uniformly regulate portable engines and portable engine-driven equipment units. After being registered in this program, engines and equipment units may operate throughout the state without the need to obtain individual permits from air districts, although operation of registered portable engines still may be subject to certain district requirements for reporting and notification. Owners or operators of portable engines and certain types of equipment can voluntarily register their units under this program, while engines with less than 50 brake horsepower are exempt. Some of the construction equipment engines used for the Proposed Project activities (i.e., those with less than 50 brake horsepower) would be exempt.

3.5.2.10 Title 24 Energy Efficiency Standards and California Green Building Standards

California Code of Regulations (CCR) Title 24 Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficient technologies and methods. CCR, Title 24, Part 11: California Green Building Standards Code (CALGreen) is a comprehensive and uniform regulatory code for all residential, commercial, and school buildings that went in effect on January 1, 2011, and is administered by the California Building Standards Commission. CALGreen is updated on a regular basis, with the most recent approved update consisting of the 2019 California Green Building Code Standards that will be effective January 1, 2020., The State Building Code provides the minimum standard that buildings must meet in order to be certified for occupancy; however, local jurisdictions are permitted to adopt more stringent requirements. Energy efficient buildings require less electricity; therefore, increased energy efficiency reduces fossil fuel consumption and decreases greenhouse gas (GHG) emissions. The 2019 version of Title 24 was adopted by the California Energy Commission (CEC) and became effective on January 1, 2020.

The 2019 Title 24 standards will result in less energy use, thereby reducing air pollutant emissions associated with energy consumption in the SCAB and across the State of California. For example, the 2019 Title 24 standards will update indoor and outdoor lighting requirements for nonresidential buildings. Nonresidential buildings (such as those of the Proposed Project) will use approximately 30 percent less energy due to lighting upgrade requirements. The January 1, 2019, the 2019 CALGreen standards are applicable to the Project and require, among other items:

- Designated parking. In new projects or additions to alterations that add 10 or more vehicular parking spaces, provide designated parking for any combination of low-emitting, fuel-efficient and carpool/van pool vehicles (5.106.5.2).
- Construction waste management. Recycle and/or salvage for reuse a minimum of 65% of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1. 5.405.1.2, or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent (5.408.1).
- Excavated soil and land clearing debris. 100% of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled. For a phased project, such material may be stockpiled on site until the storage site is developed (5.408.3).
- Recycling by Occupants. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste, and metals or meet a lawfully enacted local recycling ordinance, if more restrictive (5.410.1).
- Water conserving plumbing fixtures and fittings. Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following:
    - Water Closets. The effective flush volume of all water closets shall not exceed 1.28 gallons per flush (5.303.3.1)
    - Urinals. The effective flush volume of wall-mounted urinals shall not exceed 0.125 gallons per flush (5.303.3.2.1). The effective flush volume of floor-mounted or other urinals shall not exceed 0.5 gallons per flush (5.303.3.2.2).
    - Showerheads. Single showerheads shall have a minimum flow rate of not more than 1.8 gallons per minute and 80 psi (5.303.3.3.1). When a shower is served by more than one showerhead,

the combine flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.8 gallons per minute at 80 psi (5.303.3.3.2).

  - Faucets and fountains. Nonresidential lavatory faucets shall have a maximum flow rate of note more than 0.5 gallons per minute at 60 psi (5.303.3.4.1). Kitchen faucets shall have a maximum flow rate of not more than 1.8 gallons per minute of 60 psi (5.303.3.4.2). Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute (5.303.3.4.3). Metering faucets shall not deliver more than 0.20 gallons per cycle (5.303.3.4.4). Metering faucets for wash fountains shall have a maximum flow rate not more than 0.20 gallons per cycle (5.303.3.4.5).

- Outdoor portable water use in landscaped areas. Nonresidential developments shall comply with a local water efficient landscape ordinance or the current California Department of Water Resources' Model Water Efficient (MWELO), whichever is more stringent (5.304.1).

3.5.3 Local Regulations

3.5.3.1 SCAQMD Air Quality Management Plan

The SCAQMD's 2016 AQMP assesses the attainment status of the SCAB and provides a strategy for attainment of State and federal air quality standards. The AQMP strategies are developed based on population, housing, and employment growth forecasts anticipated under local city general plans and the Southern California Association of Governments' (SCAG) 2016 Regional Transportation Plan/Sustainable Communities Strategy (SCAG, 2016). A project would conflict with or obstruct an applicable air quality plan if it would lead to population, housing or employment growth that exceeds the forecasts used in the development of the applicable air quality plan.

3.5.3.2 SCAQMD Rule 402 Nuisance

This rule prohibits the discharge of air contaminants or other material which may cause, "injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public," or which may, "endanger the comfort, repose, health or safety of any such persons or the public," or which may, "cause, or have a natural tendency to cause, injury or damage to business or property."

3.5.3.3 SCAQMD Rule 203 Permit to Operate

This rule requires that a permit to operate be obtained before operation or use any equipment that may cause the issuance of air contaminants. It would apply to portable generators used during construction.

4. METHODOLOGY

Land uses such as the Project affect air quality through construction-source and operational-source emissions, and through direct and indirect emissions. For construction-source emissions, criteria air pollutants would result from onsite (i.e., off-road) sources, and off-site (i.e., mobile) sources. Air quality criteria pollutant emissions from construction of the Proposed Project were estimated using the California Emissions Estimator Model (CalEEMod) version 2020.4.0, consistent with guidance from SCAQMD (SCAQMD 2021).

In July 2021, the SCAQMD in conjunction with the California Air Pollution Control Officers Association (CAPCOA) and other California air districts, released the latest version of CalEEMod Version 2020.4.0. This model has been used to calculate construction-source criteria pollutants (VOCs, NO_X, SO_X, CO, PM_{10}, and $PM_{2.5}$) from onsite and offsite (i.e., mobile) sources; and quantify applicable air quality reductions achieved from compliance with existing regulations and adherence to mitigation measures. The latest version of CalEEMod, which incorporates the latest vehicle emissions standards, construction fleet mix standards, and other applicable regulations has been used to estimate construction air quality emissions. Output from the model is provided in Appendix A of this report.

Model inputs were developed based on information in the Project Description chapter of the PEIR, which are summarized in detail in Sections 2.1.1 through 2.1.6, and default values from the CalEEMod computer program. CalEEMod requires the selection of a land use type, but has limited choices for them (e.g., residential, commercial, industrial, educational, recreational, retail, and parking). The selection of "Industrial, Refrigerated Warehouse, No Rail" as a land use type for the AWPF, wells, pump stations, and wellhead treatment allows for project-specific entries for energy use, construction equipment and vehicle trips. The selection of "Parking, Other Asphalt Surfaces" for the pipelines and turnouts allows for project-specific entries on demolition, construction equipment and vehicle trips, and resurfacing and does not have model default operational energy usage or ongoing vehicle trips. The selection of "Industrial, Unrefrigerated Warehouse, No Rail" for the storage tank allows for project-specific entries for construction equipment and vehicle trips, site grading, and facilities construction, without model default operational energy usage or ongoing vehicle trips. As explained in Section 2.1.7, it was assumed that construction of the Project would commence in 2025 and proceed through the start of operations of the AWPF in 2028. In reality, construction of the Project components may be phased without overlap and this assumption, therefore, represents a conservative "worst case" scenario for maximum daily emissions. It was assumed that the Proposed Project would implement the construction best management practices noted in Section 2.1.8 that are required by state law, as well as the dust minimization measures required by SCAQMD Rule 403.

5. SIGNIFICANCE THRESHOLDS

The Project has been evaluated to determine if it will violate an air quality standard, contribute to an existing or projected air quality violation, or determine if it will result in a cumulatively considerable net increase of a criteria pollutant for which the SCAB is non-attainment under an applicable NAAQS and CAAQS. Additionally, the Project has been evaluated to determine consistency with the applicable AQMP, exposure of sensitive receptors to substantial pollutant concentrations, and the impacts of odors. The significance of these potential impacts is described in the following section.

The criteria used to determine the significance of potential Project-related air quality impacts are taken from the Initial Study Checklist in Appendix G of the State CEQA Guidelines (14 California Code of Regulations §§15000, et seq.). Based on these thresholds, a project would result in a significant impact related to air quality if it would:

a) Conflict with or obstruct implementation of the applicable air quality plan

b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard

c) Expose sensitive receptors to substantial pollutant concentrations

d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people

The SCAQMD has also developed regional significance thresholds for other regulated pollutants, as summarized in Table 8. These SCAQMD's CEQA Air Quality Significance Thresholds (April 2019) indicate that any projects in the SCAB with daily construction and/or operational emissions that exceed any of the indicated thresholds should be considered as having an individually and cumulatively significant air quality impact.

Table 8: Maximum Daily Regional Emissions Thresholds

Mass Daily Thresholds		
Pollutant	Construction Regional Thresholds	Operational Regional Thresholds
NO_X	100 lbs/day	55 lbs/day
VOC	75 lbs/day	55 lbs/day
PM_{10}	150 lbs/day	150 lbs/day
$PM_{2.5}$	55 lbs/day	55 lbs/day
SO_X	150 lbs/day	150 lbs/day
CO	550 lbs/day	550 lbs/day
Pb	3 lbs/day	3 lbs/day

lbs/day = Pounds Per Day

These SCAQMD thresholds of significance apply to all sources of air pollutants, including equipment and businesses not regulated by the SCAQMD and motor vehicles. SCAQMD's thresholds of significance are intended to address cumulative, basin-wide air pollutant impacts. Therefore, if a project's emissions do not exceed the SCAQMD significance thresholds, it can be assumed that it will not result in a cumulatively considerable net increase of a criteria pollutant for which the SCAB is non-attainment based on federal and State AAQS.

The SCAQMD works to clean the air and protect the health of all residents in the South Coast Air District. The SCAQMD thresholds of significance are designed to evaluate impacts at a project level as they relate to the California and National Ambient Air Quality Standards. The SCAQMD thresholds of significance ensure projects do not conflict with the latest adopted clean air plans, which are developed to ensure the Air Basin is on track to achieve compliance with federal and State AAQS. The AAQS provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Therefore, if a project is consistent with the latest adopted clean air plan and does not exceed the SCAQMD significance thresholds, it can be assumed that it will not have a substantial adverse impact on public health.

In addition, the SCAQMD has developed Localized Significance Thresholds (LSTs) in response to concern regarding exposure of individuals to criteria pollutants in local communities. LSTs have been developed for nitrogen oxides (NO_X), CO, PM_{10} and $PM_{2.5}$. LSTs represent the maximum emissions from a project that will not cause or contribute to an air quality exceedance of the most stringent applicable federal or State AAQS at the nearest sensitive receptor, taking into consideration ambient concentrations in each source receptor area, distance to the sensitive receptor, and project size. LSTs only apply to emissions within a fixed stationary location; they are not applicable to mobile sources. The use of LSTs is voluntary, to be implemented at the discretion of local agencies (SCAQMD 2008).

The SCAQMD LSTs have been defined for emissions within construction areas up to five acres in size. The SCAQMD provides lookup tables for sites that measure up to one, two, or five acres. The Project has several individual sites that would have construction disturbance areas that would range in size from approximately one-half acre (well sites, daily pipeline disturbance area, turnouts, pump stations, wellhead treatment) to approximately five acres (AWPF, storage tank). Pursuant to SCAQMD guidance, LSTs for the one-acre site should be used for sites that are less than one acre in size. LSTs for construction on one-acre and five-acre sites in SRA-34 are shown in Table 9. For most of the Project facilities, LSTs are provided for receptors at a distance of 25 meters (82 feet), which is the most conservative LST distance (LSTs range from 25 to 500 meters). However, for the AWPF, the nearest sensitive receptor is located approximately 500 meters from the AWPF. Therefore, the LST for a receptor located 500 meters from a 5-acre site is used for the AWPF. LSTs are defined for 37 source receptor areas (SRAs). The Project is located within multiple SRAs:

it is located partially within SRA-32, Northwest San Bernardino Valley, SRA-33, Southwest San Bernardino Valley, partially within SRA-34, Central San Bernardino Valley, and partially within SRA-22, Norco/Corona (SCAQMD 2008). The emissions limits for the most restrictive SRA are shown in Table 9.

Table 9: SCAQMD LSTs for Construction and Operation

Pollutant	Allowable emission from a one-acre site for a receptor within 25 meters, or 82 feet away (pounds/day)	Allowable emission from a five-acre site for a receptor within 25 meters, or 82 feet away (pounds/day)	Allowable emission from a five-acre site for a receptor within 500 meters, or 82 feet away (pounds/day)
Gradual Conversion of NO_x to NO_2	118	270	778
CO	667	1,746	22,490
PM_{10} – operation	1	4	55
PM_{10} – construction	4	12	228
$PM_{2.5}$ – operation	1	2	28
$PM_{2.5}$ – construction	3	8	113

Source: SCAQMD 2009

6. PROJECT IMPACTS

6.1 Short-term Criteria Pollutant Emissions

Air emissions of criteria pollutants during construction of the Proposed Project would result from the use of construction equipment with internal combustion engines, and off-site vehicles to transport workers, deliver materials to the site, and haul export material from the site. Proposed Project construction emissions are summarized in Table 10. Consistent with SCAQMD guidelines, daily maximum construction-related fugitive dust, NO_x, ROC, PM_{10}, and $PM_{2.5}$ emissions from grading, paving, and other activities have been quantified for each year of Proposed Project construction and compared to the regional maximum daily threshold for construction-related emissions.

Proposed Project maximum daily construction emissions were estimated for the most impactful simultaneous construction activities, with 2027 being the most impactful year. In 2027, construction would be underway on the storage reservoir, AWPF, pump stations, wellhead treatment, turnouts, pipelines, and wells. In 2025, construction activities would include the wells and pipelines. In 2026, the wells, pipelines, and turnouts would be under construction.

Table 10: Proposed Project Maximum Daily Construction Emissions Compared to Regional Thresholds (lbs./day)

Year	NO_x	ROG	CO	SO_x	$PM_{2.5}$	PM_{10}
2025	154	14	127	0.5	15	30
2026	224	22	189	0.6	22	45
2027	280	31	238	0.8	29	57
Threshold	*100*	*75*	*550*	*150*	*55*	*150*
Threshold Exceeded?	Yes	No	No	No	No	No
Note: Emissions represent the maximum of winter or summer and are rounded to the nearest whole number. Values are taken from the "mitigated" CalEEMod output tables for $PM_{2.5}$ and PM_{10} to represent emissions with dust control measures required by SCAQMD Rule 403. See CalEEMod output sheets in Attachment A.						

As shown in Table 10, ROG/VOC, CO, SO_x, PM_{10}, and $PM_{2.5}$, emissions would not exceed maximum daily thresholds. The values shown for $PM_{2.5}$ and PM_{10} are the "mitigated" values in the CalEEMod output sheets. These "mitigated" values reflect the Project's compliance with SCAQMD Rule 403 to control fugitive dust emissions, as opposed to mitigation measures under CEQA. CalEEMod does not allow for the input of adherence to existing regulations, such as SCAQMD Rule 403, separate from CEQA mitigation measures. To comply with SCAQMD Rule 403, the Proposed Project would implement fugitive dust control measures, including watering the site twice daily, reducing onsite construction vehicle speed to 15 mph, and cleaning paved roads to prevent construction vehicle dust track-out.

Emissions would exceed applicable regional maximum daily thresholds for NO_x throughout the entire duration of Project construction as shown in Table 10. The use of an engine fleet with at least 95 percent Tier 4 engines on applicable equipment[1] would reduce NO_x emissions to below the regional maximum daily thresholds. The Project emissions with the incorporation of mitigation to use Tier 4 engines are shown Table 11.

Mitigation Measure: Tier 4 Engines. IEUA shall use off-road equipment that meets the United States Environmental Protection Agency (EPA) certified Tier 4 final engines or engines that are certified to meet or exceed the emission ratings for EPA Tier 4 final or interim engines such that average daily nitrogen oxide (NO_X) emissions are lower than SCAQMD Regional Mass Emissions Thresholds of 100 pounds per day. One way for this to be accomplished would be for 95 percent of the construction equipment and vehicles, with the exception of drill rigs, used for the Project to be equipped with Tier 4 final engines.

[1] Note that drill rigs with a Tier 4 engine may not be available at the time of construction. Therefore, this analysis did not assume any change in the engine type for drill rigs.

Table 11: Mitigated Proposed Project Maximum Daily Construction Emissions Compared to Regional Thresholds (lbs./day)

Year	NO_x	ROG	CO	SO_x	$PM_{2.5}$	PM_{10}
2025	59	5	141	0.5	15	30
2026	75	7	211	0.6	22	45
2027	92	19	265	0.8	29	57
Threshold	*100*	*75*	*550*	*150*	*55*	*150*
Threshold Exceeded?	No	No	No	No	No	No
Note: Emissions represent the maximum of winter or summer and are rounded to the nearest whole number. See CalEEMod output sheets in Attachment A. Values are taken from the "mitigated" CalEEMod output tables to represent emissions with dust control measures and Tier 4 engines for at least three-quarters of the applicable construction equipment fleet.						

The quantities presented in Table 10 and Table 11 above, represent the estimated emissions associated with the simultaneous construction of the wells and pipelines in 2025, the wells, pipelines and turnouts in 2026; and the wells, pipelines, turnouts, wellhead treatment, pump stations, AWPF, and storage tank in 2027. As analyzed above, the Proposed Project would not exceed the applicable emissions standards during construction, with incorporation of Tier 4 engines into the construction equipment vehicle fleet. As noted previously, the construction phasing scheduled used for the purposes of this air quality analysis assumed the most impactful scenario of construction activities taking place simultaneously. In reality, construction phasing may be spaced out without as much overlap as was assumed in this analysis. Thus, although the maximum daily emissions in the year 2027 shown in Table 11 are at the threshold level, actual regional maximum daily emissions may not be this high. Construction would be short-term and temporary. Therefore, construction of the Proposed Project would not result in a cumulatively considerable net increase of a criteria pollutant for which the SCAB is non-attainment.

6.2 Long-term Criteria Pollutant Emissions

Long-term operation of the Chino Basin Program would involve occasional operations and maintenance trips, and energy consumption to operate the AWPF, wellhead treatment, pump stations, and injection and extraction wells. While emissions of criteria pollutants would result from motor vehicle trips associated with maintenance and operation of the Proposed Project facilities, these emissions are assumed to be negligible because, once constructed, the Project facilities would be largely monitored remotely and would require no more than five to six trips per day, on average, for inspections, testing, and maintenance.

Emissions associated with long-term electricity consumption would not result in direct Project emissions of criteria air pollutants. Only direct emissions of criteria pollutants from energy sources that combust on-site, such as natural gas, are attributed with individual projects. The Project does not propose to combust natural gas onsite. Criteria pollutant emissions from the power plants that would provide electricity to the Proposed Project are associated with the power plants themselves, which are stationary sources permitted by air districts and/or the EPA, and are subject to local, state and federal control measures. Thus, emissions of criteria pollutants from electricity consumption are not attributable to individual projects.

Because emissions would be below the significance levels, the Proposed Project would not result in a cumulatively considerable net increase of a criteria pollutant for which the SCAB is non-attainment.

6.3 Other Emissions

SCAQMD Rule 402 Nuisance, prohibits discharge from any source whatsoever of air contaminants or other material which cause injury, detriment, nuisance or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health or safety or any such persons or the public or which cause or have a natural tendency to cause injury or damage to business or property. This rule covers generation of odors. Typical sources of odor complaints include facilities such as sewage treatment plants, landfills, recycling facilities, petroleum refineries, and livestock operations. Under the right meteorological conditions, some odors may still be offensive several miles from the source (CARB 2005).

Implementation of the Proposed Project would have the potential to generate objectionable odors through construction activities and during operation of certain components. Construction activities are not typical sources of nuisance odors, although construction could result in minor amounts of odors associated with diesel exhaust or evaporation of VOCs within architectural coatings. These smells are largely due to the presence of sulfur and creation of hydrocarbons during combustion. As shown in Table 10 and Table 11 above, construction would not result in significant emissions of sulfur oxides. Additionally, construction would be temporary, and equipment would not be located in a single location throughout the construction period. Odorous hydrocarbons tend to dissipate quickly and would only affect receptors in the immediate vicinity, rather than a substantial number of people at any given time. Therefore, construction activities would not result in nuisance odors.

Operation of the Proposed Project, including the AWPF, pump stations, wells, wellhead treatment, pipelines and storage tank, is not expected to result in odor impacts. RP-4 already treats and stores wastewater and recycled water, which requires operation of odor control measures to prevent objectionable odors. Addition of the AWPF facility with an improved level of treatment would not create odors because source water would be secondary effluent suitable for reuse and product water would be pure water suitable for groundwater replenishment, neither of which has associated odor. The AWFP would be designed and constructed in compliance with applicable regulations and standards relative to water produced for groundwater replenishment.

6.4 Exposure of Sensitive Receptors to Substantial Pollutant Concentrations

Sensitive receptors are typically defined as schools (preschool–12th grade), hospitals, resident care facilities, senior housing facilities, day care centers, or other facilities that may house individuals with health conditions that would be adversely impacted by changes in air quality (CARB 2018). Sensitive receptors are located within the vicinity of the Proposed Project.

LSTs represent the maximum emissions from a project that will not cause or contribute to an air quality exceedance of the most stringent applicable federal or State AAQS at the nearest sensitive receptor. Therefore, projects that conform to the LSTs are assumed to have a less than significant impact on nearby sensitive receptors.

The Proposed Project emissions are compared to LSTs for the Project area and are provided below. LSTs are only applicable to emissions within a fixed, stationary location, such as construction sites, and vary based on project site size. Table 12 and Table 13 provide LSTs that are applicable to construction of each component of the Proposed Project, as each component has a different construction location and footprint. As explained under the Significance Thresholds, above, SCAQMD provides LST lookup tables for sites that measure up to one, two, or five acres; LSTs for construction sites smaller than one acre should use the one acre threshold. SCAQMD provides LST lookup tables for receptors located 25, 50, 100, 200, and 500 meters from the boundary of the site. The specific location of many of the Proposed Project facilities is not yet known, therefore emissions are compared to the most restrictive, 25-meter LST. The site of the AWPF, however, is known. The nearest sensitive receptor is located approximately 500 meters from the AWPF. Therefore, the LST for a receptor located 500 meters from a 5-acre site is used for the AWPF.

Table 12: Proposed Project Maximum Daily Construction Emissions Compared to LSTs (lbs./day)

Emissions Source (onsite stationary emissions only)	NO_x	CO	PM_{10}	$PM_{2.5}$
Well Sites	14	13	2	1
Well Sites LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
Pipelines	1.5	1.4	<1	<1
Pipeline LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
Turnouts	22	20	4	2
Turnout LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
Wellhead Treatment Sites	7	8	<1	<1
Wellhead Treatment Sites LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
Pump Station Sites	12	9	3	2
Pump Station LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
AWPF Site	25	18	8	5
AWPF LST (*five-acre, 500 meters LST*)	778	22,490	228	113
Threshold exceeded?	No	No	No	No
Storage Reservoir Site	15	16	3	2
Storage Reservoir LST (five-acre, 25 meters LST)	*270*	*1,746*	*14*	*8*
Threshold exceeded?	No	No	No	No
Note: Emissions represent the maximum of winter or summer and are rounded to the nearest whole number. Values are taken from the "mitigated" CalEEMod output tables for $PM_{2.5}$ and PM_{10} to represent emissions with dust control measures required by SCAQMD Rule 403. See CalEEMod output sheets in Attachment A.				

Table 13: Mitigated Proposed Project Maximum Daily Construction Emissions Compared to LSTs (lbs./day)

Emissions Source (onsite stationary emissions only)	NO_x	CO	PM_{10}	$PM_{2.5}$
Well Sites	4	14	2	1
Well Sites LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
Pipelines	<1	1.5	<1	<1
Pipeline LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
Turnouts	4	23	4	2
Turnout LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
Wellhead Treatment Sites	2	9	<1	<1
Wellhead Treatment Sites LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
Pump Station Sites	2	11	3	2
Pump Station LST (one-acre, 25 meters LST)	*118*	*667*	*4*	*3*
Threshold exceeded?	No	No	No	No
AWPF Site	3	21	8	5
AWPF LST (*five-acre, 500 meters LST*)	778	22,490	228	113
Threshold exceeded?	No	No	No	No
Storage Reservoir Site	3	18	3	2
Storage Reservoir LST (five-acre, 25 meters LST)	*270*	*1,746*	*14*	*8*
Threshold exceeded?	No	No	No	No
Note: Emissions represent the maximum of winter or summer and are rounded to the nearest whole number. See CalEEMod output sheets in Attachment A. Values are taken from the "mitigated" CalEEMod output tables to represent emissions with dust control measures and Tier 4 engines for at least three-quarters of the applicable construction equipment fleet.				

The Proposed Project's construction and operational emissions would not exceed SCAQMD regional thresholds or LSTs with the implementation of applicable fugitive dust control measures. With implementation of mitigation to incorporate Tier 4 engines, NO_X emissions would not exceed regional thresholds; however, both the unmitigated and mitigated NO_X emissions would be below the LSTs. Therefore, sensitive receptors would not be subjected to substantial pollutant concentrations and impacts would be less than significant.

As described in Section 6.1, the Proposed Project would not result in considerable pollutant levels during construction. Construction would be short-term and emissions of PM_{10} and $PM_{2.5}$, including particulate matter from diesel exhaust, would be below thresholds, which are designed to protect public health and the health of sensitive receptors. The Proposed Project would also adhere to Rule 403 required by SCAQMD, which would further reduce dust emissions. As explained above in Section 5, the California and National AAQS provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly. If a project is consistent with the latest adopted clean air plan and does not exceed the SCAQMD significance thresholds, it can be assumed that it will not have a substantial adverse impact on public health. Operation of the Proposed Project would result in negligible long-term criteria air pollutant concentrations that would not exceed SCAQMD emissions standards. Ongoing operations and maintenance trips would be minimal and would not contribute to CO “hotspots.” The Proposed Project would construct facilities that are similar to the facilities at the existing RP-4, which do not currently generate substantial sources of toxic air contaminant emissions that could pose or contribute to a health risk (SCAQMD 2020). Likewise, the proposed pipelines, turnouts, storage tank, and wells would be largely monitored remotely, would not involve substantial vehicle maintenance trips, and would not introduce a source of toxic air contaminants such as diesel particulate matter that could pose or contribute to a health risk; these types of facilities are not mentioned in the SCAQMD Air Toxics “Hot Spots” Program annual reporting (SCAQMD 2020). Therefore, neither construction nor operation of the Proposed Project are anticipated to expose sensitive receptors to substantial pollutant concentrations.

6.5 Consistency with Air Quality Plans

6.5.1 SCAQMD AQMP

SCAQMD’s 2016 AQMP is the applicable air quality control plan. A project would conflict with or obstruct an applicable air quality plan if it would lead to population, housing or employment growth that exceeds the forecasts used in the development of the applicable air quality plan. The Proposed Project would involve the replacement of imported water with a local supply, which would add reliability to the IEUA water portfolio serving existing customers, as well as future customers from planned growth in the area. Therefore, the Proposed Project would not lead to unplanned population, housing or employment growth that exceeds the forecasts used in the development of the AQMP. Furthermore, with mitigation and adherence to existing regulations, the Proposed Project would not result in emissions of criteria air pollutants that would conflict with the AQMP regional standards to achieve the federal air quality standards.

6.6 Cumulative Impacts

The geographic scope for the analysis of cumulative impacts of criteria air pollutants and air quality plans is the South Coast Air Basin. The SCAQMD AQMP addresses cumulative air quality impacts in the SCAB based on future growth predictions based on the general plans of local jurisdictions. For this reason, development consistent with the applicable general plan would also be consistent with the AQMP. Cumulative development within the SCAB is not anticipated to result in a significant impact in terms of conflicting with the AQMP because the majority of cumulative projects would be consistent with their respective general plans and the growth anticipated under the AQMP. The CBP would serve water supply needs for existing and planned water demand and would not result in or accommodate unplanned growth. Therefore, the CBP, in combination with other cumulative projects would not conflict with or obstruct implementation of the AQMP. No cumulative impact would occur.

The cumulative impact to the SCAB due to criteria air pollution emissions associated with existing basin-wide polluting activities is significant because the SCAB is already classified as nonattainment for O_3, PM_{10}, and $PM_{2.5}$ (see Table 6). The SCAQMD’s CEQA Air Quality Significance Thresholds (April 2019) indicate that any projects in the SCAB with daily construction and/or operational emissions that exceed any of the indicated thresholds in Table 8 should be considered as having an individually and cumulatively significant air quality impact. With mitigation incorporated, emissions from the CBP would not exceed the regional thresholds, even with worst-case maximum daily construction scenarios (see Table 11). The CBP would not result in a cumulatively considerable contribution to a cumulative air quality impact.

The geographic scope for the analysis of cumulative impacts relative to sensitive receptors is the Project area (see Figure 1) because sensitive receptors (e.g., residences, schools, and hospitals) are interspersed throughout the area where the proposed CBP facilities would be located. Cumulative growth in the Project area would have the potential to result in carbon monoxide hotspots, and emissions of diesel particulate matter. However, emissions from Proposed Project construction and operation, including emissions of carbon monoxide and $PM_{2.5}$, would be below significance thresholds that are designed to protect the health of sensitive receptors. The overall net vehicle trips associated with the Proposed Project would be negligible. Therefore, the CBP, together with other cumulative projects, would not result in a cumulatively considerable air quality impact on sensitive receptors.

The geographic scope for the analysis of cumulative impacts relative to objectionable odors is the area immediately surrounding the odor source. Objectionable odors are not cumulative in nature because the air emissions that cause the odors disperse beyond the odor source, making the odor less detectable. Cumulative projects would be required to comply with SCAQMD Rule 402 (Nuisance). Therefore, the CBP, in combination with other cumulative projects, would not result in a significant cumulative impact associated with objectionable odors.

7. REFERENCES

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ATTACHMENT A: CALEEMOD OUTPUT SHEETS

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Chino Basin Program - Construction

South Coast Air Basin, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Refrigerated Warehouse-No Rail	1,354.00	1000sqft	31.08	1,354,000.00	0
Other Asphalt Surfaces	1,056.00	1000sqft	24.24	1,056,000.00	0
Unrefrigerated Warehouse-No Rail	163.00	1000sqft	3.74	163,000.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.2 **Precipitation Freq (Days)** 31

Climate Zone 10 **Operational Year** 2028

Utility Company Southern California Edison

CO2 Intensity (lb/MWhr) 390.98 **CH4 Intensity (lb/MWhr)** 0.033 **N2O Intensity (lb/MWhr)** 0.004

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - CalEEMod has limited choices for land use types. Industrial Refrigerated Warehouse - no rail chosen for most CBP components because allows for project-specific entries for energy use, and construction. Parking Other Asphalt Surfaces chosen for pipes, turnouts because allows for project-specific entries on construction equipment, etc., and doesn't have operational energy usage.

Construction Phase - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Grading - see project description

Demolition -

Trips and VMT - see project description.

Vehicle Trips - construction only

Area Coating - construction only

Landscape Equipment - construction only

Energy Use - construction only

Water And Wastewater - construction only

Solid Waste - construction only

Construction Off-road Equipment Mitigation - rule 403 and 90-percent Tier 4

Table Name	Column Name	Default Value	New Value
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tblAreaCoating	Area_Nonresidential_Interior	2275500	0
tblAreaCoating	Area_Parking	63360	0
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstDustMitigation	CleanPavedRoadPercentReduction	0	25

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	13.00
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EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

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EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

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tblTripsAndVMT	WorkerTripNumber	1,081.00	10.00
tblVehicleTrips	ST_TR	2.12	0.00
tblVehicleTrips	ST_TR	1.74	0.00
tblVehicleTrips	SU_TR	2.12	0.00
tblVehicleTrips	SU_TR	1.74	0.00
tblVehicleTrips	WD_TR	2.12	0.00
tblVehicleTrips	WD_TR	1.74	0.00
tblWater	IndoorWaterUseRate	313,112,500.00	0.00
tblWater	IndoorWaterUseRate	37,693,750.00	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2025	14.1696	153.7284	126.9202	0.4644	56.3107	5.3204	61.6311	27.9208	4.9715	32.8923	0.0000	47,133.32 98	47,133.32 98	6.9802	3.1661	48,251.31 72
2026	21.5622	224.1793	188.9808	0.6182	85.4511	8.2025	93.6536	43.3792	7.6704	51.0496	0.0000	62,261.67 19	62,261.67 19	9.9941	3.6029	63,585.19 44
2027	31.1655	280.0541	237.6336	0.7552	110.8735	10.5341	121.4076	56.9777	9.8285	66.8062	0.0000	75,990.88 39	75,990.88 39	12.5314	4.9989	77,596.66 10
Maximum	**31.1655**	**280.0541**	**237.6336**	**0.7552**	**110.8735**	**10.5341**	**121.4076**	**56.9777**	**9.8285**	**66.8062**	**0.0000**	**75,990.88 39**	**75,990.88 39**	**12.5314**	**4.9989**	**77,596.66 10**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2025	4.9686	59.2789	141.1539	0.4644	29.2846	1.0258	30.3104	13.7408	0.9804	14.7213	0.0000	47,133.32 98	47,133.32 98	6.9802	3.1661	48,251.31 72
2026	6.9120	75.4441	211.2366	0.6182	43.1136	1.4045	44.5181	20.9081	1.3466	22.2547	0.0000	62,261.67 19	62,261.67 19	9.9941	3.6029	63,585.19 44
2027	19.0485	91.9555	265.3938	0.7552	55.0039	1.6707	56.6746	27.1551	1.6026	28.7577	0.0000	75,990.88 38	75,990.88 38	12.5314	4.9989	77,596.66 10
Maximum	**19.0485**	**91.9555**	**265.3938**	**0.7552**	**55.0039**	**1.6707**	**56.6746**	**27.1551**	**1.6026**	**28.7577**	**0.0000**	**75,990.88 38**	**75,990.88 38**	**12.5314**	**4.9989**	**77,596.66 10**

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	53.77	65.55	-11.61	0.00	49.57	82.95	52.47	51.82	82.51	56.40	0.00	0.00	0.00	0.00	0.00	0.00

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	30.4348	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total	**30.4348**	**2.3700e-003**	**0.2620**	**2.0000e-005**	**0.0000**	**9.3000e-004**	**9.3000e-004**	**0.0000**	**9.3000e-004**	**9.3000e-004**		**0.5631**	**0.5631**	**1.4600e-003**	**0.0000**	**0.5997**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	30.4348	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total	**30.4348**	**2.3700e-003**	**0.2620**	**2.0000e-005**	**0.0000**	**9.3000e-004**	**9.3000e-004**	**0.0000**	**9.3000e-004**	**9.3000e-004**		**0.5631**	**0.5631**	**1.4600e-003**	**0.0000**	**0.5997**

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Wells	Grading	1/1/2025	12/31/2027	5	783	Wells
2	Pipelines25	Grading	1/1/2025	3/3/2025	5	44	Pipelines25
3	Pipelines26	Grading	1/1/2026	3/3/2026	5	44	Pipelines26
4	Turnouts	Grading	1/1/2026	12/31/2027	5	522	Turnouts
5	WellheadDemo	Demolition	1/1/2027	1/28/2027	5	20	WellheadDemo
6	AWPFSiteprep	Site Preparation	1/1/2027	1/7/2027	5	5	AWPFSiteprep
7	Pipelines27	Grading	1/1/2027	3/3/2027	5	44	Pipelines27
8	PumpStationsGrading	Grading	1/1/2027	12/31/2027	5	261	PumpStationsGrading
9	PumpStationsConstruct	Building Construction	1/1/2027	12/31/2027	5	261	PumpStationsConstruct
10	AWPFGrading	Grading	1/8/2027	1/19/2027	5	8	AWPFGrading
11	AWPFConstruction	Building Construction	1/20/2027	12/7/2027	5	230	AWPFConstruction
12	WellheadGrading	Grading	1/29/2027	2/25/2027	5	20	WellheadGrading
13	WellheadConstruct	Building Construction	2/26/2027	12/3/2027	5	201	WellheadConstruct
14	StorageResGrading	Grading	8/2/2027	8/13/2027	5	10	StorageResGrading
15	StorageResConstruct	Building Construction	8/16/2027	11/26/2027	5	75	StorageResConstruct
16	StorageResPaving	Paving	11/29/2027	12/10/2027	5	10	StorageResPaving
17	WellheadPaving	Paving	12/6/2027	12/31/2027	5	20	WellheadPaving
18	AWPFPaving	Paving	12/8/2027	12/31/2027	5	18	AWPFPaving

Acres of Grading (Site Preparation Phase): 0

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Acres of Grading (Grading Phase): 18.5

Acres of Paving: 24.24

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Wells	Rubber Tired Dozers	4	6.00	247	0.40
Wells	Tractors/Loaders/Backhoes	12	6.00	97	0.37
Wells	Bore/Drill Rigs	1	24.00	221	0.50
Wells	Cranes	4	6.00	231	0.29
Wells	Welders	4	4.00	46	0.45
Pipelines25	Excavators	3	4.00	158	0.38
Pipelines25	Graders	1	8.00	187	0.41
Pipelines25	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines25	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines25	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines25	Cranes	3	6.00	231	0.29
Pipelines25	Rollers	3	6.00	80	0.38
Pipelines25	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines25	Paving Equipment	3	2.00	132	0.36
Pipelines25	Generator Sets	3	1.00	84	0.74
Pipelines26	Excavators	3	4.00	158	0.38
Pipelines26	Graders	1	8.00	187	0.41
Pipelines26	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines26	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines26	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines26	Cranes	3	6.00	231	0.29
Pipelines26	Rollers	3	6.00	80	0.38

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Pipelines26	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines26	Paving Equipment	3	2.00	132	0.36
Pipelines26	Generator Sets	3	1.00	84	0.74
Pipelines27	Excavators	3	4.00	158	0.38
Pipelines27	Graders	1	8.00	187	0.41
Pipelines27	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines27	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines27	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines27	Cranes	3	6.00	231	0.29
Pipelines27	Rollers	3	6.00	80	0.38
Pipelines27	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines27	Paving Equipment	3	2.00	132	0.36
Pipelines27	Generator Sets	3	1.00	84	0.74
Turnouts	Excavators	3	4.00	158	0.38
Turnouts	Graders	1	8.00	187	0.41
Turnouts	Rubber Tired Dozers	6	6.00	247	0.40
Turnouts	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Turnouts	Crushing/Proc. Equipment	6	6.00	85	0.78
Turnouts	Cranes	3	6.00	231	0.29
Turnouts	Rollers	3	6.00	80	0.38
Turnouts	Sweepers/Scrubbers	3	4.00	64	0.46
Turnouts	Paving Equipment	3	2.00	132	0.36
Turnouts	Generator Sets	3	1.00	84	0.74
AWPFSiteprep	Rubber Tired Dozers	3	8.00	247	0.40
AWPFSiteprep	Tractors/Loaders/Backhoes	4	8.00	97	0.37
AWPFGrading	Excavators	1	8.00	158	0.38
AWPFGrading	Graders	1	8.00	187	0.41
AWPFGrading	Rubber Tired Dozers	1	8.00	247	0.40
AWPFGrading	Tractors/Loaders/Backhoes	3	8.00	97	0.37

AWPFConstruction	Cranes	1	7.00	231	0.29
AWPFConstruction	Forklifts	3	8.00	89	0.20
AWPFConstruction	Generator Sets	1	8.00	84	0.74
AWPFConstruction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
AWPFConstruction	Welders	1	8.00	46	0.45
AWPFPaving	Cement and Mortar Mixers	2	6.00	9	0.56
AWPFPaving	Pavers	1	8.00	130	0.42
AWPFPaving	Paving Equipment	2	6.00	132	0.36
AWPFPaving	Rollers	2	6.00	80	0.38
AWPFPaving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
PumpStationsGrading	Graders	1	8.00	187	0.41
PumpStationsGrading	Rubber Tired Dozers	1	8.00	247	0.40
PumpStationsGrading	Tractors/Loaders/Backhoes	2	7.00	97	0.37
PumpStationsConstruct	Cranes	1	4.00	231	0.29
PumpStationsConstruct	Forklifts	1	4.00	89	0.20
PumpStationsConstruct	Tractors/Loaders/Backhoes	2	4.00	97	0.37
PumpStationsConstruct	Welders	1	4.00	46	0.45
WellheadDemo	Concrete/Industrial Saws	2	6.00	81	0.73
WellheadDemo	Rubber Tired Dozers	2	6.00	247	0.40
WellheadGrading	Graders	2	6.00	187	0.41
WellheadGrading	Tractors/Loaders/Backhoes	4	6.00	97	0.37
WellheadConstruct	Cranes	2	4.00	231	0.29
WellheadConstruct	Forklifts	2	6.00	89	0.20
WellheadConstruct	Generator Sets	2	4.00	84	0.74
WellheadConstruct	Tractors/Loaders/Backhoes	4	6.00	97	0.37
WellheadConstruct	Welders	2	4.00	46	0.45
WellheadPaving	Pavers	2	6.00	130	0.42
WellheadPaving	Paving Equipment	2	6.00	132	0.36
WellheadPaving	Rollers	2	6.00	80	0.38

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

StorageResGrading	Excavators	1	8.00	158	0.38
StorageResGrading	Graders	1	8.00	187	0.41
StorageResGrading	Rubber Tired Dozers	1	8.00	247	0.40
StorageResGrading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
StorageResConstruct	Cranes	1	7.00	231	0.29
StorageResConstruct	Forklifts	3	8.00	89	0.20
StorageResConstruct	Generator Sets	1	8.00	84	0.74
StorageResConstruct	Tractors/Loaders/Backhoes	3	7.00	97	0.37
StorageResConstruct	Welders	1	8.00	46	0.45
StorageResPaving	Cement and Mortar Mixers	2	6.00	9	0.56
StorageResPaving	Pavers	1	8.00	130	0.42
StorageResPaving	Paving Equipment	2	6.00	132	0.36
StorageResPaving	Rollers	2	6.00	80	0.38
StorageResPaving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Wells	Generator Sets	4	4.00	84	0.74
Pipelines25	Plate Compactors	3	2.00	8	0.43
Pipelines25	Signal Boards	3	6.00	6	0.82
Pipelines26	Plate Compactors	3	2.00	8	0.43
Pipelines26	Signal Boards	3	6.00	6	0.82
Turnouts	Plate Compactors	3	2.00	8	0.43
Turnouts	Signal Boards	3	6.00	6	0.82
Pipelines27	Plate Compactors	3	2.00	8	0.43
Pipelines27	Signal Boards	3	6.00	6	0.82
WellheadPaving	Plate Compactors	2	6.00	8	0.43
AWPFPaving	Plate Compactors	1	6.00	8	0.43

Trips and VMT

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Wells	29	80.00	128.00	40.00	14.70	50.00	20.00	LD_Mix	HDT_Mix	HHDT
Pipelines25	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Pipelines26	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Pipelines27	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Turnouts	40	28.00	28.00	2,000.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
AWPFSiteprep	7	40.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
AWPFGrading	6	40.00	30.00	0.00	14.70	40.00	20.00	LD_Mix	HDT_Mix	HHDT
AWPFConstruction	9	40.00	30.00	0.00	14.70	40.00	20.00	LD_Mix	HDT_Mix	HHDT
AWPFPaving	9	40.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
PumpStationsGrading	4	10.00	12.00	0.00	14.70	20.00	20.00	LD_Mix	HDT_Mix	HHDT
PumpStationsConstruct	5	10.00	0.00	0.00	40.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT
WellheadDemo	4	20.00	0.00	20.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
WellheadGrading	6	20.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
WellheadConstruct	12	20.00	20.00	0.00	20.00	40.00	20.00	LD_Mix	HDT_Mix	HHDT
WellheadPaving	8	20.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT
StorageResGrading	6	24.00	0.00	600.00	20.00	6.90	50.00	LD_Mix	HDT_Mix	HHDT
StorageResConstruct	9	24.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT
StorageResPaving	8	24.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

3.2 Wells - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0913	0.0000	18.0913	9.9334	0.0000	9.9334			0.0000			0.0000
Off-Road	5.6721	54.4844	51.0006	0.1177		2.2175	2.2175		2.0619	2.0619		11,288.63 68	11,288.63 68	3.1992		11,368.61 78
Total	**5.6721**	**54.4844**	**51.0006**	**0.1177**	**18.0913**	**2.2175**	**20.3088**	**9.9334**	**2.0619**	**11.9953**		**11,288.63 68**	**11,288.63 68**	**3.1992**		**11,368.61 78**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.1000e-004	6.2700e-003	1.8100e-003	3.0000e-005	8.9000e-004	4.0000e-005	9.4000e-004	2.4000e-004	4.0000e-005	2.9000e-004		3.1414	3.1414	2.0000e-004	5.0000e-004	3.2954
Vendor	0.4567	25.1806	5.7311	0.1522	5.9171	0.1847	6.1018	1.7013	0.1767	1.8780		16,460.68 13	16,460.68 13	0.6323	2.3778	17,185.05 76
Worker	0.2211	0.1369	2.4191	7.3300e-003	0.8942	4.5900e-003	0.8988	0.2372	4.2200e-003	0.2414		741.3134	741.3134	0.0157	0.0157	746.3807
Total	**0.6779**	**25.3237**	**8.1519**	**0.1595**	**6.8122**	**0.1894**	**7.0016**	**1.9387**	**0.1810**	**2.1197**		**17,205.13 62**	**17,205.13 62**	**0.6482**	**2.3939**	**17,934.73 37**

3.2 Wells - 2025

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1411	0.0000	8.1411	4.4700	0.0000	4.4700			0.0000			0.0000
Off-Road	1.9203	14.3205	57.2122	0.1177		0.4265	0.4265		0.4037	0.4037	0.0000	11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**1.9203**	**14.3205**	**57.2122**	**0.1177**	**8.1411**	**0.4265**	**8.5676**	**4.4700**	**0.4037**	**4.8737**	**0.0000**	**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.1000e-004	6.2700e-003	1.8100e-003	3.0000e-005	7.2000e-004	4.0000e-005	7.7000e-004	2.0000e-004	4.0000e-005	2.5000e-004		3.1414	3.1414	2.0000e-004	5.0000e-004	3.2954
Vendor	0.4567	25.1806	5.7311	0.1522	4.8594	0.1847	5.0441	1.4417	0.1767	1.6184		16,460.6813	16,460.6813	0.6323	2.3778	17,185.0576
Worker	0.2211	0.1369	2.4191	7.3300e-003	0.6999	4.5900e-003	0.7045	0.1894	4.2200e-003	0.1937		741.3134	741.3134	0.0157	0.0157	746.3807
Total	**0.6779**	**25.3237**	**8.1519**	**0.1595**	**5.5600**	**0.1894**	**5.7493**	**1.6313**	**0.1810**	**1.8123**		**17,205.1362**	**17,205.1362**	**0.6482**	**2.3939**	**17,934.7337**

3.2 Wells - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0913	0.0000	18.0913	9.9334	0.0000	9.9334			0.0000			0.0000
Off-Road	5.6721	54.4844	51.0006	0.1177		2.2175	2.2175		2.0619	2.0619		11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**5.6721**	**54.4844**	**51.0006**	**0.1177**	**18.0913**	**2.2175**	**20.3088**	**9.9334**	**2.0619**	**11.9953**		**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.2000e-003	1.8300e-003	3.0000e-005	8.9000e-004	4.0000e-005	9.4000e-004	2.4000e-004	4.0000e-005	2.9000e-004		3.0823	3.0823	2.0000e-004	4.9000e-004	3.2336
Vendor	0.4419	24.9792	5.6484	0.1492	5.9171	0.1846	6.1017	1.7013	0.1766	1.8779		16,156.5852	16,156.5852	0.6337	2.3367	16,868.7738
Worker	0.2081	0.1243	2.2716	7.1100e-003	0.8942	4.3500e-003	0.8986	0.2372	4.0000e-003	0.2412		718.5630	718.5630	0.0142	0.0148	723.3295
Total	**0.6501**	**25.1097**	**7.9218**	**0.1564**	**6.8122**	**0.1890**	**7.0012**	**1.9387**	**0.1806**	**2.1193**		**16,878.2305**	**16,878.2305**	**0.6482**	**2.3520**	**17,595.3368**

3.2 Wells - 2026

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1411	0.0000	8.1411	4.4700	0.0000	4.4700			0.0000			0.0000
Off-Road	1.9203	14.3205	57.2122	0.1177		0.4265	0.4265		0.4037	0.4037	0.0000	11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**1.9203**	**14.3205**	**57.2122**	**0.1177**	**8.1411**	**0.4265**	**8.5676**	**4.4700**	**0.4037**	**4.8737**	**0.0000**	**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.2000e-003	1.8300e-003	3.0000e-005	7.2000e-004	4.0000e-005	7.7000e-004	2.0000e-004	4.0000e-005	2.5000e-004		3.0823	3.0823	2.0000e-004	4.9000e-004	3.2336
Vendor	0.4419	24.9792	5.6484	0.1492	4.8594	0.1846	5.0440	1.4417	0.1766	1.6183		16,156.5852	16,156.5852	0.6337	2.3367	16,868.7738
Worker	0.2081	0.1243	2.2716	7.1100e-003	0.6999	4.3500e-003	0.7042	0.1894	4.0000e-003	0.1935		718.5630	718.5630	0.0142	0.0148	723.3295
Total	**0.6501**	**25.1097**	**7.9218**	**0.1564**	**5.5600**	**0.1890**	**5.7490**	**1.6313**	**0.1806**	**1.8120**		**16,878.2305**	**16,878.2305**	**0.6482**	**2.3520**	**17,595.3368**

3.2 Wells - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0913	0.0000	18.0913	9.9334	0.0000	9.9334			0.0000			0.0000
Off-Road	5.6721	54.4844	51.0006	0.1177		2.2175	2.2175		2.0619	2.0619		11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**5.6721**	**54.4844**	**51.0006**	**0.1177**	**18.0913**	**2.2175**	**20.3088**	**9.9334**	**2.0619**	**11.9953**		**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.1300e-003	1.8400e-003	3.0000e-005	8.9000e-004	4.0000e-005	9.4000e-004	2.4000e-004	4.0000e-005	2.9000e-004		3.0207	3.0207	2.0000e-004	4.8000e-004	3.1691
Vendor	0.4289	24.7616	5.5782	0.1462	5.9171	0.1840	6.1011	1.7013	0.1760	1.8773		15,837.9596	15,837.9596	0.6328	2.2938	16,537.3320
Worker	0.1963	0.1137	2.1461	6.9100e-003	0.8942	4.0800e-003	0.8983	0.2372	3.7600e-003	0.2409		698.3635	698.3635	0.0130	0.0141	702.8778
Total	**0.6252**	**24.8815**	**7.7261**	**0.1531**	**6.8122**	**0.1882**	**7.0003**	**1.9387**	**0.1798**	**2.1185**		**16,539.3438**	**16,539.3438**	**0.6460**	**2.3083**	**17,243.3789**

3.2 Wells - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1411	0.0000	8.1411	4.4700	0.0000	4.4700			0.0000			0.0000
Off-Road	1.9203	14.3205	57.2122	0.1177		0.4265	0.4265		0.4037	0.4037	0.0000	11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**1.9203**	**14.3205**	**57.2122**	**0.1177**	**8.1411**	**0.4265**	**8.5676**	**4.4700**	**0.4037**	**4.8737**	**0.0000**	**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.1300e-003	1.8400e-003	3.0000e-005	7.2000e-004	4.0000e-005	7.7000e-004	2.0000e-004	4.0000e-005	2.5000e-004		3.0207	3.0207	2.0000e-004	4.8000e-004	3.1691
Vendor	0.4289	24.7616	5.5782	0.1462	4.8594	0.1840	5.0434	1.4417	0.1760	1.6177		15,837.9596	15,837.9596	0.6328	2.2938	16,537.3320
Worker	0.1963	0.1137	2.1461	6.9100e-003	0.6999	4.0800e-003	0.7039	0.1894	3.7600e-003	0.1932		698.3635	698.3635	0.0130	0.0141	702.8778
Total	**0.6252**	**24.8815**	**7.7261**	**0.1531**	**5.5600**	**0.1882**	**5.7481**	**1.6313**	**0.1798**	**1.8112**		**16,539.3438**	**16,539.3438**	**0.6460**	**2.3083**	**17,243.3789**

3.3 Pipelines25 - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category					lb/day								lb/day			
Fugitive Dust					27.2199	0.0000	27.2199	14.9090	0.0000	14.9090			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.2199**	**2.8404**	**30.0603**	**14.9090**	**2.6591**	**17.5682**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category					lb/day								lb/day			
Hauling	0.0468	3.4212	0.8471	0.0163	0.5242	0.0260	0.5502	0.1437	0.0248	0.1685		1,805.6307	1,805.6307	0.1167	0.2874	1,894.2020
Vendor	0.0893	4.7870	1.1263	0.0286	1.1096	0.0347	1.1443	0.3191	0.0332	0.3522		3,095.3118	3,095.3118	0.1189	0.4473	3,231.5656
Worker	0.4756	0.3369	6.3336	0.0207	2.5535	0.0125	2.5660	0.6770	0.0115	0.6885		2,092.0822	2,092.0822	0.0315	0.0374	2,104.0229
Total	**0.6117**	**8.5451**	**8.3071**	**0.0656**	**4.1873**	**0.0731**	**4.2604**	**1.1397**	**0.0695**	**1.2092**		**6,993.0247**	**6,993.0247**	**0.2671**	**0.7721**	**7,229.7906**

3.3 Pipelines25 - 2025

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2490	0.0000	12.2490	6.7091	0.0000	6.7091			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2490**	**0.3369**	**12.5858**	**6.7091**	**0.3263**	**7.0354**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0468	3.4212	0.8471	0.0163	0.4251	0.0260	0.4510	0.1193	0.0248	0.1441		1,805.6307	1,805.6307	0.1167	0.2874	1,894.2020
Vendor	0.0893	4.7870	1.1263	0.0286	0.9113	0.0347	0.9460	0.2704	0.0332	0.3035		3,095.3118	3,095.3118	0.1189	0.4473	3,231.5656
Worker	0.4756	0.3369	6.3336	0.0207	1.9982	0.0125	2.0107	0.5407	0.0115	0.5522		2,092.0822	2,092.0822	0.0315	0.0374	2,104.0229
Total	**0.6117**	**8.5451**	**8.3071**	**0.0656**	**3.3345**	**0.0731**	**3.4077**	**0.9304**	**0.0695**	**0.9999**		**6,993.0247**	**6,993.0247**	**0.2671**	**0.7721**	**7,229.7906**

3.4 Pipelines26 - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					27.2199	0.0000	27.2199	14.9090	0.0000	14.9090			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.2199**	**2.8404**	**30.0603**	**14.9090**	**2.6591**	**17.5682**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0461	3.3832	0.8582	0.0160	0.5242	0.0259	0.5501	0.1437	0.0247	0.1684		1,771.6507	1,771.6507	0.1172	0.2821	1,858.6503
Vendor	0.0865	4.7490	1.1103	0.0281	1.1096	0.0347	1.1443	0.3191	0.0331	0.3522		3,038.1251	3,038.1251	0.1192	0.4395	3,172.0858
Worker	0.4492	0.3045	5.9349	0.0201	2.5535	0.0118	2.5653	0.6770	0.0109	0.6879		2,027.8893	2,027.8893	0.0284	0.0352	2,039.0919
Total	**0.5818**	**8.4367**	**7.9034**	**0.0641**	**4.1873**	**0.0723**	**4.2596**	**1.1397**	**0.0688**	**1.2085**		**6,837.6650**	**6,837.6650**	**0.2647**	**0.7569**	**7,069.8279**

3.4 Pipelines26 - 2026

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Fugitive Dust					12.2490	0.0000	12.2490	6.7091	0.0000	6.7091			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2490**	**0.3369**	**12.5858**	**6.7091**	**0.3263**	**7.0354**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0461	3.3832	0.8582	0.0160	0.4251	0.0259	0.4509	0.1193	0.0247	0.1440		1,771.6507	1,771.6507	0.1172	0.2821	1,858.6503
Vendor	0.0865	4.7490	1.1103	0.0281	0.9113	0.0347	0.9459	0.2704	0.0331	0.3035		3,038.1251	3,038.1251	0.1192	0.4395	3,172.0858
Worker	0.4492	0.3045	5.9349	0.0201	1.9982	0.0118	2.0100	0.5407	0.0109	0.5516		2,027.8893	2,027.8893	0.0284	0.0352	2,039.0919
Total	**0.5818**	**8.4367**	**7.9034**	**0.0641**	**3.3345**	**0.0723**	**3.4069**	**0.9304**	**0.0688**	**0.9992**		**6,837.6650**	**6,837.6650**	**0.2647**	**0.7569**	**7,069.8279**

3.5 Turnouts - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					27.1197	0.0000	27.1197	14.8982	0.0000	14.8982			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.1197**	**2.8404**	**29.9601**	**14.8982**	**2.6591**	**17.5573**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0118	0.8642	0.2192	4.0800e-003	0.1339	6.6000e-003	0.1405	0.0367	6.3200e-003	0.0430		452.5289	452.5289	0.0299	0.0721	474.7510
Vendor	0.0807	4.4324	1.0363	0.0262	1.0356	0.0323	1.0680	0.2978	0.0309	0.3287		2,835.5834	2,835.5834	0.1112	0.4102	2,960.6134
Worker	0.1497	0.1015	1.9783	6.6900e-003	0.8512	3.9500e-003	0.8551	0.2257	3.6300e-003	0.2293		675.9631	675.9631	9.4600e-003	0.0117	679.6973
Total	**0.2423**	**5.3981**	**3.2338**	**0.0370**	**2.0207**	**0.0429**	**2.0636**	**0.5601**	**0.0409**	**0.6010**		**3,964.0754**	**3,964.0754**	**0.1506**	**0.4940**	**4,115.0617**

3.5 Turnouts - 2026

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2039	0.0000	12.2039	6.7042	0.0000	6.7042			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2039**	**0.3369**	**12.5408**	**6.7042**	**0.3263**	**7.0305**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0118	0.8642	0.2192	4.0800e-003	0.1086	6.6000e-003	0.1152	0.0305	6.3200e-003	0.0368		452.5289	452.5289	0.0299	0.0721	474.7510
Vendor	0.0807	4.4324	1.0363	0.0262	0.8505	0.0323	0.8829	0.2524	0.0309	0.2833		2,835.5834	2,835.5834	0.1112	0.4102	2,960.6134
Worker	0.1497	0.1015	1.9783	6.6900e-003	0.6661	3.9500e-003	0.6700	0.1802	3.6300e-003	0.1839		675.9631	675.9631	9.4600e-003	0.0117	679.6973
Total	**0.2423**	**5.3981**	**3.2338**	**0.0370**	**1.6252**	**0.0429**	**1.6681**	**0.4631**	**0.0409**	**0.5039**		**3,964.0754**	**3,964.0754**	**0.1506**	**0.4940**	**4,115.0617**

Chino Basin Program - Construction - South Coast Air Basin, Summer

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

3.5 Turnouts - 2027

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Fugitive Dust					27.1197	0.0000	27.1197	14.8982	0.0000	14.8982			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.1197**	**2.8404**	**29.9601**	**14.8982**	**2.6591**	**17.5573**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0116	0.8542	0.2214	3.9900e-003	0.1339	6.5700e-003	0.1405	0.0367	6.2800e-003	0.0430		443.4740	443.4740	0.0299	0.0706	465.2722
Vendor	0.0784	4.3942	1.0236	0.0257	1.0356	0.0322	1.0679	0.2978	0.0308	0.3286		2,779.6692	2,779.6692	0.1111	0.4027	2,902.4491
Worker	0.1417	0.0924	1.8655	6.5000e-003	0.8512	3.7000e-003	0.8549	0.2257	3.4100e-003	0.2291		656.9661	656.9661	8.5700e-003	0.0111	660.4942
Total	**0.2317**	**5.3408**	**3.1105**	**0.0362**	**2.0207**	**0.0425**	**2.0632**	**0.5601**	**0.0405**	**0.6007**		**3,880.1093**	**3,880.1093**	**0.1496**	**0.4845**	**4,028.2155**

3.5 Turnouts - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2039	0.0000	12.2039	6.7042	0.0000	6.7042			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2039**	**0.3369**	**12.5408**	**6.7042**	**0.3263**	**7.0305**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0116	0.8542	0.2214	3.9900e-003	0.1086	6.5700e-003	0.1151	0.0305	6.2800e-003	0.0368		443.4740	443.4740	0.0299	0.0706	465.2722
Vendor	0.0784	4.3942	1.0236	0.0257	0.8505	0.0322	0.8828	0.2524	0.0308	0.2832		2,779.6692	2,779.6692	0.1111	0.4027	2,902.4491
Worker	0.1417	0.0924	1.8655	6.5000e-003	0.6661	3.7000e-003	0.6698	0.1802	3.4100e-003	0.1836		656.9661	656.9661	8.5700e-003	0.0111	660.4942
Total	**0.2317**	**5.3408**	**3.1105**	**0.0362**	**1.6252**	**0.0425**	**1.6677**	**0.4631**	**0.0405**	**0.5036**		**3,880.1093**	**3,880.1093**	**0.1496**	**0.4845**	**4,028.2155**

3.6 WellheadDemo - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	1.4148	13.3507	9.9638	0.0222		0.5744	0.5744		0.5396	0.5396		2,129.438 7	2,129.438 7	0.4403		2,140.446 0
Total	**1.4148**	**13.3507**	**9.9638**	**0.0222**	**0.0000**	**0.5744**	**0.5744**	**0.0000**	**0.5396**	**0.5396**		**2,129.438 7**	**2,129.438 7**	**0.4403**		**2,140.446 0**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	2.0300e-003	0.1201	0.0360	5.3000e-004	0.0175	8.6000e-004	0.0184	4.7900e-003	8.2000e-004	5.6200e-003		59.1296	59.1296	3.9500e-003	9.4200e-003	62.0345
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0491	0.0284	0.5365	1.7300e-003	0.2236	1.0200e-003	0.2246	0.0593	9.4000e-004	0.0602		174.5909	174.5909	3.2500e-003	3.5100e-003	175.7195
Total	**0.0511**	**0.1485**	**0.5726**	**2.2600e-003**	**0.2410**	**1.8800e-003**	**0.2429**	**0.0641**	**1.7600e-003**	**0.0659**		**233.7204**	**233.7204**	**7.2000e-003**	**0.0129**	**237.7540**

3.6 WellheadDemo - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.2996	1.6423	11.4631	0.0222		0.0583	0.0583		0.0562	0.0562	0.0000	2,129.438 7	2,129.438 7	0.4403		2,140.446 0
Total	**0.2996**	**1.6423**	**11.4631**	**0.0222**	**0.0000**	**0.0583**	**0.0583**	**0.0000**	**0.0562**	**0.0562**	**0.0000**	**2,129.438 7**	**2,129.438 7**	**0.4403**		**2,140.446 0**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	2.0300e-003	0.1201	0.0360	5.3000e-004	0.0142	8.6000e-004	0.0150	3.9800e-003	8.2000e-004	4.8000e-003		59.1296	59.1296	3.9500e-003	9.4200e-003	62.0345
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0491	0.0284	0.5365	1.7300e-003	0.1750	1.0200e-003	0.1760	0.0474	9.4000e-004	0.0483		174.5909	174.5909	3.2500e-003	3.5100e-003	175.7195
Total	**0.0511**	**0.1485**	**0.5726**	**2.2600e-003**	**0.1892**	**1.8800e-003**	**0.1910**	**0.0513**	**1.7600e-003**	**0.0531**		**233.7204**	**233.7204**	**7.2000e-003**	**0.0129**	**237.7540**

3.7 AWPFSiteprep - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	2.4727	25.2339	17.9118	0.0381		1.0868	1.0868		0.9999	0.9999		3,689.1037	3,689.1037	1.1931		3,718.9320
Total	**2.4727**	**25.2339**	**17.9118**	**0.0381**	**18.0663**	**1.0868**	**19.1531**	**9.9307**	**0.9999**	**10.9305**		**3,689.1037**	**3,689.1037**	**1.1931**		**3,718.9320**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0981	0.0569	1.0731	3.4500e-003	0.4471	2.0400e-003	0.4492	0.1186	1.8800e-003	0.1205		349.1818	349.1818	6.5000e-003	7.0300e-003	351.4389
Total	**0.0981**	**0.0569**	**1.0731**	**3.4500e-003**	**0.4471**	**2.0400e-003**	**0.4492**	**0.1186**	**1.8800e-003**	**0.1205**		**349.1818**	**349.1818**	**6.5000e-003**	**7.0300e-003**	**351.4389**

3.7 AWPFSiteprep - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	0.5860	3.4105	20.6916	0.0381		0.1236	0.1236		0.1183	0.1183	0.0000	3,689.1037	3,689.1037	1.1931		3,718.9320
Total	**0.5860**	**3.4105**	**20.6916**	**0.0381**	**8.1298**	**0.1236**	**8.2534**	**4.4688**	**0.1183**	**4.5872**	**0.0000**	**3,689.1037**	**3,689.1037**	**1.1931**		**3,718.9320**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0981	0.0569	1.0731	3.4500e-003	0.3499	2.0400e-003	0.3520	0.0947	1.8800e-003	0.0966		349.1818	349.1818	6.5000e-003	7.0300e-003	351.4389
Total	**0.0981**	**0.0569**	**1.0731**	**3.4500e-003**	**0.3499**	**2.0400e-003**	**0.3520**	**0.0947**	**1.8800e-003**	**0.0966**		**349.1818**	**349.1818**	**6.5000e-003**	**7.0300e-003**	**351.4389**

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

3.8 Pipelines27 - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					27.2199	0.0000	27.2199	14.9090	0.0000	14.9090			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.2199**	**2.8404**	**30.0603**	**14.9090**	**2.6591**	**17.5682**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0455	3.3443	0.8668	0.0156	0.5242	0.0257	0.5499	0.1437	0.0246	0.1682		1,736.2007	1,736.2007	0.1172	0.2765	1,821.5408
Vendor	0.0840	4.7080	1.0968	0.0275	1.1096	0.0345	1.1442	0.3191	0.0330	0.3521		2,978.2170	2,978.2170	0.1190	0.4315	3,109.7669
Worker	0.4249	0.2772	5.5964	0.0195	2.5535	0.0111	2.5646	0.6770	0.0102	0.6872		1,970.8983	1,970.8983	0.0257	0.0334	1,981.4825
Total	**0.5545**	**8.3295**	**7.5600**	**0.0626**	**4.1873**	**0.0714**	**4.2587**	**1.1397**	**0.0679**	**1.2076**		**6,685.3161**	**6,685.3161**	**0.2619**	**0.7414**	**6,912.7901**

3.8 Pipelines27 - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2490	0.0000	12.2490	6.7091	0.0000	6.7091			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2490**	**0.3369**	**12.5858**	**6.7091**	**0.3263**	**7.0354**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0455	3.3443	0.8668	0.0156	0.4251	0.0257	0.4508	0.1193	0.0246	0.1439		1,736.2007	1,736.2007	0.1172	0.2765	1,821.5408
Vendor	0.0840	4.7080	1.0968	0.0275	0.9113	0.0345	0.9458	0.2704	0.0330	0.3034		2,978.2170	2,978.2170	0.1190	0.4315	3,109.7669
Worker	0.4249	0.2772	5.5964	0.0195	1.9982	0.0111	2.0093	0.5407	0.0102	0.5509		1,970.8983	1,970.8983	0.0257	0.0334	1,981.4825
Total	**0.5545**	**8.3295**	**7.5600**	**0.0626**	**3.3345**	**0.0714**	**3.4059**	**0.9304**	**0.0679**	**0.9983**		**6,685.3161**	**6,685.3161**	**0.2619**	**0.7414**	**6,912.7901**

3.9 PumpStationsGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.0302	0.0000	6.0302	3.3111	0.0000	3.3111			0.0000			0.0000
Off-Road	1.1904	12.4243	8.4937	0.0206		0.4961	0.4961		0.4564	0.4564		1,995.7975	1,995.7975	0.6455		2,011.9345
Total	**1.1904**	**12.4243**	**8.4937**	**0.0206**	**6.0302**	**0.4961**	**6.5263**	**3.3111**	**0.4564**	**3.7675**		**1,995.7975**	**1,995.7975**	**0.6455**		**2,011.9345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0204	1.0068	0.2702	5.5800e-003	0.2221	6.9400e-003	0.2290	0.0639	6.6400e-003	0.0705		604.2430	604.2430	0.0241	0.0877	630.9705
Worker	0.0245	0.0142	0.2683	8.6000e-004	0.1118	5.1000e-004	0.1123	0.0296	4.7000e-004	0.0301		87.2954	87.2954	1.6300e-003	1.7600e-003	87.8597
Total	**0.0450**	**1.0210**	**0.5385**	**6.4400e-003**	**0.3339**	**7.4500e-003**	**0.3413**	**0.0935**	**7.1100e-003**	**0.1006**		**691.5384**	**691.5384**	**0.0258**	**0.0894**	**718.8302**

3.9 PumpStationsGrading - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					2.7136	0.0000	2.7136	1.4900	0.0000	1.4900			0.0000			0.0000
Off-Road	0.2947	1.5862	10.8451	0.0206		0.0553	0.0553		0.0535	0.0535	0.0000	1,995.797 5	1,995.797 5	0.6455		2,011.934 5
Total	**0.2947**	**1.5862**	**10.8451**	**0.0206**	**2.7136**	**0.0553**	**2.7689**	**1.4900**	**0.0535**	**1.5435**	**0.0000**	**1,995.797 5**	**1,995.797 5**	**0.6455**		**2,011.934 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0204	1.0068	0.2702	5.5800e-003	0.1824	6.9400e-003	0.1894	0.0541	6.6400e-003	0.0608		604.2430	604.2430	0.0241	0.0877	630.9705
Worker	0.0245	0.0142	0.2683	8.6000e-004	0.0875	5.1000e-004	0.0880	0.0237	4.7000e-004	0.0242		87.2954	87.2954	1.6300e-003	1.7600e-003	87.8597
Total	**0.0450**	**1.0210**	**0.5385**	**6.4400e-003**	**0.2699**	**7.4500e-003**	**0.2774**	**0.0778**	**7.1100e-003**	**0.0849**		**691.5384**	**691.5384**	**0.0258**	**0.0894**	**718.8302**

3.10 PumpStationsConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.4419	3.9994	4.4906	8.0500e-003		0.1638	0.1638		0.1523	0.1523		759.2233	759.2233	0.2219		764.7696
Total	**0.4419**	**3.9994**	**4.4906**	**8.0500e-003**		**0.1638**	**0.1638**		**0.1523**	**0.1523**		**759.2233**	**759.2233**	**0.2219**		**764.7696**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0506	0.0330	0.6662	2.3200e-003	0.3040	1.3200e-003	0.3053	0.0806	1.2200e-003	0.0818		234.6308	234.6308	3.0600e-003	3.9700e-003	235.8908
Total	**0.0506**	**0.0330**	**0.6662**	**2.3200e-003**	**0.3040**	**1.3200e-003**	**0.3053**	**0.0806**	**1.2200e-003**	**0.0818**		**234.6308**	**234.6308**	**3.0600e-003**	**3.9700e-003**	**235.8908**

3.10 PumpStationsConstruct - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.1164	1.0027	4.9426	8.0500e-003		0.0186	0.0186		0.0181	0.0181	0.0000	759.2233	759.2233	0.2219		764.7696
Total	**0.1164**	**1.0027**	**4.9426**	**8.0500e-003**		**0.0186**	**0.0186**		**0.0181**	**0.0181**	**0.0000**	**759.2233**	**759.2233**	**0.2219**		**764.7696**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0506	0.0330	0.6662	2.3200e-003	0.2379	1.3200e-003	0.2392	0.0644	1.2200e-003	0.0656		234.6308	234.6308	3.0600e-003	3.9700e-003	235.8908
Total	**0.0506**	**0.0330**	**0.6662**	**2.3200e-003**	**0.2379**	**1.3200e-003**	**0.2392**	**0.0644**	**1.2200e-003**	**0.0656**		**234.6308**	**234.6308**	**3.0600e-003**	**3.9700e-003**	**235.8908**

3.11 AWPFGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.6849	0.0000	6.6849	3.3818	0.0000	3.3818			0.0000			0.0000
Off-Road	1.5227	15.3148	14.5402	0.0297		0.6236	0.6236		0.5737	0.5737		2,873.705 2	2,873.705 2	0.9294		2,896.940 5
Total	**1.5227**	**15.3148**	**14.5402**	**0.0297**	**6.6849**	**0.6236**	**7.3085**	**3.3818**	**0.5737**	**3.9555**		**2,873.705 2**	**2,873.705 2**	**0.9294**		**2,896.940 5**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0840	4.7080	1.0968	0.0275	1.1096	0.0345	1.1442	0.3191	0.0330	0.3521		2,978.217 0	2,978.217 0	0.1190	0.4315	3,109.766 9
Worker	0.0981	0.0569	1.0731	3.4500e-003	0.4471	2.0400e-003	0.4492	0.1186	1.8800e-003	0.1205		349.1818	349.1818	6.5000e-003	7.0300e-003	351.4389
Total	**0.1822**	**4.7649**	**2.1698**	**0.0309**	**1.5567**	**0.0366**	**1.5933**	**0.4376**	**0.0349**	**0.4725**		**3,327.398 8**	**3,327.398 8**	**0.1255**	**0.4385**	**3,461.205 8**

3.11 AWPFGrading - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.0082	0.0000	3.0082	1.5218	0.0000	1.5218			0.0000			0.0000
Off-Road	0.4210	2.2308	17.6296	0.0297		0.0779	0.0779		0.0754	0.0754	0.0000	2,873.705 2	2,873.705 2	0.9294		2,896.940 5
Total	**0.4210**	**2.2308**	**17.6296**	**0.0297**	**3.0082**	**0.0779**	**3.0861**	**1.5218**	**0.0754**	**1.5972**	**0.0000**	**2,873.705 2**	**2,873.705 2**	**0.9294**		**2,896.940 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0840	4.7080	1.0968	0.0275	0.9113	0.0345	0.9458	0.2704	0.0330	0.3034		2,978.217 0	2,978.217 0	0.1190	0.4315	3,109.766 9
Worker	0.0981	0.0569	1.0731	3.4500e-003	0.3499	2.0400e-003	0.3520	0.0947	1.8800e-003	0.0966		349.1818	349.1818	6.5000e-003	7.0300e-003	351.4389
Total	**0.1822**	**4.7649**	**2.1698**	**0.0309**	**1.2612**	**0.0366**	**1.2978**	**0.3651**	**0.0349**	**0.4000**		**3,327.398 8**	**3,327.398 8**	**0.1255**	**0.4385**	**3,461.205 8**

3.12 AWPFConstruction - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3674	12.4697	16.0847	0.0270		0.5276	0.5276		0.4963	0.4963		2,556.474 4	2,556.474 4	0.6010		2,571.498 1
Total	**1.3674**	**12.4697**	**16.0847**	**0.0270**		**0.5276**	**0.5276**		**0.4963**	**0.4963**		**2,556.474 4**	**2,556.474 4**	**0.6010**		**2,571.498 1**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0840	4.7080	1.0968	0.0275	1.1096	0.0345	1.1442	0.3191	0.0330	0.3521		2,978.217 0	2,978.217 0	0.1190	0.4315	3,109.766 9
Worker	0.0981	0.0569	1.0731	3.4500e-003	0.4471	2.0400e-003	0.4492	0.1186	1.8800e-003	0.1205		349.1818	349.1818	6.5000e-003	7.0300e-003	351.4389
Total	**0.1822**	**4.7649**	**2.1698**	**0.0309**	**1.5567**	**0.0366**	**1.5933**	**0.4376**	**0.0349**	**0.4725**		**3,327.398 8**	**3,327.398 8**	**0.1255**	**0.4385**	**3,461.205 8**

3.12 AWPFConstruction - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3633	2.6497	17.3850	0.0270		0.0583	0.0583		0.0572	0.0572	0.0000	2,556.4744	2,556.4744	0.6010		2,571.4981
Total	**0.3633**	**2.6497**	**17.3850**	**0.0270**		**0.0583**	**0.0583**		**0.0572**	**0.0572**	**0.0000**	**2,556.4744**	**2,556.4744**	**0.6010**		**2,571.4981**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0840	4.7080	1.0968	0.0275	0.9113	0.0345	0.9458	0.2704	0.0330	0.3034		2,978.2170	2,978.2170	0.1190	0.4315	3,109.7669
Worker	0.0981	0.0569	1.0731	3.4500e-003	0.3499	2.0400e-003	0.3520	0.0947	1.8800e-003	0.0966		349.1818	349.1818	6.5000e-003	7.0300e-003	351.4389
Total	**0.1822**	**4.7649**	**2.1698**	**0.0309**	**1.2612**	**0.0366**	**1.2978**	**0.3651**	**0.0349**	**0.4000**		**3,327.3988**	**3,327.3988**	**0.1255**	**0.4385**	**3,461.2058**

3.13 WellheadGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.3182	0.0000	0.3182	0.0344	0.0000	0.0344			0.0000			0.0000
Off-Road	0.8630	9.1903	9.0802	0.0193		0.3292	0.3292		0.3028	0.3028		1,866.527 0	1,866.527 0	0.6037		1,881.618 8
Total	**0.8630**	**9.1903**	**9.0802**	**0.0193**	**0.3182**	**0.3292**	**0.6473**	**0.0344**	**0.3028**	**0.3372**		**1,866.527 0**	**1,866.527 0**	**0.6037**		**1,881.618 8**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0491	0.0284	0.5365	1.7300e-003	0.2236	1.0200e-003	0.2246	0.0593	9.4000e-004	0.0602		174.5909	174.5909	3.2500e-003	3.5100e-003	175.7195
Total	**0.0491**	**0.0284**	**0.5365**	**1.7300e-003**	**0.2236**	**1.0200e-003**	**0.2246**	**0.0593**	**9.4000e-004**	**0.0602**		**174.5909**	**174.5909**	**3.2500e-003**	**3.5100e-003**	**175.7195**

3.13 WellheadGrading - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.1432	0.0000	0.1432	0.0155	0.0000	0.0155			0.0000			0.0000
Off-Road	0.2526	1.2318	11.4683	0.0193		0.0402	0.0402		0.0395	0.0395	0.0000	1,866.527 0	1,866.527 0	0.6037		1,881.618 8
Total	**0.2526**	**1.2318**	**11.4683**	**0.0193**	**0.1432**	**0.0402**	**0.1834**	**0.0155**	**0.0395**	**0.0549**	**0.0000**	**1,866.527 0**	**1,866.527 0**	**0.6037**		**1,881.618 8**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0491	0.0284	0.5365	1.7300e-003	0.1750	1.0200e-003	0.1760	0.0474	9.4000e-004	0.0483		174.5909	174.5909	3.2500e-003	3.5100e-003	175.7195
Total	**0.0491**	**0.0284**	**0.5365**	**1.7300e-003**	**0.1750**	**1.0200e-003**	**0.1760**	**0.0474**	**9.4000e-004**	**0.0483**		**174.5909**	**174.5909**	**3.2500e-003**	**3.5100e-003**	**175.7195**

3.14 WellheadConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3257	12.1385	15.4372	0.0266		0.4990	0.4990		0.4699	0.4699		2,517.5523	2,517.5523	0.5884		2,532.2613
Total	**1.3257**	**12.1385**	**15.4372**	**0.0266**		**0.4990**	**0.4990**		**0.4699**	**0.4699**		**2,517.5523**	**2,517.5523**	**0.5884**		**2,532.2613**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0560	3.1387	0.7312	0.0183	0.7397	0.0230	0.7628	0.2127	0.0220	0.2347		1,985.4780	1,985.4780	0.0793	0.2876	2,073.1779
Worker	0.0600	0.0363	0.7033	2.3400e-003	0.3041	1.3600e-003	0.3054	0.0806	1.2500e-003	0.0819		236.3203	236.3203	3.8500e-003	4.4400e-003	237.7404
Total	**0.1160**	**3.1750**	**1.4344**	**0.0207**	**1.0438**	**0.0244**	**1.0682**	**0.2933**	**0.0233**	**0.3166**		**2,221.7983**	**2,221.7983**	**0.0832**	**0.2921**	**2,310.9183**

3.14 WellheadConstruct - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3618	2.6716	16.8379	0.0266		0.0595	0.0595		0.0582	0.0582	0.0000	2,517.552 3	2,517.552 3	0.5884		2,532.261 3
Total	**0.3618**	**2.6716**	**16.8379**	**0.0266**		**0.0595**	**0.0595**		**0.0582**	**0.0582**	**0.0000**	**2,517.552 3**	**2,517.552 3**	**0.5884**		**2,532.261 3**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0560	3.1387	0.7312	0.0183	0.6075	0.0230	0.6306	0.1803	0.0220	0.2023		1,985.478 0	1,985.478 0	0.0793	0.2876	2,073.177 9
Worker	0.0600	0.0363	0.7033	2.3400e-003	0.2380	1.3600e-003	0.2393	0.0644	1.2500e-003	0.0657		236.3203	236.3203	3.8500e-003	4.4400e-003	237.7404
Total	**0.1160**	**3.1750**	**1.4344**	**0.0207**	**0.8455**	**0.0244**	**0.8699**	**0.2447**	**0.0233**	**0.2679**		**2,221.798 3**	**2,221.798 3**	**0.0832**	**0.2921**	**2,310.918 3**

3.15 StorageResGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.4463	0.0000	6.4463	3.3560	0.0000	3.3560			0.0000			0.0000
Off-Road	1.5227	15.3148	14.5402	0.0297		0.6236	0.6236		0.5737	0.5737		2,873.705 2	2,873.705 2	0.9294		2,896.940 5
Total	**1.5227**	**15.3148**	**14.5402**	**0.0297**	**6.4463**	**0.6236**	**7.0699**	**3.3560**	**0.5737**	**3.9297**		**2,873.705 2**	**2,873.705 2**	**0.9294**		**2,896.940 5**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.2122	16.4629	4.1200	0.0778	2.6208	0.1284	2.7492	0.7181	0.1228	0.8409		8,643.317 5	8,643.317 5	0.5847	1.3768	9,068.209 3
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0720	0.0436	0.8439	2.8100e-003	0.3649	1.6300e-003	0.3665	0.0968	1.5000e-003	0.0983		283.5844	283.5844	4.6200e-003	5.3300e-003	285.2884
Total	**0.2841**	**16.5065**	**4.9640**	**0.0806**	**2.9857**	**0.1300**	**3.1157**	**0.8149**	**0.1243**	**0.9392**		**8,926.901 8**	**8,926.901 8**	**0.5893**	**1.3821**	**9,353.497 8**

3.15 StorageResGrading - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					2.9008	0.0000	2.9008	1.5102	0.0000	1.5102			0.0000			0.0000
Off-Road	0.4210	2.2308	17.6296	0.0297		0.0779	0.0779		0.0754	0.0754	0.0000	2,873.705 2	2,873.705 2	0.9294		2,896.940 5
Total	**0.4210**	**2.2308**	**17.6296**	**0.0297**	**2.9008**	**0.0779**	**2.9788**	**1.5102**	**0.0754**	**1.5856**	**0.0000**	**2,873.705 2**	**2,873.705 2**	**0.9294**		**2,896.940 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.2122	16.4629	4.1200	0.0778	2.1250	0.1284	2.2534	0.5964	0.1228	0.7193		8,643.317 5	8,643.317 5	0.5847	1.3768	9,068.209 3
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0720	0.0436	0.8439	2.8100e-003	0.2856	1.6300e-003	0.2872	0.0773	1.5000e-003	0.0788		283.5844	283.5844	4.6200e-003	5.3300e-003	285.2884
Total	**0.2841**	**16.5065**	**4.9640**	**0.0806**	**2.4106**	**0.1300**	**2.5406**	**0.6737**	**0.1243**	**0.7980**		**8,926.901 8**	**8,926.901 8**	**0.5893**	**1.3821**	**9,353.497 8**

3.16 StorageResConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3674	12.4697	16.0847	0.0270		0.5276	0.5276		0.4963	0.4963		2,556.4744	2,556.4744	0.6010		2,571.4981
Total	**1.3674**	**12.4697**	**16.0847**	**0.0270**		**0.5276**	**0.5276**		**0.4963**	**0.4963**		**2,556.4744**	**2,556.4744**	**0.6010**		**2,571.4981**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0720	0.0436	0.8439	2.8100e-003	0.3649	1.6300e-003	0.3665	0.0968	1.5000e-003	0.0983		283.5844	283.5844	4.6200e-003	5.3300e-003	285.2884
Total	**0.0720**	**0.0436**	**0.8439**	**2.8100e-003**	**0.3649**	**1.6300e-003**	**0.3665**	**0.0968**	**1.5000e-003**	**0.0983**		**283.5844**	**283.5844**	**4.6200e-003**	**5.3300e-003**	**285.2884**

3.16 StorageResConstruct - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3633	2.6497	17.3850	0.0270		0.0583	0.0583		0.0572	0.0572	0.0000	2,556.4744	2,556.4744	0.6010		2,571.4981
Total	**0.3633**	**2.6497**	**17.3850**	**0.0270**		**0.0583**	**0.0583**		**0.0572**	**0.0572**	**0.0000**	**2,556.4744**	**2,556.4744**	**0.6010**		**2,571.4981**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0720	0.0436	0.8439	2.8100e-003	0.2856	1.6300e-003	0.2872	0.0773	1.5000e-003	0.0788		283.5844	283.5844	4.6200e-003	5.3300e-003	285.2884
Total	**0.0720**	**0.0436**	**0.8439**	**2.8100e-003**	**0.2856**	**1.6300e-003**	**0.2872**	**0.0773**	**1.5000e-003**	**0.0788**		**283.5844**	**283.5844**	**4.6200e-003**	**5.3300e-003**	**285.2884**

3.17 StorageResPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.8197	7.5321	12.1778	0.0189		0.3524	0.3524		0.3259	0.3259		1,805.3926	1,805.3926	0.5673		1,819.5741
Paving	6.3509					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**7.1706**	**7.5321**	**12.1778**	**0.0189**		**0.3524**	**0.3524**		**0.3259**	**0.3259**		**1,805.3926**	**1,805.3926**	**0.5673**		**1,819.5741**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0720	0.0436	0.8439	2.8100e-003	0.3649	1.6300e-003	0.3665	0.0968	1.5000e-003	0.0983		283.5844	283.5844	4.6200e-003	5.3300e-003	285.2884
Total	**0.0720**	**0.0436**	**0.8439**	**2.8100e-003**	**0.3649**	**1.6300e-003**	**0.3665**	**0.0968**	**1.5000e-003**	**0.0983**		**283.5844**	**283.5844**	**4.6200e-003**	**5.3300e-003**	**285.2884**

3.17 StorageResPaving - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.2432	1.2327	13.4633	0.0189		0.0434	0.0434		0.0421	0.0421	0.0000	1,805.3926	1,805.3926	0.5673		1,819.5741
Paving	6.3509					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**6.5941**	**1.2327**	**13.4633**	**0.0189**		**0.0434**	**0.0434**		**0.0421**	**0.0421**	**0.0000**	**1,805.3926**	**1,805.3926**	**0.5673**		**1,819.5741**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0720	0.0436	0.8439	2.8100e-003	0.2856	1.6300e-003	0.2872	0.0773	1.5000e-003	0.0788		283.5844	283.5844	4.6200e-003	5.3300e-003	285.2884
Total	**0.0720**	**0.0436**	**0.8439**	**2.8100e-003**	**0.2856**	**1.6300e-003**	**0.2872**	**0.0773**	**1.5000e-003**	**0.0788**		**283.5844**	**283.5844**	**4.6200e-003**	**5.3300e-003**	**285.2884**

3.18 WellheadPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.7465	6.8132	11.2492	0.0178		0.3285	0.3285		0.3034	0.3034		1,706.7780	1,706.7780	0.5407		1,720.2942
Paving	3.1754					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.9220**	**6.8132**	**11.2492**	**0.0178**		**0.3285**	**0.3285**		**0.3034**	**0.3034**		**1,706.7780**	**1,706.7780**	**0.5407**		**1,720.2942**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0600	0.0363	0.7033	2.3400e-003	0.3041	1.3600e-003	0.3054	0.0806	1.2500e-003	0.0819		236.3203	236.3203	3.8500e-003	4.4400e-003	237.7404
Total	**0.0600**	**0.0363**	**0.7033**	**2.3400e-003**	**0.3041**	**1.3600e-003**	**0.3054**	**0.0806**	**1.2500e-003**	**0.0819**		**236.3203**	**236.3203**	**3.8500e-003**	**4.4400e-003**	**237.7404**

3.18 WellheadPaving - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.2327	1.1495	12.9316	0.0178		0.0402	0.0402		0.0393	0.0393	0.0000	1,706.778 0	1,706.778 0	0.5407		1,720.294 2
Paving	3.1754					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.4081**	**1.1495**	**12.9316**	**0.0178**		**0.0402**	**0.0402**		**0.0393**	**0.0393**	**0.0000**	**1,706.778 0**	**1,706.778 0**	**0.5407**		**1,720.294 2**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0600	0.0363	0.7033	2.3400e-003	0.2380	1.3600e-003	0.2393	0.0644	1.2500e-003	0.0657		236.3203	236.3203	3.8500e-003	4.4400e-003	237.7404
Total	**0.0600**	**0.0363**	**0.7033**	**2.3400e-003**	**0.2380**	**1.3600e-003**	**0.2393**	**0.0644**	**1.2500e-003**	**0.0657**		**236.3203**	**236.3203**	**3.8500e-003**	**4.4400e-003**	**237.7404**

3.19 AWPFPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.8498	7.7205	12.3356	0.0193		0.3597	0.3597		0.3332	0.3332		1,831.252 1	1,831.252 1	0.5700		1,845.500 7
Paving	3.5283					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.3781**	**7.7205**	**12.3356**	**0.0193**		**0.3597**	**0.3597**		**0.3332**	**0.3332**		**1,831.252 1**	**1,831.252 1**	**0.5700**		**1,845.500 7**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0981	0.0569	1.0731	3.4500e-003	0.4471	2.0400e-003	0.4492	0.1186	1.8800e-003	0.1205		349.1818	349.1818	6.5000e-003	7.0300e-003	351.4389
Total	**0.0981**	**0.0569**	**1.0731**	**3.4500e-003**	**0.4471**	**2.0400e-003**	**0.4492**	**0.1186**	**1.8800e-003**	**0.1205**		**349.1818**	**349.1818**	**6.5000e-003**	**7.0300e-003**	**351.4389**

3.19 AWPFPaving - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.2453	1.2459	13.4744	0.0193		0.0439	0.0439		0.0427	0.0427	0.0000	1,831.2521	1,831.2521	0.5700		1,845.5007
Paving	3.5283					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.7736**	**1.2459**	**13.4744**	**0.0193**		**0.0439**	**0.0439**		**0.0427**	**0.0427**	**0.0000**	**1,831.2521**	**1,831.2521**	**0.5700**		**1,845.5007**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0981	0.0569	1.0731	3.4500e-003	0.3499	2.0400e-003	0.3520	0.0947	1.8800e-003	0.0966		349.1818	349.1818	6.5000e-003	7.0300e-003	351.4389
Total	**0.0981**	**0.0569**	**1.0731**	**3.4500e-003**	**0.3499**	**2.0400e-003**	**0.3520**	**0.0947**	**1.8800e-003**	**0.0966**		**349.1818**	**349.1818**	**6.5000e-003**	**7.0300e-003**	**351.4389**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Asphalt Surfaces	0.00	0.00	0.00		
Refrigerated Warehouse-No Rail	0.00	0.00	0.00		
Unrefrigerated Warehouse-No Rail	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Asphalt Surfaces	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0
Refrigerated Warehouse-No Rail	16.60	8.40	6.90	59.00	0.00	41.00	92	5	3
Unrefrigerated Warehouse-No Rail	16.60	8.40	6.90	59.00	0.00	41.00	92	5	3

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Other Asphalt Surfaces	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480
Refrigerated Warehouse-No Rail	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480
Unrefrigerated Warehouse-No Rail	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	30.4348	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Unmitigated	30.4348	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	30.4106					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0241	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Total	**30.4348**	**2.3700e-003**	**0.2620**	**2.0000e-005**		**9.3000e-004**	**9.3000e-004**		**9.3000e-004**	**9.3000e-004**		**0.5631**	**0.5631**	**1.4600e-003**		**0.5997**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	30.4106					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0241	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Total	**30.4348**	**2.3700e-003**	**0.2620**	**2.0000e-005**		**9.3000e-004**	**9.3000e-004**		**9.3000e-004**	**9.3000e-004**		**0.5631**	**0.5631**	**1.4600e-003**		**0.5997**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Chino Basin Program - Construction

South Coast Air Basin, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Refrigerated Warehouse-No Rail	1,354.00	1000sqft	31.08	1,354,000.00	0
Other Asphalt Surfaces	1,056.00	1000sqft	24.24	1,056,000.00	0
Unrefrigerated Warehouse-No Rail	163.00	1000sqft	3.74	163,000.00	0

1.2 Other Project Characteristics

Urbanization Urban

Wind Speed (m/s) 2.2

Precipitation Freq (Days) 31

Climate Zone 10

Operational Year 2028

Utility Company Southern California Edison

CO2 Intensity (lb/MWhr) 390.98

CH4 Intensity (lb/MWhr) 0.033

N2O Intensity (lb/MWhr) 0.004

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - CalEEMod has limited choices for land use types. Industrial Refrigerated Warehouse - no rail chosen for most CBP components because allows for project-specific entries for energy use, and construction. Parking Other Asphalt Surfaces chosen for pipes, turnouts because allows for project-specific entries on construction equipment, etc., and doesn't have operational energy usage.

Construction Phase - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Grading - see project description

Demolition -

Trips and VMT - see project description.

Vehicle Trips - construction only

Area Coating - construction only

Landscape Equipment - construction only

Energy Use - construction only

Water And Wastewater - construction only

Solid Waste - construction only

Construction Off-road Equipment Mitigation - rule 403 and 90-percent Tier 4

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_Nonresidential_Exterior	758500	0
tblAreaCoating	Area_Nonresidential_Interior	2275500	0
tblAreaCoating	Area_Parking	63360	0
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstDustMitigation	CleanPavedRoadPercentReduction	0	25

tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	13.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	20.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	9.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	9.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	17.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	34.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	51.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	19.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	17.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	9.00
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tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	11.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	14.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	11.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
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EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

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tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
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tblConstructionPhase	NumDays	1,110.00	75.00
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tblConstructionPhase	NumDays	110.00	8.00
tblConstructionPhase	NumDays	110.00	20.00
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tblConstructionPhase	NumDays	110.00	44.00
tblConstructionPhase	NumDays	110.00	44.00
tblConstructionPhase	NumDays	110.00	522.00
tblConstructionPhase	NumDays	110.00	44.00
tblConstructionPhase	NumDays	110.00	261.00
tblConstructionPhase	NumDays	75.00	10.00
tblConstructionPhase	NumDays	75.00	20.00
tblConstructionPhase	NumDays	75.00	18.00
tblConstructionPhase	NumDays	40.00	5.00
tblEnergyUse	LightingElect	2.37	0.00
tblEnergyUse	LightingElect	1.17	0.00
tblEnergyUse	NT24E	36.52	0.00
tblEnergyUse	NT24E	0.82	0.00
tblEnergyUse	NT24NG	48.51	0.00

tblEnergyUse	NT24NG	0.03	0.00
tblEnergyUse	T24E	0.95	0.00
tblEnergyUse	T24E	0.33	0.00
tblEnergyUse	T24NG	3.22	0.00
tblEnergyUse	T24NG	1.98	0.00
tblGrading	AcresOfGrading	1,174.50	18.50
tblGrading	AcresOfGrading	8.00	5.00
tblGrading	AcresOfGrading	15.00	6.00
tblGrading	AcresOfGrading	10.00	4.00
tblGrading	AcresOfGrading	121.00	5.00
tblGrading	AcresOfGrading	121.00	5.00
tblGrading	AcresOfGrading	1,435.50	10.00
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tblGrading	AcresOfGrading	121.00	5.00
tblGrading	AcresOfGrading	261.00	2.00
tblLandscapeEquipment	NumberSummerDays	250	0
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tblOffRoadEquipment	OffRoadEquipmentType		Signal Boards
tblOffRoadEquipment	OffRoadEquipmentType		Plate Compactors
tblOffRoadEquipment	OffRoadEquipmentType		Signal Boards
tblOffRoadEquipment	OffRoadEquipmentType		Plate Compactors
tblOffRoadEquipment	OffRoadEquipmentType		Signal Boards
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tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
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tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	3.00
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tblOffRoadEquipment	UsageHours	8.00	4.00
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tblOffRoadEquipment	UsageHours	8.00	6.00

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tblOffRoadEquipment	UsageHours	8.00	4.00
tblSolidWaste	SolidWasteGenerationRate	1,272.76	0.00
tblSolidWaste	SolidWasteGenerationRate	153.22	0.00
tblTripsAndVMT	HaulingTripLength	20.00	50.00
tblTripsAndVMT	HaulingTripLength	20.00	40.00
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tblTripsAndVMT	VendorTripLength	6.90	20.00
tblTripsAndVMT	VendorTripNumber	0.00	128.00

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

tblTripsAndVMT	VendorTripNumber	0.00	30.00
tblTripsAndVMT	VendorTripNumber	422.00	30.00
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tblTripsAndVMT	VendorTripNumber	0.00	30.00
tblTripsAndVMT	VendorTripNumber	0.00	12.00
tblTripsAndVMT	VendorTripNumber	422.00	0.00
tblTripsAndVMT	WorkerTripLength	14.70	20.00
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tblTripsAndVMT	WorkerTripNumber	10.00	20.00
tblTripsAndVMT	WorkerTripNumber	18.00	40.00
tblTripsAndVMT	WorkerTripNumber	100.00	84.00
tblTripsAndVMT	WorkerTripNumber	1,081.00	10.00
tblVehicleTrips	ST_TR	2.12	0.00
tblVehicleTrips	ST_TR	1.74	0.00
tblVehicleTrips	SU_TR	2.12	0.00
tblVehicleTrips	SU_TR	1.74	0.00
tblVehicleTrips	WD_TR	2.12	0.00
tblVehicleTrips	WD_TR	1.74	0.00
tblWater	IndoorWaterUseRate	313,112,500.00	0.00
tblWater	IndoorWaterUseRate	37,693,750.00	0.00

2.0 Emissions Summary

Chino Basin Program - Construction - South Coast Air Basin, Winter

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2025	14.2506	155.1718	126.0471	0.4629	56.3107	5.3206	61.6313	27.9208	4.9717	32.8925	0.0000	46,980.78 73	46,980.78 73	6.9786	3.1717	48,100.42 93
2026	21.6605	225.8374	187.9566	0.6164	85.4511	8.2027	93.6538	43.3792	7.6706	51.0498	0.0000	62,077.39 75	62,077.39 75	9.9923	3.6093	63,402.79 26
2027	31.2361	281.7535	236.4349	0.7530	110.8735	10.5343	121.4078	56.9777	9.8287	66.8064	0.0000	75,763.54 06	75,763.54 06	12.5298	5.0051	77,371.60 15
Maximum	**31.2361**	**281.7535**	**236.4349**	**0.7530**	**110.8735**	**10.5343**	**121.4078**	**56.9777**	**9.8287**	**66.8064**	**0.0000**	**75,763.54 06**	**75,763.54 06**	**12.5298**	**5.0051**	**77,371.60 15**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2025	5.0496	60.7223	140.2809	0.4629	29.2846	1.0260	30.3106	13.7408	0.9806	14.7214	0.0000	46,980.78 73	46,980.78 73	6.9786	3.1717	48,100.42 93
2026	7.0103	77.1022	210.2124	0.6164	43.1136	1.4047	44.5183	20.9081	1.3468	22.2549	0.0000	62,077.39 75	62,077.39 75	9.9923	3.6093	63,402.79 26
2027	19.1191	93.9790	264.1950	0.7530	55.0039	1.6709	56.6748	27.1551	1.6028	28.7579	0.0000	75,763.54 06	75,763.54 06	12.5298	5.0051	77,371.60 14
Maximum	**19.1191**	**93.9790**	**264.1950**	**0.7530**	**55.0039**	**1.6709**	**56.6748**	**27.1551**	**1.6028**	**28.7579**	**0.0000**	**75,763.54 06**	**75,763.54 06**	**12.5298**	**5.0051**	**77,371.60 14**

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	53.57	65.02	-11.67	0.00	49.57	82.95	52.47	51.82	82.51	56.39	0.00	0.00	0.00	0.00	0.00	0.00

Chino Basin Program - Construction - South Coast Air Basin, Winter

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	30.4348	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total	**30.4348**	**2.3700e-003**	**0.2620**	**2.0000e-005**	**0.0000**	**9.3000e-004**	**9.3000e-004**	**0.0000**	**9.3000e-004**	**9.3000e-004**		**0.5631**	**0.5631**	**1.4600e-003**	**0.0000**	**0.5997**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	30.4348	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total	**30.4348**	**2.3700e-003**	**0.2620**	**2.0000e-005**	**0.0000**	**9.3000e-004**	**9.3000e-004**	**0.0000**	**9.3000e-004**	**9.3000e-004**		**0.5631**	**0.5631**	**1.4600e-003**	**0.0000**	**0.5997**

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Wells	Grading	1/1/2025	12/31/2027	5	783	Wells
2	Pipelines25	Grading	1/1/2025	3/3/2025	5	44	Pipelines25
3	Pipelines26	Grading	1/1/2026	3/3/2026	5	44	Pipelines26
4	Turnouts	Grading	1/1/2026	12/31/2027	5	522	Turnouts
5	WellheadDemo	Demolition	1/1/2027	1/28/2027	5	20	WellheadDemo
6	AWPFSiteprep	Site Preparation	1/1/2027	1/7/2027	5	5	AWPFSiteprep
7	Pipelines27	Grading	1/1/2027	3/3/2027	5	44	Pipelines27
8	PumpStationsGrading	Grading	1/1/2027	12/31/2027	5	261	PumpStationsGrading
9	PumpStationsConstruct	Building Construction	1/1/2027	12/31/2027	5	261	PumpStationsConstruct
10	AWPFGrading	Grading	1/8/2027	1/19/2027	5	8	AWPFGrading
11	AWPFConstruction	Building Construction	1/20/2027	12/7/2027	5	230	AWPFConstruction
12	WellheadGrading	Grading	1/29/2027	2/25/2027	5	20	WellheadGrading
13	WellheadConstruct	Building Construction	2/26/2027	12/3/2027	5	201	WellheadConstruct
14	StorageResGrading	Grading	8/2/2027	8/13/2027	5	10	StorageResGrading
15	StorageResConstruct	Building Construction	8/16/2027	11/26/2027	5	75	StorageResConstruct
16	StorageResPaving	Paving	11/29/2027	12/10/2027	5	10	StorageResPaving
17	WellheadPaving	Paving	12/6/2027	12/31/2027	5	20	WellheadPaving
18	AWPFPaving	Paving	12/8/2027	12/31/2027	5	18	AWPFPaving

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 18.5

Acres of Paving: 24.24

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Wells	Rubber Tired Dozers	4	6.00	247	0.40
Wells	Tractors/Loaders/Backhoes	12	6.00	97	0.37
Wells	Bore/Drill Rigs	1	24.00	221	0.50
Wells	Cranes	4	6.00	231	0.29
Wells	Welders	4	4.00	46	0.45
Pipelines25	Excavators	3	4.00	158	0.38
Pipelines25	Graders	1	8.00	187	0.41
Pipelines25	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines25	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines25	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines25	Cranes	3	6.00	231	0.29
Pipelines25	Rollers	3	6.00	80	0.38
Pipelines25	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines25	Paving Equipment	3	2.00	132	0.36
Pipelines25	Generator Sets	3	1.00	84	0.74
Pipelines26	Excavators	3	4.00	158	0.38
Pipelines26	Graders	1	8.00	187	0.41
Pipelines26	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines26	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines26	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines26	Cranes	3	6.00	231	0.29
Pipelines26	Rollers	3	6.00	80	0.38

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Pipelines26	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines26	Paving Equipment	3	2.00	132	0.36
Pipelines26	Generator Sets	3	1.00	84	0.74
Pipelines27	Excavators	3	4.00	158	0.38
Pipelines27	Graders	1	8.00	187	0.41
Pipelines27	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines27	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines27	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines27	Cranes	3	6.00	231	0.29
Pipelines27	Rollers	3	6.00	80	0.38
Pipelines27	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines27	Paving Equipment	3	2.00	132	0.36
Pipelines27	Generator Sets	3	1.00	84	0.74
Turnouts	Excavators	3	4.00	158	0.38
Turnouts	Graders	1	8.00	187	0.41
Turnouts	Rubber Tired Dozers	6	6.00	247	0.40
Turnouts	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Turnouts	Crushing/Proc. Equipment	6	6.00	85	0.78
Turnouts	Cranes	3	6.00	231	0.29
Turnouts	Rollers	3	6.00	80	0.38
Turnouts	Sweepers/Scrubbers	3	4.00	64	0.46
Turnouts	Paving Equipment	3	2.00	132	0.36
Turnouts	Generator Sets	3	1.00	84	0.74
AWPFSiteprep	Rubber Tired Dozers	3	8.00	247	0.40
AWPFSiteprep	Tractors/Loaders/Backhoes	4	8.00	97	0.37
AWPFGrading	Excavators	1	8.00	158	0.38
AWPFGrading	Graders	1	8.00	187	0.41
AWPFGrading	Rubber Tired Dozers	1	8.00	247	0.40
AWPFGrading	Tractors/Loaders/Backhoes	3	8.00	97	0.37

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

AWPFConstruction	Cranes	1	7.00	231	0.29
AWPFConstruction	Forklifts	3	8.00	89	0.20
AWPFConstruction	Generator Sets	1	8.00	84	0.74
AWPFConstruction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
AWPFConstruction	Welders	1	8.00	46	0.45
AWPFPaving	Cement and Mortar Mixers	2	6.00	9	0.56
AWPFPaving	Pavers	1	8.00	130	0.42
AWPFPaving	Paving Equipment	2	6.00	132	0.36
AWPFPaving	Rollers	2	6.00	80	0.38
AWPFPaving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
PumpStationsGrading	Graders	1	8.00	187	0.41
PumpStationsGrading	Rubber Tired Dozers	1	8.00	247	0.40
PumpStationsGrading	Tractors/Loaders/Backhoes	2	7.00	97	0.37
PumpStationsConstruct	Cranes	1	4.00	231	0.29
PumpStationsConstruct	Forklifts	1	4.00	89	0.20
PumpStationsConstruct	Tractors/Loaders/Backhoes	2	4.00	97	0.37
PumpStationsConstruct	Welders	1	4.00	46	0.45
WellheadDemo	Concrete/Industrial Saws	2	6.00	81	0.73
WellheadDemo	Rubber Tired Dozers	2	6.00	247	0.40
WellheadGrading	Graders	2	6.00	187	0.41
WellheadGrading	Tractors/Loaders/Backhoes	4	6.00	97	0.37
WellheadConstruct	Cranes	2	4.00	231	0.29
WellheadConstruct	Forklifts	2	6.00	89	0.20
WellheadConstruct	Generator Sets	2	4.00	84	0.74
WellheadConstruct	Tractors/Loaders/Backhoes	4	6.00	97	0.37
WellheadConstruct	Welders	2	4.00	46	0.45
WellheadPaving	Pavers	2	6.00	130	0.42
WellheadPaving	Paving Equipment	2	6.00	132	0.36
WellheadPaving	Rollers	2	6.00	80	0.38

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

StorageResGrading	Excavators	1	8.00	158	0.38
StorageResGrading	Graders	1	8.00	187	0.41
StorageResGrading	Rubber Tired Dozers	1	8.00	247	0.40
StorageResGrading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
StorageResConstruct	Cranes	1	7.00	231	0.29
StorageResConstruct	Forklifts	3	8.00	89	0.20
StorageResConstruct	Generator Sets	1	8.00	84	0.74
StorageResConstruct	Tractors/Loaders/Backhoes	3	7.00	97	0.37
StorageResConstruct	Welders	1	8.00	46	0.45
StorageResPaving	Cement and Mortar Mixers	2	6.00	9	0.56
StorageResPaving	Pavers	1	8.00	130	0.42
StorageResPaving	Paving Equipment	2	6.00	132	0.36
StorageResPaving	Rollers	2	6.00	80	0.38
StorageResPaving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Wells	Generator Sets	4	4.00	84	0.74
Pipelines25	Plate Compactors	3	2.00	8	0.43
Pipelines25	Signal Boards	3	6.00	6	0.82
Pipelines26	Plate Compactors	3	2.00	8	0.43
Pipelines26	Signal Boards	3	6.00	6	0.82
Turnouts	Plate Compactors	3	2.00	8	0.43
Turnouts	Signal Boards	3	6.00	6	0.82
Pipelines27	Plate Compactors	3	2.00	8	0.43
Pipelines27	Signal Boards	3	6.00	6	0.82
WellheadPaving	Plate Compactors	2	6.00	8	0.43
AWPFPaving	Plate Compactors	1	6.00	8	0.43

Trips and VMT

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Wells	29	80.00	128.00	40.00	14.70	50.00	20.00	LD_Mix	HDT_Mix	HHDT
Pipelines25	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Pipelines26	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Pipelines27	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Turnouts	40	28.00	28.00	2,000.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
AWPFSiteprep	7	40.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
AWPFGrading	6	40.00	30.00	0.00	14.70	40.00	20.00	LD_Mix	HDT_Mix	HHDT
AWPFConstruction	9	40.00	30.00	0.00	14.70	40.00	20.00	LD_Mix	HDT_Mix	HHDT
AWPFPaving	9	40.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
PumpStationsGrading	4	10.00	12.00	0.00	14.70	20.00	20.00	LD_Mix	HDT_Mix	HHDT
PumpStationsConstruct	5	10.00	0.00	0.00	40.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT
WellheadDemo	4	20.00	0.00	20.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
WellheadGrading	6	20.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
WellheadConstruct	12	20.00	20.00	0.00	20.00	40.00	20.00	LD_Mix	HDT_Mix	HHDT
WellheadPaving	8	20.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT
StorageResGrading	6	24.00	0.00	600.00	20.00	6.90	50.00	LD_Mix	HDT_Mix	HHDT
StorageResConstruct	9	24.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT
StorageResPaving	8	24.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Wells - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0913	0.0000	18.0913	9.9334	0.0000	9.9334			0.0000			0.0000
Off-Road	5.6721	54.4844	51.0006	0.1177		2.2175	2.2175		2.0619	2.0619		11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**5.6721**	**54.4844**	**51.0006**	**0.1177**	**18.0913**	**2.2175**	**20.3088**	**9.9334**	**2.0619**	**11.9953**		**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.5500e-003	1.8300e-003	3.0000e-005	8.9000e-004	4.0000e-005	9.4000e-004	2.4000e-004	4.0000e-005	2.9000e-004		3.1447	3.1447	2.0000e-004	5.0000e-004	3.2989
Vendor	0.4660	26.2305	5.7652	0.1522	5.9171	0.1849	6.1019	1.7013	0.1768	1.8781		16,464.8402	16,464.8402	0.6317	2.3796	17,189.7511
Worker	0.2369	0.1500	2.2080	6.9300e-003	0.8942	4.5900e-003	0.8988	0.2372	4.2200e-003	0.2414		700.1040	700.1040	0.0160	0.0167	705.4685
Total	**0.7030**	**26.3871**	**7.9749**	**0.1592**	**6.8122**	**0.1895**	**7.0017**	**1.9387**	**0.1811**	**2.1198**		**17,168.0889**	**17,168.0889**	**0.6479**	**2.3968**	**17,898.5185**

3.2 Wells - 2025

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1411	0.0000	8.1411	4.4700	0.0000	4.4700			0.0000			0.0000
Off-Road	1.9203	14.3205	57.2122	0.1177		0.4265	0.4265		0.4037	0.4037	0.0000	11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**1.9203**	**14.3205**	**57.2122**	**0.1177**	**8.1411**	**0.4265**	**8.5676**	**4.4700**	**0.4037**	**4.8737**	**0.0000**	**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.5500e-003	1.8300e-003	3.0000e-005	7.2000e-004	4.0000e-005	7.7000e-004	2.0000e-004	4.0000e-005	2.5000e-004		3.1447	3.1447	2.0000e-004	5.0000e-004	3.2989
Vendor	0.4660	26.2305	5.7652	0.1522	4.8594	0.1849	5.0443	1.4417	0.1768	1.6185		16,464.8402	16,464.8402	0.6317	2.3796	17,189.7511
Worker	0.2369	0.1500	2.2080	6.9300e-003	0.6999	4.5900e-003	0.7045	0.1894	4.2200e-003	0.1937		700.1040	700.1040	0.0160	0.0167	705.4685
Total	**0.7030**	**26.3871**	**7.9749**	**0.1592**	**5.5600**	**0.1895**	**5.7495**	**1.6313**	**0.1811**	**1.8124**		**17,168.0889**	**17,168.0889**	**0.6479**	**2.3968**	**17,898.5185**

3.2 Wells - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0913	0.0000	18.0913	9.9334	0.0000	9.9334			0.0000			0.0000
Off-Road	5.6721	54.4844	51.0006	0.1177		2.2175	2.2175		2.0619	2.0619		11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**5.6721**	**54.4844**	**51.0006**	**0.1177**	**18.0913**	**2.2175**	**20.3088**	**9.9334**	**2.0619**	**11.9953**		**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.4800e-003	1.8500e-003	3.0000e-005	8.9000e-004	4.0000e-005	9.4000e-004	2.4000e-004	4.0000e-005	2.9000e-004		3.0856	3.0856	2.0000e-004	4.9000e-004	3.2370
Vendor	0.4506	26.0189	5.6849	0.1493	5.9171	0.1847	6.1018	1.7013	0.1767	1.8780		16,160.7340	16,160.7340	0.6331	2.3385	16,873.4248
Worker	0.2237	0.1363	2.0743	6.7100e-003	0.8942	4.3500e-003	0.8986	0.2372	4.0000e-003	0.2412		678.6612	678.6612	0.0145	0.0157	683.7069
Total	**0.6744**	**26.1617**	**7.7611**	**0.1560**	**6.8122**	**0.1891**	**7.0013**	**1.9387**	**0.1807**	**2.1194**		**16,842.4807**	**16,842.4807**	**0.6479**	**2.3547**	**17,560.3687**

3.2 Wells - 2026

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1411	0.0000	8.1411	4.4700	0.0000	4.4700			0.0000			0.0000
Off-Road	1.9203	14.3205	57.2122	0.1177		0.4265	0.4265		0.4037	0.4037	0.0000	11,288.63 68	11,288.63 68	3.1992		11,368.61 78
Total	**1.9203**	**14.3205**	**57.2122**	**0.1177**	**8.1411**	**0.4265**	**8.5676**	**4.4700**	**0.4037**	**4.8737**	**0.0000**	**11,288.63 68**	**11,288.63 68**	**3.1992**		**11,368.61 78**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.4800e-003	1.8500e-003	3.0000e-005	7.2000e-004	4.0000e-005	7.7000e-004	2.0000e-004	4.0000e-005	2.5000e-004		3.0856	3.0856	2.0000e-004	4.9000e-004	3.2370
Vendor	0.4506	26.0189	5.6849	0.1493	4.8594	0.1847	5.0441	1.4417	0.1767	1.6184		16,160.73 40	16,160.73 40	0.6331	2.3385	16,873.42 48
Worker	0.2237	0.1363	2.0743	6.7100e-003	0.6999	4.3500e-003	0.7042	0.1894	4.0000e-003	0.1935		678.6612	678.6612	0.0145	0.0157	683.7069
Total	**0.6744**	**26.1617**	**7.7611**	**0.1560**	**5.5600**	**0.1891**	**5.7491**	**1.6313**	**0.1807**	**1.8121**		**16,842.48 07**	**16,842.48 07**	**0.6479**	**2.3547**	**17,560.36 87**

3.2 Wells - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0913	0.0000	18.0913	9.9334	0.0000	9.9334			0.0000			0.0000
Off-Road	5.6721	54.4844	51.0006	0.1177		2.2175	2.2175		2.0619	2.0619		11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**5.6721**	**54.4844**	**51.0006**	**0.1177**	**18.0913**	**2.2175**	**20.3088**	**9.9334**	**2.0619**	**11.9953**		**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.4100e-003	1.8600e-003	3.0000e-005	8.9000e-004	4.0000e-005	9.4000e-004	2.4000e-004	4.0000e-005	2.9000e-004		3.0239	3.0239	2.0000e-004	4.8000e-004	3.1725
Vendor	0.4370	25.7911	5.6164	0.1462	5.9171	0.1842	6.1012	1.7013	0.1762	1.8774		15,842.0915	15,842.0915	0.6322	2.2954	16,541.9390
Worker	0.2116	0.1246	1.9605	6.5300e-003	0.8942	4.0800e-003	0.8983	0.2372	3.7600e-003	0.2409		659.6069	659.6069	0.0133	0.0149	664.3854
Total	**0.6487**	**25.9221**	**7.5788**	**0.1528**	**6.8122**	**0.1883**	**7.0005**	**1.9387**	**0.1800**	**2.1186**		**16,504.7223**	**16,504.7223**	**0.6457**	**2.3108**	**17,209.4969**

3.2 Wells - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1411	0.0000	8.1411	4.4700	0.0000	4.4700			0.0000			0.0000
Off-Road	1.9203	14.3205	57.2122	0.1177		0.4265	0.4265		0.4037	0.4037	0.0000	11,288.6368	11,288.6368	3.1992		11,368.6178
Total	**1.9203**	**14.3205**	**57.2122**	**0.1177**	**8.1411**	**0.4265**	**8.5676**	**4.4700**	**0.4037**	**4.8737**	**0.0000**	**11,288.6368**	**11,288.6368**	**3.1992**		**11,368.6178**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.0000e-004	6.4100e-003	1.8600e-003	3.0000e-005	7.2000e-004	4.0000e-005	7.7000e-004	2.0000e-004	4.0000e-005	2.5000e-004		3.0239	3.0239	2.0000e-004	4.8000e-004	3.1725
Vendor	0.4370	25.7911	5.6164	0.1462	4.8594	0.1842	5.0435	1.4417	0.1762	1.6178		15,842.0915	15,842.0915	0.6322	2.2954	16,541.9390
Worker	0.2116	0.1246	1.9605	6.5300e-003	0.6999	4.0800e-003	0.7039	0.1894	3.7600e-003	0.1932		659.6069	659.6069	0.0133	0.0149	664.3854
Total	**0.6487**	**25.9221**	**7.5788**	**0.1528**	**5.5600**	**0.1883**	**5.7483**	**1.6313**	**0.1800**	**1.8113**		**16,504.7223**	**16,504.7223**	**0.6457**	**2.3108**	**17,209.4969**

3.3 Pipelines25 - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					27.2199	0.0000	27.2199	14.9090	0.0000	14.9090			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.2199**	**2.8404**	**30.0603**	**14.9090**	**2.6591**	**17.5682**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0447	3.5675	0.8536	0.0163	0.5242	0.0260	0.5502	0.1437	0.0249	0.1685		1,806.6021	1,806.6021	0.1166	0.2876	1,895.2186
Vendor	0.0907	4.9881	1.1355	0.0286	1.1096	0.0347	1.1443	0.3191	0.0332	0.3523		3,096.2886	3,096.2886	0.1188	0.4476	3,232.6521
Worker	0.5322	0.3696	5.6219	0.0195	2.5535	0.0125	2.5660	0.6770	0.0115	0.6885		1,974.6389	1,974.6389	0.0305	0.0398	1,987.2471
Total	**0.6676**	**8.9251**	**7.6110**	**0.0645**	**4.1873**	**0.0732**	**4.2605**	**1.1397**	**0.0695**	**1.2093**		**6,877.5295**	**6,877.5295**	**0.2658**	**0.7750**	**7,115.1178**

3.3 Pipelines25 - 2025

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2490	0.0000	12.2490	6.7091	0.0000	6.7091			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2490**	**0.3369**	**12.5858**	**6.7091**	**0.3263**	**7.0354**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0447	3.5675	0.8536	0.0163	0.4251	0.0260	0.4510	0.1193	0.0249	0.1442		1,806.6021	1,806.6021	0.1166	0.2876	1,895.2186
Vendor	0.0907	4.9881	1.1355	0.0286	0.9113	0.0347	0.9460	0.2704	0.0332	0.3036		3,096.2886	3,096.2886	0.1188	0.4476	3,232.6521
Worker	0.5322	0.3696	5.6219	0.0195	1.9982	0.0125	2.0107	0.5407	0.0115	0.5522		1,974.6389	1,974.6389	0.0305	0.0398	1,987.2471
Total	**0.6676**	**8.9251**	**7.6110**	**0.0645**	**3.3345**	**0.0732**	**3.4077**	**0.9304**	**0.0695**	**0.9999**		**6,877.5295**	**6,877.5295**	**0.2658**	**0.7750**	**7,115.1178**

3.4 Pipelines26 - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					27.2199	0.0000	27.2199	14.9090	0.0000	14.9090			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.2199**	**2.8404**	**30.0603**	**14.9090**	**2.6591**	**17.5682**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0441	3.5280	0.8646	0.0160	0.5242	0.0259	0.5501	0.1437	0.0248	0.1684		1,772.6143	1,772.6143	0.1171	0.2823	1,859.6588
Vendor	0.0878	4.9482	1.1199	0.0281	1.1096	0.0347	1.1443	0.3191	0.0332	0.3522		3,039.0992	3,039.0992	0.1190	0.4399	3,173.1635
Worker	0.5048	0.3340	5.2673	0.0189	2.5535	0.0118	2.5653	0.6770	0.0109	0.6879		1,914.1759	1,914.1759	0.0275	0.0374	1,926.0043
Total	**0.6367**	**8.8102**	**7.2518**	**0.0630**	**4.1873**	**0.0724**	**4.2597**	**1.1397**	**0.0688**	**1.2085**		**6,725.8894**	**6,725.8894**	**0.2636**	**0.7596**	**6,958.8265**

3.4 Pipelines26 - 2026

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2490	0.0000	12.2490	6.7091	0.0000	6.7091			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2490**	**0.3369**	**12.5858**	**6.7091**	**0.3263**	**7.0354**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0441	3.5280	0.8646	0.0160	0.4251	0.0259	0.4509	0.1193	0.0248	0.1441		1,772.6143	1,772.6143	0.1171	0.2823	1,859.6588
Vendor	0.0878	4.9482	1.1199	0.0281	0.9113	0.0347	0.9460	0.2704	0.0332	0.3035		3,039.0992	3,039.0992	0.1190	0.4399	3,173.1635
Worker	0.5048	0.3340	5.2673	0.0189	1.9982	0.0118	2.0100	0.5407	0.0109	0.5516		1,914.1759	1,914.1759	0.0275	0.0374	1,926.0043
Total	**0.6367**	**8.8102**	**7.2518**	**0.0630**	**3.3345**	**0.0724**	**3.4069**	**0.9304**	**0.0688**	**0.9992**		**6,725.8894**	**6,725.8894**	**0.2636**	**0.7596**	**6,958.8265**

3.5 Turnouts - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					27.1197	0.0000	27.1197	14.8982	0.0000	14.8982			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.1197**	**2.8404**	**29.9601**	**14.8982**	**2.6591**	**17.5573**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0113	0.9012	0.2209	4.0800e-003	0.1339	6.6100e-003	0.1405	0.0367	6.3200e-003	0.0430		452.7750	452.7750	0.0299	0.0721	475.0086
Vendor	0.0819	4.6183	1.0452	0.0262	1.0356	0.0324	1.0680	0.2978	0.0310	0.3287		2,836.4926	2,836.4926	0.1111	0.4106	2,961.6192
Worker	0.1683	0.1113	1.7558	6.3100e-003	0.8512	3.9500e-003	0.8551	0.2257	3.6300e-003	0.2293		638.0586	638.0586	9.1600e-003	0.0125	642.0014
Total	**0.2614**	**5.6308**	**3.0219**	**0.0366**	**2.0207**	**0.0429**	**2.0636**	**0.5601**	**0.0409**	**0.6011**		**3,927.3263**	**3,927.3263**	**0.1502**	**0.4951**	**4,078.6293**

3.5 Turnouts - 2026

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2039	0.0000	12.2039	6.7042	0.0000	6.7042			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2039**	**0.3369**	**12.5408**	**6.7042**	**0.3263**	**7.0305**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0113	0.9012	0.2209	4.0800e-003	0.1086	6.6100e-003	0.1152	0.0305	6.3200e-003	0.0368		452.7750	452.7750	0.0299	0.0721	475.0086
Vendor	0.0819	4.6183	1.0452	0.0262	0.8505	0.0324	0.8829	0.2524	0.0310	0.2833		2,836.4926	2,836.4926	0.1111	0.4106	2,961.6192
Worker	0.1683	0.1113	1.7558	6.3100e-003	0.6661	3.9500e-003	0.6700	0.1802	3.6300e-003	0.1839		638.0586	638.0586	9.1600e-003	0.0125	642.0014
Total	**0.2614**	**5.6308**	**3.0219**	**0.0366**	**1.6252**	**0.0429**	**1.6681**	**0.4631**	**0.0409**	**0.5040**		**3,927.3263**	**3,927.3263**	**0.1502**	**0.4951**	**4,078.6293**

3.5 Turnouts - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					27.1197	0.0000	27.1197	14.8982	0.0000	14.8982			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.1197**	**2.8404**	**29.9601**	**14.8982**	**2.6591**	**17.5573**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0111	0.8908	0.2230	4.0000e-003	0.1339	6.5700e-003	0.1405	0.0367	6.2900e-003	0.0430		443.7180	443.7180	0.0299	0.0707	465.5276
Vendor	0.0795	4.5782	1.0328	0.0257	1.0356	0.0323	1.0679	0.2978	0.0309	0.3286		2,780.5745	2,780.5745	0.1109	0.4030	2,903.4462
Worker	0.1598	0.1013	1.6554	6.1400e-003	0.8512	3.7000e-003	0.8549	0.2257	3.4100e-003	0.2291		620.1506	620.1506	8.3100e-003	0.0118	623.8756
Total	**0.2504**	**5.5704**	**2.9112**	**0.0358**	**2.0207**	**0.0425**	**2.0632**	**0.5601**	**0.0406**	**0.6007**		**3,844.4430**	**3,844.4430**	**0.1491**	**0.4855**	**3,992.8493**

3.5 Turnouts - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2039	0.0000	12.2039	6.7042	0.0000	6.7042			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2039**	**0.3369**	**12.5408**	**6.7042**	**0.3263**	**7.0305**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0111	0.8908	0.2230	4.0000e-003	0.1086	6.5700e-003	0.1151	0.0305	6.2900e-003	0.0368		443.7180	443.7180	0.0299	0.0707	465.5276
Vendor	0.0795	4.5782	1.0328	0.0257	0.8505	0.0323	0.8828	0.2524	0.0309	0.2832		2,780.5745	2,780.5745	0.1109	0.4030	2,903.4462
Worker	0.1598	0.1013	1.6554	6.1400e-003	0.6661	3.7000e-003	0.6698	0.1802	3.4100e-003	0.1836		620.1506	620.1506	8.3100e-003	0.0118	623.8756
Total	**0.2504**	**5.5704**	**2.9112**	**0.0358**	**1.6252**	**0.0425**	**1.6677**	**0.4631**	**0.0406**	**0.5036**		**3,844.4430**	**3,844.4430**	**0.1491**	**0.4855**	**3,992.8493**

3.6 WellheadDemo - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	1.4148	13.3507	9.9638	0.0222		0.5744	0.5744		0.5396	0.5396		2,129.438 7	2,129.438 7	0.4403		2,140.446 0
Total	**1.4148**	**13.3507**	**9.9638**	**0.0222**	**0.0000**	**0.5744**	**0.5744**	**0.0000**	**0.5396**	**0.5396**		**2,129.438 7**	**2,129.438 7**	**0.4403**		**2,140.446 0**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.8900e-003	0.1255	0.0365	5.3000e-004	0.0175	8.6000e-004	0.0184	4.7900e-003	8.3000e-004	5.6200e-003		59.1933	59.1933	3.9400e-003	9.4300e-003	62.1011
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0529	0.0312	0.4901	1.6300e-003	0.2236	1.0200e-003	0.2246	0.0593	9.4000e-004	0.0602		164.9017	164.9017	3.3200e-003	3.7300e-003	166.0964
Total	**0.0548**	**0.1567**	**0.5266**	**2.1600e-003**	**0.2410**	**1.8800e-003**	**0.2429**	**0.0641**	**1.7700e-003**	**0.0659**		**224.0950**	**224.0950**	**7.2600e-003**	**0.0132**	**228.1975**

3.6 WellheadDemo - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.2996	1.6423	11.4631	0.0222		0.0583	0.0583		0.0562	0.0562	0.0000	2,129.4387	2,129.4387	0.4403		2,140.4460
Total	**0.2996**	**1.6423**	**11.4631**	**0.0222**	**0.0000**	**0.0583**	**0.0583**	**0.0000**	**0.0562**	**0.0562**	**0.0000**	**2,129.4387**	**2,129.4387**	**0.4403**		**2,140.4460**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.8900e-003	0.1255	0.0365	5.3000e-004	0.0142	8.6000e-004	0.0150	3.9800e-003	8.3000e-004	4.8100e-003		59.1933	59.1933	3.9400e-003	9.4300e-003	62.1011
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0529	0.0312	0.4901	1.6300e-003	0.1750	1.0200e-003	0.1760	0.0474	9.4000e-004	0.0483		164.9017	164.9017	3.3200e-003	3.7300e-003	166.0964
Total	**0.0548**	**0.1567**	**0.5266**	**2.1600e-003**	**0.1892**	**1.8800e-003**	**0.1910**	**0.0513**	**1.7700e-003**	**0.0531**		**224.0950**	**224.0950**	**7.2600e-003**	**0.0132**	**228.1975**

3.7 AWPFSiteprep - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	2.4727	25.2339	17.9118	0.0381		1.0868	1.0868		0.9999	0.9999		3,689.1037	3,689.1037	1.1931		3,718.9320
Total	**2.4727**	**25.2339**	**17.9118**	**0.0381**	**18.0663**	**1.0868**	**19.1531**	**9.9307**	**0.9999**	**10.9305**		**3,689.1037**	**3,689.1037**	**1.1931**		**3,718.9320**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.1058	0.0623	0.9803	3.2600e-003	0.4471	2.0400e-003	0.4492	0.1186	1.8800e-003	0.1205		329.8034	329.8034	6.6400e-003	7.4600e-003	332.1927
Total	**0.1058**	**0.0623**	**0.9803**	**3.2600e-003**	**0.4471**	**2.0400e-003**	**0.4492**	**0.1186**	**1.8800e-003**	**0.1205**		**329.8034**	**329.8034**	**6.6400e-003**	**7.4600e-003**	**332.1927**

3.7 AWPFSiteprep - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	0.5860	3.4105	20.6916	0.0381		0.1236	0.1236		0.1183	0.1183	0.0000	3,689.103 7	3,689.103 7	1.1931		3,718.932 0
Total	**0.5860**	**3.4105**	**20.6916**	**0.0381**	**8.1298**	**0.1236**	**8.2534**	**4.4688**	**0.1183**	**4.5872**	**0.0000**	**3,689.103 7**	**3,689.103 7**	**1.1931**		**3,718.932 0**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.1058	0.0623	0.9803	3.2600e-003	0.3499	2.0400e-003	0.3520	0.0947	1.8800e-003	0.0966		329.8034	329.8034	6.6400e-003	7.4600e-003	332.1927
Total	**0.1058**	**0.0623**	**0.9803**	**3.2600e-003**	**0.3499**	**2.0400e-003**	**0.3520**	**0.0947**	**1.8800e-003**	**0.0966**		**329.8034**	**329.8034**	**6.6400e-003**	**7.4600e-003**	**332.1927**

3.8 Pipelines27 - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					27.2199	0.0000	27.2199	14.9090	0.0000	14.9090			0.0000			0.0000
Off-Road	7.2079	65.3752	59.4606	0.1215		2.8404	2.8404		2.6591	2.6591		11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**7.2079**	**65.3752**	**59.4606**	**0.1215**	**27.2199**	**2.8404**	**30.0603**	**14.9090**	**2.6591**	**17.5682**		**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0435	3.4876	0.8732	0.0156	0.5242	0.0257	0.5500	0.1437	0.0246	0.1683		1,737.1558	1,737.1558	0.1171	0.2767	1,822.5404
Vendor	0.0852	4.9053	1.1066	0.0275	1.1096	0.0346	1.1442	0.3191	0.0331	0.3521		2,979.1869	2,979.1869	0.1189	0.4318	3,110.8352
Worker	0.4794	0.3039	4.9662	0.0184	2.5535	0.0111	2.5646	0.6770	0.0102	0.6872		1,860.4517	1,860.4517	0.0249	0.0354	1,871.6267
Total	**0.6080**	**8.6968**	**6.9460**	**0.0616**	**4.1873**	**0.0714**	**4.2587**	**1.1397**	**0.0679**	**1.2076**		**6,576.7945**	**6,576.7945**	**0.2609**	**0.7439**	**6,805.0022**

3.8 Pipelines27 - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.2490	0.0000	12.2490	6.7091	0.0000	6.7091			0.0000			0.0000
Off-Road	1.7587	11.0896	67.4827	0.1215		0.3369	0.3369		0.3263	0.3263	0.0000	11,646.5321	11,646.5321	2.8657		11,718.1751
Total	**1.7587**	**11.0896**	**67.4827**	**0.1215**	**12.2490**	**0.3369**	**12.5858**	**6.7091**	**0.3263**	**7.0354**	**0.0000**	**11,646.5321**	**11,646.5321**	**2.8657**		**11,718.1751**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0435	3.4876	0.8732	0.0156	0.4251	0.0257	0.4508	0.1193	0.0246	0.1439		1,737.1558	1,737.1558	0.1171	0.2767	1,822.5404
Vendor	0.0852	4.9053	1.1066	0.0275	0.9113	0.0346	0.9459	0.2704	0.0331	0.3034		2,979.1869	2,979.1869	0.1189	0.4318	3,110.8352
Worker	0.4794	0.3039	4.9662	0.0184	1.9982	0.0111	2.0093	0.5407	0.0102	0.5509		1,860.4517	1,860.4517	0.0249	0.0354	1,871.6267
Total	**0.6080**	**8.6968**	**6.9460**	**0.0616**	**3.3345**	**0.0714**	**3.4059**	**0.9304**	**0.0679**	**0.9983**		**6,576.7945**	**6,576.7945**	**0.2609**	**0.7439**	**6,805.0022**

3.9 PumpStationsGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.0302	0.0000	6.0302	3.3111	0.0000	3.3111			0.0000			0.0000
Off-Road	1.1904	12.4243	8.4937	0.0206		0.4961	0.4961		0.4564	0.4564		1,995.797 5	1,995.797 5	0.6455		2,011.934 5
Total	**1.1904**	**12.4243**	**8.4937**	**0.0206**	**6.0302**	**0.4961**	**6.5263**	**3.3111**	**0.4564**	**3.7675**		**1,995.797 5**	**1,995.797 5**	**0.6455**		**2,011.934 5**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0203	1.0505	0.2748	5.5800e-003	0.2221	6.9500e-003	0.2290	0.0639	6.6500e-003	0.0705		604.6322	604.6322	0.0241	0.0878	631.3887
Worker	0.0265	0.0156	0.2451	8.2000e-004	0.1118	5.1000e-004	0.1123	0.0296	4.7000e-004	0.0301		82.4509	82.4509	1.6600e-003	1.8700e-003	83.0482
Total	**0.0467**	**1.0661**	**0.5199**	**6.4000e-003**	**0.3339**	**7.4600e-003**	**0.3413**	**0.0935**	**7.1200e-003**	**0.1006**		**687.0830**	**687.0830**	**0.0257**	**0.0896**	**714.4369**

3.9 PumpStationsGrading - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					2.7136	0.0000	2.7136	1.4900	0.0000	1.4900			0.0000			0.0000
Off-Road	0.2947	1.5862	10.8451	0.0206		0.0553	0.0553		0.0535	0.0535	0.0000	1,995.797 5	1,995.797 5	0.6455		2,011.934 5
Total	**0.2947**	**1.5862**	**10.8451**	**0.0206**	**2.7136**	**0.0553**	**2.7689**	**1.4900**	**0.0535**	**1.5435**	**0.0000**	**1,995.797 5**	**1,995.797 5**	**0.6455**		**2,011.934 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0203	1.0505	0.2748	5.5800e-003	0.1824	6.9500e-003	0.1894	0.0541	6.6500e-003	0.0608		604.6322	604.6322	0.0241	0.0878	631.3887
Worker	0.0265	0.0156	0.2451	8.2000e-004	0.0875	5.1000e-004	0.0880	0.0237	4.7000e-004	0.0242		82.4509	82.4509	1.6600e-003	1.8700e-003	83.0482
Total	**0.0467**	**1.0661**	**0.5199**	**6.4000e-003**	**0.2699**	**7.4600e-003**	**0.2774**	**0.0778**	**7.1200e-003**	**0.0849**		**687.0830**	**687.0830**	**0.0257**	**0.0896**	**714.4369**

3.10 PumpStationsConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.4419	3.9994	4.4906	8.0500e-003		0.1638	0.1638		0.1523	0.1523		759.2233	759.2233	0.2219		764.7696
Total	**0.4419**	**3.9994**	**4.4906**	**8.0500e-003**		**0.1638**	**0.1638**		**0.1523**	**0.1523**		**759.2233**	**759.2233**	**0.2219**		**764.7696**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0571	0.0362	0.5912	2.1900e-003	0.3040	1.3200e-003	0.3053	0.0806	1.2200e-003	0.0818		221.4823	221.4823	2.9700e-003	4.2200e-003	222.8127
Total	**0.0571**	**0.0362**	**0.5912**	**2.1900e-003**	**0.3040**	**1.3200e-003**	**0.3053**	**0.0806**	**1.2200e-003**	**0.0818**		**221.4823**	**221.4823**	**2.9700e-003**	**4.2200e-003**	**222.8127**

3.10 PumpStationsConstruct - 2027

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Off-Road	0.1164	1.0027	4.9426	8.0500e-003		0.0186	0.0186		0.0181	0.0181	0.0000	759.2233	759.2233	0.2219		764.7696
Total	**0.1164**	**1.0027**	**4.9426**	**8.0500e-003**		**0.0186**	**0.0186**		**0.0181**	**0.0181**	**0.0000**	**759.2233**	**759.2233**	**0.2219**		**764.7696**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0571	0.0362	0.5912	2.1900e-003	0.2379	1.3200e-003	0.2392	0.0644	1.2200e-003	0.0656		221.4823	221.4823	2.9700e-003	4.2200e-003	222.8127
Total	**0.0571**	**0.0362**	**0.5912**	**2.1900e-003**	**0.2379**	**1.3200e-003**	**0.2392**	**0.0644**	**1.2200e-003**	**0.0656**		**221.4823**	**221.4823**	**2.9700e-003**	**4.2200e-003**	**222.8127**

3.11 AWPFGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.6849	0.0000	6.6849	3.3818	0.0000	3.3818			0.0000			0.0000
Off-Road	1.5227	15.3148	14.5402	0.0297		0.6236	0.6236		0.5737	0.5737		2,873.705 2	2,873.705 2	0.9294		2,896.940 5
Total	**1.5227**	**15.3148**	**14.5402**	**0.0297**	**6.6849**	**0.6236**	**7.3085**	**3.3818**	**0.5737**	**3.9555**		**2,873.705 2**	**2,873.705 2**	**0.9294**		**2,896.940 5**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0852	4.9053	1.1066	0.0275	1.1096	0.0346	1.1442	0.3191	0.0331	0.3521		2,979.186 9	2,979.186 9	0.1189	0.4318	3,110.835 2
Worker	0.1058	0.0623	0.9803	3.2600e-003	0.4471	2.0400e-003	0.4492	0.1186	1.8800e-003	0.1205		329.8034	329.8034	6.6400e-003	7.4600e-003	332.1927
Total	**0.1910**	**4.9676**	**2.0869**	**0.0308**	**1.5567**	**0.0366**	**1.5933**	**0.4376**	**0.0349**	**0.4726**		**3,308.990 4**	**3,308.990 4**	**0.1255**	**0.4393**	**3,443.027 9**

3.11 AWPFGrading - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.0082	0.0000	3.0082	1.5218	0.0000	1.5218			0.0000			0.0000
Off-Road	0.4210	2.2308	17.6296	0.0297		0.0779	0.0779		0.0754	0.0754	0.0000	2,873.705 2	2,873.705 2	0.9294		2,896.940 5
Total	**0.4210**	**2.2308**	**17.6296**	**0.0297**	**3.0082**	**0.0779**	**3.0861**	**1.5218**	**0.0754**	**1.5972**	**0.0000**	**2,873.705 2**	**2,873.705 2**	**0.9294**		**2,896.940 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0852	4.9053	1.1066	0.0275	0.9113	0.0346	0.9459	0.2704	0.0331	0.3034		2,979.186 9	2,979.186 9	0.1189	0.4318	3,110.835 2
Worker	0.1058	0.0623	0.9803	3.2600e-003	0.3499	2.0400e-003	0.3520	0.0947	1.8800e-003	0.0966		329.8034	329.8034	6.6400e-003	7.4600e-003	332.1927
Total	**0.1910**	**4.9676**	**2.0869**	**0.0308**	**1.2612**	**0.0366**	**1.2978**	**0.3651**	**0.0349**	**0.4000**		**3,308.990 4**	**3,308.990 4**	**0.1255**	**0.4393**	**3,443.027 9**

3.12 AWPFConstruction - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3674	12.4697	16.0847	0.0270		0.5276	0.5276		0.4963	0.4963		2,556.474 4	2,556.474 4	0.6010		2,571.498 1
Total	**1.3674**	**12.4697**	**16.0847**	**0.0270**		**0.5276**	**0.5276**		**0.4963**	**0.4963**		**2,556.474 4**	**2,556.474 4**	**0.6010**		**2,571.498 1**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0852	4.9053	1.1066	0.0275	1.1096	0.0346	1.1442	0.3191	0.0331	0.3521		2,979.186 9	2,979.186 9	0.1189	0.4318	3,110.835 2
Worker	0.1058	0.0623	0.9803	3.2600e-003	0.4471	2.0400e-003	0.4492	0.1186	1.8800e-003	0.1205		329.8034	329.8034	6.6400e-003	7.4600e-003	332.1927
Total	**0.1910**	**4.9676**	**2.0869**	**0.0308**	**1.5567**	**0.0366**	**1.5933**	**0.4376**	**0.0349**	**0.4726**		**3,308.990 4**	**3,308.990 4**	**0.1255**	**0.4393**	**3,443.027 9**

3.12 AWPFConstruction - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3633	2.6497	17.3850	0.0270		0.0583	0.0583		0.0572	0.0572	0.0000	2,556.4744	2,556.4744	0.6010		2,571.4981
Total	**0.3633**	**2.6497**	**17.3850**	**0.0270**		**0.0583**	**0.0583**		**0.0572**	**0.0572**	**0.0000**	**2,556.4744**	**2,556.4744**	**0.6010**		**2,571.4981**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0852	4.9053	1.1066	0.0275	0.9113	0.0346	0.9459	0.2704	0.0331	0.3034		2,979.1869	2,979.1869	0.1189	0.4318	3,110.8352
Worker	0.1058	0.0623	0.9803	3.2600e-003	0.3499	2.0400e-003	0.3520	0.0947	1.8800e-003	0.0966		329.8034	329.8034	6.6400e-003	7.4600e-003	332.1927
Total	**0.1910**	**4.9676**	**2.0869**	**0.0308**	**1.2612**	**0.0366**	**1.2978**	**0.3651**	**0.0349**	**0.4000**		**3,308.9904**	**3,308.9904**	**0.1255**	**0.4393**	**3,443.0279**

3.13 WellheadGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.3182	0.0000	0.3182	0.0344	0.0000	0.0344			0.0000			0.0000
Off-Road	0.8630	9.1903	9.0802	0.0193		0.3292	0.3292		0.3028	0.3028		1,866.527 0	1,866.527 0	0.6037		1,881.618 8
Total	**0.8630**	**9.1903**	**9.0802**	**0.0193**	**0.3182**	**0.3292**	**0.6473**	**0.0344**	**0.3028**	**0.3372**		**1,866.527 0**	**1,866.527 0**	**0.6037**		**1,881.618 8**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0529	0.0312	0.4901	1.6300e-003	0.2236	1.0200e-003	0.2246	0.0593	9.4000e-004	0.0602		164.9017	164.9017	3.3200e-003	3.7300e-003	166.0964
Total	**0.0529**	**0.0312**	**0.4901**	**1.6300e-003**	**0.2236**	**1.0200e-003**	**0.2246**	**0.0593**	**9.4000e-004**	**0.0602**		**164.9017**	**164.9017**	**3.3200e-003**	**3.7300e-003**	**166.0964**

3.13 WellheadGrading - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.1432	0.0000	0.1432	0.0155	0.0000	0.0155			0.0000			0.0000
Off-Road	0.2526	1.2318	11.4683	0.0193		0.0402	0.0402		0.0395	0.0395	0.0000	1,866.5270	1,866.5270	0.6037		1,881.6188
Total	**0.2526**	**1.2318**	**11.4683**	**0.0193**	**0.1432**	**0.0402**	**0.1834**	**0.0155**	**0.0395**	**0.0549**	**0.0000**	**1,866.5270**	**1,866.5270**	**0.6037**		**1,881.6188**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0529	0.0312	0.4901	1.6300e-003	0.1750	1.0200e-003	0.1760	0.0474	9.4000e-004	0.0483		164.9017	164.9017	3.3200e-003	3.7300e-003	166.0964
Total	**0.0529**	**0.0312**	**0.4901**	**1.6300e-003**	**0.1750**	**1.0200e-003**	**0.1760**	**0.0474**	**9.4000e-004**	**0.0483**		**164.9017**	**164.9017**	**3.3200e-003**	**3.7300e-003**	**166.0964**

3.14 WellheadConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3257	12.1385	15.4372	0.0266		0.4990	0.4990		0.4699	0.4699		2,517.5523	2,517.5523	0.5884		2,532.2613
Total	**1.3257**	**12.1385**	**15.4372**	**0.0266**		**0.4990**	**0.4990**		**0.4699**	**0.4699**		**2,517.5523**	**2,517.5523**	**0.5884**		**2,532.2613**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0568	3.2702	0.7377	0.0183	0.7397	0.0230	0.7628	0.2127	0.0220	0.2348		1,986.1246	1,986.1246	0.0792	0.2879	2,073.8901
Worker	0.0657	0.0398	0.6352	2.2100e-003	0.3041	1.3600e-003	0.3054	0.0806	1.2500e-003	0.0819		223.1521	223.1521	3.8700e-003	4.7100e-003	224.6538
Total	**0.1225**	**3.3100**	**1.3729**	**0.0205**	**1.0438**	**0.0244**	**1.0682**	**0.2933**	**0.0233**	**0.3166**		**2,209.2767**	**2,209.2767**	**0.0831**	**0.2926**	**2,298.5440**

3.14 WellheadConstruct - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3618	2.6716	16.8379	0.0266		0.0595	0.0595		0.0582	0.0582	0.0000	2,517.552 3	2,517.552 3	0.5884		2,532.261 3
Total	**0.3618**	**2.6716**	**16.8379**	**0.0266**		**0.0595**	**0.0595**		**0.0582**	**0.0582**	**0.0000**	**2,517.552 3**	**2,517.552 3**	**0.5884**		**2,532.261 3**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0568	3.2702	0.7377	0.0183	0.6075	0.0230	0.6306	0.1803	0.0220	0.2023		1,986.124 6	1,986.124 6	0.0792	0.2879	2,073.890 1
Worker	0.0657	0.0398	0.6352	2.2100e-003	0.2380	1.3600e-003	0.2393	0.0644	1.2500e-003	0.0657		223.1521	223.1521	3.8700e-003	4.7100e-003	224.6538
Total	**0.1225**	**3.3100**	**1.3729**	**0.0205**	**0.8455**	**0.0244**	**0.8699**	**0.2447**	**0.0233**	**0.2680**		**2,209.276 7**	**2,209.276 7**	**0.0831**	**0.2926**	**2,298.544 0**

3.15 StorageResGrading - 2027

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Fugitive Dust					6.4463	0.0000	6.4463	3.3560	0.0000	3.3560			0.0000			0.0000
Off-Road	1.5227	15.3148	14.5402	0.0297		0.6236	0.6236		0.5737	0.5737		2,873.705 2	2,873.705 2	0.9294		2,896.940 5
Total	**1.5227**	**15.3148**	**14.5402**	**0.0297**	**6.4463**	**0.6236**	**7.0699**	**3.3560**	**0.5737**	**3.9297**		**2,873.705 2**	**2,873.705 2**	**0.9294**		**2,896.940 5**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.2041	17.1597	4.1449	0.0779	2.6208	0.1285	2.7493	0.7181	0.1229	0.8410		8,647.136 7	8,647.136 7	0.5842	1.3774	9,072.209 1
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0789	0.0477	0.7622	2.6500e-003	0.3649	1.6300e-003	0.3665	0.0968	1.5000e-003	0.0983		267.7825	267.7825	4.6400e-003	5.6600e-003	269.5846
Total	**0.2830**	**17.2074**	**4.9071**	**0.0805**	**2.9857**	**0.1301**	**3.1158**	**0.8149**	**0.1244**	**0.9393**		**8,914.919 2**	**8,914.919 2**	**0.5889**	**1.3831**	**9,341.793 7**

3.15 StorageResGrading - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					2.9008	0.0000	2.9008	1.5102	0.0000	1.5102			0.0000			0.0000
Off-Road	0.4210	2.2308	17.6296	0.0297		0.0779	0.0779		0.0754	0.0754	0.0000	2,873.705 2	2,873.705 2	0.9294		2,896.940 5
Total	**0.4210**	**2.2308**	**17.6296**	**0.0297**	**2.9008**	**0.0779**	**2.9788**	**1.5102**	**0.0754**	**1.5856**	**0.0000**	**2,873.705 2**	**2,873.705 2**	**0.9294**		**2,896.940 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.2041	17.1597	4.1449	0.0779	2.1250	0.1285	2.2535	0.5964	0.1229	0.7193		8,647.136 7	8,647.136 7	0.5842	1.3774	9,072.209 1
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0789	0.0477	0.7622	2.6500e-003	0.2856	1.6300e-003	0.2872	0.0773	1.5000e-003	0.0788		267.7825	267.7825	4.6400e-003	5.6600e-003	269.5846
Total	**0.2830**	**17.2074**	**4.9071**	**0.0805**	**2.4106**	**0.1301**	**2.5407**	**0.6737**	**0.1244**	**0.7981**		**8,914.919 2**	**8,914.919 2**	**0.5889**	**1.3831**	**9,341.793 7**

3.16 StorageResConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3674	12.4697	16.0847	0.0270		0.5276	0.5276		0.4963	0.4963		2,556.4744	2,556.4744	0.6010		2,571.4981
Total	**1.3674**	**12.4697**	**16.0847**	**0.0270**		**0.5276**	**0.5276**		**0.4963**	**0.4963**		**2,556.4744**	**2,556.4744**	**0.6010**		**2,571.4981**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0789	0.0477	0.7622	2.6500e-003	0.3649	1.6300e-003	0.3665	0.0968	1.5000e-003	0.0983		267.7825	267.7825	4.6400e-003	5.6600e-003	269.5846
Total	**0.0789**	**0.0477**	**0.7622**	**2.6500e-003**	**0.3649**	**1.6300e-003**	**0.3665**	**0.0968**	**1.5000e-003**	**0.0983**		**267.7825**	**267.7825**	**4.6400e-003**	**5.6600e-003**	**269.5846**

3.16 StorageResConstruct - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.3633	2.6497	17.3850	0.0270		0.0583	0.0583		0.0572	0.0572	0.0000	2,556.4744	2,556.4744	0.6010		2,571.4981
Total	**0.3633**	**2.6497**	**17.3850**	**0.0270**		**0.0583**	**0.0583**		**0.0572**	**0.0572**	**0.0000**	**2,556.4744**	**2,556.4744**	**0.6010**		**2,571.4981**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0789	0.0477	0.7622	2.6500e-003	0.2856	1.6300e-003	0.2872	0.0773	1.5000e-003	0.0788		267.7825	267.7825	4.6400e-003	5.6600e-003	269.5846
Total	**0.0789**	**0.0477**	**0.7622**	**2.6500e-003**	**0.2856**	**1.6300e-003**	**0.2872**	**0.0773**	**1.5000e-003**	**0.0788**		**267.7825**	**267.7825**	**4.6400e-003**	**5.6600e-003**	**269.5846**

3.17 StorageResPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.8197	7.5321	12.1778	0.0189		0.3524	0.3524		0.3259	0.3259		1,805.3926	1,805.3926	0.5673		1,819.5741
Paving	6.3509					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**7.1706**	**7.5321**	**12.1778**	**0.0189**		**0.3524**	**0.3524**		**0.3259**	**0.3259**		**1,805.3926**	**1,805.3926**	**0.5673**		**1,819.5741**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0789	0.0477	0.7622	2.6500e-003	0.3649	1.6300e-003	0.3665	0.0968	1.5000e-003	0.0983		267.7825	267.7825	4.6400e-003	5.6600e-003	269.5846
Total	**0.0789**	**0.0477**	**0.7622**	**2.6500e-003**	**0.3649**	**1.6300e-003**	**0.3665**	**0.0968**	**1.5000e-003**	**0.0983**		**267.7825**	**267.7825**	**4.6400e-003**	**5.6600e-003**	**269.5846**

3.17 StorageResPaving - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.2432	1.2327	13.4633	0.0189		0.0434	0.0434		0.0421	0.0421	0.0000	1,805.3926	1,805.3926	0.5673		1,819.5741
Paving	6.3509					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**6.5941**	**1.2327**	**13.4633**	**0.0189**		**0.0434**	**0.0434**		**0.0421**	**0.0421**	**0.0000**	**1,805.3926**	**1,805.3926**	**0.5673**		**1,819.5741**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0789	0.0477	0.7622	2.6500e-003	0.2856	1.6300e-003	0.2872	0.0773	1.5000e-003	0.0788		267.7825	267.7825	4.6400e-003	5.6600e-003	269.5846
Total	**0.0789**	**0.0477**	**0.7622**	**2.6500e-003**	**0.2856**	**1.6300e-003**	**0.2872**	**0.0773**	**1.5000e-003**	**0.0788**		**267.7825**	**267.7825**	**4.6400e-003**	**5.6600e-003**	**269.5846**

3.18 WellheadPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.7465	6.8132	11.2492	0.0178		0.3285	0.3285		0.3034	0.3034		1,706.7780	1,706.7780	0.5407		1,720.2942
Paving	3.1754					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.9220**	**6.8132**	**11.2492**	**0.0178**		**0.3285**	**0.3285**		**0.3034**	**0.3034**		**1,706.7780**	**1,706.7780**	**0.5407**		**1,720.2942**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0657	0.0398	0.6352	2.2100e-003	0.3041	1.3600e-003	0.3054	0.0806	1.2500e-003	0.0819		223.1521	223.1521	3.8700e-003	4.7100e-003	224.6538
Total	**0.0657**	**0.0398**	**0.6352**	**2.2100e-003**	**0.3041**	**1.3600e-003**	**0.3054**	**0.0806**	**1.2500e-003**	**0.0819**		**223.1521**	**223.1521**	**3.8700e-003**	**4.7100e-003**	**224.6538**

3.18 WellheadPaving - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.2327	1.1495	12.9316	0.0178		0.0402	0.0402		0.0393	0.0393	0.0000	1,706.7780	1,706.7780	0.5407		1,720.2942
Paving	3.1754					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.4081**	**1.1495**	**12.9316**	**0.0178**		**0.0402**	**0.0402**		**0.0393**	**0.0393**	**0.0000**	**1,706.7780**	**1,706.7780**	**0.5407**		**1,720.2942**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0657	0.0398	0.6352	2.2100e-003	0.2380	1.3600e-003	0.2393	0.0644	1.2500e-003	0.0657		223.1521	223.1521	3.8700e-003	4.7100e-003	224.6538
Total	**0.0657**	**0.0398**	**0.6352**	**2.2100e-003**	**0.2380**	**1.3600e-003**	**0.2393**	**0.0644**	**1.2500e-003**	**0.0657**		**223.1521**	**223.1521**	**3.8700e-003**	**4.7100e-003**	**224.6538**

3.19 AWPFPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.8498	7.7205	12.3356	0.0193		0.3597	0.3597		0.3332	0.3332		1,831.2521	1,831.2521	0.5700		1,845.5007
Paving	3.5283					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.3781**	**7.7205**	**12.3356**	**0.0193**		**0.3597**	**0.3597**		**0.3332**	**0.3332**		**1,831.2521**	**1,831.2521**	**0.5700**		**1,845.5007**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.1058	0.0623	0.9803	3.2600e-003	0.4471	2.0400e-003	0.4492	0.1186	1.8800e-003	0.1205		329.8034	329.8034	6.6400e-003	7.4600e-003	332.1927
Total	**0.1058**	**0.0623**	**0.9803**	**3.2600e-003**	**0.4471**	**2.0400e-003**	**0.4492**	**0.1186**	**1.8800e-003**	**0.1205**		**329.8034**	**329.8034**	**6.6400e-003**	**7.4600e-003**	**332.1927**

3.19 AWPFPaving - 2027

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.2453	1.2459	13.4744	0.0193		0.0439	0.0439		0.0427	0.0427	0.0000	1,831.2521	1,831.2521	0.5700		1,845.5007
Paving	3.5283					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.7736**	**1.2459**	**13.4744**	**0.0193**		**0.0439**	**0.0439**		**0.0427**	**0.0427**	**0.0000**	**1,831.2521**	**1,831.2521**	**0.5700**		**1,845.5007**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.1058	0.0623	0.9803	3.2600e-003	0.3499	2.0400e-003	0.3520	0.0947	1.8800e-003	0.0966		329.8034	329.8034	6.6400e-003	7.4600e-003	332.1927
Total	**0.1058**	**0.0623**	**0.9803**	**3.2600e-003**	**0.3499**	**2.0400e-003**	**0.3520**	**0.0947**	**1.8800e-003**	**0.0966**		**329.8034**	**329.8034**	**6.6400e-003**	**7.4600e-003**	**332.1927**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Asphalt Surfaces	0.00	0.00	0.00		
Refrigerated Warehouse-No Rail	0.00	0.00	0.00		
Unrefrigerated Warehouse-No Rail	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Asphalt Surfaces	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0
Refrigerated Warehouse-No	16.60	8.40	6.90	59.00	0.00	41.00	92	5	3
Unrefrigerated Warehouse-No	16.60	8.40	6.90	59.00	0.00	41.00	92	5	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Other Asphalt Surfaces	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480
Refrigerated Warehouse-No Rail	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480
Unrefrigerated Warehouse-No Rail	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	30.4348	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Unmitigated	30.4348	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	30.4106					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0241	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Total	**30.4348**	**2.3700e-003**	**0.2620**	**2.0000e-005**		**9.3000e-004**	**9.3000e-004**		**9.3000e-004**	**9.3000e-004**		**0.5631**	**0.5631**	**1.4600e-003**		**0.5997**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	30.4106					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0241	2.3700e-003	0.2620	2.0000e-005		9.3000e-004	9.3000e-004		9.3000e-004	9.3000e-004		0.5631	0.5631	1.4600e-003		0.5997
Total	**30.4348**	**2.3700e-003**	**0.2620**	**2.0000e-005**		**9.3000e-004**	**9.3000e-004**		**9.3000e-004**	**9.3000e-004**		**0.5631**	**0.5631**	**1.4600e-003**		**0.5997**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

woodardcurran.com

COMMITMENT & INTEGRITY DRIVE RESULTS

APPENDIX 6

Biological Resources (compiled)

OBMPU BIOLOGICAL RESOURCES REPORT

Program Biological Resources Report
Optimum Basin Management Program Update

March 15, 2020

Chino Basin Watermaster and Inland Empire Utilities Agency

Jacobs

Program Biological Resources Report

March 2020

STATE OF CALIFORNIA
Chino Basin Watermaster and Inland Empire Utilities Agency

Prepared By: ______________________ Date: __________

Lisa M. Patterson, Ecologist/Regulatory Specialist/QSP
(909) 838-1333
Jacobs
55616 Pipes Canyon Road, Yucca Valley, CA 92284

Recommended
for Approval by: ______________________ Date: __________

Sylvie Lee email: slee@ieua.org Tel: (909) 993-1646
Inland Empire Utilities Agency
6075 Kimball Avenue
Chino, CA 91708

Recommended
for Approval by: ______________________ Date: __________

Peter Kavounas email: PKavounas@cbmw.org Tel: (909) 484-3888
Chino Basin Watermaster
9641 San Bernardino Road
Rancho Cuamonga, CA 91730

Contents

List of Abbreviated Terms

amsl	average mean sea level
APE	Area of Potential Effect
BAA	Biological Analysis Area
BNSF	BNSF Railway Company
BSA	Biological Study Area
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFGC	California Fish and Game Code
CFR	Code of Federal Regulations
CNDDB	California Natural Diversity Database
CRLF	California red-legged frogs
CWA	Clean Water Act
DCH	Designated Critical Habitats
DOR	Division of Rail
Eagle Act	The Bald and Golden Eagle Protection Act
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Orders
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FE	Federally Endangered
FESA	Federal Endangered Species Act
FMPs	Fishery Management Plans
FT	Federally Threatened
ITC	Intermodal Transit Center
ITP	Incidental Take Permit
MBTA	Migratory Bird Treaty Act
MP	Milepost
mph	miles per hour
MSHCP	Multiple Species Habitat Conservation Plan

List of Abbreviated Terms

NCCP	Natural Community Conservation Plans
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOP	Notice of Preparation
NPPA	Native Plant Protect Act
PEIR	Program Environmental Impact Report
PNES	Program Natural Environmental Study
ROW	Right-of-Way
RTC	Rail Traffic Controller
RWQCB	Regional Water Quality Control Board
SSC	Species of Special Concern
SCRRA	Southern California Regional Rail Authority
SJVR	San Joaquin Valley Rail
SR	State Route
ST	State Threatened
SWRCB	State Water Resources Control Board
TDA	Tom Dodson & Associates
TOD	Transit Oriented Development
UPRR	Union Pacific Railroad (or UP)
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Services
USGS	U.S. Geological Survey
VFR	Valley foothill riparian
VOW	Valley oak woodland

Chapter 1. Project Description

1.1 Introduction

The Optimum Basin Management Program Update (OBMPU) is being prepared to provide an update to the Optimum Basin Management Plan Program Environmental Impact Report that was completed in 1999. The focus of this OBMPU document is to update the projects remaining to be implemented as well as identify new or additional elements, activities, and facilities proposed by the Chino Basin Watermaster (CBWM). The project descriptions focus on the relationship between OBMPU Program elements, activities, and facilities that *may* be implemented by the CBWM or any of its member agencies/stakeholders in the Chino Groundwater Basin (Chino Basin) through the planning period, 2020 through 2050.

One of the goals of this Biological Resources Report (BRR) for this program is to generally identify the biological resources within the plan area, and to identify the general areas where they occur or may occur. Another goal of this BRR is to broadly identify project "Types" with characteristics and activities that *may* cause physical changes to biological resources, or have the potential to impact sensitive biological resources. The final goal of the BRR is to identify mitigation measures identified in the OBMP EIR and either carry them forward, carry them forward with modifications, or identify additional or new measures based on new technology or science.

The description of the OBMPU's scope in this document is of necessity expansive as it covers nine (9) Program Elements (PEs) and attempts to address all of the possible program activities and projects at a programmatic level over the next 30 years, with some site-specific detail where near-term future locations of facilities are known. The CBWM and stakeholders have been meeting to review Program Elements and define potential project activities and facilities for about the past two years. Since the Inland Empire Utilities Agency (IEUA) has jurisdiction throughout most of the Chino Basin, it has agreed to serve as the Lead Agency for purposes of complying with the California Environmental Quality Act (CEQA). The CBWM and stakeholders of the OBMPU Peace Agreement and regulatory agencies that will function as CEQA Responsible Agencies will have the option of relying upon a certified Final OBMPU Program Environmental Impact Report (PEIR) for any future actions they take in support of the proposed program or an individual project described in this PEIR.

The 2000 OBMP contains a set of management programs (the PEs) that improve the reliability and long-term sustainability of the Chino Basin and the water supply reliability of the Judgment Parties. The framework for developing the OBMPU—including the goals of the Parties, the hydrologic understanding of the basin, the institutional and regulatory environment, an assessment of the impediments to achieving the Parties' goals, and the actions required to remove the impediments and achieve the goals—were all based on 1998-1999 conditions and valid planning assumptions at that time. Below is a summary of the PE's

1.2 Summary of Findings for Project Types Being Covered by this Program Document

Since there is a wide range of potential projects and programs associated with this plan, project have been broken in to "Types" of projects and the associated potential impacts to biological resources that a given "Type" may have is identified.

1.2.1 Project Category 1: Well Development and Monitoring Devices (PEs 1-9)

This Project Category includes the development of ASR, injection, pumping, groundwater level monitoring, and groundwater quality wells, associated well housing, as well as monitoring devices such as flow meters and extensometers. The proposed wells and monitoring devices will be installed throughout the Chino Basin.

Since the proposed project is at the programmatic level, specific locations for the proposed wells have not been have yet to be determined. As such, impacts to specific species or sensitive habitat resources are speculative, and greatly depend on the previous uses of the proposed monitoring sites. Previously unknown and unrecorded biological resources may be present on or within close proximity to an individual project. Therefore, mitigation will be implemented that would require site-specific studies to identify potentially suitable habitat for sensitive species, nesting sites, or critical habitat. The project biologist will work with the project design team to minimize impacts to sensitive resources by avoiding or minimizing direct impacts where feasible. If impacts are unavoidable and permitting is required; the project proponent will obtain required permitting and conduct required mitigation measures.

Due to the probability for these PEs to involve federal funding or work within biologically sensitive areas; it is anticipated that many future projects will require species specific studies, regulatory permitting, and follow-on mitigation monitoring.

1.2.1.1 Proposed Mitigation and Minimization Measures for Pes 1-9:

- ***Where future project-related impacts will affect undeveloped land, site surveys shall be conducted by a qualified biologist/ecologist. If sensitive species are identified as a result of the survey for which mitigation/compensation must be provided in accordance with regulatory requirements, the following subsequent mitigation actions will be taken:***
  - ***The project proponent shall provide compensation for sensitive habitat acreage lost by acquiring and protecting in perpetuity (through property or mitigation bank credit acquisition) habitat for the sensitive species at a ratio of not less than 1:1 for habitat lost. The property acquisition shall include the presence of at least one animal or plant per animal or plant lost at the development site to compensate for the loss of individual sensitive species.***
  - ***b. The final mitigation may differ from the above values based on negotiations between the project proponent and USFWS and CDFW for any incidental take permits for listed species. The project proponent shall retain a copy of the incidental take permit as verification that the mitigation of significant biological resource impacts at a project site with sensitive biological resources has been accomplished.***
  - ***c.Preconstruction botanical surveys for special-status plant communities and special-status plant species will be conducted. in areas that were not previously surveyed because of access or timing issues or project design changes, pre-construction surveys for special-status plant communities and special-status plant species will be conducted before the start of ground-disturbing activities during the appropriate blooming period(s) for the species.***

- ***Biological Resources Management Plan: During final design, a BRMP will be prepared to assemble the biological resources mitigation measures for each specific infrastructure improvement in the future. The BRMP will include terms and conditions from applicable permits and agreements and make provisions for monitoring assignments, scheduling, and responsibility. The BRMP will also discuss habitat replacement and revegetation, protection during ground-disturbing activities, performance (growth) standards, maintenance criteria, and monitoring requirements for temporary and permanent native plant community impacts. The parameters of the BRMP will be formed with the mitigation measures from the project-level EIR/EIS, including terms and conditions as applicable from the USFWS, USACE, SWRCB/RWQCB, and CDFW.***

- ***To reduce or prevent activities that may adversely affect rivers, streambeds or wetlands, the following mitigation measures will be incorporated into any specific projects and/or contractor specifications for future project-related impacts to protect sensitive resources and habitat.***
    - ***Prior to discharge of fill or streambed alteration of jurisdictional areas, the project proponent shall obtain regulatory permits from the U.S. Army Corps of Engineers, local Regional Water Quality Control Board and the California Department of Fish and Wildlife. Any future project that must discharge fill into a channel or otherwise alter a streambed shall be minimized to the extent feasible, and any discharge of fill not avoidable shall be mitigated through compensatory mitigation. Mitigation can be provided by restoration of temporary impacts, enhancement of existing resources, or purchasing into any authorized mitigation bank or in-lieu fee program; by selecting a site of comparable acreage near the site and enhancing it with a native riparian habitat or invasive species removal in accordance with a habitat mitigation plan approved by regulatory agencies; or by acquiring sufficient compensating habitat to meet regulatory agency requirements. Typically, regulatory agencies require mitigation for jurisdictional waters without any riparian or wetland habitat to be mitigated at a 1:1 ratio. For loss of any riparian or other wetland areas, the mitigation ratio will begin at 2:1 and the ratio will rise based on the type of habitat, habitat quality, and presence of sensitive or listed plants or animals in the affected area. A Habitat Mitigation and Monitoring Proposal shall be prepared and reviewed and approved by the appropriate regulatory agencies. The project proponent will also obtain permits from the regulatory agencies (U.S. Army Corps of Engineers, Regional Water Quality Control Board, CDFW and any other applicable regulatory agency with jurisdiction over the proposed facility improvement) if any impacts to jurisdictional areas will occur. These agencies can impose greater mitigation requirements in their permits, but Caltrans will utilize the ratios outlined above as the minimum required to offset or compensate for impacts to jurisdictional waters, riparian areas or other wetlands.***
    - ***Jurisdictional Water Preconstruction Surveys: A jurisdictional water preconstruction survey will be conducted at least six months before the start of ground-disturbing activities to identify and map all jurisdictional waters in the project footprint and if possible within a 250-foot buffer. The purpose of this survey is to confirm the extent of jurisdictional waters in areas where permission to enter was not previously granted and where aerial photograph interpretation was used to estimate the extent of these features. If possible, surveys would be performed during the spring, when plant species are in bloom and hydrological indicators are most readily identifiable. These results would then be used to calculate impact acreages and determine the amount of compensatory mitigation required to offset the loss of wetland functions and values.***

- ***Regarding active bird nests, the following mitigation measure will be applied to this program.***
    - ***It is illegal to "take" active bird nests of native birds, and if such nests are present at a project site, no take is allowed. To avoid an illegal take of active bird nests, any grubbing, brushing or tree removal will be conducted outside of the State identified nesting season (nesting season is approximately from February 15 through September 1 of a given calendar year). Alternatively, coordination with the CDFW to conduct nesting bird surveys will be completed, and methodology of surveys will be agreed upon. All nesting bird surveys will be conducted by a qualified biologist prior to initiation of ground disturbance to demonstrate that no bird nests will be disturbed by project construction activities.***

- ***The following mitigation can reduce the impact to burrowing owl to a less than significant level.***
    - ***Prior to commencement of construction activity in locations that are not fully developed, protocol burrowing owl survey will be conducted using the 2012 survey protocol methodology identified in the "Staff Report on Burrowing Owl Mitigation, State of California, Natural Resources Agency, Department of Fish and Game, March 7, 2012", or the most***

recent CDFW survey protocol available. Protocol surveys shall be conducted by a qualified biologist to determine if any burrowing owl burrows are located within the potential area of impact. If occupied burrows may be impacted, an impact minimization plan shall be developed and approved by CDFW that will protect the burrow in place or provide for passive relocation to an alternate burrow within the vicinity but outside of the project footprint in accordance with current CDFW guidelines. Active nests must be avoided with a 250-foot buffer until all nestlings have fledged.

- ***The following mitigation can ensure consistency with any HCP or MSHCP.***
  - ***Prior to commencement of construction activity on a project facility within a MSHCP/HCP plan area, consistency with that plan, or take authorization through that plan, shall be obtained. Through avoidance, compensation or a comparable mitigation alternative, each project shall be shown to be consistent with a MSHCP/HCP.***

- ***Implementation of the above measures is protective of the environment. Should the regulatory agencies determine an alternative, equivalent mitigation program during acquisition of regulatory permits, such measure shall be deemed equivalent to the above measures and no additional environmental documentation shall be required to implement a measure different than outlined above. Note that if impacts cannot be mitigated or avoided in the manner outlined in the measures above, then subsequent environmental documentation would have to be prepared in accordance with procedures outlined in Section 15162 of the State CEQA Guidelines. Implementation of the following mitigation measures will ensure that project design and site selection reduce impacts to sensitive biological resources to the extent feasible.***
  - ***Place primary emphasis on the preservation of large, unbroken blocks of natural open space and wildlife habitat area, and protect the integrity of habitat linkages. As part of this emphasis, incorporate programs for purchase of lands, clustering of development to increase the amount of preserved open space, and assurances that the construction of facilities or infrastructure improvements meet standards identical to the environmental protection policies applicable to the specific facilities improvement.***
  - ***Require facility designs and maintenance activities to be planned to protect habitat values and to preserve significant, viable habitat areas and habitat connection in their natural conditions.***
    - ***Within designated habitat areas of rare, threatened or endangered species, prohibit disturbance of protected biotic resources.***
    - ***Within riparian areas and wetlands subject to state or federal regulations, riparian woodlands, oak and walnut woodland, and habitat linkages, require that the vegetative resources which contribute to habitat carrying capacity (vegetative diversity, faunal resting sites, foraging areas, and food sources) are preserved in place or replaced so as not to result in an measurable reduction in the reproductive capacity of sensitive biotic resources.***
    - ***Within habitats of plants listed by the CNDDB or CNPS as "special" or "of concern," require that new facilities not result in a reduction in the number of these plants, if they are present.***
  - ***Maximize the preservation of individual oak, sycamore and walnut trees within proposed development sites.***
  - ***Require the establishment of buffer zones adjacent to areas of preserved biological resources. Such buffer zones shall be of adequate width to protect biological resources from grading and construction activities, as well as from the long-term use of adjacent lands. Permitted land modification activities with preservation and buffer areas are to be limited to those that are consistent with the maintenance of the reproductive capacity of the identified resources. The land uses and design of project facilities adjacent to a vegetative preservation area, as well as activities within the designated buffer area are not to be permitted to disturb natural drainage patterns to the point that vegetative resources receive***

too much or too little water to permit their ongoing health. In addition, landscape adjacent to areas of preserved biological resources shall be designed so as to avoid invasive species which could negatively impact the value of the preserved resource.

- ***Implementation of the following mitigation measures will ensure that project construction impacts to sensitive biological resources, including the potential effects of invasive species, are reduced to the extent feasible.***
  - ***4.2-12 Following construction activities within or adjacent to any natural area, the disturbed areas shall be revegetated using a plant mix of native plant species that are suitable for long term vegetation management at the specific site, which shall be implemented in cooperation with regulatory agencies and with oversight from a qualified biologist. The seeds mix shall be verified to contain the minimum amount of invasive plant species seeds reasonably available for the project area.***
  - ***4.2-13 Clean Construction Equipment. During construction, equipment will be washed before entering the project footprint to reduce potential indirect impacts from inadvertent introduction of nonnative invasive plant species. Mud and plant materials will be removed from construction equipment when working in native plant communities, near special-status plant communities, or in areas where special-status plant species have been identified.***
  - ***Contractor Education and Environmental Training.***
    - ***Personnel who work onsite will attend a Contractor Education and Environmental Training session. The environmental training is likely to be required by the regulatory agencies and will cover general and specific biological information on the special-status plant species, including the distribution of the resources, the recovery efforts, the legal status of the resources, and the penalties for violation of project permits and laws.***
    - ***The Contractor Education and Environmental Training sessions will be given before the initiation of construction activities and repeated, as needed, when new personnel begin work within the project limits. Daily updates and synopsis of the training will be performed during the daily safety ("tailgate") meeting. All personnel who attend the training will be required to sign an attendance list stating that they have received the Contractor Education and Environmental Training.***
  - ***Biological Monitor to Be Present during Construction Activities in areas where impacts to Riparian, Riverine, Wetland, Endangered Species or Endangered Species Critical habitat occurs. A biological monitor (or monitors) will be present onsite during construction activities that could result in direct or indirect impacts on sensitive biological resources (including listed species) and to oversee permit compliance and monitoring efforts for all special-status resources.***
    - ***A biological monitor (qualified biologist) is any person who has a bachelor's degree in biological sciences, zoology, botany, ecology, or a closely related field and/or has demonstrated field experience in and knowledge about the identification and life history of the special-status species or jurisdictional waters that could be affected by project activities. The biological monitor(s) will be responsible for monitoring the Contractor to ensure compliance with the Section 404 Individual Permit, Section 401 Water Quality Certification and the Lake and Streambed Alteration Agreement. Activities to ensure compliance would include performing construction-monitoring activities, including monitoring environmental fencing, identifying areas where special-status plant species are or may be present, and advising the Contractor of methods that may minimize or avoid impacts on these resources. Biological monitor(s) will be required to be present in all areas during ground disturbance activities and for all construction activities conducted within or adjacent to identified Environmentally Sensitive Areas, Wildlife Exclusion Fencing, and Non-Disturbance Zones.***
  - ***Food and Trash: All food-related trash items (e.g., wrappers, cans, bottles, food scraps) will be disposed of in closed containers and removed at least once a week from the construction site.***
  - ***Rodenticides and Herbicides: Use of rodenticides and herbicides in the project footprint will be restricted. This measure is necessary to prevent poisoning of special-status species and the potential reduction or depletion of the prey populations of special–status wildlife species.***

- *Wildlife Exclusion Fencing: Exclusion barriers (e.g., silt fences) will be installed at the edge of the construction footprint and along the outer perimeter of Environmentally Sensitive Areas and Environmentally Restricted Areas to restrict special-status species from entering the construction area. The design specifications of the exclusion fencing will be determined through consultation with the USFWS and/or CDFW. Clearance surveys will be conducted for special-status species after the exclusion fence is installed. If necessary, clearance surveys will be conducted daily.*
- *Equipment Staging Areas: Staging areas for construction equipment will be located outside sensitive biological resources areas, including habitat for special-status species, jurisdictional waters, and wildlife movement corridors, to the maximum extent possible.*
- *Plastic mono-filament netting (erosion-control matting) or similar material will not be used in erosion control materials to prevent potential harm to wildlife. Materials such as coconut coir matting or tackified hydroseeding compounds will be used as substitutes.*
- *Vehicle Traffic: During ground-disturbing activities, project-related vehicle traffic will be restricted within the construction area to established roads, construction areas, and other designated areas to prevent avoidable impacts. Access routes will be clearly flagged and off-road traffic will be prohibited.*
- *Entrapment Prevention: All excavated, steep-sided holes or trenches more than 8 inches deep will be covered at the close of each working day with plywood or similar materials, or a minimum of one escape ramp constructed of earth fill for every 10 feet of trenching will be provided to prevent the entrapment of wildlife. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals.*
  - *All culverts or similar enclosed structures with a diameter of 4 inches or greater will be covered, screened, or stored more than 1 foot off the ground to prevent use by wildlife. Stored material will be cleared for common and special-status wildlife species before the pipe is subsequently used or moved.*
- *Weed Control Plan: A Weed Control Plan will be prepared and implemented to minimize or avoid the spread of weeds during ground-disturbing activities. In the Weed Control Plan, the following topics will be addressed:*
  - *Schedule for noxious weed surveys.*
  - *Weed control treatments, including permitted herbicides, and manual and mechanical methods for application; herbicide application will be restricted in Environmentally Sensitive Areas.*
  - *Timing of the weed control treatment for each plant species.*
  - *Fire prevention measures.*
- *Dewatering/Water Diversion: Open or flowing water may be present during construction. If construction occurs where there is open or flowing water, a strategy that is approved by the resource agencies (e.g., USACE, SWRCB/RWQCB, and CDFW), such as the creation of cofferdams, will be used to dewater or divert water from the work area. If cofferdams are constructed, implementation of the following cofferdam or water diversion measures is recommended to avoid and lessen impacts on jurisdictional waters during construction:*
  - *The cofferdams, filter fabric, and corrugated steel pipe are to be removed from the creek bed after completion of the project.*
  - *The timing of work within all channelized waters is to be coordinated with the regulatory agencies.*
  - *The cofferdam is to be placed upstream of the work area to direct base flows through an appropriately sized diversion pipe. The diversion pipe will extend through the Contractor's work area, where possible, and outlet through a sandbag dam at the downstream end.*
  - *Sediment catch basins immediately below the construction site are to be constructed when performing in-channel construction to prevent silt- and sediment-laden water from entering the main stream flow. Accumulated sediments will be periodically removed from the catch basins.*

1.2.2 Project Category 2: Conveyance Facilities and Ancillary Facilities (PEs 2, 4-9)

This category includes the construction of 550,000 LF of new pipelines, booster pump stations, reservoirs and minor appurtenances whose number. The proposed conveyance facilities and ancillary facilities would be implemented throughout the entire Chino Basin.

Potential Impacts, follow-on biological studies, and potential permitting requirements would be the same as Project Category 1.

1.2.3 Project Category 3: Storage Basins, Recharge Facilities, and Storage Bands (PEs 2, 4-5, 8/9)

This Project Category includes the construction of 310 acres of new storage basins—several locations for which are within existing facilities, improvements to existing storage basin(s), 200 acres of flood MAR facilities, new MS4-compliance facilities, and expansion of the maximum storage space (safe storage capacity) to be used within the Chino Basin from 600,000 af (through June 30, 2021) to between 700,000 af and 1,000,000 af going forward with various impacts that may result for each 100,000 af between this range of storage. The specific locations of the storage basins are described in the Project Description above; however, the locations of the flood MAR facilities and MS4 compliant projects are presently unknown.

Potential Impacts, follow-on biological studies, and potential permitting requirements would be the same as Project Category 1.

1.2.4 Project Category 4: Desalters and Water Treatment Facilities (PEs 2, 4-9)

The projects proposed under this category are: upgrades at IEUA's existing Treatment Plants (discussed in IEUA's 2017 FMP PEIR), a new advanced water treatment plant (discussed in IEUA's 2017 FMP PEIR), improvements to the WFA Agua de Lejos Treatment Plant, upgrades to the Chino Desalters, new groundwater treatment facilities at or near well sites and at regionally located sites, and improvements to existing groundwater treatment facilities. Cultural Resource impacts related to the facilities thoroughly analyzed as part of the IEUA's 2017 FMP PEIR will not be analyzed further as part of this Initial Study.

Potential Impacts, follow-on biological studies, and potential permitting requirements would be the same as Project Category 1.

1.2.5 Operational Scenarios

As part of this summary of all facilities, possible operational scenarios are provided as part of the discussion of each type of facility. The future modes of operation (activities) are provided to enable evaluation of the physical impacts that would result from OBMPU implementation. These are representative scenarios that describe a range of plausible future operations and activities. They are not intended to be exhaustive but they represent future operations based on the past activities carried out in the Chino Basin to implement the original OBMP Program Elements.

In the event that a given facility will require periodic or routine operation maintenance, the maintenance will need to be identified, permitted if needed, and best management measures should be identified to minimize impacts to biological resources. Best Management Practices include but are not limited to 1) timing of maintenance out side nesting, flouring, breeding, or other biologically sensitive period 2) minimizing impacts to native habitats, 3) minimize impacts to special aquatic sites including wetlands 3) trash control, 4) spread of invasive species.

1.2.6 Construction Scenarios

Secondarily, as part of this summary of all facilities, possible construction scenarios are provided as part of the discussion of each type of facility. The purpose of the following general construction scenarios is to assist the reviewer to understand how the proposed facilities will be installed and the amount of time required for their construction. This information also provides essential data for making the program air quality impact forecasts using the most current CalEEMod emission forecast model.

In general, the types, configuration and exact location of future specific projects that will be constructed in support of the OBMPU have not been determined. However, there are a few specific Projects that have been identified at a sufficient level of detail that a location has been pinpointed in which a specific project will be developed. For instance, the CIM Storage Basin Project is proposed to be located at the CIM; however, the Project specifications at that site have not yet been identified. For the remaining projects listed below, it is possible to foresee some of the infrastructure that is likely to be constructed and to project the maximum expected impacts that would result from construction and operation of the infrastructure. Impacts associated with specific future projects would be evaluated in second-tier CEQA evaluations to determine if the actual impacts fall within the impacts forecast by this analysis, or require subsequent CEQA evaluations and determinations. These evaluations would be conducted under Section 15162 of the State CEQA Guidelines.

1.2.7 PBHSP Biological Monitoring (PE1)

The objective of PE 1 under the OBMPU includes continuing the ongoing monitoring and reporting program and developing and updating an OBMPU Monitoring and Reporting Work Plan. Watermaster's biological monitoring program is conducted pursuant to the adaptive monitoring program (AMP) for the Prado Basin Habitat Sustainability Program (PBHSP). The objective of the PBHSP is to ensure that the groundwater-dependent ecosystem in Prado Basin will not incur unforeseeable significant adverse impacts due to implementation of the Peace II Agreement. The monitoring program produces time series data and information on the extent and quality of the riparian habitat in the Prado Basin over a historical period that includes both pre- and post-Peace II implementation. Two types of monitoring and assessment are performed: regional and site-specific. Regional monitoring and assessment of the riparian habitat is performed by mapping the extent and quality of riparian habitat over time using multi-spectral remote-sensing data and air photos. Site-specific monitoring performed in the Prado Basin includes field vegetation surveys and seasonal ground-based photo monitoring. Under the OBMPU, Watermaster will continue these efforts.

1.3 Project Location

The Chino Basin is one of the largest groundwater basins in Southern California and has an unused storage capacity of over 1,000,000 acre-feet. The Chino Basin covers approximately 235 square miles within the Upper Santa Ana River Watershed and lies within portions of San Bernardino, Riverside, and Los Angeles counties. Exhibit 1 shows the location of the Chino Basin within the Upper Santa Ana River Watershed. The Chino Basin consists of an alluvial valley that is relatively flat from east to west, sloping from north to south at a one to two percent grade. Basin elevation ranges from about 2,000 feet adjacent to the San Gabriel foothills to about 500 feet near Prado Dam. As shown in Exhibit 2, the Chino Basin is bounded:

- on the north by the San Gabriel Mountains and the Cucamonga Basin;
- on the east by the Rialto-Colton Basin, Jurupa Hills, and the Pedley Hills;
- on the south by the La Sierra Hills and the Temescal Basin; and
- on the west by the Chino Hills, Puente Hills, and the Spadra, Pomona, and Claremont Basins.

The Optimum Basin Management Program (OBMP), which was based on the Peace I Agreement in the Chino Basin, focuses on management actions within the Chino Groundwater Basin (Chino Basin or the Basin) as shown on the inset on Exhibit 1. Exhibit 2 illustrates the boundary of the Chino Basin as it is legally defined in the stipulated Judgment in the case of Chino Basin Municipal Water District *vs.* the City of Chino *et al.* Exhibit 2 also shows the Regional Water Quality Control Board, Santa Ana Region (Regional Board) management zones as established in the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan).

The principal drainage course for the Santa Ana River watershed is the Santa Ana River. It flows 69 miles across the Santa Ana Watershed from its origin in the eastern San Bernardino Mountains to the Pacific Ocean. The Santa Ana River enters the Chino Basin at the Riverside Narrows and flows along the southern boundary to the Prado Flood Control Reservoir, where it is eventually discharged through the outlet at Prado Dam and flows the remainder of its course to the Pacific Ocean. The Basin is traversed by a series of ephemeral and perennial streams that include: San Antonio Creek, Chino Creek, Cucamonga Creek, Deer Creek, Day Creek, Etiwanda Creek and San Sevaine Creek. Please refer to Exhibit 2 for the location of drainages.

These creeks flow primarily north to south and carry significant natural flows only during, and for a short time after, the passage of Pacific storm fronts that typically occur from November through April. IEUA discharges year-round flows to Chino Creek and to Cucamonga Channel from its Regional Plants. The actual volume of wastewater discharges varies seasonally and is expected to attenuated in the future by a combination of water conservation measures being implemented by water users and through diversion of flows for delivery as recycled water to future users that can utilize this source of water, including landscape irrigation, industrial operations, and recharge into the Chino Basin groundwater aquifer.

The Chino Basin is mapped within the USGS – Corona North, Cucamonga Peak, Devore, Fontana, Guasti, Mount Baldy, Ontario, Prado Dam, Riverside West and San Dimas Quadrangles, 7.5 Minute Series topographic maps. The center of the Basin is located near the intersection of Haven Avenue and Mission Boulevard at Longitude 34.038040N, and Latitude 117.575954W.

Chapter 2. Study Methods

This chapter presents the methods used to identify biological resources in the project region. In addition, this chapter provides an overview of the various regulatory requirements, definitions of terms used, background review conducted, field surveys, post-field data processing, personnel and survey dates, and coordination efforts with agency and professional contacts. It also summarizes the study limitations and how they may influence the results presented in this report.

Because this is a program level document with individual facilities improvements expected to occur over the next 22 years, only cursory level surveys were conducted throughout the project Study Area. Before conducting field surveys, existing background information was reviewed to identify the locations of jurisdictional waters, special-status plant and wildlife species, special-status plant communities, natural lands, and federally designated or proposed critical habitat units recorded or potentially occurring in the proposed infrastructure improvement areas. This section summarizes the background information that was reviewed.

2.1 Regulatory Requirements

2.1.1 Federal

Clean Water Act

The purpose of the Clean Water Act (CWA) (1977) is to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." *Section 404* of the CWA prohibits the discharge of dredged or fill material into "waters of the United States" without a permit from the United States Army Corps of Engineers (USACE). The definition of waters of the United States includes rivers, streams, estuaries, the territorial seas, ponds, lakes, and wetlands. Wetlands are defined as those areas "that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 Code of Federal Regulations [CFR] 328.3 7b). *Section 401* of the CWA is required for Section 404 permit actions; in California this certification or waiver is issued by the RWQCB.

In addition to the Section 404 and 401 regulating discharge of dredge or fill into Waters of the United States; 33 USC 408 (Chapter 9.1), Navigation and Navigable Waters. *Section 408* states it is unlawful for any person(s) to build upon, alter, deface, destroy, move, injure, obstruct or… impair the usefulness of any levee or other work built by the U.S. That the Secretary may, on the recommendation of the Chief of Engineers, grant permission for the alteration or permanent occupation or use of any of the public works when in the judgment of the Secretary such occupation or use will not be injurious to the public interest and will not impair the usefulness of such work.

Rivers and Harbors Act 1899

Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the USACE for the construction of any structure in or over any navigable waters of the U.S.

Endangered Species Act

The Federal Endangered Species Act (FESA) (1973) protects plants and wildlife that are listed by the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) as endangered or threatened. Section 9 of FESA (USA) prohibits the taking of endangered wildlife, where taking is defined as any effort to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in such conduct" (50 CFR 17.3). For plants, this statute governs removing, possessing, maliciously damaging, or destroying any endangered plant on federal land and removing, cutting, digging up, damaging, or destroying any endangered plant on non-federal land in knowing violation of state law (16 United States Code [USC] 1538). Under Section 7 of FESA, federal agencies are required to consult with the USFWS if their actions, including permit approvals or funding, could adversely affect an endangered species (including plants) or its critical habitat. Through consultation and the issuance of a biological opinion, the USFWS may issue an incidental take statement allowing take of the species that is incidental to an otherwise authorized activity, provided the action will not jeopardize the continued existence of the species. FESA specifies that the USFWS designate habitat for a species at the time of its listing in which are found the physical or biological features "essential to the conservation of the species," or which may require "special Management consideration or protection…" (16 USC § 1533[a][3].2; 16 USC § 1532[a]). This designated Critical Habitat is then afforded the same protection under the FESA as individuals of the species itself, requiring issuance of an Incidental Take Permit prior to any activity that results in "the destruction or adverse modification of habitat …. determined …. to be critical" (16 USC § 1536[a][2]).

Interagency Consultation and Biological Assessments

Section 7 of ESA provides a means for authorizing the "take" of threatened or endangered species by federal agencies, and applies to actions that are conducted, permitted, or funded by a federal agency. The statute requires federal agencies to consult with the USFWS or NMFS, as appropriate, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species. If a proposed project "may affect" a listed species or destroy or modify critical habitat, the lead agency is required to prepare a biological assessment evaluating the nature and severity of the potential effect.

Habitat Conservation Plans

Section 10 of the federal ESA requires the acquisition of an Incidental Take Permit (ITP) from the USFWS by non-federal landowners for activities that might incidentally harm (or "take") endangered or threatened wildlife on their land. To obtain a permit, an applicant must develop a Habitat Conservation Plan that is designed to offset any harmful impacts the proposed activity might have on the species.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. Sections 661 to 667e et seq.) applies to any federal project where any body of water is impounded, diverted, deepened, or otherwise modified. Project proponents are required to consult with the USFWS and the appropriate state wildlife agency.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. Section 1801 et seq.) requires all federal agencies to consult with the NMFS on all actions or proposed actions (permitted, funded, or undertaken by the agency) that may adversely affect fish habitats. It also requires cooperation among NMFS, the councils, fishing participants, and federal and state agencies to protect, conserve, and enhance essential fish habitat, which is defined as those waters and substrates needed by fish for spawning, breeding, feeding, and growth to maturity.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (The Eagle Act) (1940), amended in 1962, was originally implemented for the protection of bald eagles (Haliaeetus leucocephalus). In 1962, Congress amended the Eagle Act to cover golden eagles (Aquila chrysaetos), a move that was partially an attempt to strengthen protection of bald eagles, since the latter were often killed by people mistaking them for golden eagles. This act makes it illegal to import, export, take (molest or disturb), sell, purchase, or barter any bald eagle or golden eagle or part thereof. The golden eagle, however, is accorded somewhat lighter protection under the Eagle Act than that of the bald eagle.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (1918) implements international treaties between the United States and other nations created to protect migratory birds, any of their parts, eggs, and nests from activities, such as hunting, pursuing, capturing, killing, selling, and shipping, unless expressly authorized in the regulations or by permit. As authorized by the MBTA, the USFWS issues permits to qualified applicants for the following types of activities: falconry, raptor propagation, scientific collecting, special purposes (rehabilitation, education, migratory game bird propagation, and salvage), take of depredating birds, taxidermy, and waterfowl sale and disposal. The regulations governing migratory bird permits can be found in 50 CFR Part 13 General Permit Procedures and 50 CFR part 21 Migratory Bird Permits. The State of California has incorporated the protection of birds of prey in Sections 3800, 3513, and 3503.5 of the California Fish and Game Code (CFGC).

Executive Orders (EO)

Invasive Species—Executive Order 13112 (1999)

Issued on February 3, 1999, promotes the prevention and introduction of invasive species and provides for their control and minimizes the economic, ecological, and human health impacts that invasive species cause through the creation of the Invasive Species Council and Invasive Species Management Plan.

Protection of Wetlands—Executive Order 11990 (1977)

Issued on May 24, 1977, helps avoid the long-term and short-term adverse impacts associated with destroying or modifying wetlands and avoiding direct or indirect support of new construction in wetlands when there is a practicable alternative.

Migratory Bird—EO 13186 (2001)

Issued on January 10, 2001, promotes the conservation of migratory birds and their habitats and directs federal agencies to implement the Migratory Bird Treaty Act. Protection and Enhancement of Environmental Quality—EO 11514 (1970a), issued on March 5, 1970, supports the purpose and policies of the National Environmental Policy Act (NEPA) and directs federal agencies to take measures to meet national environmental goals.

Migratory Bird Treaty Reform Act

The Migratory Bird Treaty Reform Act (Division E, Title I, Section 143 of the Consolidated Appropriations Act, 2005, PL 108–447) amends the Migratory Bird Treaty Act (16 U.S.C. Sections 703 to 712) such that nonnative birds or birds that have been introduced by humans to the United States or its territories are excluded from protection under the Act. It defines a native migratory bird as a species present in the United States and its territories as a result of natural biological or ecological processes. This list excluded two additional species commonly observed in the United States, the rock pigeon (Columba livia) and domestic goose (Anser domesticus).

2.1.2 State

Sections 1600 through 1606 of the California Fish and Game Code (CFGC)

This section requires that a Streambed Alteration Application be submitted to the CDFW for "any activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake." The CDFW reviews the proposed actions and, if necessary, submits to the applicant a proposal for measures to protect affected fish and wildlife resources. The final proposal that is mutually agreed upon by the Department and the applicant is the Streambed Alteration Agreement. Often, projects that require a Streambed Alteration Agreement also require a permit from the USACE under Section 404 of the CWA. In these instances, the conditions of the Section 404 permit and the Streambed Alteration Agreement may overlap.

California Endangered Species Act

The California Endangered Species Act (CESA) (Sections 2050 to 2085) establishes the policy of the state to conserve, protect, restore, and enhance threatened or endangered species and their habitats by protecting "all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation." Animal species are listed by the CDFW as threatened or endangered, and plants are listed as rare, threatened, or endangered. However, only those plant species listed as threatened or endangered receive protection under the California ESA.

CESA mandates that state agencies do not approve a project that would jeopardize the continued existence of these species if reasonable and prudent alternatives are available that would avoid a jeopardy finding. There are no state agency consultation procedures under the California ESA. For projects that would affect a species that is federally and state listed, compliance with ESA satisfies the California ESA if the California Department of Fish and Wildlife (CDFW) determines that the federal incidental take authorization is consistent with the California ESA under Section 2080.1. For projects that would result in take of a species that is state listed only, the project sponsor must apply for a take permit, in accordance with Section 2081(b).

Fully Protected Species

Four sections of the California Fish and Game Code (CFGC) list 37 fully protected species (CFGC Sections 3511, 4700, 5050, and 5515). These sections prohibit take or possession "at any time" of the species listed, with few exceptions, and state that "no provision of this code or any other law will be construed to authorize the issuance of permits or licenses to 'take' the species," and that no previously issued permits or licenses for take of the species "shall have any force or effect" for authorizing take or possession.

Bird Nesting Protections

Bird nesting protections (Sections 3503, 3503.5, 3511, and 3513) in the CFGC include the following:

- Section 3503 prohibits the take, possession, or needless destruction of the nest or eggs of any bird.
- Section 3503.5 prohibits the take, possession, or needless destruction of any nests, eggs, or birds in the orders Falconiformes (new world vultures, hawks, eagles, ospreys, and falcons, among others), or Strigiformes (owls).
- Section 3511 prohibits the take or possession of fully protected birds.
- Section 3513 prohibits the take or possession of any migratory nongame bird or part thereof, as designated in the MBTA. To avoid violation of the take provisions, it is generally required that project-related disturbance at active nesting territories be reduced or eliminated during the nesting cycle.

CA Migratory Bird Act -Assembly Bill 454

Existing federal law, the Migratory Bird Treaty Act, provides for the protection of migratory birds, as specified. The federal act also authorizes states and territories of the United States to make and enforce laws or regulations that give further protection to migratory birds, their nests, and eggs. Existing state law makes unlawful the taking or possession of any migratory nongame bird, or part of any migratory nongame bird, as designated in the federal act, except as provided by rules and regulations adopted by the United States Secretary of the Interior under provisions of the federal act…… (a) It is unlawful to take or possess any migratory nongame bird as designated in the federal Migratory Bird Treaty Act (16 U.S.C. Sec. 703 et seq.), or any part of a migratory nongame bird described in this section, except as provided by rules and regulations adopted by the United States Secretary of the Interior under that federal act.

Native Plant Protection Act

The Native Plant Protect Act (NPPA) (1977) (CFGC Sections 1900-1913) was created with the intent to "preserve, protect, and enhance rare and endangered plants in this State." The NPPA is administered by CDFW. The Fish and Game Commission has the authority to designate native plants as endangered or rare and to protect endangered and rare plants from take. CESA (CFGC 2050-2116) provided further protection for rare and endangered plant species, but the NPPA remains part of the Fish and Game Code.

Natural Communities Conservation Planning Act

This act was enacted to encourage broad-based planning to provide for effective protection and conservation of the state's wildlife resources while continuing to allow appropriate development and growth (CFGC Sections 2800 to 2835). Natural Community Conservation Plans (NCCP) may be implemented, which identify measures necessary to conserve and manage natural biological diversity within the planning area, while allowing compatible and appropriate economic development, growth, and other human uses.

Senate Concurrent Resolution No. 17 – Oak Woodlands

State Senate Concurrent Resolution No. 17 is legislation that requests state agencies having land use planning duties and responsibilities to assess and determine the effects of their decisions or actions within any oak woodlands containing Blue, Engleman, Valley, or Coast Live Oak. The measure requests those state agencies to preserve and protect native oak woodlands to the maximum extent feasible or provide replacement plantings where designated oak species are removed from oak woodlands. The mitigation measures, as described above, will ensure that impacts to oak woodlands are less than significant.

2.2 Studies Required

In order to develop this programmatic Biological Resource Report, available information was reviewed from resource management plans and other relevant documents to determine locations and types of biological resources that have the potential to exist within and adjacent to the Study Area. Field studies were conducted as part of OBMP in 2013. Focused field studies will be completed once specific project activities and a schedule for those activities is determined.

The California Natural Diversity Database (CDFW, January 2020), U.S. Fish and Wildlife Service County lists (USFWS, 2020), California Native Plant Society Electronic Inventory of Rare and Endangered Plants of California (January 2020), and National Wetlands Inventory (USFWR, January 2020) were queried for occurrence of special status species and habitats within the Chino Basin. CDFW BIOS database was also queried for general habitat types and potential features subject to environmental regulations (e.g., Clean Water Act [CWA], Porter-Cologne Water Quality Control Act [Porter-Cologne] and California Department of Fish and Wildlife's Fish and Game Code 1600 et seq. jurisdictional features) that may exist within or adjacent to the Study Area.

Additionally, studies conducted for previous facility improvements within Chino Basin were reviewed. These studies include the Draft San Bernardino County Countywide Plan Biological Resources Existing Conditions Report (Dudek, May 2019)

In addition to the aforementioned literature reviews, reconnaissance-based field surveys of the Study Area were performed in 2013 to assess general and dominant vegetation types, habitat types, and the potential for special status wildlife and plant species to occur within the project areas. Community types were based on observed dominant vegetation composition and density. Vegetation classifications of plant communities in the Study Area were derived from the criteria and definitions of Holland (1986).

2.2.1 Limitations That May Influence Results

Several limitations that may influence the results of the studies presented in this report were identified. These limitations are beyond IEUA and Chino Basin Watermaster's control and are associated with permission to enter private property and physical access limitation. Several areas will require future access via a high-rail vehicle. Once these future development areas are designed and a BSA can be established, focused surveys and high-rail access will be required.

Additionally, the programmatic nature of the project with facilities being proposed over the next 20 years does not warrant focused surveys for each of the proposed locations. Typically, biological surveys are valid for one year. Any focused biological surveys conducted would need to be redone once a specific facility is designed and the second-tier level environmental process is initiated.

Estimations and assumptions regarding the potential for jurisdictional waters and special-status species were based on assessments from previous projects, and existing resource information. In some instances, these assessments are based solely on aerial photography, which provides an adequate level of detail for a programmatic environmental document.

Chapter 3. Results: Environmental Setting

3.1 Descriptions of the Existing Biological and Physical Conditions of the Study Area

3.1.1 Study Area

The Chino Basin is one of the largest groundwater basins in Southern California and has an unused storage capacity of over 1,000,000 acre-feet. The Chino Basin covers approximately 235 square miles within the Upper Santa Ana River Watershed and lies within portions of San Bernardino, Riverside, and Los Angeles counties. The Chino Basin consists of an alluvial valley that is relatively flat from east to west, sloping from north to south at a one to two percent grade. Basin elevation ranges from about 2,000 feet adjacent to the San Gabriel foothills to about 500 feet near Prado Dam. The Chino Basin is bounded:

- on the north by the San Gabriel Mountains and the Cucamonga Basin;
- on the east by the Rialto-Colton Basin, Jurupa Hills, and the Pedley Hills;
- on the south by the La Sierra Hills and the Temescal Basin; and
- on the west by the Chino Hills, Puente Hills, and the Spadra, Pomona, and Claremont Basins.

The principal drainage course for the Santa Ana River watershed is the Santa Ana River. It flows 69 miles across the Santa Ana Watershed from its origin in the eastern San Bernardino Mountains to the Pacific Ocean. The Santa Ana River enters the Chino Basin at the Riverside Narrows and flows along the southern boundary to the Prado Flood Control Reservoir, where it is eventually discharged through the outlet at Prado Dam and flows the remainder of its course to the Pacific Ocean. The Basin is traversed by a series of ephemeral and perennial streams that include: San Antonio Creek, Chino Creek, Cucamonga Creek, Deer Creek, Day Creek, Etiwanda Creek and San Sevaine Creek. Please refer to Exhibit 2 for the location of drainages.

These creeks flow primarily north to south and carry significant natural flows only during, and for a short time after, the passage of Pacific storm fronts that typically occur from November through April. IEUA discharges year-round flows to Chino Creek and to Cucamonga Channel from its Regional Plants. The actual volume of wastewater discharges varies seasonally and is expected to attenuated in the future by a combination of water conservation measures being implemented by water users and through diversion of flows for delivery as recycled water to future users that can utilize this source of water, including landscape irrigation, industrial operations, and recharge into the Chino Basin groundwater aquifer.

The Chino Basin is mapped within the USGS – Corona North, Cucamonga Peak, Devore, Fontana, Guasti, Mount Baldy, Ontario, Prado Dam, Riverside West and San Dimas Quadrangles, 7.5 Minute Series topographic maps. The center of the Basin is located near the intersection of Haven Avenue and Mission Boulevard at Longitude 34.038040N, and Latitude 117.575954W.

Data contained in these reports, where applicable, are summarized herein with editing to conform to the EIR format.

The proposed OBMPU would be require to comply with the following federal and state regulations and laws:

1. NEPA and CEQA guidelines that apply to sensitive biological resources
2. U.S. Army Corps of Engineers (COE) Clean Water Act Section 404 Permit and
3. U.S. Environmental Protection Agency (EPA) 404 (b)1 Alternatives Analysis
4. Section 7 and/or 10 of U.S. Endangered Species Act of 1973, as amended
5. U.S. Migratory Bird Treaty Act
6. U.S. Bald Eagle Act

7. California Endangered Species Act
8. California Department of Fish and Game (CDFG) Streambed Alteration Agreement
9. (Section 1600 of the Fish and Game Code)
10. State of California Native Plant Protection Act
11. Plant Protection and Management Ordinances (County Code Title 8, Div. 11)

Both the California and Federal endangered species acts provide legislation to protect the habitats of listed species as well as the species itself. If a state or federally listed endangered species was determined to be present, the proposed project may be constrained to avoid or minimize effects to the species. Species specific mitigation measures would thus need to be agreed upon and implemented to the satisfaction of all jurisdictional agencies. These jurisdictional agencies may be some or all of the following: U.S. Fish and Wildlife Service (USFWS), CDFG, and/or COE.

The project area is comprised of a primarily urban setting, as indicated on Figure 4.8-1. The vast majority of the approximately 225,000 acres that comprises the Chino Basin has been previously developed or disturbed by human activity. Relatively speaking, very few pristine areas of undisturbed natural habitat remain. The following is a discussion of areas within the Chino Basin that have the largest areas of extant habitat communities or have the most significant biological resources:

The Prado Reservoir area comprises 9,741 acres northwest of Corona and south of Chino. Approximately 4,000 acres of this area can be classified as riparian woodland vegetation, of which 2,000 to 2,500 acres is dense riparian habitat dominated by large stands of willow woodland. This is one of the largest remaining riparian woodland in southern California. This area supports a wide array of sensitive species, both floral and faunal. According to the Biological Resources section for the Chino Basin Groundwater storage Program Draft Environmental Impact Report for MWDSC, a total of 311 species of vascular plants, belonging to 65 families, were identified in the Basin area. Three major vegetational communities occur in this area. First is riparian habitat which occurs in low lying sections of the Basin and along the Santa Ana River and streams running into the Basin.

The riparian habitat is dominated by extensive stands of black willow, and smaller stands of arroyo willow. Several stands of tall cottonwoods and a single stand of sycamore have been identified. The second habitat type is upland habitat characteristic of coastal sage scrub, plus grasses and exotic weeds. This upland area has been heavily impacted by agriculture and grazing activities. The third major vegetational type is the aquatic and semi-aquatic communities occurring in permanent streams and artificial duck ponds, and intermittently filled reservoirs and streams within the Basin. The wildlife in the riparian area includes a variety of amphibians, mammals, and birds. For an additional discussion of the biological resources identified in the area, please refer to MWDSC Chino Basin Groundwater Storage EIR's biological resource section.

The Santa Ana River and its tributaries within the Chino Basin are also significant areas for biological resources as they provide refugia and breeding grounds for neotropical migrant species as well as provide habitat linkages and movement corridors connecting various large blocks of relatively undisturbed habitat areas. The MWDSC Chino Basin EIR also reports that many of these tributary streams will be fully lined as part of flood control activities in the future.

Another significant area for biological resources that lies adjacent to the Chino Basin is Chino Hills State Park has approximately 13,000 acres of wild land situated in the hills north of Santa Ana Canyon. Although Chino Hill State Park containing large blocks of non-native grasslands, it is also contains riparian habitat comprised of coast live oak and sycamore woodlands. Additionally, this park contains one of the largest remaining stands of Southern California black walnut. This park functions as an important area for connectivity to and movement between the park the boundary of the project area.

Based on the most recent field surveys of the area and desktop review for Peace II, the proposed action area traverses vacant, public land designated as flood control, water conservation and open space. Patches of agricultural, industrial and commercial land uses are evident north of the Prado Dam inundation area.

Prado Basin is dominated by flood plain riparian plant communities, with upland habitats primarily restricted to the perimeter of the Basin. The hydrological conditions in the project area promote the establishment of riparian vegetation. A freshwater marsh habitat component is also present in the project area because standing water is seasonally abundant in the Prado Basin upstream of the Prado Dam.

The present biological condition of Prado Basin was created by the construction of Prado Dam in 1941. Prado Dam was built where Chino Creek, Cucamonga Creek (also known as Mill Creek, south of Pine Avenue) and Temescal Wash have their confluence with the Santa Ana River. Due to a combination of the high groundwater table, storm flow accumulation held in the reservoir, sewage treatment plant effluent and irrigation runoff, a resultant perennial river flow exists that has created and sustains the extensive wetland habitat in the Basin. Presently, the riparian woodlands in the Basin comprise the largest single stand of this habitat in southern California. Prado Basin supports a myriad of habitat types, including but not exclusive to cottonwood/willow riparian forest, riparian scrubland, herbaceous riparian, freshwater ponds, freshwater marsh, riverine, sandy wash, fallow fields, agricultural land, ruderal, coastal sage scrub, and oak woodland.

The riparian habitat within the project area is in various seral stages and generally consists of tall, multilayered, open, canopy riparian forests. The dominant vegetative species within this riparian forest include: Eucalyptus, Freemont cottonwood (*Populus fremontii*), black cottonwood, (*P. tremuloides*) and several tree willows (*Salix spp*). Characteristic species, in addition to the eucalyptus and cottonwood, include black willow (*S. goodingii*) narrow-leved willow (*S. exigua*), arroyo willow (*S. lasiolepis*), red willow (*S. laevigata*), sandbar willow (*S. hindsiana*), mulefat (*Baccharis salicifolia*) Sycamore (*Platanus recemosa*) and elderberry (*Sambucus mexicana*).

In addition to the riparian community, there are also freshwater marsh, eucalyptus groves, coastal sage scrub, riverine, grassland, and ruderal communities found within the project area. Cattails and reeds are the dominant species within the freshwater marsh habitat.

Plant Communities

Additionally, a review of San Bernardino and Riverside County general plan documents listed the plant communities shown below as being present in the project area. The general characteristics of the plant communities described below were extracted from San Bernardino County's Biological Resources Report.

> ***Chaparral***
> *Several different chaparral subtypes occur in San Bernardino County. The most common subtypes in the valley region are southern mixed chaparral, chamise chaparral and scrub oak chaparral. These associations are located predominantly along the lower slopes of the mountains and in the interface zone between valley and mountain regions.*
>
> *Southern mixed chaparral is composed of broad-leaved sclerophyllous shrubs that grow to about 8-12 feet tall and form dense, often nearly impenetrable stands. The plants of this association are typically deep-rooted. There is usually little or no understory, except in openings; however, considerable leaf litter accumulates. This habitat occurs on dry, rocky often steep north-facing slopes with little soil. It may grade into Riversidean coastal sage scrub at lower elevations, but generally grown on moister and rockier sites. Characteristic shrub species include chamise, toyon and lemonadeberry.*

Chamise chaparral is dominated by chamise, almost to the exclusion of all other plants. This habitat occurs on shallower, drier soils or at somewhat low er elevations than mixed chaparral. Chamise has adapted to the characteristic fire cycles of this habitat by stump sprouting. In mature stands, the shrubs are densely interwoven and there is very little herbaceous understory or leaf litter.

Scrub oak chaparral is a dense evergreen association that grown to twenty feet tall and is dominated by scrub oak. This habitat occurs on wetter sites than other chaparral associations, often at slightly higher elevations. These more favorable sites recover from fire more quickly than other chaparral subtypes and substantial leaf litter accumulates. Additional shrub species found in scrub oak chaparral include eastwood manzanita, toyon and mountain mahogany, poison oak and narrow leaf bedstraw.

Other chaparral associations may occur in the Valley region but are more predominant at higher elevations. Such associations include buck brush chaparral, bigpod ceanothus chaparral and interior live oak chaparral.

Chaparral habitats are suitable for burrows and soil nests of many mammal species. Another important feature of this habitat are rock outcrops, which are important for reptiles and as raptor perch sites. No sensitive species of San Bernardino county are directly dependent upon chaparral habitat. However, sensitive faunal species from adjacent coastal sage scrub habitat may utilize chaparral as a corridor or for foraging. These species may include Stephens' kangaroo rat, Los Angeles pocket mouse, and San Diego horned lizard.

According to the California Native Plant Society (CNPS) database,

Coastal sage scrub
Coastal sage scrub in the valley region is classified as Riversidean sage scrub, the most xeric expression of coastal sage scrub south of Point Concepcion (Holland 1986). This habitat grows on steep slopes with everely drained soil and dominant species are relatively shallow-rooted shrubs, seldom over four feet tall.

Riversidean Alluvial Sage Scrub is a variation of Riversidean sage scrub which also exists in the valley region. This vegetation type is the dominant habitat of the Upper Santa Ana River floodplain and also occurs in the Cajon and Lytle washes (CNDDB, 2020)...

Coastal sage scrub habitat in Southern California is decreasing rapidly as a result of urbanization. Evidence of its decline is the growing number of declining plants often associated with it. In the valley region of San Bernardino county, three state and/or federally listed endangered species are known to occur in association with the coastal sage scrub: slender-horned spineflower (Centrostegia lepoceras), Santa Ana River woolly star (Eriastrum densifolium spp. sanctorum), and Nevin's barberry (Berberis nevinii). Additionally, Pringles monardella is federally listed as a Category I species, while Payson's jewelflower and California bedstraw are category 2 species.

San Bernardino kangaroo rat, a federally listed endangered species; and Stephens' kangaroo rat, a state-listed threatened species and federally listed endangered species are also known to have its habitat associate with this community type in the Valley area. Los Angeles pocket mouse is federally listed as a category 2 species and a species of special concern by the state. The Los Angeles pocket mouse has been found in San Bernardino county near the Cajon Wash, north of Etiwanda and San Bernardino and in Reche Canyon...The Valley region of San Bernardino county represents the northern limit of the range of the whiptail and coastal California gnatcatcher, a federally listed threatened species. Currently the U.S. Fish and Wildlife Service has proposed critical habitat for this species.

Deciduous woodlands

California walnut woodland is a rather specialized woodland habitat restricted to the Chino Hills and tiwanda area within the Valley region. This woodland, which occurs among rocky outcrops integrating with scrub habitat or on more mesic sites integrating with canyon live oak woodland, is dominated by California walnut; associated species include canyon live oak, Engelman oak, sugar bush, and squaw bush. California walnut woodland is considered a sensitive habitat due to its small acreage and limited distribution in the county; no sensitive floral species are solely dependent on this woodland habitat for their life cycle, however. No federal or state sensitivity listing exists for the live oak walnut or for any other species associated with California walnut woodland. Animals associates with California walnut woodland are similar to the species that would utilize oak woodland. These include Anna's hummingbird, acorn woodpecker, Nuttall's woodpecker, deer mouse, California ground squirrel, striped skunk, and coyote. No sensitive animals as listed by the USFWS or CDFG are dependent on California walnut woodland within the valley region in San Bernardino County.

Grasslands

The disturbed grasslands of the valley region of San Bernardino county are a heterogeneous complex that may be associated with shrubs or trees on land that has been disturbed or altered by development or fire. Non-native weedy vegetation is common in this habitat and includes slender wild oats, foxtail fescue, ripgutgrass, short-podmustard, red-stem filaree, and pin-clover. On sensitive plant species may occur in the grassland areas of the northern Valley area of San Bernardino County, Orcutt's brodiaea. This species, which is seriously threatened by development, may be found in valley/foothill grasslands, cismontane woodlands and vernal pool habitats. Birds or prey utilize grassland areas for foraging. Locally breeding raptor species include black-shouldered kite, red-tailed hawk, red-shouldered hawk, great horned owl, and barn owl, Other faunal associates include house mouse, southern grasshopper mouse, and gopher snake. No sensitive animal species are expected to utilize the grassland areas of the valley region of San Bernardino County.

Wetlands

Wetland communities are areas of land which are either permanently or seasonally wet and support vegetation that is specifically adapted for saturated soil conditions. These areas include riparian areas and marshes, where moisture is at or near the surface, and often include intermittent drainages. In southern California, wetland habitats are declining and are considered sensitive. Wetlands are further subject to state and federal regulations that include the federal Clean water Act (Section 404) and the CDFG Streambed Alteration Agreement (Section 1600 of the Fish and Game Code). A number of stream channels flow through the valley region of San Bernardino County including Cucamonga Creek, Cajon and Lytle creek washes, and Santa Ana River. Where water is present near the surface in stream channels, a riparian woodland community can be maintained. In stream channels with intermittent surface or groundwater availability, a riparian scrub community may also develop. Both of these communities exist in the valley region. Dominant woodland tree species include Fremont cottonwood, arroyo willow and black willow with western sycamore on the upper terraces. Common shrubs include mulefat, California mugwort, poison oak and the coyote bush. A well-developed stand of riparian woodland occurs in the Prado Basin of San Bernardino County and extends into Riverside county. Remnant riparian woodlands also occur in less frequently flooded areas such as the Santa Ana Wash area.

A freshwater marsh is located north of Etiwanda in the Day Canyon wash area. Freshwater marsh also occurs in the Prado Basin and may occur in the other drainages of the valley region, wherever moisture is at or near the surface for a long duration during the growing season. This habitat is usually dominated by perennial emergent species 4 to 7 feet tall. Stands of bulrushes or cattails often characterize this habitat. Also, large stands of the non-native pest plant giant reed grass (Arundo) occur along much of *the basin's riparian areas. This giant reed grass not only takes over native riparian communities, but it also uses a tremendous amount of water.*

These Riparian resources serve as important habitat, as water sources, and as movement corridors for wildlife. This habitat type also supports numerous sensitive animal species including least Bell's vireo, a state and federally listed endangered species; southwestern willow flycatcher, a state and federally listed endangered species; bald eagle, a state and federally endangered species; western yellow-billed cuckoo, a state listed threatened species; long eared own, a species of special concern and the California black rail, a state listed threatened species. The cuckoo and vireo occur in the dense riparian habitat of the Prado Basin in Riverside county but apparently have been extirpated from the valley region of San Bernardino County. The black rail, dependent on marshes, was recorded long ago at Chino but is not known to occur currently in San Bernardino County. (San Bernardino County Plan Biological Background Report, 1987)

3.1.2 Physical Conditions

The local climate is characterized by hot summers, mild winters and rainfall, which occurs almost entirely in the winter and early spring months. The average annual rainfall is about 19 inches. The climate is somewhat affected by the moderating effects of the Pacific Ocean. Average temperatures range from a minimum of 39 degrees Fahrenheit in January to an average of 91 degrees Fahrenheit in July. Winds occur from all directions, and onshore winds from the west/southwest occur during the day. At night, wind patterns reverse with an offshore flow generally coming from the east/northeast.

The five Management Zones are bordered by various waterways, such as the Santa Ana River along the southeast alignment of Management Zone 5, Chino Creek coursing northwest to southeast along the western border of Management Zone 1 and confluencing with the Santa Ana River in Prado Basin in the southern portions of MZ's 1-5, and St. Antonio Creek, which passes through MZ's 1 and 2.

Mt. Baldy to the north of the project area channels alluvial and perennial flows through several smaller waterways, which fill reservoirs (Puddingstone Reservoir in the northeast of MZ 1, Live Oak Reservoir north of MZ 1) and continue their flows into several of the creeks running north to south along the project alignment.

3.1.3 Topography and Soils

The majority of the program area is characterized by flat topography through the basin, bordered by hilly to mountainous terrain. The elevation ranges from approximately 500 feet above mean sea level (amsl) at the extreme southern portion of the Basin to 1,200 feet amsl along the foothills leading to the adjacent mountains. General soil maps (NRCS, Web Soil Survey, January 2020) identify numerous soil associations (distinctive patterns of soils in defined proportions) in the program area. An overview of topography and soil is presented in the following section. Once specific program elements are designed or proposed a more specific soil map would be prepared for those specific activities.

The following list summarizes the general soil types identified in the program area, which consists of disturbed urban land, alluvial, sedimentary sources, and distinct soil series along the more rocky terrain. Most of the soils in the inventory area formed from alluvial, sedimentary, and meta-sedimentary sources and have been formed in concert with the complex geologic history of the area. Many areas to the south of the program area have been urbanized and/or altered to produce crops.

Table 3.1
SOIL TYPES IN THE PROGRAM AREA

Management Zone	Map Unit Name	Map Unit Name
1	Urban land-Monserate-Exeter-Arlington (moderately well to well drained, slow to rapid runoff, slow to moderate permeability, 0 to 9% slope)	Ramona-Hanford-Greenfield-Gorgonio (well- to excessively drained, low to medium runoff, moderately slow to rapid permeability, 0-30% slope)
	Soper-Fontana-Calleguas-Balcom-Anaheim (well-drained, low to high runoff, slow to moderate permeability, 5 to 75% slope)	
2	Urban land-Monserate-Exeter-Arlington (moderately well to well drained, slow to rapid runoff, slow to moderate permeability, 0 to 9% slope)	Ramona-Hanford-Greenfield-Gorgonio (well- to excessively drained, low to medium runoff, moderately slow to rapid permeability, 0-30% slope)
	Urban land-Tujunga-Soboba-Hanford (well to somewhat excessively drained, negligible to low runoff, moderate to rapid permeability, 0-15% slope)	
3	Urban land-Monserate-Exeter-Arlington (moderately well to well drained, slow to rapid runoff, slow to moderate permeability, 0 to 9% slope)	Sesame-Rock outcrop-Cieneba (well to excessively drained, low to very rapid runoff, moderate to slow permeability, 0-85% slope)
	Urban land-Tujunga-Soboba-Hanford (well to somewhat excessively drained, negligible to low runoff, moderate to rapid permeability, 0-15% slope)	
4	Sesame-Rock outcrop-Cieneba (well to excessively drained, low to very rapid runoff, moderate to slow permeability, 0-85% slope)	Urban land-Tujunga-Soboba-Hanford (well to somewhat excessively drained, negligible to low runoff, moderate to rapid permeability, 0-15% slope)
5	Urban land-Monserate-Exeter-Arlington (moderately well to well drained, slow to rapid runoff, slow to moderate permeability, 0 to 9% slope)	Urban land-Tujunga-Soboba-Hanford (well to somewhat excessively drained, negligible to low runoff, moderate to rapid permeability, 0-15% slope)

3.1.4 Biological and Physical Conditions of the Study Areas

This section describes the existing biological and physical conditions of the Study Areas. The descriptions are general in nature, and specific resources are addressed in more detail in Chapter 4, Discussion of Impacts and Mitigation.

Areas with natural vegetation and wetlands are most prevalent in the lower 20 percent of the management zones, in particular Chino Creek to the southwest of and within MZ 1 and the Santa Ana River to the southeast and within MZ 1 and MZ 5. Native plants are uncommon in the program area and are generally limited to the wetland and streambed areas in the program area. Most of the land area in the five Management Zones is developed. The lack of native vegetation throughout the majority of the program area is a result of a history of industrial, commercial, agricultural and residential housing development within the program area and associated maintenance and continued construction within the program area.

3.1.5 Regional Habitat and Land Use in the Assessment Areas

This section describes the general biological conditions in and around the assessment areas, with particular emphasis on the wildlife habitats. Most of the discussion focuses specifically on the habitats adjacent to and within the program area, which is synonymous with the area slated for future program activities. The rationale for this approach is habitat conditions are particularly relevant to wildlife presence and use.

The assessment areas are located in the Southwestern California subregion (SW) of the California Floristic Province (i.e., a geographic area, made of six regions, defined by the continuity of its vegetational, topographic, geologic, and climatic features) of this subregion (Hickman 1993). Like other Mediterranean-type ecosystems, the California Floristic Province is distinguished more by the endemism of its plants than its animals. Of nearly 3,500 species of vascular plants in the hotspot, more than 2,120 (61 percent) are found nowhere else in the world. Around 52 plant genera are also endemic. The high levels of plant species endemism are due to its varied topography, climate zones, geology and soils.

Overall, the Study Areas are highly disturbed and fragmented because of historic man-made changes to the landscape, including urban, agricultural, industrial, railroad, and highways/road development. In a few areas native vegetation and quality wildlife habitat remain relatively undisturbed. The majority of land in the Study Areas is an active urban area with mixed residential, commercial, and industrial use. Urban areas are the second greatest land use, including large cities such as Chino Hills, Chino, Montclair, Ontario, Upland, Rancho Cucamonga, Fontana, Rialto, Eastvale, Norco, and Jurupa Valley. In these areas native vegetation is absent or highly disturbed, and the more typical vegetation consists of a variety of planted landscape trees and other nonnative or ornamental vegetation.

3.1.6 General Wildlife Resources in the Project Area

The riparian forest in the Prado Basin is noted for its very high bird species diversity and abundance. Neotropical migrants depend on the deciduous trees and shrubs for foraging during migration. The mature trees provide numerous cavities for cavity-dependent wildlife and the tall trees are used by nesting raptors. The emergent vegetation rooted at the water's edge provides escape cover, shade and food for fish.

The wildlife resources in Prado Basin are important due, in part, to their high diversity and the large numbers of certain wetland species that occur there. The extensive and continuous riparian woodland, unique for southern California, supports several rare and declining species, particularly birds. A robust raptor population occurs within the project area. The raptors have a wealth of resources to draw on for foraging and nesting. They use the tall eucalyptus for nesting, roosting and perching. There are records of eleven raptor species breeding successfully in Prado Basin, including the white-tailed kite (*Elanus leucurus*), Cooper's hawk, golden eagle (Aquila chrysaetos), western screech-owl (*Otus asio*), and long-eared owl (*Asio otus*). A moderate number of raptor species from other regions winter in Prado Basin along with the resident raptors. Two of the rarer wintering raptor species include the peregrine falcon (*Falco peregrinus*) and merlin (*Falco columbarius*).

The double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*), and blackcrowned night-heron (*Nycticorax nycticorax*) are conspicuous breeders among the larger water birds. The tree swallow (*Tachycinera bicolor*) is abundant locally, especially in the vicinity of dead trees with cavities where it nests. The red-winged blackbird (*Agelaius phoeniceus*) and marsh wren (*Cistothorus palustris*) are locally abundant nesters, as is piedbilled grebe (*Podilymbus podiceps*), ruddy duck (*Oxyura jamaicensis*), and American coot (*Fulica americana*). The mallard (*Anas platyrhynchos*) and cinnamon teal (*Anas cyanoptera*) are more widely scattered. Shorebirds known to nest in the Basin include: the killdeer (*Charadrius voci/erus*), American avocet (*Recurvirostra* *americana*), black-necked stilt (*Himantopus mexicanus*), and spotted sandpiper (*Actitis macularia*). Marsh-nesting birds include: the American bittern (Botaurus lentiginosus), Virginia rail (*Rallus limicola*), common moorhen (*Gallinula chloropus*), common yellowthroat, song sparrow, and tricolored blackbird (*Agelaius tricolor*).

Species that nest in the eucalyptus groves include: the Anna's hummingbird (*Calypte anna*), northern flicker (*Colaples auratus*), Cassin's kingbird (*Tyrannus vociferans*), American crow, European starling, Bullock's oriole (*Icterus bullockii*), and house finch. Nests of the red-tailedhawk (*Buteo jamaicensis*) and red-shouldered hawk are regularly found in the eucalyptus trees as well, probably because they are often the tallest trees available. Oriole and kingbird nests are locally concentrated in eucalyptus trees. The commonly encountered winter visitors in the riparian forests are the ruby-crowned kinglet (*Regulus calendula*), white-crownedsparrow (*Zonotrichia leucophrys*), American pipit (*Anthus rubescens*) and savannah sparrow (*Passerculus sandwichensis*).

Winter concentrations of waterfowl in the Prado Basin are at least as large as those on any of the southern California coastal lagoons, and the Basin may hold the largest wintering populations of some species. The wintering waterfowl resources in the Basin are vast and are exploited by several waterfowl hunt club operators. Sixteen species of waterfowl have been found in the Basin, many numbering in the thousands. The most abundant are green-winged teal (*Anas clecca*), mallard, cinnamon teal, Northern shoveler (*Anas clypeata*), American wigeon (*Anas americana*), ring-necked duck (*Aythya collaris*), and ruddy duck. Twenty-three species of mammals including three non-native species have been observed in the Prado Basin. Six species of mammals found in the Basin are listed in the California Hunting Regulations with seasons and limits set by the State Fish and Game Commission.

The mule deer is a big game animal, the Audubon cottontail and black-tailed jackrabbit (*Lepus califomicus*) are resident small game animals, the gray fox (*Urocyon cinereoargenteus*) and raccoon are fur-bearing mammals, and the bobcat is a regulated non-game mammal.

There are seven amphibians species known to occur in the Prado Basin and surrounding areas (Glaser 1970, Robertson and Shipman 1974, and Zembal et al. 1985). The bullfrog (*Rana catesbeiana*), and African clawed frog (*Xenopus laevis*) are two invasive, non-native species commonly observed in the basin. There are 13 reptile species documented in the basin. The western fence lizard is the most frequently encountered reptile within the Basin. The side-blotched lizard is concentrated in upland areas. The western whiptail (*Cnemidophorus tigris*) is also found primarily in upland scrubland habitats around the perimeter of the Basin. The western skink (*Eumeces skiltonianus*) inhabits remnant scrublands. The gopher snake (*Piruophis melanoleucus*) is the snake most frequently observed in the Basin and is found in both uplands and in drier riparian habitats.

At least 15 species of fish have been found in the Prado Basin within the Santa Ana River. Most of these occur in the affected area, at least seasonally. Two, the SASU and arroyo chub, are native to southern California; the rest are non-native introductions. According to Cam Swift, the most abundant species in the Basin are the flathead minnow and mosquitofish. These two, along with the carp (*Cyprinus carpio*), comprise about 95 percent of all fish species in the Basin (Swift unpubl. data).

Common wildlife in the project area include coyote (*Canis latrans*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), rattlesnake (Crotalus sp), western fence lizard (*Sceloporus occidentalis*), desert wood rat (*Neotoma lepida*), and deer mouse (*Peromyscus maniculatus*).

3.2 Regional Special Status Species and Habitats of Concern

Special status species are plants or animals that are legally protected under the federal ESA, the California ESA, or other regulations, as well as species considered sufficiently rare by the scientific community to qualify for such listing. Special-status species include the following:

- Species listed or proposed for listing as threatened or endangered under the federal ESA (50 CFR 17.12 [listed plants]); 50 CFR 17.11 (listed animals); and various notices in the *Federal Register* (proposed species).
- Species that are candidates for possible future listing as threatened or endangered under the federal ESA (76 Fed. Reg. 66370, October 26, 2011).
- Species listed or proposed for listing by the State of California as threatened or endangered under the California ESA (14 California Code of Regulations [C.C.R.] 670.5).
- Species that meet the definitions of "rare" or "endangered" under the California Environmental Quality Act (CEQA Guidelines Sections 15380 and 15125).
- Plants presumed by the California Native Plant Society (CNPS) to be “extinct in California” (Lists 1A, CNPS 2020).
- Plants considered by the CNPS to be “rare, threatened, or endangered in California” (Lists 1B and 2, CNPS 2020).
- Plants listed by CNPS as plants about which more information is needed to determine their status (List 3, CNPS 2020), and which may be included as special-status species on the basis of local significance or recent biological information.
- Plants listed by CNPS as plants of limited distribution or infrequent throughout a broader area in California (List 4, CNPS 2020); these plants are not “rare” from a statewide perspective but are uncommon enough that they are recommended for inclusion in environmental documents.
- Plant species listed as rare under the California Native Plant Protection Act (California Fish and Game Code 1900, et seq.).
- Animal species of special concern to the CDFW (CDFW 2019).
- Bird species of conservation concern as identified by USFWS in *Birds of Conservation Concern 2008* (USFWS 2008).
- Animals that are fully protected in California (California Fish and Game Code Sections 3511 [birds], 4,700 [mammals], 5050 [amphibians and reptiles], and 5515 [fish]) (CDFW 2011).

The following table identifies the habitat types and land uses identified within the Study Areas of the proposed project.

Table 3.2
PROJECT AREA WILDLIFE HABITAT TYPES, LAND USES, AND TYPICAL VEGETATION

Wildlife Habitat Type/ Land Use Type	Typical Vegetation
Tree-Dominated Habitats	
Montane Hardwood (MHW)	Jeffrey pine, ponderosa pine, sugar pine, incense-cedar, California white fir, bigcone Douglas-fir, California black oak, and Coulter pine. At lower elevations, associates are white alder, coast live oak, bigleaf maple, Californialaurel, bigcone Douglas-fir, and occasionally valley oak, foothill pine, and blue oak (Cheatham and Haller 1975, McDonald and Littrell 1976).
Desert Riparian (DR)	Tamarisk, velvet ash, mesquite, screwbean mesquite, Fremont cottonwood, and willows such as Gooding, Hinds, and arroyo

Wildlife Habitat Type/ Land Use Type	Typical Vegetation
	(Bradley and Deacon 1967, Cheatham and Haller 1975, Küchler 1977, Paysen et al. 1980, Parker and Matyas 1981). The subcanopy includes smaller individuals of the canopy species as well as quailbush, Mojave seablight, desert lavender, seep willow, and arrowweed (Bradley and Deacon 1967, Küchler 1977. Paysen et al. 1980, Parker and Matyas 1981).
Valley Foothill Riparian (VRI)	Cottonwood, California sycamore and valley oak. Subcanopy trees are white alder, boxelder and Oregon ash. Typical understory shrub layer plants include wild grape, wild rose, California blackberry, blue elderberry, poison oak, buttonbrush, and willows. The herbaceous layer consists of sedges, rushes, grasses, miner's lettuce, Douglas sagewort, poison-hemlock, and hoary nettle. (CDFW, 2020)
Shrub/Herbaceous-Dominated Habitats	
Riversidean Alluvial Fan Sage Scrub	Predominantly of drought-deciduous soft-leaved shrubs, but with significant cover of larger perennial species typically found in chaparral (Kirkpatrick and Hutchinson, 1977). Scalebroom (*Lepidospartum squamatum*) generally is regarded as an indicator of Riversidean alluvial scrub (Smith, 1980; Hanes, et al., 1989). In addition to scalebroom, alluvial scrub typically is composed of white sage (*Salvia apiana*), redberry (*Rhamnus crocea*), California buckwheat, Spanish bayonet, California croton (*Croton californicus*), cholla (*Opuntia spp.*), tarragon (*Artemisia dracunculus*), yerba santa (*Eriodictyon spp.*), mule fat, and mountain-mahogany (Hanes, et al., 1989; Smith, 1980). Annual species composition has not been studied but is probably similar to that found in understories of neighboring shrubland vegetation. Two sensitive annual species are endemic to alluvial scrub vegetation in the proposed Plan Area: slender-horned spineflower (*Dodecahema leptocerus*) and Santa Ana River woollystar (*Eriastrum densifolium ssp. sanctorum*). (Western Riverside County MSHCP, Chapter 3)
Mixed Chaparral (MCh)	Scrub oak, chaparral oak, and several species of ceanothus and manzanita. Individual sites may support pure stands of these shrubs or diverse mixtures of several species. Commonly associated shrubs include chamise, birchleaf mountain mahogany, silk-tassel, toyon, yerba-santa, California buckeye, poison-oak, sumac, California buckthorn, hollyleaf cherry, Montana chaparral-pea, and California fremontia. Some of these species may be locally dominant. Leather oak and interior silktassel are widely distributed on cismontane serpentine soils, and chamise and toyon may be abundant on these soils. Shrubs such as Jepson, coyote, and dwarf ceanothus and serpentine manzanita are local serpentine endemics (Cheatham and Haller 1975, Thorne 1976, Hanes 1977).

Wildlife Habitat Type/ Land Use Type	Typical Vegetation
Aquatic Habitats	
Coastal and Valley Freshwater Marsh	Located in Day Canyon wash area and Prado Basin; cattail and bulrush dominated wetlands. Also present is non-native invasive giant reed grass (Arundo), which also occur along the riparian habitat outside of marshland.
Riverine and riparian	Santa Ana River, Cucamonga Creek, Cajon Creek, Lytle Creek that are tributary to the Chino and Prado Basins; this riparian habitat is dominated by Fremont cottonwood, arroyo willow, black willow and western sycamore. Common shrubs include mulefat, California mugwort, poison oak and coyote bush.
Disturbed Habitats	
RS, RM, SD-RES	Residential
IC, IR	Community industrial and regional industrial
SD-COM, COM	Special development and commercial
FW	Floodway resource management zone
RL	Rural living
OS	Open Space
KC/SP	Kaiser Commerce Center Specific Plan
Non-vegetated Habitats	
Barren (BAR)	Unvegetated, rock, gravel, soil
Utilities ROW for water distribution	Cement-lined and herbaceous vegetation channels, pipes, culverts, pump stations, reservoirs.
HCP/Preserve Lands	
Western Riverside County Multiple-Species Habitat Conservation Plan (MSHCP) June 22, 2004	The MSHCP encompasses 1.26 million acres of land in unincorporated Riverside County west of the San Jacinto Mountains and creates conservation land for 153,000 acres of land. Focal species covered include least Bells vireo, southwestern willow flycatcher, wester yellow-billed cuckoo, Quino checkerspot butterfly, and fairy shrimp. Riparian, riverine, sage scrub and other upland vegetative communities are protected.
Designated Critical Habitat within Proximity to Proposed Project	
Spreading navarretia	19 miles southeast of the Study Area
Arroyo toad	6 miles northeast of Study Area and 9 miles south of the Study Area
Yellow-billed cuckoo	Directly overlapping with all MZ's in the south of the Study Area
Southern mountain yellow-legged frog	3 miles north of the Study Area
Thread-leaved brodiaea	7 miles northwest and 19 miles southeast of the Study Area
San Bernardino Merriam's kangaroo rat	Directly overlapping with MZ-2 in the north and within 1 mile northeast to 20 miles southeast of the Study Area
Least Bell's vireo	Directly overlapping all MZ's in the southern portion of the Study Area
Coastal California gnatcatcher	Directly overlapping the eastern portion of MZ-3 and within 1 mile of all MZ's within the Study Area
Southwestern willow flycatcher	Directly overlapping pockets in the southern portions of MZ-1, 2, 3, and 5 and within 1 mile of all MZ's in the Study Area

Wildlife Habitat Type/ Land Use Type	Typical Vegetation
Santa Ana sucker	Directly overlapping the full southern extent of MZ-5 and within 2 miles of remaining MZ's
Braunton's milk-vetch	3 miles southwest of the 5 MZ's

Wildlife Habitat Type/ Land Use Type	Typical Vegetation
Conservation Banks	
Cajon Creek Habitat Conservation Management Area Contact: Sheri Ortega Property Manager Vulcan Materials Company, Western Division 500 N. Brand Blvd. Suite 500 Glendale, CA 91203 (Division Office) 16013 Foothill Blvd., Irwindale, CA 91702 (626) 633-4236 (Office) (323) 637-2569 (Mobile) ortegas@vmcmail.com	24 T&E species and their associated habitats are covered, including: Riversidian alluvial fan sage scrub; San Bernardino kangaroo rat; Santa Ana woolly star; Slender-horned spineflower. Credits: Riversidian aleuvial fan sage scrub
Soquel Canyon Mitigation Bank Contact: Mitigation Bank Manager (877) 445-8699 bankmanager@landveritas.com	Ephemeral; Intermittent and Permanent stream/riparian; Coastal sage scrub; Chaparral; Native grassland; Walnut woodland; Oak woodland; Mulefat scrub
Chiquita Canyon Conservation Bank **Contact:** Foothill / Eastern Transportation Corridor Agency 201 E. Sandpointe, Ste 200 P.O. Box 28870 Santa Ana, CA 92799-8870 Attn: William Woollett, Jr. Chief Executive Officer	Coastal sage scrub; Riversidian sage scrub; California gnatcatcher
Black Mountain Conservation Bank Contact: WildDesert EM Holdings, LLC 3301 Industrial Avenue Rocklin, CA 95765 (916) 435-3555 Fax: (916) 435-3556	Desert tortoise; Mohave ground squirrel; American badger; Desert kit fox; Loggerhead shrike; LeConte's thrasher; stream

3.2.1 Special Status Plant and Animal Species Potentially Occurring Along or Within the Project Assessment Areas

3.2.1.1 Special Status Plant Species with Potential for Occurrence in the Project Area

Santa Ana River woollystar

Santa Ana River woollystar is a low shrubby perennial which can grow to one meter (3.3 feet) tall, with gray-green stems and leaves. This species blooms from June to August and produces bright blue flowers that are up to 1.4 inches long that occur in flower heads with about 20 blossoms each. There are three primary pollinators: long-tongued digger bee, giant flower-loving fly and hummingbirds. This species is associated with early- to moderate-successional alluvial scrub, and thus requires periodic flooding and silting for the creation of new habitats and colonization. The Santa Ana River woollystar is found only within open washes and early-successional alluvial fan scrub on open slopes above main watercourses on fluvial deposits where flooding and scouring occur at a frequency that allows the persistence of open shrublands. Suitable habitat is comprised of a patchy distribution of gravelly soils, sandy soils, rock mounds and boulder fields (Zembal and Kramer 1984; Zembal and Kramer 1985; U.S. Fish and Wildlife Service 1986). The Santa Ana River woolly-star occurs along the Santa Ana River and Lytle and Cajon Creek flood plains from the base of the San Bernardino Mountains in San Bernardino County southwest along the Santa Ana River through Riverside County into the Santa Ana Canyon of northeastern Orange County from about 150 to 580 meters (Munz 1974; Patterson 1993; Roberts 1998; Zembal and Kramer 1985; Patterson and Tanowitz 1989).

White rabbit-tobacco (Pseudognaphalium leucocephalum)

White rabbit-tobacco is a biennial or short-lived perennial, 30–60 cm; taprooted. Stems are densely and persistently white-tomentose, usually with stipitate-glandular hairs protruding through tomentum. Leaf blades (crowded, internodes mostly 1–3, sometimes to 10 mm) are linear-lanceolate, 3–7 cm × 1–5(–6) mm, bases subclasping, not decurrent, margins strongly revolute, faces bicolor, abaxial densely white-tomentose, adaxial green, densely stipitate-glandular. Heads grow in corymbiform arrays and involucres broadly campanulate, 5–6 mm. Phyllaries are in 5–7 series, are bright white (opaque, dull) and oblong to oblong-ovate, glabrous. Pistillate are in florets of 66–85 and bisexual florets are (6–14, California) are 29–44. Cypselae are ridged and smooth, 2n = 28. Flowering season is Jul–Aug and Nov–Dec. White rabbit-tobacco are grow on/near sandy or gravelly slopes, stream bottoms, arroyos, areas of oak-sycamore, oak-pine, to pine woodlands, commonly in riparian vegetation; 50–2100 m; Ariz., Calif., N.Mex.; Mexico (Baja California, Baja California Sur, Chihuahua, Durango, Sinaloa, Sonora).

3.2.1.2 Special-Status Wildlife Species with Potential for Occurrence in the Project Area

Southwestern pond turtle

These turtles are 3.5 - 8.5 inches in shell length (Stebbins 2003). It is a small to medium-sized drab dark brown, olive-brown, or blackish turtle with a low unkeeled carapace and usually with a pattern of lines or spots radiating from the centers of the scutes. The plastron lacks hinges, and has 6 pairs of shelds which can be cream or yellowish in color with large dark brown markings, or unmarked. The legs have black speckling and may show cream to yellowish coloring. The head usually has a black network or spots may show cream to yellowish coloring. Males usually have a light throat with no markings, a low-domed carapace, and a concave plastron. Females usually have a throat with dark markings, a high-domed carapace, and a flat or convex plastron which tends to be more heavily patterned than the male's. They are diurnal and thoroughly aquatic. This turtle is often seen basking above the water, but will quickly slide into the water when it feels threatened. Southwestern pond turtle is active from around February to November, hibernates underwater, often in the muddy bottom of a pool, and estivates during summer droughts by burying itself in soft bottom mud.

They eat aquatic plants, invertebrates, worms, frog and salamander eggs and larvae, crayfish, carrion, and occasionally frogs and fish. Pond turtles mate in April and May. They are found from the San Francisco Bay south, along the coast ranges into northern Baja California. Isolated populations occur along the Mojave River at Camp Cody and Afton Canyon from sea level to over 5,900 ft in elevation. This turtle is found in ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches, with abundant vegetation, and either rocky or muddy bottoms, in woodland, forest, and grassland. In streams, it prefers pools to shallower areas. Logs, rocks, cattail mats, and exposed banks are required for basking.

Tricolored blackbird

The CDFG maintains a biodiversity database for tricolors. This database includes records for breeding and non-breeding tricolors during the breeding season and a winter distribution database. The recent breeding records were compiled by U.C. Davis and are included in annual reports to USFWS and CDFG. Since 1980, breeding has occurred in 46 California counties (Beedy and Hamilton 1999). With the exception of a few peripheral sites, the geographic distribution has not declined perceptively. Unlike most species when tricolors settle at high densities, as in flooded willows, territories may be vertically stacked. Arrival date on breeding grounds is mid-March through mid-July. Tricolored Blackbirds are at as high a risk as any of the narrowly endemic North American bird species and are at far greater risk than Swainson's Hawks, Burrowing Owls and other relatively widely distributed California species. But because they are a flocking species, and are in some places abundant, they do not command management attention.

Burrowing Owl

Burrowing owl is a small ground-dwelling Owl with a round head and no ear tufts. They have white eyebrows, yellow eyes, and long legs. The Owl is sandy colored on the head, back, and upperparts of the wings and white-to-cream with barring on the breast and belly and a prominent white chin stripe. They have a rounded head, and yellow eyes with white eyebrows. The young are brown on the head, back, and wings with a white belly and chest. They molt into an adult-like plumage during their first summer. Burrowing Owls are comparatively easy to see because they are often active in daylight and are surprisingly bold and approachable.

The burrowing owl occurs in shortgrass prairies, grasslands, lowland scrub, agricultural lands particularly rangelands), prairies, coastal dunes, desert floors, and some artificial, open areas as a year-long resident (Haug, et al. 1993). They require large open expanses of sparsely vegetated areas on gently rolling or level terrain with an abundance of active small mammal burrows. As a critical habitat feature need, they require the use of rodent or other burrows for roosting and nesting cover. They may also dig their own burrow in soft, friable soil (as found in Florida) and may also use pipes, culverts, and nest boxes where burrows are scarce (Robertson 1929). The mammal burrows are modified and enlarged. One burrow is typically selected for use as the nest, however, satellite burrows are usually found within the immediate vicinity of the nest burrow within the defended territory of the owl.

Yellow-billed cuckoo

The yellow-billed cuckoo is dependent on the combination of a dense willow understory for nesting, a cottonwood overstory for foraging and large patches of habitat in excess of 20 ha. (Laymon and Halterman 1991). It is also not known to utilize non-native vegetation in the majority of its range (Hunter et al. 1984). It is a medium sized bird. Its profile is long and slim. Its legs are short and bluish-gray. Its long tail is gray-brown above and black below with three striking pairs of large white dots visible in flight. Its body is brown above with white under parts. The undersides of its pointed wings are rufous. Adult birds have a long curved bill which is blue-black above and yellow at the base of the mandibles. Juveniles have a completely blue-black bill. While they have been known to take beetles, cicadas, bugs, wasps, flies, katydids, dragonflies, damselflies, praying mantids, lacewings, mosquito hawks, cankerworms, fall webworms (Platyprepia virginalis), and even tree frogs (Beal 1898, Green 1978, Laymon 1980, Ryser 1985, Dillinger 1989), more than three fourths of the yellow-billed cuckoo diet is made up of grasshoppers and caterpillars (Beal 1898). The yellow-billed cuckoo is an "incipient brood parasite," its eggs have been found in the nests of black-billed cuckoos, American robins, black-throated sparrows, mourning doves, house finches and red-winged blackbirds (Ryser 1985).

Black-billed cuckoos have also been known to occasionally parasitize yellow-billed cuckoos. Though they will occupy a variety of marginal habitats, particularly at the edges of their range, yellow-billed cuckoos in the West are overwhelmingly associated with relatively expansive stands of mature cottonwood willow forests. Canopy height ranged from 5-25 m, canopy cover from 20-90%, and nderstory cover from 30-90%. Willows and open water are required and the habitat will vary from dense willow-cottonwood forests to marshy bottomlands with scattered willow thickets. The cuckoo was once common in riparian habitat throughout the western United States. In California the yellow-billed cuckoo has declined from a "fairly common breeding species" throughout most of the state to a current population of less than 50 pairs (Gaines and Laymon 1984; Laymon and Halterman 1991). In 1971 it was listed by the California Department of Fish and Game as Rare. By 1977 it had become "one of the rarest birds" in the state. A 1977 survey of historical sites and suitable habitat at six widely scattered rivers turned up 54 birds in the Sacramento Valley (Tehama, Putte, Glenn, Colusa, and Sutter counties), 9 on the South Fork of the Kern River near Weldon, 3 along the Santa Ana River, Riverside County, 4 in Owens Valley, Inyo County, 6 on the Armargosa River south of Tecopa, Inyo and San Bernardino County, and 65 on both sides of the Colorado River from the Nevada state line to the Mexican border (Gaines 1977).

Arroyo Chub

The Arroyo chub is a cyprinid fish found only in the coastal streams of southern California, United States. The shape of the arroyo chub is somewhat chunky, with a deep body and thick caudal peduncle. The eyes are larger than average for cyprinids. Coloration ranges from silver to gray to olive green above, shading to white below, usually with a dull gray band along each side. This is a small fish, with most adults in the 7-10 cm length range, and a maximum of 12 cm. Omnivorous, their diet includes algae, insects, and crustaceans. Arroyo chub habitat is primarily the warm streams of the Los Angeles Plain, which are typically muddy torrents during the winter, and clear quiet brooks in the summer, possibly drying up in places. They are found both in slow-moving and fast-moving sections, but generally deeper than 40 cm. They are native to Los Angeles, Santa Margarita, San Gabriel, San Luis Rey, and Santa Ana Rivers, as well as to Malibu and San Juan Creeks. Many of the original populations have been extirpated, but it has recently been reestablished in the Arroyo Seco (Los Angeles County), a tributary of the Los Angeles River. The species also has been successfully introduced in a number of other rivers in the area, and can be found as far north as Chorro Creek in San Luis Obispo County, and as far east as the Mojave River. The Mojave and Cuyama River populations extend into the ranges of related fishes, and hybridize with Mojave chub and California roach, respectively.

Grasshopper sparrow

Grasshopper sparrow is a small, chunky grassland sparrow with clear buff breast and scaly-looking,dark rufous upperparts and a pale central stripe on crown; short, pointed tail. Apparently it can survive in areas where the introduced plants are combined with the native plants and the livestock grazing is not too intensive. It is found in open grassy and weedy meadows, pastures, and plains. This sparrow breeds from British Columbia, Manitoba, and New Hampshire south to Florida (rare), West Indies, and Mexico but winters north to California, Texas, and North Carolina. This elusive sparrow is named for its buzzy song. As soon as a weedy field becomes overgrown or trees have filled in an abandoned pasture, the Grasshopper Sparrow no longer uses the site for breeding. Less of a seed-eater than our other grass sparrows, it feeds largely on insects. When flushed, this sparrow flies a short distance and drops out of sight, into tall grass.

Western yellow bat

Western yellow bat can be distinguished from other bat species by the combination of yellow coloration, size (forearm = 42-50 mm), and short ears. Lasiurus xanthinus occurs in northern Mexico, western Arizona, southern California, southern Nevada, and southwestern New Mexico. Western yellow bats are associated with dry, thorny vegetation on the Mexican Plateau, and are found in desert regions of the southwestern United States, where they show a particular association with palms and other desert riparian habitats. They are known to occur in a number of palm oases, but are also believed to be expanding their range with the increased usage of ornamental palms in landscaping. Yellow bats are suspected to be non-colonial. Individuals usually roost in trees, hanging from the underside of a leaf. They are commonly found in the southwestern U.S. roosting in the skirt of dead fronds in both native and non-native palm trees, and have also been documented roosting in cottonwood trees. At least some individuals or populations may be migratory, although some individuals appear to be present year-round, even in the northernmost portion of their range. Yellow bats are insectivorous. Probably one of the primary threats in the U.S., however, is the cosmetic trimming of palm fronds. The use of pesticides in date-palm and other orchards may also constitute a threat to both roosting bats and the insects upon which they forage.

Coastal California gnatcatcher (*Polioptila californica californica*)

The Coastal California gnatcatcher is a small blue-gray songbird. It has dark blue-gray feathers on its back and grayish-white feathers on its underside. The wings have a brownish wash to them. Its long tail is mostly black with white outer tail feathers. They have a thin, small bill. The males have a black cap during the summer which is absent during the winter. The gnatcatcher typically occurs in or near sage scrub habitat, which includes the following plant communities as classified by Holland (1986): Venturan coastal sage scrub, Diegan coastal sage scrub, maritime succulent scrub, Riversidean sage scrub, Riversidean alluvial fan sage scrub, southern coastal bluff scrub, and coastal sage-chaparral scrub. Ninety-nine percent of all gnatcatcher locality records occur at or below an elevation of 984 feet (Atwood 1990). Gnatcatchers also use chaparral, grassland, and riparian habitats where they occur adjacent to sage scrub (Bontrager 1991). These non-sage scrub habitats are used for dispersal (Bowler 1995; Campbell et al. 1995). Gnatcatchers are persistent nest builders and often attempt multiple broods, which is suggestive of a high reproductive potential. Historically, gnatcatchers occurred from southern Ventura County southward through Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties, and into Baja California, Mexico (Atwood 1990). The amount of coastal sage scrub available to gnatcatchers has continued to decrease during the period after the listing of the species. It is estimated that up to 90 percent of coastal sage scrub vegetation has been lost as a result of development and land conversion (Barbour and Major 1977).

Yellow-breasted chat

The yellow-breasted chat Grinnell and Miller (1944) reported that chats bred over the entire length and breadth of the state exclusive of higher mountains and coastal islands, and were more numerous toward the interior. Breeders arrive from April to early May. Departure from breeding grounds occurs from August – September (after complete prebasic molt); some may leave in July, some stragglers into October. Spring migration: March - May. Fall migration: July - October. Poorly documented due to the species' secretive nature; it goes largely undetected once singing ceases in mid-July (Dunn and Garrett 1997). Delacour (1959) reported the capture of an adult chat in Los Angeles on 5 December 1958. Dunn and Garrett (1997) report that western birds appear to move south during fall migration on a broad front, although migrants are generally scarcer near the coast. In California, chats require dense riparian thickets of willows, vine tangles, and dense brush associated with streams, swampy ground and the borders of small ponds (Small 1994). Chat nests frequently host Brown-headed Cowbird (Molothrus ater) and rarely hosts the Bronzed Cowbird (Molothrus aeneus). Flood control and river channelization eliminates early successional riparian habitat (willow/alder shrub habitats with a dense understory) that chats (and many other riparian focal species) use for breeding. Hunter et al. (1988) found that chats will use the exotic saltcedar (Tamarix chinensis), and they suggest that chats may use the saltcedar preferentially to native habitat. The authors do not report the frequency of nest placement in saltcedar, but Brown and Trosset (1989) report that chats nest in tamarisk and native shrubs in proportion to the occurrence of the different types of vegetation.

Least Bell's vireo

The least Bell's vireo (LBVI) is a small, olive-gray migratory songbird that nests and forages almost exclusively in riparian woodland habitats. Bell's vireos as a group are highly territorial and are almost exclusively insectivorous.

Least Bell's vireo nesting habitat typically consists of well developed overstory, understory, and low densities of aquatic and herbaceous cover. The understory frequently contains dense sub-shrub or shrub thickets. These thickets are often dominated by plants such as narrow-leaf willow, mulefat, young individuals of other willow species such as arroyo willow or black willow, and one or more herbaceous species. LBVI generally begin to arrive from their wintering range in southern Baja California and establish breeding territories by mid-March to late-March. A large majority of breeding vireos apparently depart their breeding grounds by the third week of September and only a very few have been found wintering in the United States.

LBVI typically inhabit riparian forests with well-developed overstories and understories. The understory often contains dense subscrub or thickets above the ground. These thickets are usually dominated by sandbar willow, mulefat, blackberry (Rubus ursinus), and young trees of other willow species such as black willow and arroyo willow. The overstory usually contains black willow, cottonwood and Sycamore. Although LBVI use a variety of riparian plant species for nesting, it appears that the structure of the vegetation is more important than other factors such as species composition or the age of the stand. Vireos forage in riparian and adjacent chaparral habitats up to 984 feet from the nest, and use both high and low scrub layers as foraging substrate.

Table 3.3
FLORA AND FAUNA WITH POTENTIAL TO OCCUR IN THE PROGRAM AREA
(*Source: CNDDB, January 2020*, Occurrence Potential Assessed)

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Amphibians	1	arroyo toad /Anaxyrus californicus	Endangered / SSC	Semi-arid regions near washes or intermittent streams, including valley-foothill and desert riparian, desert wash, etc. Rivers with sandy banks, willows, cottonwoods, and sycamores; loose, gravelly areas of streams in drier parts of range.	Medium potential to occur in the Study Area, dependent on shallow pools persisting due to higher flow conditions. Last known occurrence in the Study Area was in 1999 southeast of Frankish Peak in a catch basin along Cucamonga Creek.
Amphibians	1	Coast Range newt /Taricha torosa	None / SSC	Coastal drainages from Mendocino County to San Diego County. Lives in terrestrial habitats & will migrate over 1 km to breed in ponds, reservoirs & slow moving streams.	Low potential to occur in the STUDY AREA, dependent on ponds, reservoirs, and slow moving streams. Last known occurrence in the Study Area was in the 1990's in Cobal Canyon (Claremont Hills Wilderness Park).
Amphibians	1	foothill yellow-legged frog /Rana boylii	None / Candidate Threatened	Partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Needs at least some cobble-sized substrate for egg-laying. Needs at least 15 weeks to attain metamorphosis.	Likely extirpated. Low occurrence potential due to disturbance level on future project sites.
Amphibians	1, 2, 3	San Gabriel slender salamander /Batrachoseps gabrieli	None / None	Known only from the San Gabriel Mtns. Found under rocks, wood, and fern fronds, and on soil at the base of talus slopes. Most active on the surface in winter and early spring.	Several individuals have been observed between 1998 and 2016, but outside the OBMPU area near Lytle Creek. Low occurrence potential.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Amphibians	1, 2, 3	southern mountain yellow-legged frog /Rana muscosa	Endangered / Endangered	Federal listing refers to populations in the San Gabriel, San Jacinto and San Bernardino mountains (southern DPS). Northern DPS was determined to warrant listing as endangered, Apr 2014, effective Jun 30, 2014. Always encountered within a few feet of water. Tadpoles may require 2 - 4 yrs to complete their aquatic development.	Several individuals last observed in 1994, but outside the OBMPU area near Lytle Creek. Low occurrence potential; likely extirpated.
Amphibians	1, 2, 3, 4, 5	western spadefoot /Spea hammondii	None / None	Occurs primarily in grassland habitats, but can be found in valley-foothill hardwood woodlands. Vernal pools are essential for breeding and egg-laying.	Low potential to occur due to suitable habitat of vernal pools. Most recent observations in were in 2011 and 2014, outside of the Program area in isolated pools in the Chino Hills area.
Birds	2, 3, 4, 5	Bell's sage sparrow /Artemisiospiza belli belli	None / None	Nests in chaparral dominated by fairly dense stands of chamise. Found in coastal sage scrub in south of range. Nest located on the ground beneath a shrub or in a shrub 6-18 inches above ground. Territories about 50 yds apart.	Medium to high potential to occur in the Study Area where dense chamise exists.
Birds	1	black swift /Cypseloides niger	None / SSC	Coastal belt of Santa Cruz and Monterey counties; central & southern Sierra Nevada; San Bernardino & San Jacinto mountains. Breeds in small colonies on cliffs behind or adjacent to waterfalls in deep canyons and sea-bluffs above the surf; forages widely.	Potential to occur on the Study Area is low to medium, with higher potential to occur along the montane area north of MZ 1. Potential for foraging individuals throughout the western boundaries of the STUDY AREA.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Birds	1, 2, 3, 4, 5	burrowing owl /Athene cunicularia	None / None	Open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	Potential to occur is high in all MZ's. Burrowing owl has been shown to adapt to urban areas and overwinter in drain pipes, abandoned tires and other cover sites.
Birds	1, 2, 3, 4, 5	California black rail /Laterallus jamaicensis coturniculus	None / Threatened	Inhabits freshwater marshes, wet meadows and shallow margins of saltwater marshes bordering larger bays. Needs water depths of about 1 inch that do not fluctuate during the year and dense vegetation for nesting habitat.	Occurrence potential is low for this species although suitable habitat exists in more vegetated weltand areas. The most recent observation was in 1931. Adequate dense vegetation in wetland areas is suitable habitat in the southern portion of the Study Area
Birds	1, 2, 5	coastal cactus wren /Campylorhynchus brunneicapillus sandiegensis	None / SSC	Southern California coastal sage scrub. Wrens require tall opuntia cactus for nesting and roosting.	Low potential for occurrence. This species requires tall cactus for nesting found more inland or on coastal bluffs.
Birds	1, 2, 3, 4, 5	coastal California gnatcatcher /Polioptila californica californica	Threatened / SSC	Obligate, permanent resident of coastal sage scrub below 2500 ft in Southern California. Low, coastal sage scrub in arid washes, on mesas and slopes. Not all areas classified as coastal sage scrub are occupied.	Occurrence potential is medium to high. Several individuals have been observed as recently as 2017 in the Study Area. Potential for occurrence is concentrated in pockets of sage scrub habitat.
Birds	1, 2, 3, 4, 5	Cooper's hawk /Accipiter cooperii	None / None	Woodland, chiefly of open, interrupted or marginal type. Nest sites mainly in riparian growths of deciduous trees, as in canyon bottoms on river flood-plains; also, live oaks.	Occurrence potential for this species is medium to high, as the bird has adapted to semi-urban environments for foraging. Individuals have been observed recently in Chino Hills and Jurupa Valley.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Birds	1, 2, 5	golden eagle /Aquila chrysaetos	None / None	Rolling foothills, mountain areas, sage-juniper flats, and desert. Cliff-walled canyons provide nesting habitat in most parts of range; also, large trees in open areas.	Medium to high potential to occur in foothills to the north and west of the Study Area, but also in isolated rocky outcrops throughout the Study Area.
Birds	1, 2, 5	grasshopper sparrow /Ammodramus savannarum	None / SSC	Dense grasslands on rolling hills, lowland plains, in valleys and on hillsides on lower mountain slopes. Favors native grasslands with a mix of grasses, forbs and scattered shrubs. Loosely colonial when nesting.	Suitable habitat exists in pockets throughout the STUDY AREA, although occurrence potential is low to medium. Last recorded individual was in the Chino Hills in 2001.
Birds	4, 5	Lawrence's goldfinch /Spinus lawrencei	None / None	Nests in open oak or other arid woodland and chaparral, near water. Nearby herbaceous habitats used for feeding. Closely associated with oaks.	Occurrence potential is medium, although only one observation has been recorded near the Santa Ana River in 2015.
Birds	1, 2, 3, 4, 5	least Bell's vireo /Vireo bellii pusillus	Endangered / Endangered	Summer resident of Southern California in low riparian in vicinity of water or in dry river bottoms; below 2000 ft. Nests placed along margins of bushes or on twigs projecting into pathways, usually willow, Baccharis, mesquite. Critical habitat overlaps with the southern portion of the STUDY AREA.	Occurrence potential for this species is high in riparian areas on the edges of the Study Area. Critical habitat overlaps with the Program Area in the south and individuals have been observed from 2003 through 2014 along the Santa Ana River.
Birds	1, 2, 5	long-eared owl /Asio otus	None / SSC	Riparian bottomlands grown to tall willows and cottonwoods; also, belts of live oak paralleling stream courses. Require adjacent open land, productive of mice and the presence of old nests of crows, hawks, or magpies for breeding.	Occurrence potential is low to medium. Suitable habitat exists, but the last recorded observation was in 1925.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Birds	1	merlin /Falco columbarius	None / None	Seacoast, tidal estuaries, open woodlands, savannahs, edges of grasslands & deserts, farms & ranches. Clumps of trees or windbreaks are required for roosting in open country.	Occurrence potential is medium along the Chino Hills and other fringe wildlife and urban habitat transition zones.
Birds	1, 2, 3, 4, 5	southern California rufous-crowned sparrow /Aimophila ruficeps canescens	None / None	Resident in Southern California coastal sage scrub and sparse mixed chaparral. Frequents relatively steep, often rocky hillsides with grass and forb patches.	Occurrence potential is high for this species due to suitable sage scrub and mixed chaparral throughout the Program area.
Birds	1, 2, 3, 4, 5	southwestern willow flycatcher /Empidonax traillii extimus	Endangered / Endangered	Riparian woodlands in Southern California. Critical habitat extends along the southern portion of the STUDY AREA.	Occurrence potential for this species is medium to high in areas with willow or cottonwood riparian areas on the edges of the Study Area. Critical habitat overlaps with the southern portions of the Program area and few occurrences have been recorded in the southern Program area along the Santa Ana River as recently as 2005.
Birds	1, 2, 3, 4, 5	Swainson's hawk /Buteo swainsoni	None / Threatened	Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, & agricultural or ranch lands with groves or lines of trees. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	Occurrence potential is low to medium for this species, which adapts well to a variety of habitat, both in-tact and disturbed. However, no recently recorded observations have been made of this species in the Program area (Chino area in 1920).

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Birds	1, 2, 3, 4, 5	tricolored blackbird /Agelaius tricolor	None / Threatened	Highly colonial species, most numerous in Central Valley & vicinity. Largely endemic to California. Requires open water, protected nesting substrate, and foraging area with insect prey within a few km of the colony.	Occurrence potential for this species is medium to high, particularly along the Santa Ana River corridor along the southern portion of the Program area. Individuals have been recorded in the area most recently between 2009 - 2015.
Birds	1, 2, 3, 4, 5	western yellow-billed cuckoo /Coccyzus americanus occidentalis	Threatened / Endangered	Riparian forest nester, along the broad, lower flood-bottoms of larger river systems. Nests in riparian jungles of willow, often mixed with cottonwoods, with lower story of blackberry, nettles, or wild grape. Critical habitat extends along the southern portion of the STUDY AREA.	Occurrence potential for this species is low due to presumed low population numbers and the only one recent observation in the Study Area in 2001 along the Santa Ana River. This species could inhabit areas with willow or cottonwood riparian areas on the edges of the STUDY AREA. Critical habitat overlaps with the southern portions of the Program area.
Birds	1, 2, 5	white-tailed kite /Elanus leucurus	None / None	Rolling foothills and valley margins with scattered oaks & river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	Occurrence potential for this species is medium to high, particularly along the southwestern boundary of the Program area where more valley marginal habitat and deciduous forest is present. Individuals have been recorded in the area most recently in 2009.
Birds	1, 2, 3, 4, 5	yellow rail /Coturnicops noveboracensis	None / SSC	Summer resident in eastern Sierra Nevada in Mono County. Freshwater marshlands.	Occurrence potential is low due to lack of recent recorded observations (last observed in the area in 1914). The most likely area of potential occurrence is limited to the marshland in the southern portion of the Program area.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Birds	1, 2, 3, 4, 5	yellow warbler /Setophaga petechia	None / SSC	Riparian plant associations in close proximity to water. Also nests in montane shrubbery in open conifer forests in Cascades and Sierra Nevada. Frequently found nesting and foraging in willow shrubs and thickets, and in other riparian plants including cottonwoods, sycamores, ash, and alders.	Occurrence potential for this species is medium to high, particularly along the Santa Ana River corridor / Prado Basin, along the southern portion of the Program area. Individuals have been recorded in this area most recently between 2016.
Birds	1, 2, 3, 4, 5	yellow-breasted chat /Icteria virens	None / SSC	Summer resident; inhabits riparian thickets of willow and other brushy tangles near watercourses. Nests in low, dense riparian, consisting of willow, blackberry, wild grape; forages and nests within 10 ft of ground.	Occurrence potential for this species is medium to high, particularly along the Santa Ana River corridor / Prado Basin, along the southern portion of the Program area. Individuals have been recorded in this area most recently between 2015.
Fish	1, 2, 3, 4, 5	arroyo chub /Gila orcuttii	None / None	Native to streams from Malibu Creek to San Luis Rey River basin. Introduced into streams in Santa Clara, Ventura, Santa Ynez, Mojave & San Diego river basins. Slow water stream sections with mud or sand bottoms. Feeds heavily on aquatic vegetation and associated invertebrates.	Occurrence potential is medium. Suitable habitat exists in the Santa Ana River and Chino Creek. The most recent occurrence is found outside of the Study Area in Covina, CA, 2013. All other occurrences were in the late 1990's and early 2000's.
Fish	2, 3, 4, 5	Santa Ana speckled dace /Rhinichthys osculus ssp. 3	None / None	Headwaters of the Santa Ana and San Gabriel rivers. May be extirpated from the Los Angeles River system. Requires permanent flowing streams with summer water temps of 17-20 C. Usually inhabits shallow cobble and gravel riffles.	Suitable habitat exists in the Santa Ana River. The only recent occurrence is found inside of the Study Area along the Santa Ana River in the Hidden Valley Wildlife Area.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Fish	1, 2, 3, 4, 5	Santa Ana sucker /Catostomus santaanae	Threatened / None	Endemic to Los Angeles Basin south coastal streams. Habitat generalists, but prefer sand-rubble-boulder bottoms, cool, clear water, and algae.	Occurrence potential is medium to high. Occurrences observed from 2002 through 2011 in the Santa Ana River and Chino Creek.
Fish	1, 2, 3, 4, 5	steelhead - southern California DPS /Oncorhynchus mykiss irideus pop. 10	Endangered / None	Federal listing refers to populations from Santa Maria River south to southern extent of range (San Mateo Creek in San Diego County). Southern steelhead likely have greater physiological tolerances to warmer water and more variable conditions.	Occurrence potential is low in the Program area and no known occurrences have been recently recorded in the Santa Ana River.
Insects	1, 2, 3, 4, 5	Crotch bumble bee /Bombus crotchii	None / Candidate Endangered	Coastal California east to the Sierra-Cascade crest and south into Mexico. Food plant genera include Antirrhinum, Phacelia, Clarkia, Dendromecon, Eschscholzia, and Eriogonum.	No recent observation data in the project area. Low occurrence potential.
Insects	1, 2, 3, 4	Delhi Sands flower-loving fly /Rhaphiomidas terminatus abdominalis	Endangered / None	Found only in areas of the Delhi Sands formation in southwestern San Bernardino & northwestern Riverside counties. Requires fine, sandy soils, often with wholly or partly consolidated dunes & sparse vegetation. Oviposition req. shade.	Occurrence potential low in disturbed areas. The last known observance of this species was in 2010. Presumed extant is in the northeast portions of MZ's 2, 3, and 4.
Insects	2, 3, 4	greenest tiger beetle /Cicindela tranquebarica viridissima	None / None	Inhabits the woodlands adjacent to the Santa Ana River basin. Usually found in open spots between trees.	Low occurrence potential. This species was last observed in the area in 1987 in the eastern portion of MZ 4 along the Santa Ana River corridor.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Insects	4, 5	quino checkerspot butterfly /Euphydryas editha quino	Endangered / None	Sunny openings within chaparral & coastal sage shrublands in parts of Riverside & San Diego counties. Hills and mesas near the coast. Need high densities of food plants Plantago erecta, P. insularis, and Orthocarpus purpurescens.	Low potential for occurrence. Occurs primarily outside the immediate project vicinity.
Mammals	1	American badger /Taxidea taxus	None / SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Needs sufficient food, friable soils and open, uncultivated ground. Preys on burrowing rodents. Digs burrows.	Low potential to occur in majority of the project area. Higher potential to occur where undeveloped land just outside project boundaries exists.
Mammals	1, 2	big free-tailed bat /Nyctinomops macrotis	None / SSC	Low-lying arid areas in Southern California. Need high cliffs or rocky outcrops for roosting sites. Feeds principally on large moths.	Potential to occur on the Study Area is low to medium, with higher potential to occur along the montane area west of MZ 1 and 2.
Mammals	1, 2	desert bighorn sheep /Ovis canadensis nelsoni	None / None	Widely distributed from the White Mtns in Mono Co. to the Chocolate Mts in Imperial Co. Open, rocky, steep areas with available water and herbaceous forage.	Low potential for occurrence. This species will remain outside of urban areas, possibly descending hills to access water for drinking, although this will be temporary and the sheep will avoid human activity.
Mammals	1	hoary bat /Lasiurus cinereus	None / None	Prefers open habitats or habitat mosaics, with access to trees for cover and open areas or habitat edges for feeding. Roosts in dense foliage of medium to large trees. Feeds primarily on moths. Requires water.	There is low potential for occurrence, although some may be found along habitat edges where water and large trees exist along the northern fringe of MZ 1.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Mammals	1, 2, 3, 4	Los Angeles pocket mouse /Perognathus longimembris brevinasus	None / SSC	Lower elevation grasslands and coastal sage communities in and around the Los Angeles Basin. Open ground with fine, sandy soils. May not dig extensive burrows, hiding under weeds and dead leaves instead.	Low to medium occurrence potential. The most recent observations have been in 2017 along Cajon Wash. No recently observed occurrence within the 4 Management Zones.
Mammals	1, 2, 3, 4	northwestern San Diego pocket mouse /Chaetodipus fallax fallax	None / SSC	Coastal scrub, chaparral, grasslands, sagebrush, etc. in western San Diego County. Sandy, herbaceous areas, usually in association with rocks or coarse gravel.	Low occurrence potential due to lack of specific habitat requirements.
Mammals	1, 2	pallid bat /Antrozous pallidus	None / None	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites.	Low occurrence potential. Suitable habitat exist in some rocky areas and scrub habitat, although no observations have been made since the 1950's in the project area.
Mammals	2, 3	pallid San Diego pocket mouse /Chaetodipus fallax pallidus	None / SSC	Desert border areas in eastern San Diego County in desert wash, desert scrub, desert succulent scrub, pinyon-juniper, etc. Sandy, herbaceous areas, usually in association with rocks or coarse gravel.	Low occurrence potential due to lack of specific habitat requirements.
Mammals	1, 2, 3, 4, 5	pocketed free-tailed bat /Nyctinomops femorosaccus	None / SSC	Variety of arid areas in Southern California; pine-juniper woodlands, desert scrub, palm oasis, desert wash, desert riparian, etc. Rocky areas with high cliffs.	Low potential for occurrence in the project area. Some of this species was observed in habitat outside the project area along the Santa Ana River corridor in the mid-1980's.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Mammals	1, 2, 3, 4, 5	San Bernardino kangaroo rat /Dipodomys merriami parvus	Endangered / Candidate Endangered	Alluvial scrub vegetation on sandy loam substrates characteristic of alluvial fans and flood plains. Needs early to intermediate seral stages.	There is a low potential for occurrence of this species. It is possibly extirpated and has not been observed recently in the project area.
Mammals	2, 3, 4, 5	San Diego black-tailed jackrabbit /Lepus californicus bennettii	None / SSC	Intermediate canopy stages of shrub habitats & open shrub / herbaceous & tree / herbaceous edges. Coastal sage scrub habitats in Southern California.	There is low potential for occurrence, although observations as recently as the late 1990's have been made of this species in Jurupa Valley up to Fontana.
Mammals	1, 2, 3, 4	San Diego desert woodrat /Neotoma lepida intermedia	None / SSC	Coastal scrub of Southern California from San Diego County to San Luis Obispo County. Moderate to dense canopies preferred. They are particularly abundant in rock outcrops, rocky cliffs, and slopes.	Medium potential to occur, based on recent observations, 2010.
Mammals	1, 2, 3, 4, 5	Stephens' kangaroo rat /Dipodomys stephensi	Endangered / Threatened	Primarily annual & perennial grasslands, but also occurs in coastal scrub & sagebrush with sparse canopy cover. Prefers buckwheat, chamise, brome grass and filaree. Will burrow into firm soil.	Low occurrence potential due. Possibly extirpated.
Mammals	1, 2, 3, 4, 5	western mastiff bat /Eumops perotis californicus	None / None	Many open, semi-arid to arid habitats, including conifer & deciduous woodlands, coastal scrub, grasslands, chaparral, etc. Roosts in crevices in cliff faces, high buildings, trees and tunnels.	Medium potential to occur in the project area in all MZ's with suitable habitat (crevices of buildings). Their ability to roost in manmade structures, makes this essential for detection before initiating a new project.
Mammals	1, 2, 3, 4, 5	western yellow bat /Lasiurus xanthinus	None / SSC	Found in valley foothill riparian, desert riparian, desert wash, and palm oasis habitats. Roosts in trees, particularly	Medium potential to occur in the project area in all MZ's with suitable habitat (desertic vegetation such as palm trees).

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
				palms. Forages over water and among trees.	
Plants	1, 2, 3, 4	aparejo grass /Muhlenbergia utilis	None / None	Meadows and seeps, marshes and swamps, chaparral, coastal scrub, cismontane woodland. Sometimes alkaline, sometimes serpentinite. 25-2325 m.	Low to medium potential to occur in the southern portion of the project site where more chaparral and marshland exist.. CRPR Plant Rank 2B.2
Plants	1, 2, 3, 4, 5	Brand's star phacelia /Phacelia stellaris	None / None	Coastal scrub, coastal dunes. Open areas. 3-370 m. (CNPS 2019)	Potential to occur in the Study Area is low to medium and only in open pockets of scrub shrub habitat.. CRPR Plant Rank 1B.1
Plants	1, 2, 5	Braunton's milk-vetch /Astragalus brauntonii	Endangered / None	Chaparral, coastal scrub, valley and foothill grassland. Recent burns or disturbed areas; usually on sandstone with carbonate layers. Soil specialist; requires shallow soils to defeat pocket gophers and open areas, preferably on hilltops, saddles or bowls between hills. 3-640 m. (CNPS 2011)	Potential to occur in the Study Area is low due to specific shallow soil type necessary for successful growth and avoidance of burrowing mammals. Observed occurrence was recorded southwest of the Program area in southern cottonwood willow riparian forest in 2010. CRPR Plant Rank 1B.1
Plants	1, 2, 3, 4	California saw-grass /Cladium californicum	None / None	Meadows and seeps, marshes and swamps (alkaline or freshwater). Freshwater or alkaline moist habitats. -20-2135 m. (CNPS 2017)	Occurrence potential medium in the southern portions of the Study Area. CRPR Plant Rank 2B.2
Plants	1, 2, 3, 4, 5	Chaparral sand-verbena	None / None	Chaparral, coastal scrub, desert dunes. Sandy areas. -60-1570 m. (CNPS 2011)	Low potential to occur. CRPR Plant Rank 1B.1

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
		/Abronia villosa var. aurita			
Plants	4, 5	Coulter's goldfields /Lasthenia glabrata ssp. coulteri	None / None	Coastal salt marshes, playas, vernal pools. Usually found on alkaline soils in playas, sinks, and grasslands. 1-1375 m. (CNPS 2014)	Low potential to occur. CRPR Plant Rank 1B.1
Plants	1, 2, 5	Coulter's saltbush /Atriplex coulteri	None / None	Coastal bluff scrub, coastal dunes, coastal scrub, valley and foothill grassland. Ocean bluffs, ridgetops, as well as alkaline low places. Alkaline or clay soils. 2-460 m. (CNPS 2010)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	1	Greata's aster /Symphyotrichum greatae	None / None	Chaparral, cismontane woodland, broadleafed upland forest, lower montane coniferous forest, riparian woodland. Mesic canyons. 335-2015 m. (CNPS 2010)	Low potential to occur. CRPR Plant Rank 1B.3
Plants	2	grey-leaved violet /Viola pinetorum ssp. grisea	None / None	Subalpine coniferous forest, upper montane coniferous forest, meadows and seeps. Dry mountain peaks and slopes. 1580-3700 m. (CNPS 2017)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	1	Hall's monardella /Monardella macrantha ssp. hallii	None / None	Broadleafed upland forest, chaparral, lower montane coniferous forest, cismontane woodland, valley and foothill grassland. Dry slopes and ridges in openings. 700-1800 m. (CNPS 2010)	Low potential to occur. CRPR Plant Rank 1B.3

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Plants	1, 2, 5	intermediate mariposa-lily /Calochortus weedii var. intermedius	None / None	Coastal scrub, chaparral, valley and foothill grassland. Dry, rocky calcareous slopes and rock outcrops. 60-1575 m. (CNPS 2010)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	2	Johnston's buckwheat /Eriogonum microthecum var. johnstonii	None / None	Subalpine coniferous forest, upper montane coniferous forest. Slopes and ridges on granite or limestone. 1795-2865 m (CNPS 2019)	Low potential to occur. CRPR Plant Rank 1B.3
Plants	1, 2, 5	Jokerst's monardella /Monardella australis ssp. jokerstii	None / None	Lower montane coniferous forest, chapparal. Steep scree or talus slopes between breccia. Secondary alluvial benches along drainages and washes. 210-1740 m. (CNPS 2014)	Low potential to occur. CRPR Plant Rank 1B.1
Plants	1, 2, 3	lemon lily /Lilium parryi	None / None	Lower montane coniferous forest, meadows and seeps, riparian forest, upper montane coniferous forest. Wet, mountainous terrain; generally in forested areas; on shady edges of streams, in open boggy meadows & seeps. 625-2930 m. (CNPS 2010)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	1, 2, 5	lucky morning-glory /Calystegia felix	None / None	Meadows and seeps, riparian scrub. Sometimes alkaline, alluvial. 9-205 m. (CNPS 2017)	Low potential to occur. CRPR Plant Rank 1B.1

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Plants	1, 2, 3, 4, 5	many-stemmed dudleya /Dudleya multicaulis	None / None	Chaparral, coastal scrub, valley and foothill grassland. In heavy, often clayey soils or grassy slopes. 1-910 m. (CNPS 2010)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	2, 3, 4	marsh sandwort /Arenaria paludicola	Endangered / Endangered	Marshes and swamps. Growing up through dense mats of Typha, Juncus, Scirpus, etc. in freshwater marsh. Sandy soil. 3-170 m.	Occurrence potential is low. This species seems to be all but extirpated and no recently recorded individuals have been detected in the Program area. CRPR Plant Rank 1B.1
Plants	1, 2, 3, 4	mesa horkelia /Horkelia cuneata var. puberula	None / None	Chaparral, cismontane woodland, coastal scrub. Sandy or gravelly sites. 15-1645 m. (CNPS 2012)	Low potential to occur. CRPR Plant Rank 1B.1
Plants	1, 2	Nevin's barberry /Berberis nevinii	Endangered / Endangered	Chaparral, cismontane woodland, coastal scrub, riparian scrub. On steep, N-facing slopes or in low grade sandy washes. 90-1590 m. This species is also a California Native Plant Society S.1 critically imperiled species. (CNPS 2015)	Occurrence potential for this species is low due to historical disturbance in the Study Area. As recently as 2005, some of this species has been detected in the Study Area although this appears to be isolated to the north outside of the Program area. CRPR Plant Rank 1B.1
Plants	2, 3, 4	Parish's bush-mallow /Malacothamnus parishii	None / None	Chaparral, coastal sage scrub. In a wash. 305-455 m.	Low potential to occur. CRPR Plant Rank 1A
Plants	2, 3, 4	Parish's desert-thorn /Lycium parishii	None / None	Coastal scrub, Sonoran desert scrub. -3-570 m.	Low potential to occur. CRPR Plant Rank 2B.3

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Plants	1, 2, 3, 4	Parry's spineflower /Chorizanthe parryi var. parryi	None / None	Coastal scrub, chaparral, cismontane woodland, valley and foothill grassland. Dry slopes and flats; sometimes at interface of 2 vegetation types, such as chaparral and oak woodland. Dry, sandy soils. 90-1220 m. (CNPS 2010)	Low potential to occur. CRPR Plant Rank 1B.1
Plants	2	Peirson's spring beauty /Claytonia peirsonii ssp. peirsonii	None / None	Upper montane coniferous forest, subalpine coniferous forest. Granitic scree slopes, often with a sandy or fine soil component and granitic cobbles. 1510-2745 m.	Low potential to occur. CRPR Plant Rank 1B.2
Plants	2, 3, 4	prairie wedge grass /Sphenopholis obtusata	None / None	Cismontane woodland, meadows and seeps. Open moist sites, along rivers and springs, alkaline desert seeps. 15-2625 m. (CNPS 2013)	Low potential to occur. CRPR Plant Rank 2B.2
Plants	2, 3, 4	Pringle's monardella /Monardella pringlei	None / None	Coastal scrub. Sandy hills. 300-400 m. (CNPS 2019)	Low potential to occur. CRPR Plant Rank 1A
Plants	1, 2, 3, 4	prostrate vernal pool navarretia /Navarretia prostrata	None / None	Coastal scrub, valley and foothill grassland, vernal pools, meadows and seeps. Alkaline soils in grassland, or in vernal pools. Mesic, alkaline sites. 3-1235 m. (CNPS 2015)	Low potential to occur. CRPR Plant Rank 1B.2

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Plants	1, 2	rigid fringepod /Thysanocarpus rigidus	None / None	Pinyon and juniper woodland. Dry, rocky slopes and ridges of oak and pine woodland in arid mountain ranges. 425-2165 m. (CNPS 2019)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	1	Rock Creek broomrape /Orobanche valida ssp. valida	None / None	Chaparral, pinyon and juniper woodland. On slopes of loose decomposed granite; parasitic on various chaparral shrubs. 975-1985 m. (CNPS 2011)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	2, 3, 4	salt marsh bird's-beak /Chloropyron maritimum ssp. maritimum	Endangered / Endangered	Marshes and swamps, coastal dunes. Limited to the higher zones of salt marsh habitat. 0-10 m.	This is a possibly extirpated species with no recently recorded individual plants in the Study Area. Occurrence potential low. CRPR Plant Rank 1B.2
Plants	1, 2, 5	salt spring checkerbloom /Sidalcea neomexicana	None / None	Playas, chaparral, coastal scrub, lower montane coniferous forest, Mojavean desert scrub. Alkali springs and marshes. 3-2380 m. (CNPS 2013)	Low potential to occur. CRPR Plant Rank 2B.2
Plants	1, 2, 3, 4, 5	San Bernardino aster /Symphyotrichum defoliatum	None / None	Meadows and seeps, cismontane woodland, coastal scrub, lower montane coniferous forest, marshes and swamps, valley and foothill grassland. Vernally mesic grassland or near ditches, streams and springs; disturbed areas. 3-2045 m. (CNPS 2018)	Low potential to occur. CRPR Plant Rank 1B.2

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Plants	4, 5	San Diego ambrosia /Ambrosia pumila	Endangered / None	Chaparral, coastal scrub, valley and foothill grassland. Sandy loam or clay soil; sometimes alkaline. In valleys; persists where disturbance has been superficial. Sometimes on margins or near vernal pools. 3-580 m. (CNPS 2011)	This is a presumed extirpated species with no recently recorded individual plants in the Study Area. Occurrence potential low. CRPR Plant Rank 1B.1
Plants	1, 2	San Gabriel linanthus /Linanthus concinnus	None / None	Lower montane coniferous forest, upper montane coniferous forest, chaparral. Dry rocky slopes, often in Jeffrey pine/canyon oak forest. 1310-2560 m. (CNPS 2012)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	1, 2	San Gabriel manzanita /Arctostaphylos glandulosa ssp. gabrielensis	None / None	Chaparral. Rocky outcrops; can be dominant shrub where it occurs. 960-2015 m. (CNPS 201)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	2	Sanford's arrowhead /Sagittaria sanfordii	None / None	Marshes and swamps. In standing or slow-moving freshwater ponds, marshes, and ditches. 0-605 m. (CNPS 2012)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	1, 2, 3, 4, 5	Santa Ana River woollystar /Eriastrum densifolium ssp. sanctorum	Endangered / Endangered	Coastal scrub, chaparral. In sandy soils on river floodplains or terraced fluvial deposits. 180-705 m. This species is also a California Native Plant Society S.1 critically imperiled species. (CNPS 2016)	Occurrence potential for this species is low to medium due to historical disturbance in the Study Area, although some individuals have been recorded as recently as 2014 in the eastern portion of the Study Area. CRPR Plant Rank 1B.1

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Plants	2, 3	short-joint beavertail /Opuntia basilaris var. brachyclada	None / None	Chaparral, Joshua tree woodland, Mojavean desert scrub, pinyon and juniper woodland. Sandy soil or coarse, granitic loam. 425-2015 m. (CNPS 2011)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	2, 3	singlewhorl burrobrush /Ambrosia monogyra	None / None	Chaparral, Sonoran desert scrub. Sandy soils. 5-475 m. (CNPS 2013)	Low potential to occur. CRPR Plant Rank 2B.2
Plants	1	slender mariposa-lily /Calochortus clavatus var. gracilis	None / None	Chaparral, coastal scrub, valley and foothill grassland. Shaded foothill canyons; often on grassy slopes within other habitat. 210-1815 m. (CNPS 2015)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	1, 2, 3	slender-horned spineflower /Dodecahema leptoceras	Endangered / Endangered	Chaparral, cismontane woodland, coastal scrub (alluvial fan sage scrub). Flood deposited terraces and washes; associates include Encelia, Dalea, Lepidospartum, etc. Sandy soils. 200-765 m. This species is also a California Native Plant Society S.1 critically imperiled species. Many historical examples have been lost by development and stream channelization. (CNPS 2010)	Occurrence potential for this species is low due to historical disturbance in Study Area. Individual plants have been recorded as recently as 2013 in Cajon Wash north of the Program area. CRPR Plant Rank 1B.1
Plants	1, 2, 3, 4, 5	smooth tarplant /Centromadia pungens ssp. laevis	None / None	Valley and foothill grassland, chenopod scrub, meadows and seeps, playas, riparian woodland. Alkali meadow, alkali scrub; also in disturbed places. 5-1170 m. Many historical occurences may be extirpated. Frequently confused with other Centromadia species such as C. parryi ssp.	Low potential to occur. CRPR Plant Rank 1B.1

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
				australis in ORA, LAX, and SDG cos., and C. pungens ssp. Pungens. (CNPS 2016)	
Plants	1, 2, 3, 5	Southern California black walnut /Juglans californica	None / None	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland; alluvial. (CNPS 2015)	Occurrence potential of this fragmented species is low due to its historic fragementation, possible hybridization with horticultural varieties of walnut.. CRPR Plant Rank 4.2
Plants	1	Watson's amaranth /Amaranthus watsonii	None / None	Mojavean desert scrub, Sonoran desert scrub. (CNPS 2017)	Occurence potential is low. One occurrence northwest of the STUDY AREAon foothills of Mt. Baldy. (Calflora 2020).. CRPR Plant Rank 4.3
Plants	1, 2, 3, 4, 5	white rabbit-tobacco /Pseudognaphalium leucocephalum	None / None	Riparian woodland, cismontane woodland, coastal scrub, chaparral. Sandy, gravelly sites. 35-515 m. (CNPS 2016)	Low potential to occur. CRPR Plant Rank 2B.2
Plants	2, 3	white-bracted spineflower /Chorizanthe xanti var. leucotheca	None / None	Mojavean desert scrub, pinyon and juniper woodland, coastal scrub (alluvial fans). Sandy or gravelly places. 365-1830 m. (CNPS 2010)	Low potential to occur. CRPR Plant Rank 1B.2
Plants	1, 2	woolly mountain-parsley /Oreonana vestita	None / None	Subalpine coniferous forest, upper montane coniferous forest, lower montane coniferous forest. High ridges; on scree, talus, or gravel. 800-3370 m. (CNPS 2011)	Low potential to occur. CRPR Plant Rank 1B.3

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Reptiles	1, 2, 3, 4, 5	California glossy snake /Arizona elegans occidentalis	None / SSC	Patchily distributed from the eastern portion of San Francisco Bay, southern San Joaquin Valley, and the Coast, Transverse, and Peninsular ranges, south to Baja California. Generalist reported from a range of scrub and grassland habitats, often with loose or sandy soils.	Occurrence potential is low to medium for this species in all areas of the Study Area where loose or sandy soils in scrub or grassland patches of habitat occur. The California glossy snake has adapted to a range of shrub and grassland habitats that exist to varying degree in all MZ's. The most recently recorded observations occur outside of the Program area in 2016.
Reptiles	1, 2, 3, 4, 5	coast horned lizard /Phrynosoma blainvillii	None / None	Frequents a wide variety of habitats, most common in lowlands along sandy washes with scattered low bushes. Open areas for sunning, bushes for cover, patches of loose soil for burial, and abundant supply of ants and other insects.	Occurrence potential is medium, although potential is higher outside of the immediate Program area, where more undisturbed suitable habitat occurs. Recent observations have been in Santa Ana Canyon in 2005 and Cajon Canyon Creek in 2008 and 2009.
Reptiles	1, 4, 5	coastal whiptail /Aspidoscelis tigris stejnegeri	None / SSC	Found in deserts and semi-arid areas with sparse vegetation and open areas. Also found in woodland & riparian areas. Ground may be firm soil, sandy, or rocky.	Occurrence potential is low to medium in the riparian areas of the Program area, although there have been no recorded observations past 2006 in the Study Area.
Reptiles	1, 2, 3, 4, 5	orange-throated whiptail /Aspidoscelis hyperythra	None / None	Inhabits low-elevation coastal scrub, chaparral, and valley-foothill hardwood habitats. Prefers washes and other sandy areas with patches of brush and rocks. Perennial plants necessary for its major food: termites.	Occurrence potential is low to medium in the scrub brush and chaparral areas of the Program area. Recently recorded observations in 2010 place this species most likely in the Mockingbird Canyon area in the southern portion of the Program area.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Reptiles	1, 2, 3, 4, 5	red-diamond rattlesnake /Crotalus ruber	None / SSC	Chaparral, woodland, grassland, & desert areas from coastal San Diego County to the eastern slopes of the mountains. Occurs in rocky areas and dense vegetation. Needs rodent burrows, cracks in rocks or surface cover objects.	Occurrence potential is low to medium in the central Program area, and more likely to occur in the rocky, densely vegetated areas, in particular west and outside of MZ-1 in the Puente Hills, where the species was most recently observed in 2017.
Reptiles	2, 3, 4, 5	San Diego banded gecko /Coleonyx variegatus abbotti	None / SSC	Coastal & cismontane Southern California. Found in granite or rocky outcrops in coastal scrub and chaparral habitats.	Occurrence potential is low in the central Program area, and more likely to occur in the rocky, chaparral habitat areas, in particular in the eastern portion of MZ-5 and west and outside of MZ-1 in the Puente Hills, where the species was most recently observed in 2003.
Reptiles	1, 2, 3, 4, 5	southern California legless lizard /Anniella stebbinsi	None / SSC	Generally south of the Transverse Range, extending to northwestern Baja California. Occurs in sandy or loose loamy soils under sparse vegetation. Disjunct populations in the Tehachapi and Piute Mountains in Kern County. Variety of habitats; generally in moist, loose soil. They prefer soils with a high moisture content.	Occurrence potential is medium to high. Several individuals have been observed as recently as 2018 throughout the Study Area. This species has been observed in semi-urbanized areas and can be expected to survive in these areas and adapt to development, while remaining on the fringe habitat that exists in the Program area.
Reptiles	1, 2	two-striped gartersnake /Thamnophis hammondii	None / None	Coastal California from vicinity of Salinas to northwest Baja California. From sea to about 7,000 ft elevation. Highly aquatic, found in or near permanent fresh water. Often along streams with rocky beds and riparian growth.	Low Occurrence potential in MZ's 2, 3, 4 and 5. Slightly higher potential in the northwest fringe of MZ 1, due to more suitable habitat requirements.

Taxonomic Group	Management Zone with Potential to Occur	Common Name / Scientific Name	Status Federal / State	Typical Habitat	Occurrence Potential
Reptiles	1, 2, 3, 4, 5	western pond turtle /Emys marmorata	None / SSC	A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches, usually with aquatic vegetation, below 6000 ft elevation. Needs basking sites and suitable (sandy banks or grassy open fields) upland habitat up to 0.5 km from water for egg-laying.	Occurrence potential is medium. As recently as 2011, western pond turtles have been observed in the Santa Ana River corridor within MZ 5.

Chapter 4. Discussion of Impacts and Mitigation

4.1 Discussion of Project Impacts

The construction and operation of the infrastructure required to support the OBMPU may result in direct impacts and indirect impacts on special-status wildlife species. The extent and nature of impacts on special-status wildlife species varies depending on the species under consideration, their range, and the type and quality of suitable habitats present.

In general, permanent and temporary direct impacts on special-status wildlife species during construction of the future infrastructure improvements include mortality or injury, and disturbances to suitable habitats for special-status wildlife species, including disruption of wetland and streambeds; water pollution; and reptile, bird, and mammal burrow or nest disturbance. These habitat disturbances within the program area, or at specific new or modified facilities, could lead to the permanent or temporary abandonment of these habitats by special-status species, a disruption in the life cycle of these species, or mortality or injury of these species. Because it is difficult to determine the number or extent of these kinds of impacts, direct impacts on special-status wildlife species will be addressed in subsequent environmental review once a specific component of the OBMPU has been defined for design and implementation.

Permanent and temporary indirect impacts on special-status wildlife species would occur through construction or maintenance of the program in a number of ways depending on the species and type of disturbance. Potential indirect impacts include erosion, soil compaction, increased siltation and sedimentation, fractures in the hardpan soils or rock outcroppings, alteration of jurisdictional water hydrology, dust aerosolization, host plant stress, destruction of native vegetation, habitat fragmentation, and noise and light pollution. These indirect impacts could lead to the disturbance of special-status wildlife species such as a temporary shift in foraging patterns or territories, refugia abandonment, increased predation, decreased reproductive success, and reduced population viability. Because it is difficult to quantify and measure these kinds of impacts, indirect impacts on special-status wildlife species are described qualitatively and will be quantitatively addressed in subsequent environmental documentation once specific aspects of the program is proposed for implementation and designed.

Construction of any of the program alternatives should only result in mostly minimal impacts on special-status wildlife species, because only a limited amount of marginal habitat for special-status wildlife species would be impacted by this activity. All facilities would impact only barren, urban, or agricultural areas and thus construction would potentially impact only the special-status wildlife species that use mostly urban area (e.g., special-status bird species, special-status mammal species, special-status bat species or species present in wetland or streambed habitats).

During ongoing operations or maintenance activities requiring ground disturbance, clearing, or grubbing that could cause erosion and sedimentation or that could indirectly affect the hydrology of nearby jurisdictional waters and the species that depend on these resources. Chemical runoff from trucks or equipment within the future OBMPU facility rights-of-way could indirectly degrade suitable habitat used by these species that are present adjacent to or within the management zone boundaries. If operational maintenance requires weed abatement activities, such as the use of herbicides, these activities could also contribute to chemical runoff and pollution of adjacent suitable habitats. However, maintenance activities that have potential impacts on special-status wildlife species are limited to the program right-of-way areas that are currently in service or that will be added to normal program operations and maintenance through separate design, environmental review and construction of such facilities at a later date.

Potential impacts on jurisdictional waters, special-status plant communities, protected trees, special-status plant, and wildlife species (including critical habitat) will be analyzed for each facility as site-specific design has been established. Once a particular facility APE is established, the following steps will be taken during a detailed second-tier evaluation to assure resource impacts are quantified, and site specific measures are identified. Where none of the biological resource impacts below will occur, no further biological resource impact analysis may be necessary within a second-tier analysis. Further, where potentially significant impacts may occur, but specific mitigation outlined below can reduce such impacts to a less than significant level, future documentation may rely upon the procedures outlined in Sections 15162 and 15168 of the State CEQA Guidelines to determine the required level of CEQA documentation for future infrastructure projects. OBMPU program proponents will perform these analyses at the time individual infrastructure improvements are considered for funding.

- Each resource will be evaluated for its presence or absence, and for the presence of habitat that could support the resource or provide habitat for the resource. Suitable habitat was determined based on background review and identification of species-specific life-history requirements.
- Potential impacts on special-status wildlife species will be determined using a habitat-based approach where the presence of the species was assumed in suitable habitat. Habitats in the project footprint and vicinity were determined through a combination of background review, habitat mapping during field surveys, and aerial photograph interpretation.
- Potential impacts on designated critical habitat will be based on the location of the critical habitat relative to the project footprint and the presence of primary constituent elements (PCEs) associated with the critical habitat designation.

In determining the potential direct and indirect impacts associated with construction and operation impacts on biological resources, a number of assumptions and limitations are identified:

- Construction and operation impacts will be considered temporary if they can be fully restored to pre-disturbance conditions following construction. Temporary impacts would include construction staging areas, construction laydown areas, relocation of underground utilities, and other work space that would not be occupied by permanent facilities during project operation.
- Impacts will be considered permanent when they have lasting effects beyond the project construction period, or cannot be fully restored following construction. Permanent impacts would include new right-of-way for new or expanded facility or water conveyance systems, road crossings, electrical substations, maintenance and operations facilities, and monitoring stations.
- Certain jurisdictional waters types (wetlands) are especially sensitive to disturbance; therefore, impacts on these features will be considered permanent where these features cannot be restored to their pre-project condition due to the permanent loss by new infrastructure.

4.2 Mitigation Measures

Because the individual projects implemented throughout the Program could result in potentially significant impacts on biological resources, mitigation measures were designed to avoid or reduce the impacts on these resources. The mitigation strategy includes avoidance of impacts on biological resources to the extent possible: field verification of sensitive resources and filling data gaps; the formulation of alternative designs (minimization and avoidance); limiting modifications to access and egress points to facilities (minimization); designing cuts and fills to minimize the area of disturbance; and where necessary, and compensation to offset unavoidable impacts to individual species or sensitive habitat.

The following mitigation measures are required to reduce impacts associated with future San Joaquin Corridor Rail Improvement program site-specific projects to a less than significant level. Each stakeholder implementing specific project-related specific capital improvement projects shall implement the measures outlined below, as needed, when the impact being mitigated will be caused by such project.

To reduce or prevent activities that may adversely affect sensitive species, the following mitigation measures will be incorporated into any specific projects and/or contractor specifications for future project-related impacts to protect sensitive resources and habitat.

4.2-1 ***Where future project-related impacts will affect undeveloped land, site surveys shall be conducted by a qualified biologist/ecologist. If sensitive species are identified as a result of the survey for which mitigation/compensation must be provided in accordance with regulatory requirements, the following subsequent mitigation actions will be taken:***

- ***a.*** ***The project proponent shall provide compensation for sensitive habitat acreage lost by acquiring and protecting in perpetuity (through property or mitigation bank credit acquisition) habitat for the sensitive species at a ratio of not less than 1:1 for habitat lost. The property acquisition shall include the presence of at least one animal or plant per animal or plant lost at the development site to compensate for the loss of individual sensitive species.***

- ***b.*** ***The final mitigation may differ from the above values based on negotiations between the project proponent and USFWS and CDFW for any incidental take permits for listed species. The project proponent shall retain a copy of the incidental take permit as verification that the mitigation of significant biological resource impacts at a project site with sensitive biological resources has been accomplished.***

- ***c.*** ***Preconstruction botanical surveys for special-status plant communities and special-status plant species will be conducted. in areas that were not previously surveyed because of access or timing issues or project design changes, pre-construction surveys for special-status plant communities and special-status plant species will be conducted before the start of ground-disturbing activities during the appropriate blooming period(s) for the species.***

4.2-2 ***Biological Resources Management Plan: During final design, a BRMP will be prepared to assemble the biological resources mitigation measures for each specific infrastructure improvement in the future. The BRMP will include terms and conditions from applicable permits and agreements and make provisions for monitoring assignments, scheduling, and responsibility. The BRMP will also discuss habitat replacement and revegetation, protection during ground-disturbing activities, performance (growth) standards, maintenance criteria, and monitoring requirements for temporary and permanent native plant community impacts. The parameters of the BRMP will be formed with the mitigation measures from the project-level EIR/EIS, including terms and conditions as applicable from the USFWS, USACE, SWRCB/RWQCB, and CDFW.***

To reduce or prevent activities that may adversely affect rivers, streambeds or wetlands, the following mitigation measures will be incorporated into any specific projects and/or contractor specifications for future project-related impacts to protect sensitive resources and habitat.

4.2-3 ***Prior to discharge of fill or streambed alteration of jurisdictional areas, the project proponent shall obtain regulatory permits from the U.S. Army Corps of Engineers, local Regional Water Quality Control Board and the California Department of Fish and Wildlife. Any future project that must discharge fill into a channel or otherwise alter a streambed shall be minimized to the extent feasible, and any discharge of fill not avoidable shall be mitigated through compensatory mitigation. Mitigation can be provided by restoration of temporary impacts, enhancement of existing resources, or purchasing into any authorized mitigation bank or in-lieu fee program; by selecting a site of comparable acreage near the site and enhancing it with a native riparian habitat or invasive species removal in accordance with a habitat mitigation plan approved by regulatory agencies; or by acquiring sufficient compensating habitat to meet regulatory agency requirements. Typically, regulatory agencies require mitigation for jurisdictional waters without any riparian or wetland habitat to be mitigated at a 1:1 ratio. For loss of any riparian or other wetland areas, the mitigation ratio will begin at 2:1 and the ratio will rise based on the type of habitat, habitat quality, and presence***

of sensitive or listed plants or animals in the affected area. A Habitat Mitigation and Monitoring Proposal shall be prepared and reviewed and approved by the appropriate regulatory agencies. The project proponent will also obtain permits from the regulatory agencies (U.S. Army Corps of Engineers, Regional Water Quality Control Board, CDFW and any other applicable regulatory agency with jurisdiction over the proposed facility improvement) if any impacts to jurisdictional areas will occur. These agencies can impose greater mitigation requirements in their permits, but Caltrans will utilize the ratios outlined above as the minimum required to offset or compensate for impacts to jurisdictional waters, riparian areas or other wetlands.

***4.2-4** Jurisdictional Water Preconstruction Surveys: A jurisdictional water preconstruction survey will be conducted at least six months before the start of ground-disturbing activities to identify and map all jurisdictional waters in the project footprint and if possible within a 250-foot buffer. The purpose of this survey is to confirm the extent of jurisdictional waters in areas where permission to enter was not previously granted and where aerial photograph interpretation was used to estimate the extent of these features. If possible, surveys would be performed during the spring, when plant species are in bloom and hydrological indicators are most readily identifiable. These results would then be used to calculate impact acreages and determine the amount of compensatory mitigation required to offset the loss of wetland functions and values.*

Regarding active bird nests, the following mitigation measure will be applied to this program.

***4.2-5** It is illegal to "take" active bird nests of native birds, and if such nests are present at a project site, no take is allowed. To avoid an illegal take of active bird nests, any grubbing, brushing or tree removal will be conducted outside of the State identified nesting season (nesting season is approximately from February 15 through September 1 of a given calendar year). Alternatively, coordination with the CDFW to conduct nesting bird surveys will be completed, and methodology of surveys will be agreed upon. All nesting bird surveys will be conducted by a qualified biologist prior to initiation of ground disturbance to demonstrate that no bird nests will be disturbed by project construction activities.*

The following mitigation can reduce the impact to burrowing owl to a less than significant level.

***4.2-6** Prior to commencement of construction activity in locations that are not fully developed, protocol burrowing owl survey will be conducted using the 2012 survey protocol methodology identified in the "Staff Report on Burrowing Owl Mitigation, State of California, Natural Resources Agency, Department of Fish and Game, March 7, 2012", or the most recent CDFW survey protocol available. Protocol surveys shall be conducted by a qualified biologist to determine if any burrowing owl burrows are located within the potential area of impact. If occupied burrows may be impacted, an impact minimization plan shall be developed and approved by CDFW that will protect the burrow in place or provide for passive relocation to an alternate burrow within the vicinity but outside of the project footprint in accordance with current CDFW guidelines. Active nests must be avoided with a 250-foot buffer until all nestlings have fledged.*

The following mitigation can ensure consistency with any HCP or MSHCP.

***4.2-7** Prior to commencement of construction activity on a project facility within a MSHCP/HCP plan area, consistency with that plan, or take authorization through that plan, shall be obtained. Through avoidance, compensation or a comparable mitigation alternative, each project shall be shown to be consistent with a MSHCP/HCP.*

Implementation of the above measures is protective of the environment. Should the regulatory agencies determine an alternative, equivalent mitigation program during acquisition of regulatory permits, such measure shall be deemed equivalent to the above measures and no additional environmental documentation shall be required to implement a measure different than outlined above. Note that if impacts cannot be mitigated or avoided in the manner outlined in the measures above, then subsequent environmental documentation would have to be prepared in accordance with procedures outlined in Section 15162 of the State CEQA Guidelines.

Implementation of the following mitigation measures will ensure that project design and site selection reduce impacts to sensitive biological resources to the extent feasible.

4.2.8 ***Place primary emphasis on the preservation of large, unbroken blocks of natural open space and wildlife habitat area, and protect the integrity of habitat linkages. As part of this emphasis, incorporate programs for purchase of lands, clustering of development to increase the amount of preserved open space, and assurances that the construction of facilities or infrastructure improvements meet standards identical to the environmental protection policies applicable to the specific facilities improvement.***

4.2.9 ***Require facility designs and maintenance activities to be planned to protect habitat values and to preserve significant, viable habitat areas and habitat connection in their natural conditions.***

- ***a.*** ***Within designated habitat areas of rare, threatened or endangered species, prohibit disturbance of protected biotic resources.***
- ***b.*** ***Within riparian areas and wetlands subject to state or federal regulations, riparian woodlands, oak and walnut woodland, and habitat linkages, require that the vegetative resources which contribute to habitat carrying capacity (vegetative diversity, faunal resting sites, foraging areas, and food sources) are preserved in place or replaced so as not to result in an measurable reduction in the reproductive capacity of sensitive biotic resources.***
- ***c.*** ***Within habitats of plants listed by the CNDDB or CNPS as "special" or "of concern," require that new facilities not result in a reduction in the number of these plants, if they are present.***

4.2-10 ***Maximize the preservation of individual oak, sycamore and walnut trees within proposed development sites.***

4.2-11 ***Require the establishment of buffer zones adjacent to areas of preserved biological resources. Such buffer zones shall be of adequate width to protect biological resources from grading and construction activities, as well as from the long-term use of adjacent lands. Permitted land modification activities with preservation and buffer areas are to be limited to those that are consistent with the maintenance of the reproductive capacity of the identified resources. The land uses and design of project facilities adjacent to a vegetative preservation area, as well as activities within the designated buffer area are not to be permitted to disturb natural drainage patterns to the point that vegetative resources receive too much or too little water to permit their ongoing health. In addition, landscape adjacent to areas of preserved biological resources shall be designed so as to avoid invasive species which could negatively impact the value of the preserved resource.***

Implementation of the following mitigation measures will ensure that project construction impacts to sensitive biological resources, including the potential effects of invasive species, are reduced to the extent feasible.

4.2-12 ***Following construction activities within or adjacent to any natural area, the disturbed areas shall be revegetated using a plant mix of native plant species that are suitable for long term vegetation management at the specific site, which shall be implemented in cooperation with regulatory agencies and with oversight from a qualified biologist. The seeds mix shall be verified to contain the minimum amount of invasive plant species seeds reasonably available for the project area.***

4.2-13 ***Clean Construction Equipment. During construction, equipment will be washed before entering the project footprint to reduce potential indirect impacts from inadvertent introduction of nonnative invasive plant species. Mud and plant materials will be removed from construction equipment when***

working in native plant communities, near special-status plant communities, or in areas where special-status plant species have been identified.

4.2-14 Contractor Education and Environmental Training.

Personnel who work onsite will attend a Contractor Education and Environmental Training session. The environmental training is likely to be required by the regulatory agencies and will cover general and specific biological information on the special-status plant species, including the distribution of the resources, the recovery efforts, the legal status of the resources, and the penalties for violation of project permits and laws.

The Contractor Education and Environmental Training sessions will be given before the initiation of construction activities and repeated, as needed, when new personnel begin work within the project limits. Daily updates and synopsis of the training will be performed during the daily safety ("tailgate") meeting. All personnel who attend the training will be required to sign an attendance list stating that they have received the Contractor Education and Environmental Training.

4.2-15 Biological Monitor to Be Present during Construction Activities in areas where impacts to Riparian, Riverine, Wetland, Endangered Species or Endangered Species Critical habitat occurs. A biological monitor (or monitors) will be present onsite during construction activities that could result in direct or indirect impacts on sensitive biological resources (including listed species) and to oversee permit compliance and monitoring efforts for all special-status resources.

A biological monitor (qualified biologist) is any person who has a bachelor's degree in biological sciences, zoology, botany, ecology, or a closely related field and/or has demonstrated field experience in and knowledge about the identification and life history of the special-status species or jurisdictional waters that could be affected by project activities. The biological monitor(s) will be responsible for monitoring the Contractor to ensure compliance with the Section 404 Individual Permit, Section 401 Water Quality Certification and the Lake and Streambed Alteration Agreement. Activities to ensure compliance would include performing construction-monitoring activities, including monitoring environmental fencing, identifying areas where special-status plant species are or may be present, and advising the Contractor of methods that may minimize or avoid impacts on these resources. Biological monitor(s) will be required to be present in all areas during ground disturbance activities and for all construction activities conducted within or adjacent to identified Environmentally Sensitive Areas, Wildlife Exclusion Fencing, and Non-Disturbance Zones.

4.2-16 Food and Trash: All food-related trash items (e.g., wrappers, cans, bottles, food scraps) will be disposed of in closed containers and removed at least once a week from the construction site.

4.2-17 Rodenticides and Herbicides: Use of rodenticides and herbicides in the project footprint will be restricted. This measure is necessary to prevent poisoning of special-status species and the potential reduction or depletion of the prey populations of special–status wildlife species.

4.2-18 Wildlife Exclusion Fencing: Exclusion barriers (e.g., silt fences) will be installed at the edge of the construction footprint and along the outer perimeter of Environmentally Sensitive Areas and Environmentally Restricted Areas to restrict special-status species from entering the construction area. The design specifications of the exclusion fencing will be determined through consultation with the USFWS and/or CDFW. Clearance surveys will be conducted for special-status species after the exclusion fence is installed. If necessary, clearance surveys will be conducted daily.

4.2-19 Equipment Staging Areas: Staging areas for construction equipment will be located outside sensitive biological resources areas, including habitat for special-status species, jurisdictional waters, and wildlife movement corridors, to the maximum extent possible.

4.2-20 Plastic mono-filament netting (erosion-control matting) or similar material will not be used in erosion control materials to prevent potential harm to wildlife. Materials such as coconut coir matting or tackified hydroseeding compounds will be used as substitutes.

4.2-21 Vehicle Traffic: During ground-disturbing activities, project-related vehicle traffic will be restricted within the construction area to established roads, construction areas, and other designated areas to prevent avoidable impacts. Access routes will be clearly flagged and off-road traffic will be prohibited.

4.2-22 Entrapment Prevention: All excavated, steep-sided holes or trenches more than 8 inches deep will be covered at the close of each working day with plywood or similar materials, or a minimum of one escape ramp constructed of earth fill for every 10 feet of trenching will be provided to prevent the entrapment of wildlife. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals.

All culverts or similar enclosed structures with a diameter of 4 inches or greater will be covered, screened, or stored more than 1 foot off the ground to prevent use by wildlife. Stored material will be cleared for common and special-status wildlife species before the pipe is subsequently used or moved.

4.2-23 Weed Control Plan: A Weed Control Plan will be prepared and implemented to minimize or avoid the spread of weeds during ground-disturbing activities. In the Weed Control Plan, the following topics will be addressed:

- *Schedule for noxious weed surveys.*
- *Weed control treatments, including permitted herbicides, and manual and mechanical methods for application; herbicide application will be restricted in Environmentally Sensitive Areas.*
- *Timing of the weed control treatment for each plant species.*
- *Fire prevention measures.*

4.2-24 Dewatering/Water Diversion: Open or flowing water may be present during construction. If construction occurs where there is open or flowing water, a strategy that is approved by the resource agencies (e.g., USACE, SWRCB/RWQCB, and CDFW), such as the creation of cofferdams, will be used to dewater or divert water from the work area. If cofferdams are constructed, implementation of the following cofferdam or water diversion measures is recommended to avoid and lessen impacts on jurisdictional waters during construction:

- *The cofferdams, filter fabric, and corrugated steel pipe are to be removed from the creek bed after completion of the project.*

- *The timing of work within all channelized waters is to be coordinated with the regulatory agencies.*

- *The cofferdam is to be placed upstream of the work area to direct base flows through an appropriately sized diversion pipe. The diversion pipe will extend through the Contractor's work area, where possible, and outlet through a sandbag dam at the downstream end.*

- *Sediment catch basins immediately below the construction site are to be constructed when performing in-channel construction to prevent silt- and sediment-laden water from entering the main stream flow. Accumulated sediments will be periodically removed from the catch basins.*

Implementation of the above mitigation measures is considered adequate to minimize construction-related impacts to the extent feasible, including the potential for invasive species occupancy caused by project-related disturbance of natural areas.

4.3 Regulatory Compliance

Impacts on biological resources will be permitted or authorized through consultation with the various natural resource regulatory agencies (USFWS, USACE, SWRCB/RWQCB, and CDFW). Both formal and informal consultation with these agencies may result in additional project-specific avoidance and minimization measures.

4.3.1 Regulatory Agency Access

If requested, before, during, or on completion of ground-disturbing activities, access to the construction site will be provided to USFWS, USACE, SWRCB/RWQCB, and CDFW staff. Because of safety concerns, agency personnel will check in with the Contractor before accessing the construction site. If agency personal access the construction site, the biological monitor will prepare a memorandum within 1 day of the visit that documents agency access and issues raised during the field meeting.

4.4 Critical Habitat

Critical habitat has been designated for several species adjacent to, directly overlapping, or in the general vicinity of the Program area, with significant concentration along the Santa Ana River corridor. One example is the critical habitat designated for the Southwestern willow flycatcher along the Santa Ana River to the south of the Program area. The specific locations of pertinent critical habitat areas are shown in maps contained in Chapter 6 - Figures. The primary mitigation for potential impacts to critical habitat will be avoidance. Where avoidance is not feasible, mitigation measures 4.2-1 and 4.2-7 will be implemented. It is rare that critical habitat extends directly within the property owned by project proponents because these areas are generally maintained to support the OBMPU operations, not protect habitat. However, where either permanent or temporary disturbances will occur within critical habitat, full mitigation will be provided to offset impacts to such habitat. As indicated in the subsequent discussion on cumulative impacts, certain areas that contain critical habitat for species may not be fully mitigable, and an unavoidable significant adverse biological resource impact may occur. This can only be determined after the new projects are identified, and engineering and designs are completed, and avoidance measures incorporated per specific, necessary project actions. Where avoidance cannot be achieved, the residual impact to critical habitat may be unavoidable.

4.4.1 Wetlands and Other Waters Coordination Summary

Wetlands and other waters in the project vicinity, including waters of the U.S., waters of the state, and state streambeds, are regulated by the federal government (USACE) and the State of California (RWRCB and CDFW). When considering wetlands and other waters, these features are collectively termed jurisdictional waters. Wetlands and other waters are assumed to fall under the jurisdiction of the USACE, SWRCB, and CDFW for purposes of this discussion. The jurisdictional status of these waters will be confirmed by the USACE, SWRCB, and CDFW when the regulatory permitting process is conducted. Further definitions are presented below.

- **Wetlands**: According to the USACE Wetlands Delineation Manual (Environmental Laboratory 1987) and the recently published Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) (USACE 2008b), three criteria must be satisfied to classify an area as a jurisdictional wetland: (1) a predominance of plant life that is adapted to life in wet conditions (hydrophytic vegetation), (2) soils that saturate, flood, or pond long enough during the growing season to develop anaerobic conditions in the upper part (hydric soils), and (3) permanent or periodic inundation or soils saturation, at least seasonally (wetland hydrology).
- **Waters of the U.S.**: The CWA defines waters of the U.S. as follows: (1) all waters that are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide; (2) all interstate waters including interstate wetlands; (3) all other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce; (4) all impoundments of

waters otherwise defined as waters of the U.S.; (5) tributaries to the foregoing types of waters; and (6) wetlands adjacent to the foregoing waters (33 CFR 328.3[a]). Current status of the Waters of the US Rule continues to change. Any regulatory environment must be reassessed for each future project to determine which rules apply and which permitting may be necessary during the planning and permitting phase.

- **Waters of the State**: Waters of the state are broadly defined by the Porter-Cologne Water Quality Control Act (Section 1305[e]). Under this definition, isolated wetlands that may not be subject to regulations under federal law are considered waters of the state. On March 9, 2012, the California Water Boards released a preliminary draft of their Wetland Area Protection Policy, which includes a proposed wetland definition. Under their proposed definition, an area is a wetland if, under normal circumstances, it (1) is continuously or recurrently inundated with shallow water or saturated within the upper substrate; (2) has anaerobic conditions within the upper substrate caused by such hydrology; and (3) either lacks vegetation or the vegetation is dominated by hydrophytes (SWRCB 2012).
- **State Streambeds**: CDFW has not released an official definition of lake or streambed and therefore the extent of the area regulated under Section 1602 remains undefined. However, CDFW jurisdiction generally includes the streambed and bank, together with the adjacent floodplain and riparian vegetation.

Based on the background review and subsequent windshield surveys, numerous jurisdictional waters occur in the Study Area for the OBMPU. Many of the jurisdictional waters (built waterways) are heavily managed by local irrigation districts, which serve public water needs and agricultural production. As a result, some of these jurisdictional waters support few natural biological functions and values. The biological functions of these man-made features include limited habitat for wildlife and capacity for water storage or release. A number of these jurisdictional waters have been previously degraded or impacted by existing roads and water resource management infrastructure.

Direct impacts on natural and man-made features include the removal or modification of local hydrology, the redirection of flow, and the placement of fill material. In the case of man-made features, these impacts would remove or disrupt the limited biological functions that these features provide. In natural areas, these activities would remove or disrupt the hydrology, vegetation, wildlife use, water quality conditions, and other biological functions provided by the resources.

Temporary impacts on jurisdictional waters include the placement of temporary fill during construction in both man-made and natural jurisdictional waters. Temporary fill could be placed during the construction of access roads and staging/equipment storage areas. The temporary fill would result in a temporary loss of jurisdictional waters and could potentially increase erosion and sediment transport into adjacent areas.

Potential indirect impacts on jurisdictional waters include a number of water-quality-related impacts: erosion and transport of fine sediments or fill downstream of construction to unintentional release of contaminants into jurisdictional waters that are outside of the project footprint. These discharges would indirectly impact adjacent or downstream jurisdictional waters.

A Jurisdictional Determination and subsequent approval of the determination by the regulatory agencies will be conducted on each facility as the design becomes available and construction of a particular facility is scheduled to occur within the foreseeable future. However, unforeseen direct impacts, indirect impacts, and temporary impacts to natural and man-made water bodies may occur depending upon the design of the infrastructure improvement, and the construction methodology required.

4.5 Cumulative Impacts

Cumulative biological resource impacts can only occur when such resources are not avoided, protected or mitigated as outlined above. The mitigation requirements outlined in Section 4.2 are identified to ensure that biological resources are avoided or otherwise protected or mitigated, such that no cumulatively considerable impacts to significant biological resources are forecast to occur if the proposed project is implemented as analyzed in this document.

These impacts may include direct impacts such as the removal or modification of local hydrology, the redirection of flow, and the placement of fill material. Potential indirect impacts on jurisdictional waters include a number of water-quality-related impacts: erosion and transport of fine sediments or fill downstream of construction to unintentional release of contaminants into jurisdictional waters that are outside of the project footprint. Temporary impacts on jurisdictional waters include the placement of temporary fill during construction in both man-made and natural jurisdictional waters. Temporary fill could be placed during the construction of access roads and staging/equipment storage areas. The temporary fill would result in a temporary loss of jurisdictional waters and could potentially increase erosion and sediment transport into adjacent areas.

In the case of man-made features, these impacts would remove or disrupt the limited biological functions that these features provide. In natural areas, these activities would remove or disrupt the hydrology, vegetation, wildlife use, water quality conditions, and other biological functions provided by the resources. Therefore, these impacts should be quantified and analyzed in a second tier environmental documentation.

However, there are certain areas within the overall project area of potential impact where the resource impacts from constructing new infrastructure may cause unavoidable significant adverse impacts on biological resources. These areas are highly dependent upon the final design of each Program goal, i.e. individual project, and if those actions cannot be reasonably or feasibly offset, the ultimate design of these Program improvements must be based on sound engineering. In each case where most environmental impacts cannot be fully avoided, it may be possible to avoid certain impacts by designs that avoid such impacts through sound mitigation-based planning at each step.

Chapter 5. References

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Chapter 6. Figures

Exhibit 1

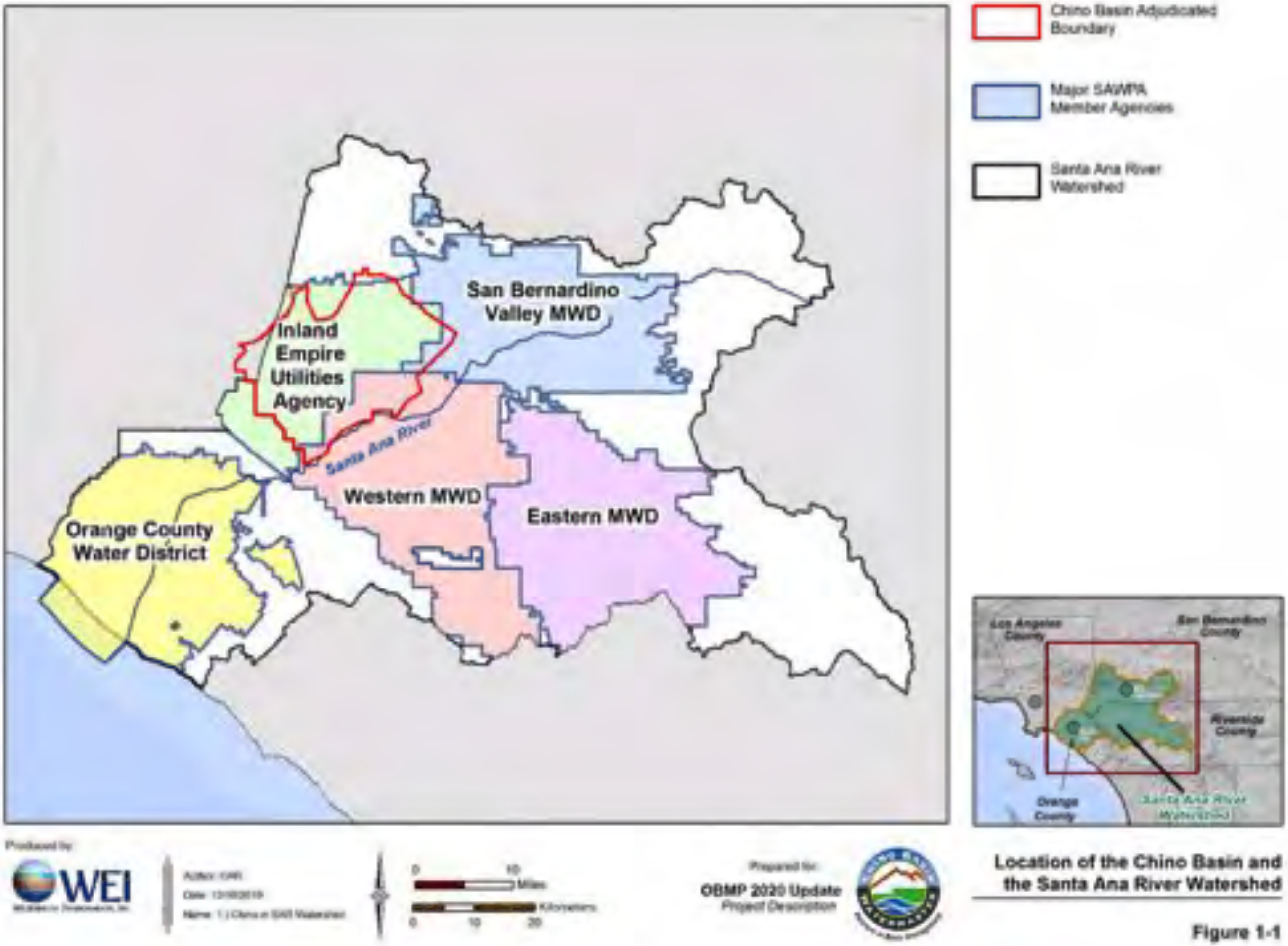
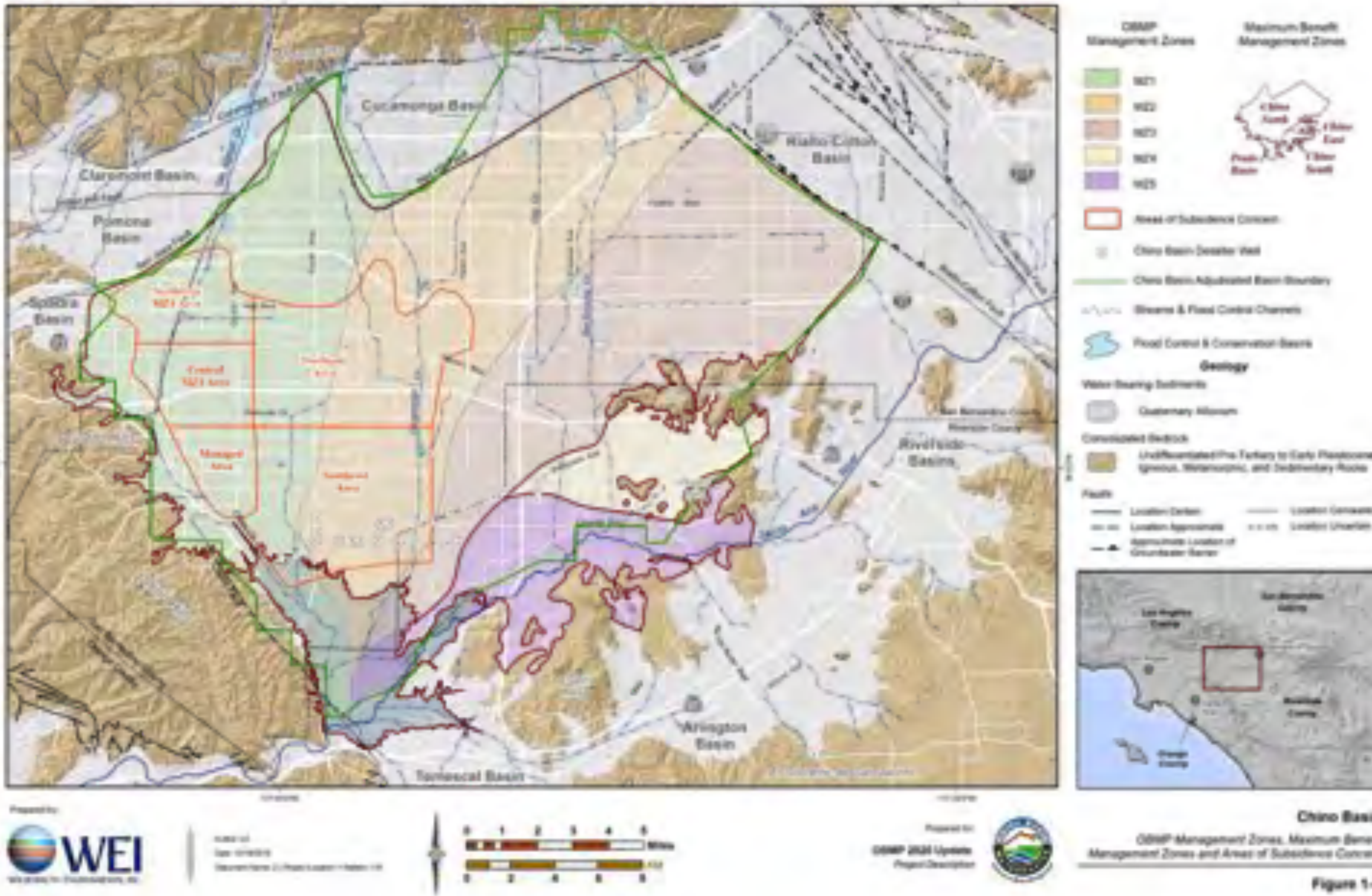

Chino Basin Adjudicated Boundary
Major SAWPA Member Agencies
Santa Ana River Watershed
San Bernardino Valley MWD
Inland Empire Utilities Agency
Santa Ana River
Western MWD
Eastern MWD
Orange County Water District
Santa Ana River Watershed
Produced by:
WEI
Miles
Kilometers
0
10
0
10
20
Prepared for:
OBMP 2020 Update
Project Description
Location of the Chino Basin and the Santa Ana River Watershed
Figure 1-1

Exhibit 2



Chino Basin

OBMP Management Zones, Maximum Benefit Management Zones and Areas of Subsidence Concern

Figure 1-1

Exhibit 3

Figure 1 – Drivers and Trends and Their Implications
2020 OBMP Update

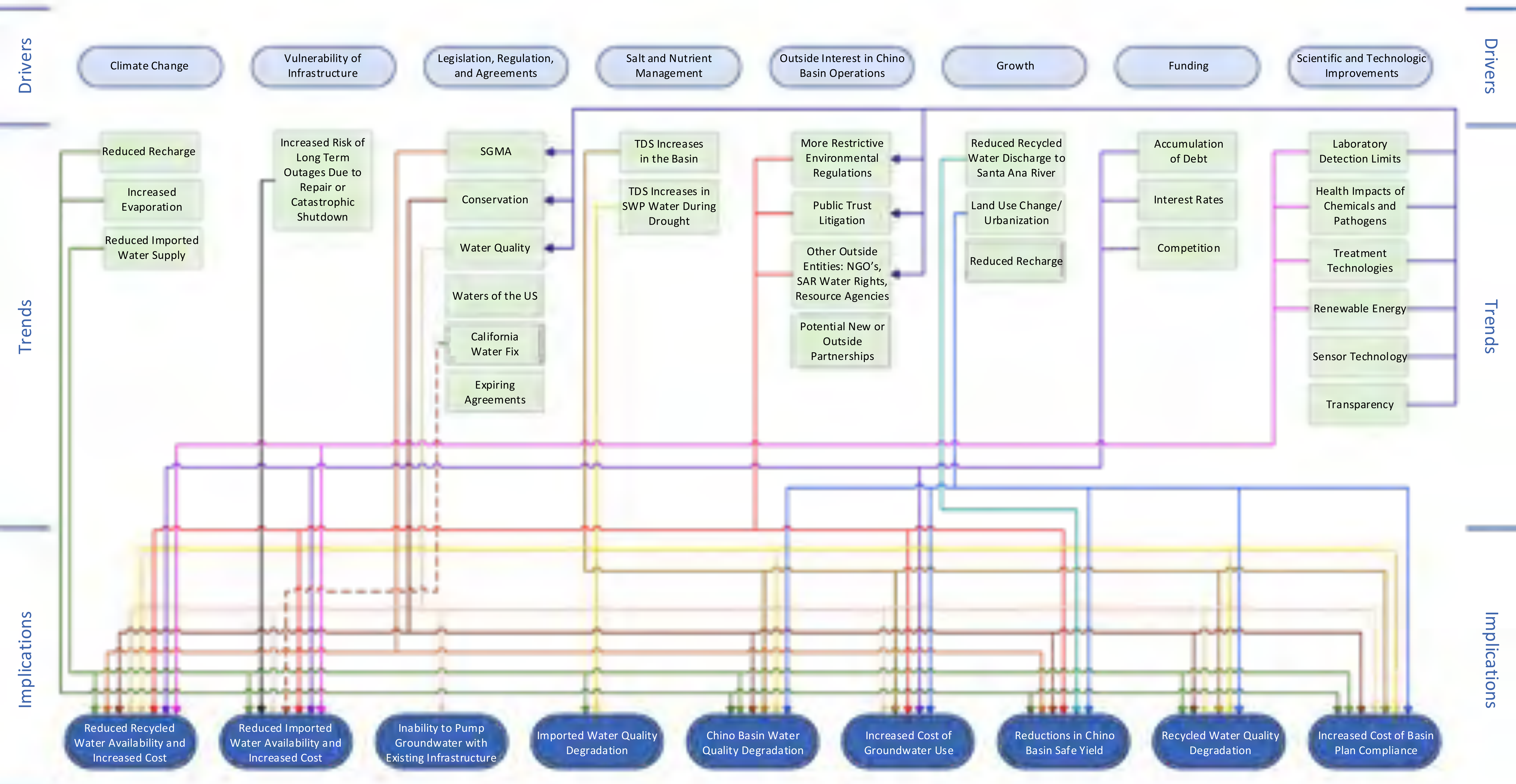


Exhibit 4

Implementation actions for the next 20 years by Program Element
Program Element 1
Watermaster will continue to conduct the required monitoring and reporting programs, including collection of: groundwater production, groundwater level, groundwater quality, ground level, surface water, climate, water supply planning, biological, and well construction/destruction monitoring data.
Perform review and update of Watermaster's regulatory and Court-ordered monitoring and reporting programs and document in a work plan: *OBMP Monitoring and Reporting Work Plan* .
Perform periodic review and update of the *OBMP Monitoring and Reporting Work Plan* (or other guidance documents developed by Watermaster) and modify the monitoring and reporting programs, as appropriate.
Program Element 2
Continue to convene the Recharge Investigations and Projects Committee.
Complete the 2023 Recharge Master Plan Update (RMPU).
Implement recharge projects based on need and available resources.
Update the RMPU no less than every five years (2028, 2033, 2038).
Program Element 4
Implement Watermaster's Subsidence Management Plan, and adapt it as necessary.
Watermaster will arrange for the physical recharge of at least 6,500 afy of Supplemental Water in MZ-1 as an annual average. Watermaster may re-evaluate the minimum annual quantity of Supplemental Water recharge in MZ-1 and may increase this quantity through the term of the Peace Agreement.
Program Element 5
The IEUA will maximize the reuse of its recycled water in the Chino Basin.
The IEUA, the TVMWD, the WMWD, and/or other Party acting as a coordinating agency will establish or expand future recycled water planning efforts to maximize the reuse of all available sources of recycled water.
Watermaster will support the IEUA, the TVMWD, the WMWD, and/or others in their efforts to maximize recycled water reuse to ensure these efforts are integrated with Watermaster's groundwater and salinity management efforts.
The IEUA, the TVMWD, the WMWD, and/or other Party acting as a coordinating agency will establish or expand future integrated water resources planning efforts to address water supply reliability for all Watermaster Parties.
Watermaster will support the IEUA, the TVMWD, the WMWD, and/or others in their efforts to improve water supply reliability to ensure those efforts are integrated with Watermaster's groundwater management efforts.

Implementation actions for the next 20 years by Program Element
Program Element 6
Re-convene the water quality committee and meet periodically to update groundwater quality management priorities.
Develop and implement an initial emerging contaminants monitoring plan.
Prepare a water quality assessment of the Chino Basin to evaluate the need for a *Groundwater Quality Management Plan* and prepare a long-term emerging contaminants monitoring plan.
Continue to support the Parties in identifying funding from outside sources to finance cleanup efforts.
Develop and implement a *Groundwater Quality Management Plan* and periodically update it.
Implement long-term emerging contaminants monitoring plan.
Continue to conduct investigations to assist the parties and/or the Regional Board in accomplishing mutually beneficial objectives as needed.
Implement projects of mutual interest.
Program Element 7
Complete the 2020 update of TDS and nitrate projections to evaluate compliance with maximum benefit salt and nutrient management plan, and, if necessary, based on the outcome, prepare a plan and schedule to implement a salt offset compliance strategy.
Continue to implement the maximum-benefit salt and nutrient management plan pursuant to the Basin Plan.
Starting in 2025 and every five years thereafter, update water quality projections to evaluate compliance with the maximum-benefit salt and nutrient management plan.
Program Element 8/9
Complete and submit to the Court the 2020 Safe Yield Recalculation.
Complete and submit to the Court the 2020 Storage Management Plan (SMP).
Develop a *Storage and Recovery Master Plan* to support the design of optimized storage and recovery programs that are consistent with the 2020 Storage Management Plan and provide the Watermaster with criteria to review, condition, and approve applications in a manner that is consistent with the Judgment and the Peace Agreement.
Assess losses from storage accounts based on the findings of the 2020 Safe Yield Recalculation.
Update the Storage Management Plan in 2025 and every five years thereafter, and when: • the Safe Yield is recalculated, • Watermaster determines a review and update is warranted based new information and/or the needs of the parties or the basin, and • at least five years before the aggregate amount of managed storage by the parties is projected to fall below 340,000 af
Perform safe yield recalculation every 10 years (2030, 2040).
Update the storage loss rate following each recalculation of Safe Yield (2030, 2040) and during periodic updates of the SMP.

Actions in blue represent actions that are not in the 2000 OBMP ("new" actions).

Exhibit 5

List of facilities to be evaluated in CEQA	PE1	PE2	PE4	PE5	PE6	PE7	PE8/9
New monitoring wells	✓	✓	✓	✓	✓	✓	✓
New surface water and groundwater recharge monitoring facilities	✓	✓					✓
New meteorological monitoring facilities	✓	✓					✓
New meter installation at pumping wells	✓						
New extensometers	✓		✓				✓
New benchmarks	✓		✓				✓
New stormwater diversion, storage, transfer and recharge facilities		✓	✓	✓			✓
CIM storage facilities*		✓	✓	✓			✓
Flood MAR*		✓	✓	✓			✓
Regional conveyance:*		✓	✓	✓			✓
Lower Cucamonga Basin		✓		✓			✓
Mills Wetlands		✓		✓			✓
Riverside Basin		✓		✓			✓
Vulcan Basin *		✓		✓			✓
Confluence Project*		✓		✓			✓
Injection wells*		✓	✓	✓			✓
Treatment (for some sources)*		✓	✓	✓			✓
Restore WFA Agua de Lejos Treatment Plant capacity for in-lieu recharge		✓	✓	✓			✓
MS4 recharge project incentives		✓	✓				✓
Relocate pumping from MZ1 to MZ2/3 and southern portion of the Chino Basin and/or increase recharge in MZ1			✓				✓
New production wells*			✓				✓
Acquire supplemental water supplies*		✓		✓			
Regional conveyance				✓			✓
New dedicated regional conveyance facilities				✓			✓
North-south pipeline*				✓			✓
East-west pipeline*				✓			✓
Incorporate local conveyance facilities into a regional conveyance system*				✓			✓
Maximize recycled water reuse				✓			
Expand system for indirect reuse*				✓			
Advanced water treatment*				✓		✓	
Direct potable use*				✓			
New regional groundwater treatment plants (up to 10 mgd for local use; up to 30 mgd for export)*				✓	✓		✓
Expansion of existing groundwater treatment plants*				✓	✓		✓
Upgrade recycled water treatment plant to desalt effluent*						✓	
Maintain or increase groundwater pumping in Chino Creek Well Field (CCWF) area:							
New production wells in CCWF area*						✓	✓
Acquire wells in CCWF area*						✓	✓
New ASR wells in MZ2/3 north of Highway 60*							✓

*Includes conveyance infrastructure

Exhibit 6

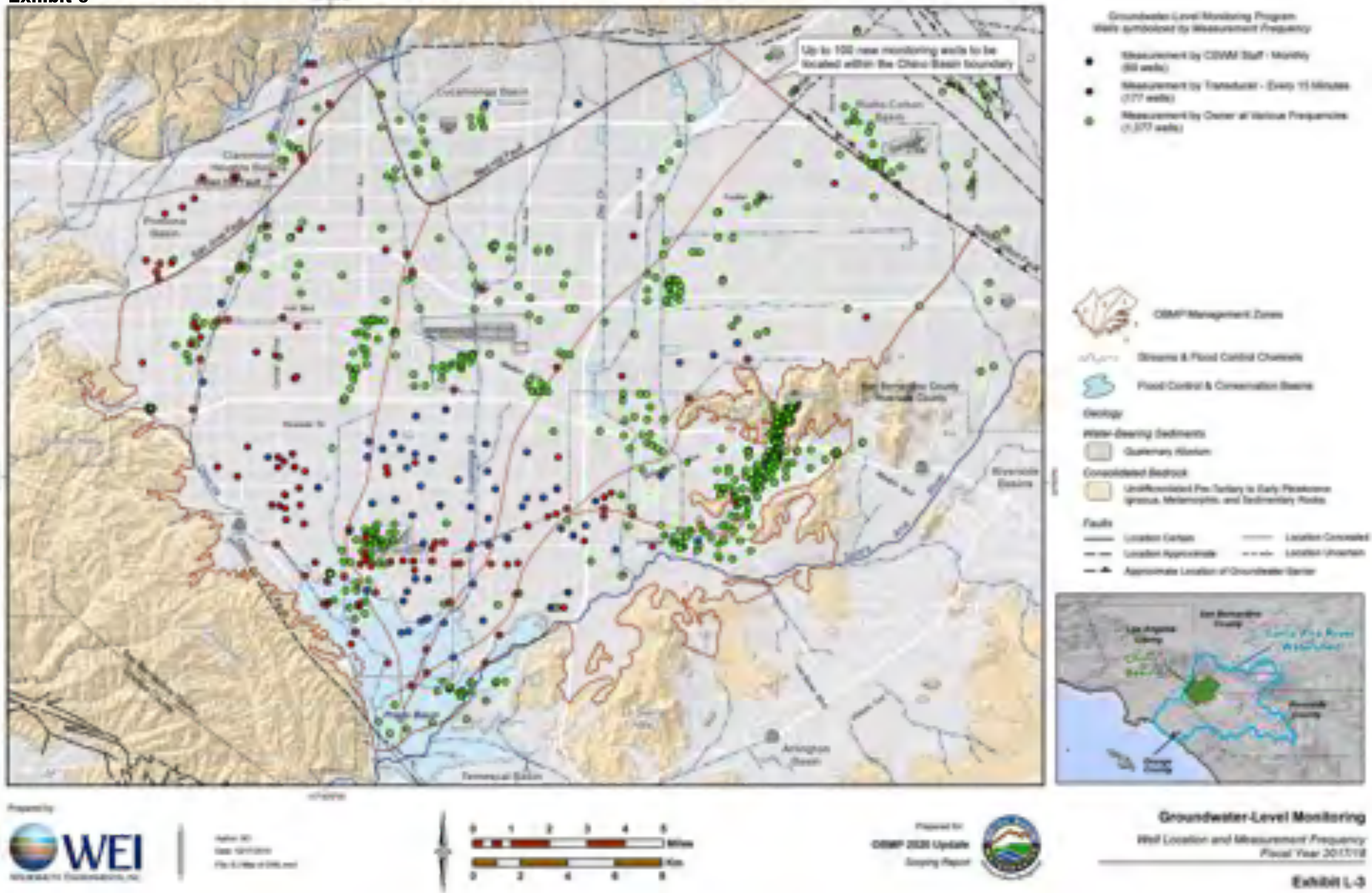
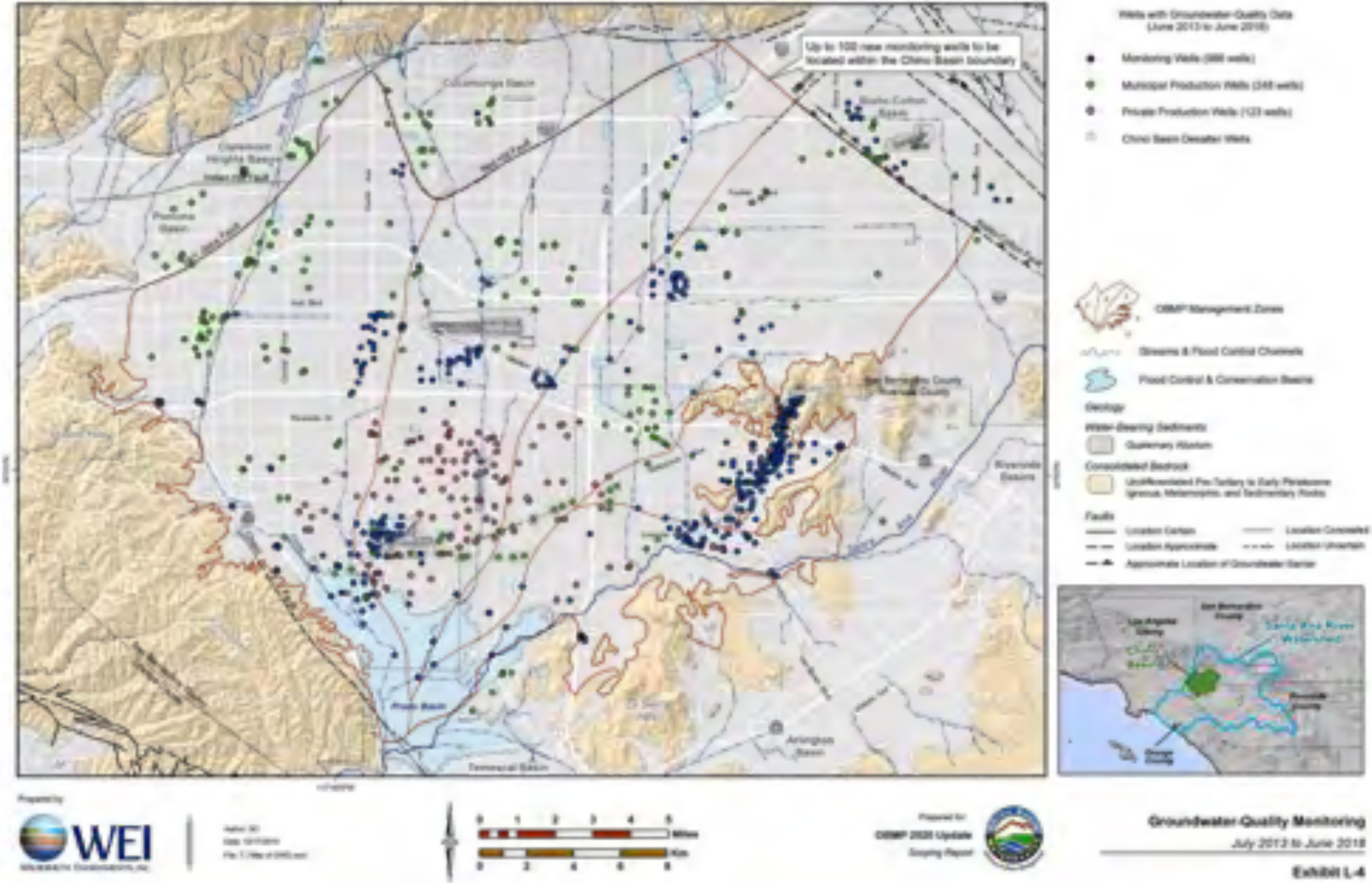

Groundwater-Level Monitoring
Well Location and Measurement Frequency
Fiscal Year 2017/18
Exhibit L-3

Exhibit 7



Up to 100 new monitoring wells to be located within the Chino Basin boundary
Monitoring Wells
Municipal Production Wells
Private Production Wells
Chino Basin Desalter Wells
OBMP Management Zones
Streams & Flood Control Channels
Flood Control & Conservation Basins
Geology
Water-Bearing Sediments
Quaternary Alluvium
Consolidated Bedrock
Faults
Prepared by
WEI
Miles
Km
Prepared for
OBMP 2020 Update
Scoping Report
Groundwater Quality Monitoring
July 2013 to June 2018
Exhibit L-4

Exhibit 8

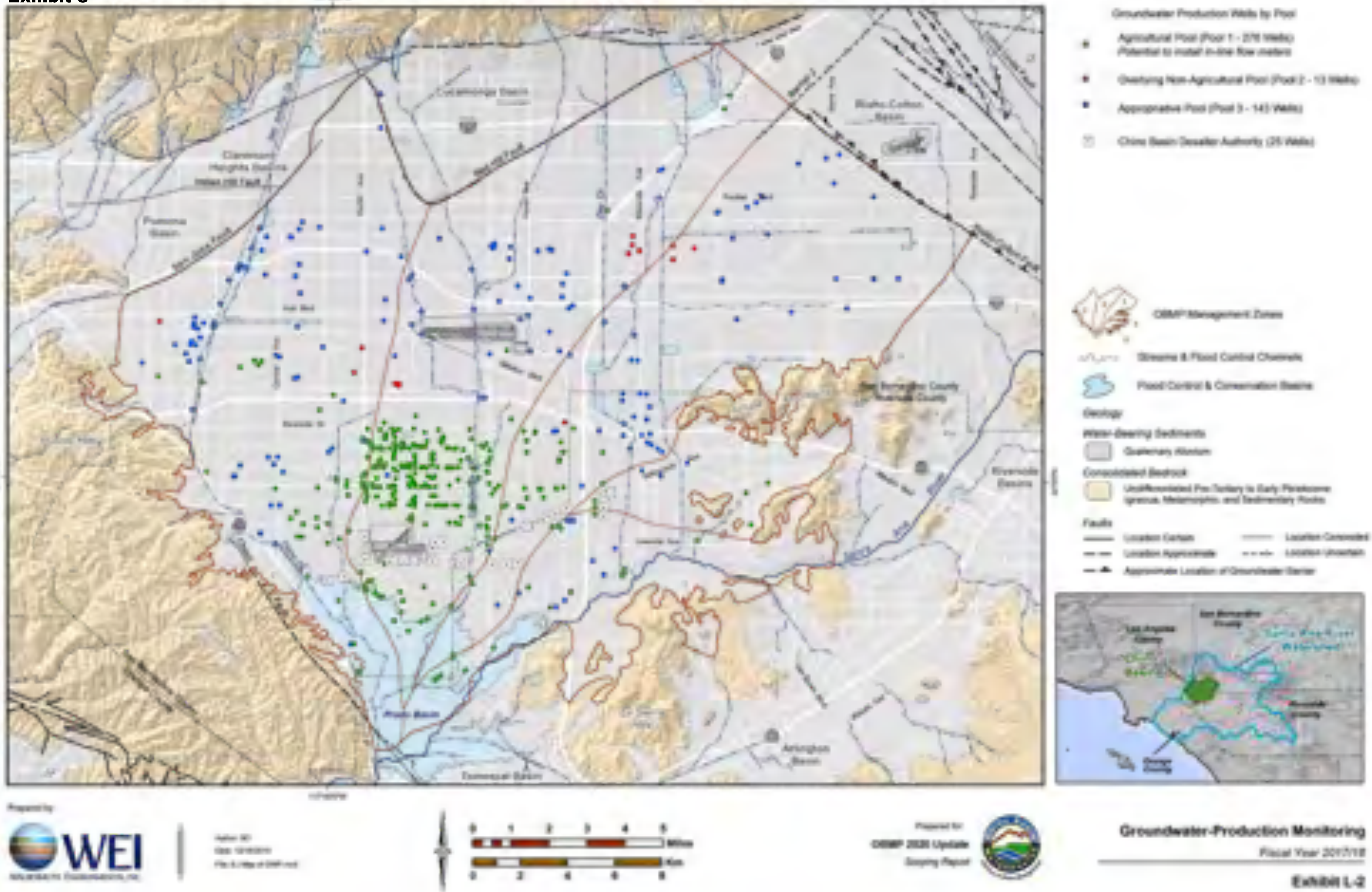

WEI
Groundwater-Production Monitoring
Fiscal Year 2017/18
Exhibit L-2

Exhibit 9

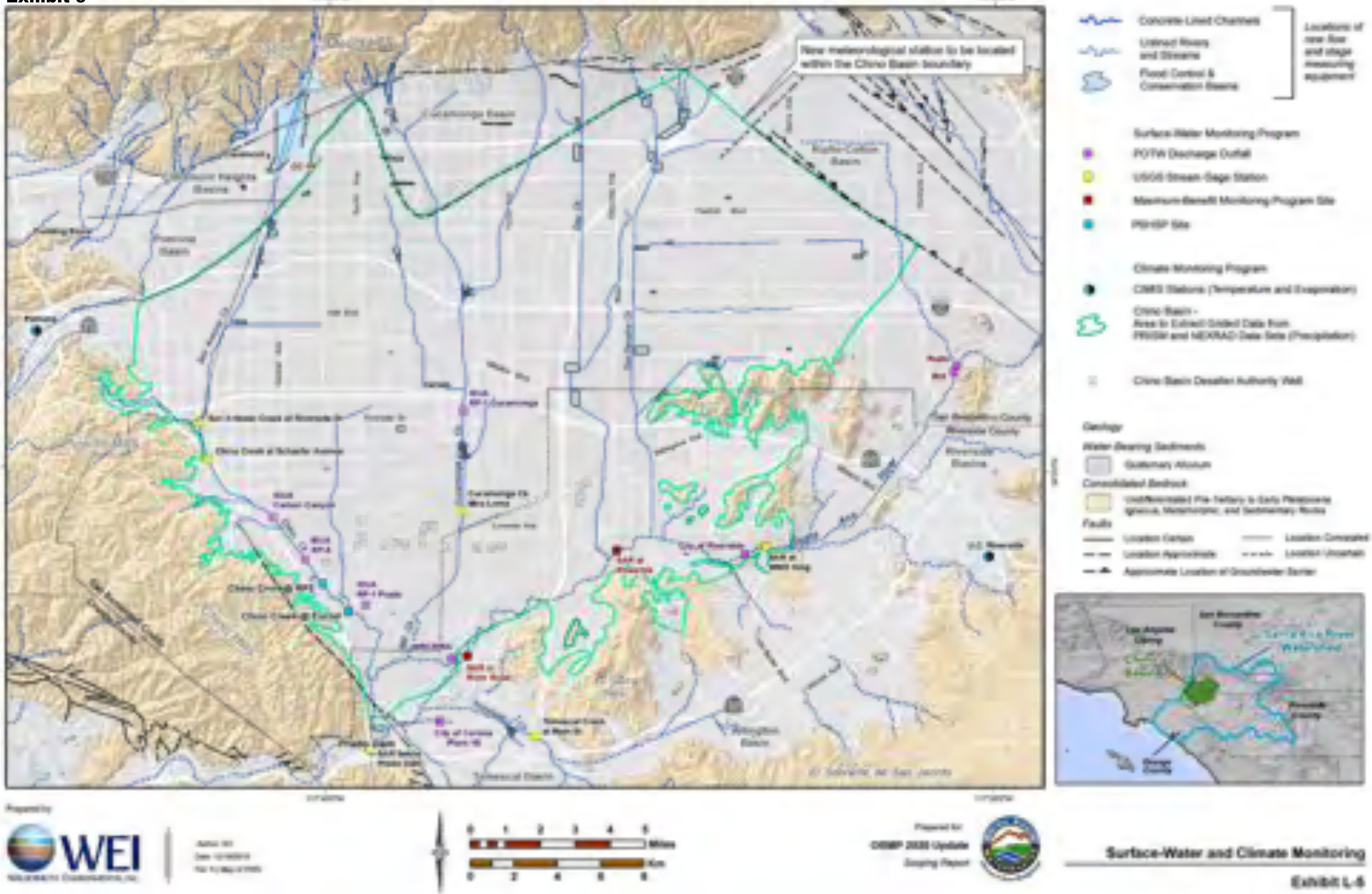
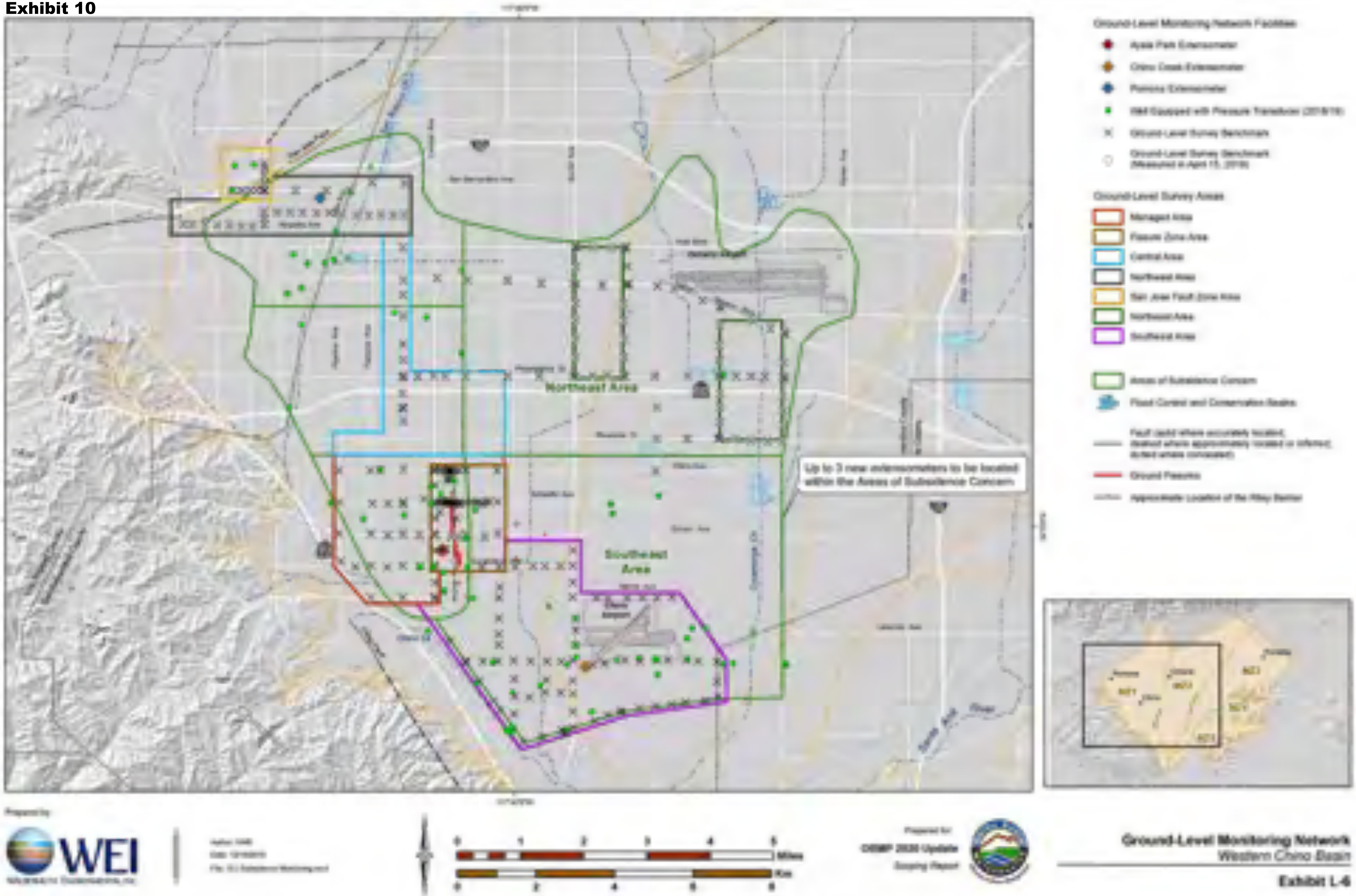
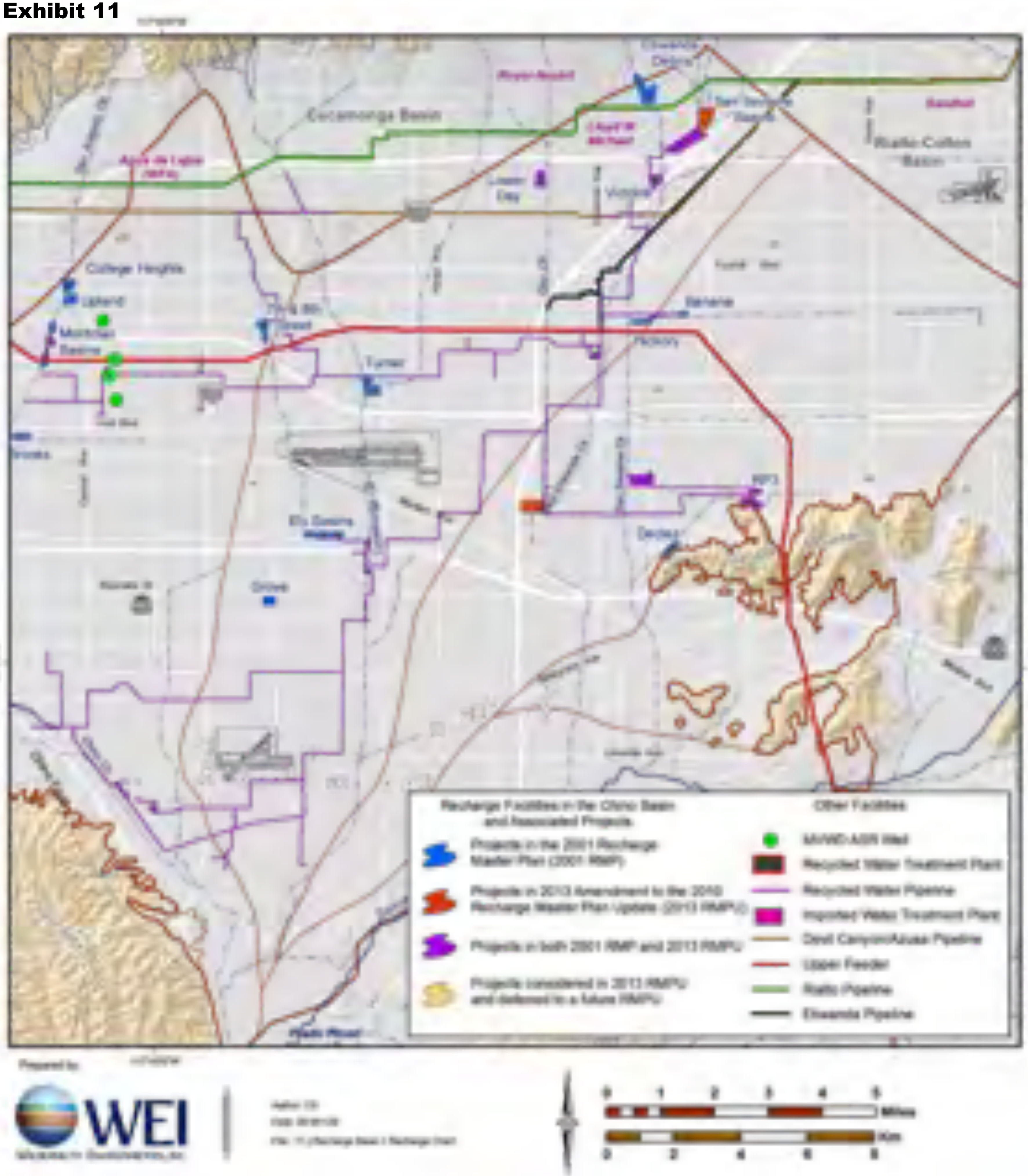

New meteorological station to be located within the Chino Basin boundary
WEI
Surface-Water and Climate Monitoring
Exhibit L-6

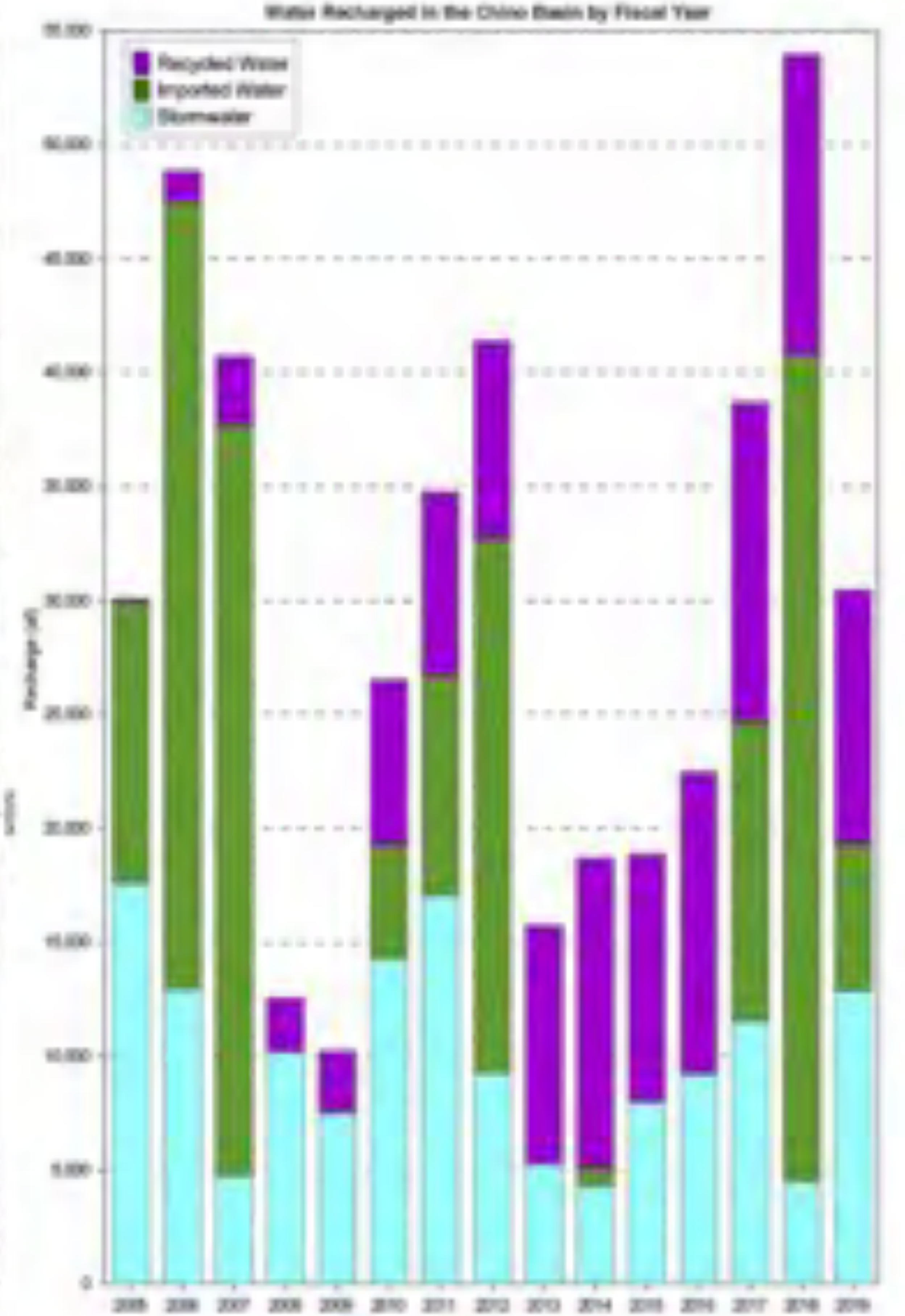
Exhibit 10



Northeast Area
Southeast Area
Up to 3 new extensometers to be located within the Areas of Subsidence Concern
WEI
Ground-Level Monitoring Network
Western Chino Basin
Exhibit L-6

Exhibit 11





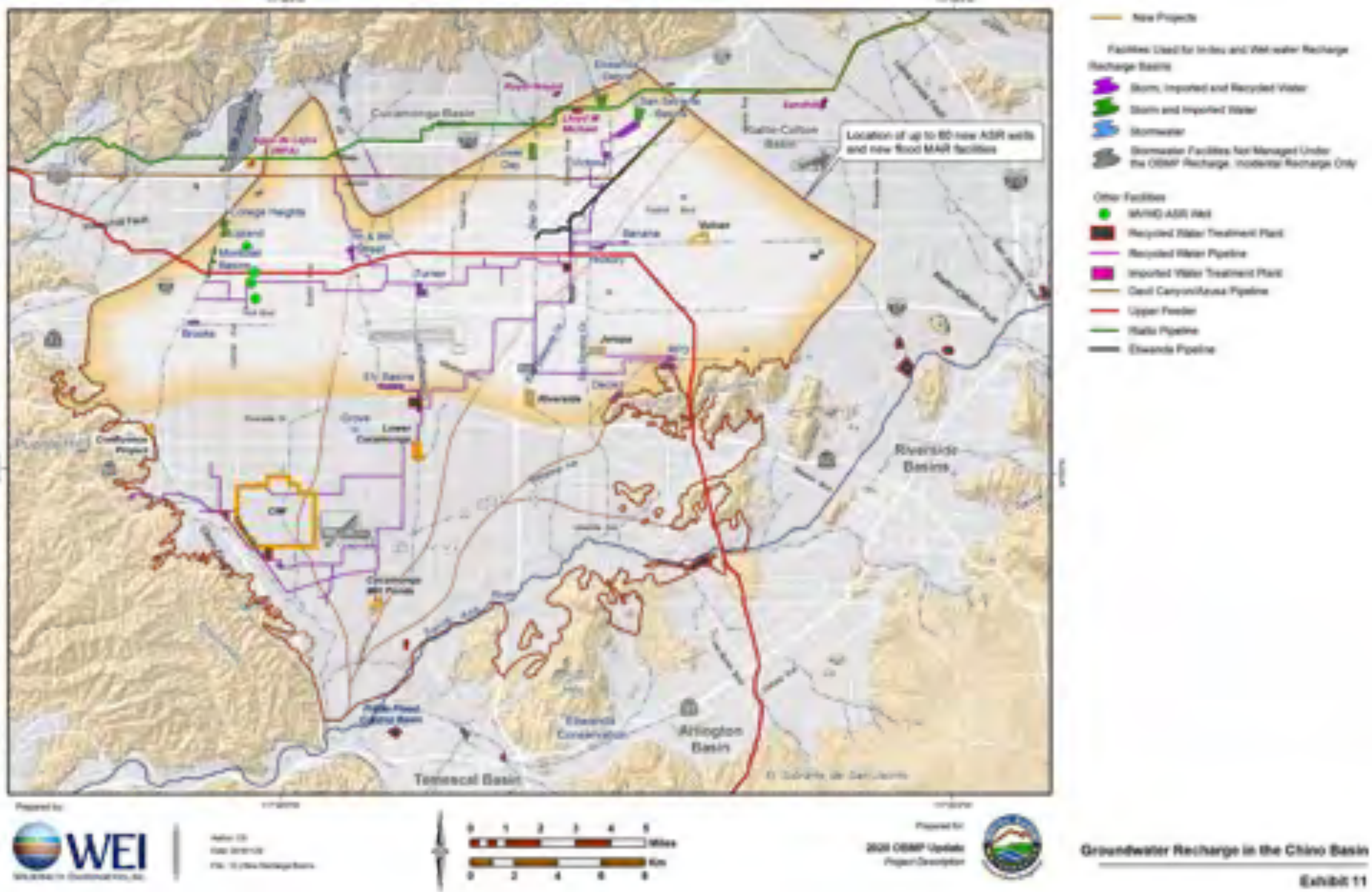
Prepared for:

2020 OBMP Update
Project Description

Groundwater Recharge in the Chino Basin

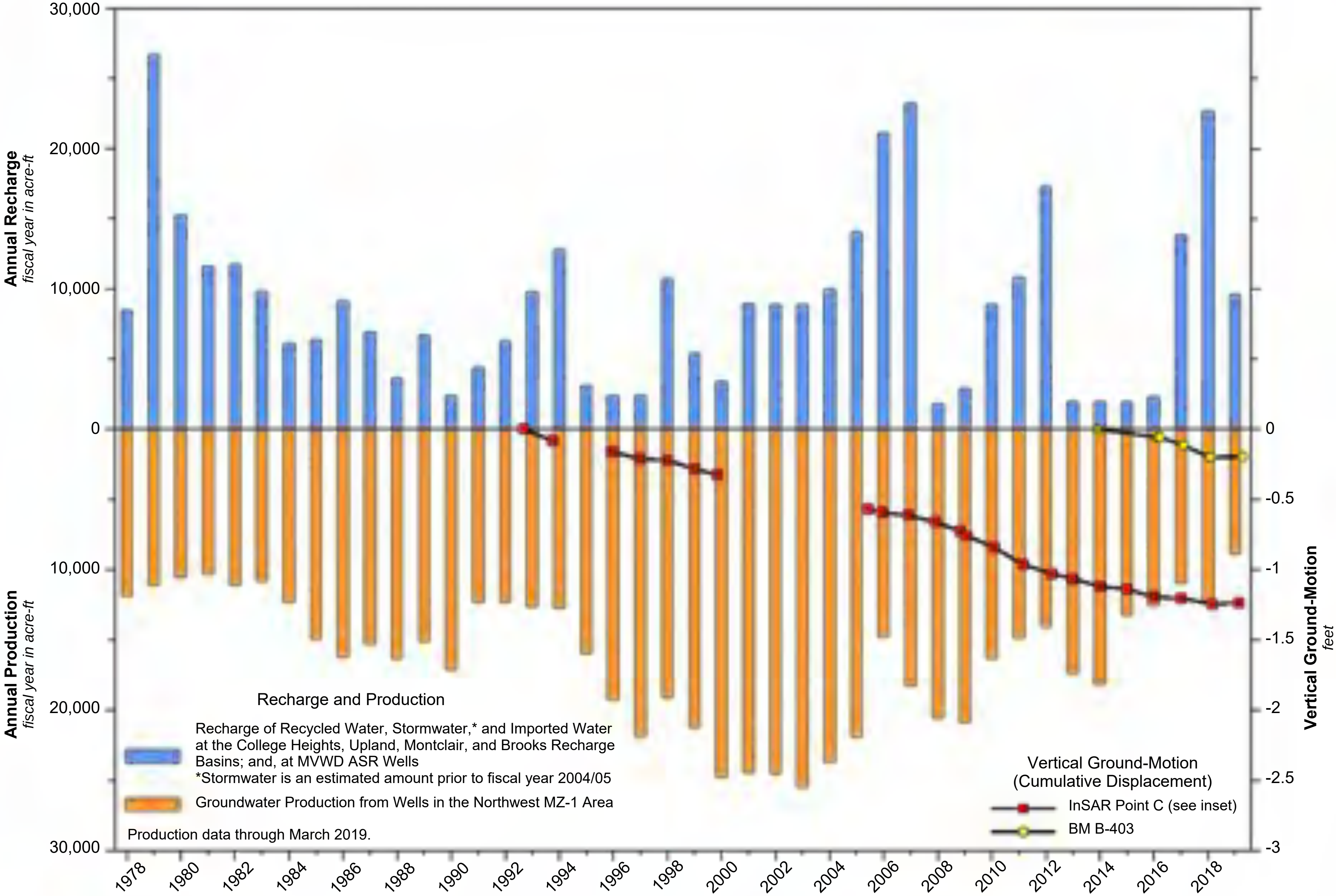
Exhibit 10

Exhibit 12



New Projects
Cucamonga Basin
Riverside Basin
Arlington Basin
Temescal Basin
WEI
Miles
Km
Groundwater Recharge in the Chino Basin
Exhibit 11

Exhibit 13



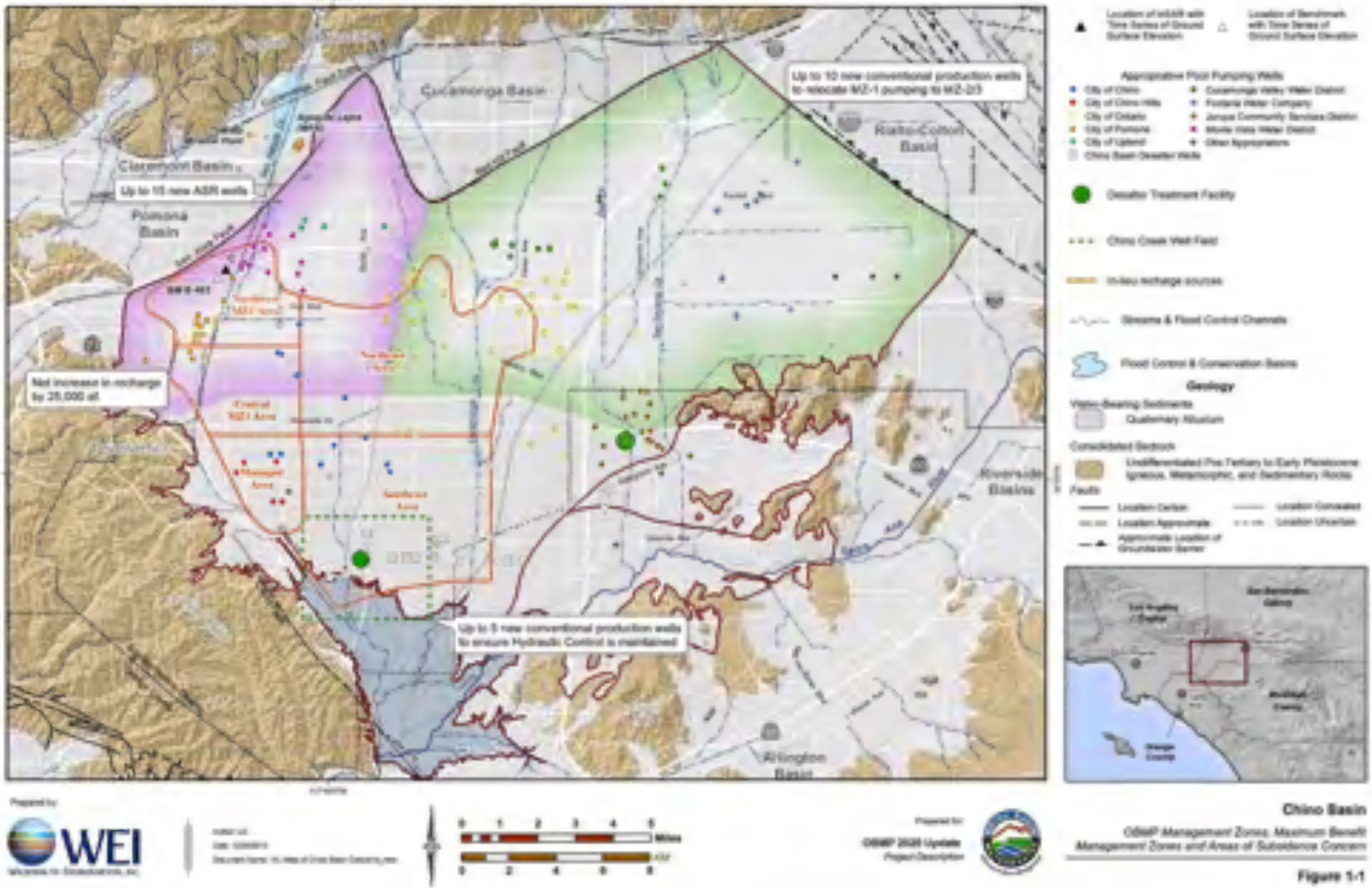
WEI

Prepared for:
OBMP 2020 Update
Scoping Report

Pumping, Recharge and Land Subsidence in the Northwest MZ-1 Area

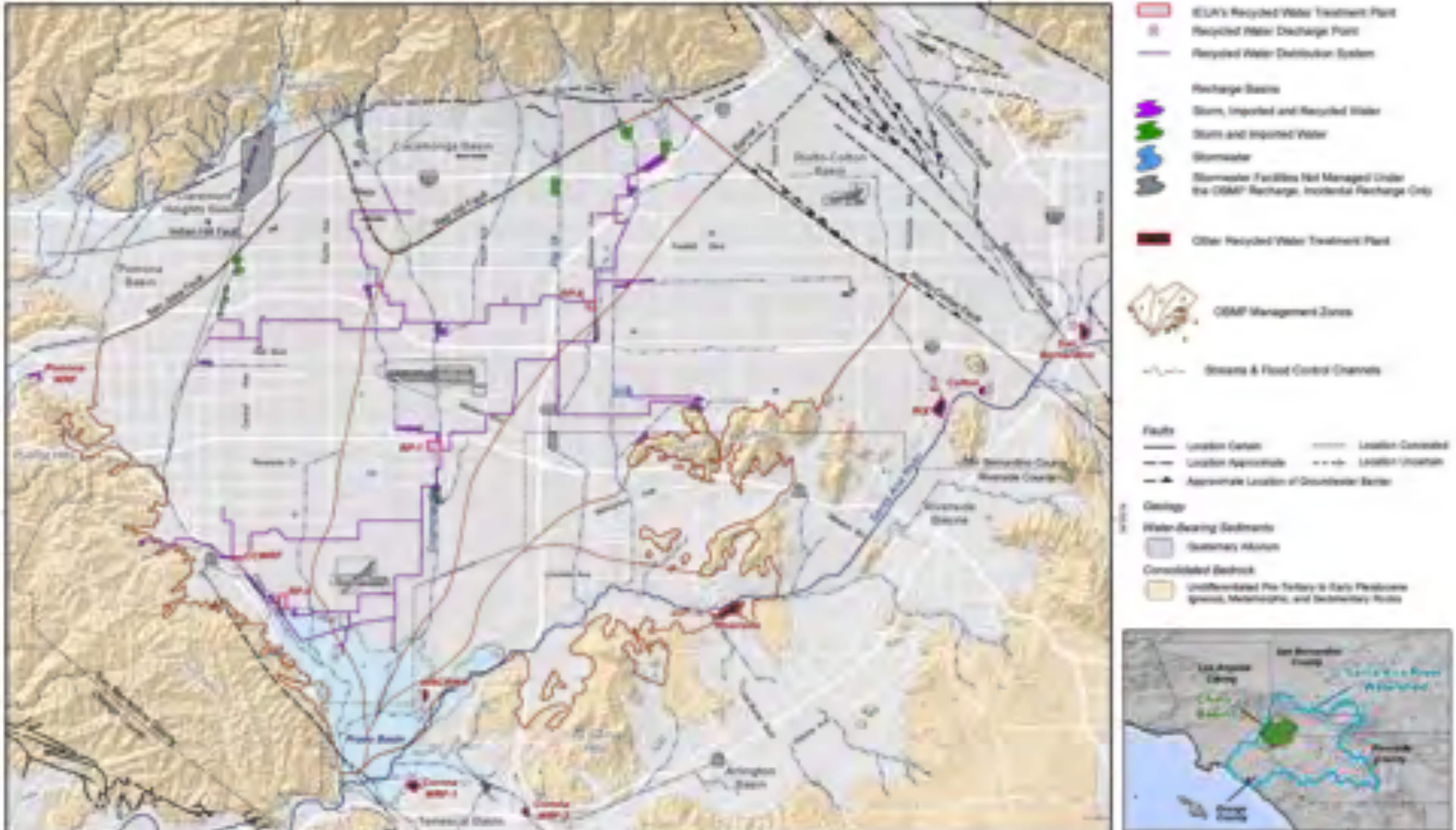
Exhibit CG-3

Exhibit 14



Cucamonga Basin
Claremont Basin
Pomona Basin
Rialto-Colton Basin
Riverside Basin
Arlington Basin
Up to 10 new ASR wells
Up to 10 new conventional production wells to relocate MZ-1 pumping to MZ-2/3
Net increase in recharge by 25,000 af
Up to 5 new conventional production wells to ensure Hydraulic Control is maintained
Desalter Treatment Facility
Chino Creek Well Field
Streams & Flood Control Channels
Flood Control & Conservation Basins
Geology
Quaternary Alluvium
Faults
Prepared by:
WEI
Miles
Chino Basin
Figure 1-1

Exhibit 15



Prepared by

WEI

Prepared for

OBMP 2020 Update

Scoping Report

Recycled Water Treatment Plants and Discharge Points

Exhibit D-1

Exhibit 16

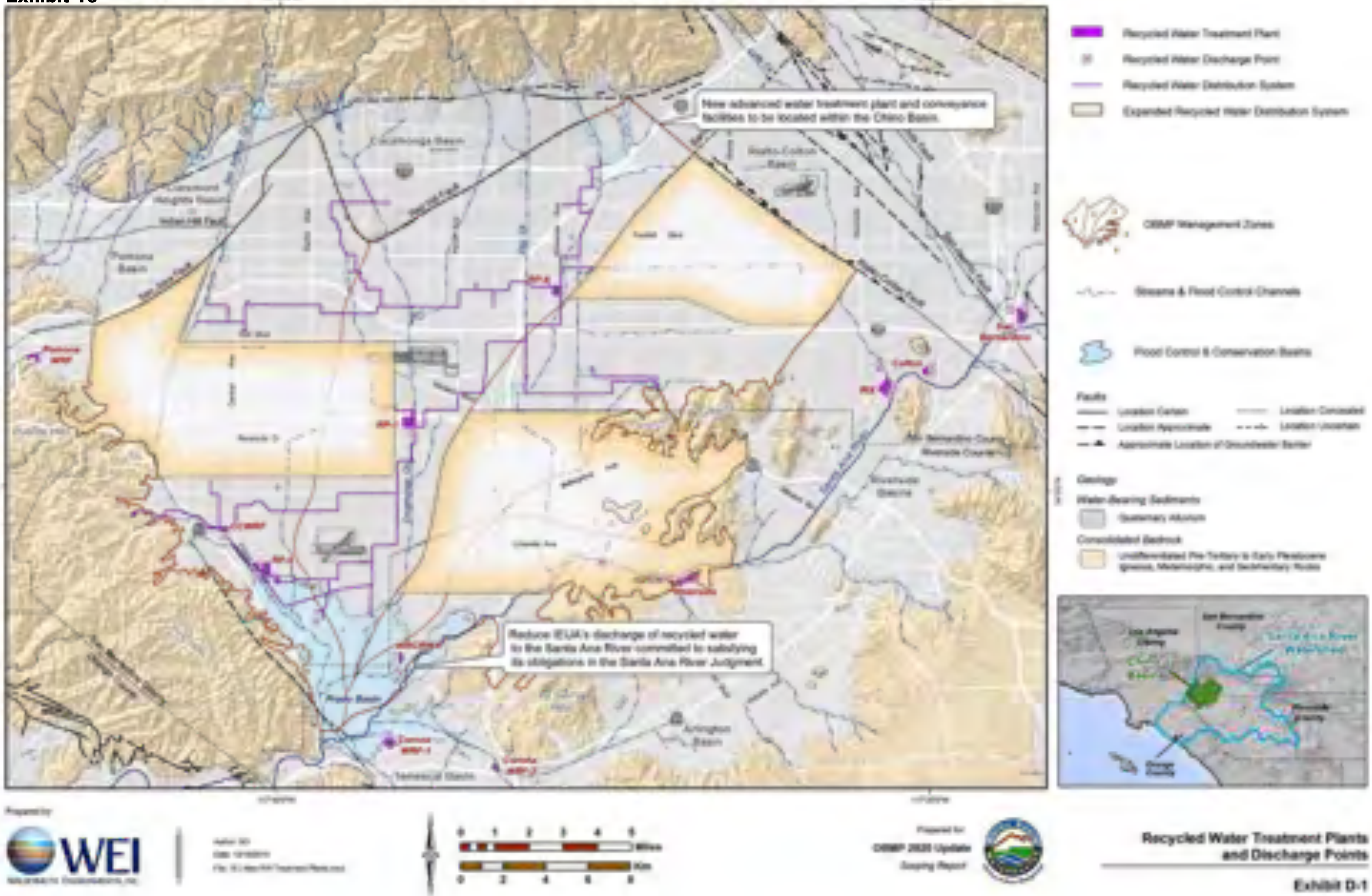

New advanced water treatment plant and conveyance facilities to be located within the Chino Basin.
Reduce IEUA's discharge of recycled water to the Santa Ana River committed to satisfying its obligations in the Santa Ana River Judgment.
WEI
Recycled Water Treatment Plants and Discharge Points
Exhibit D-1

Exhibit 17

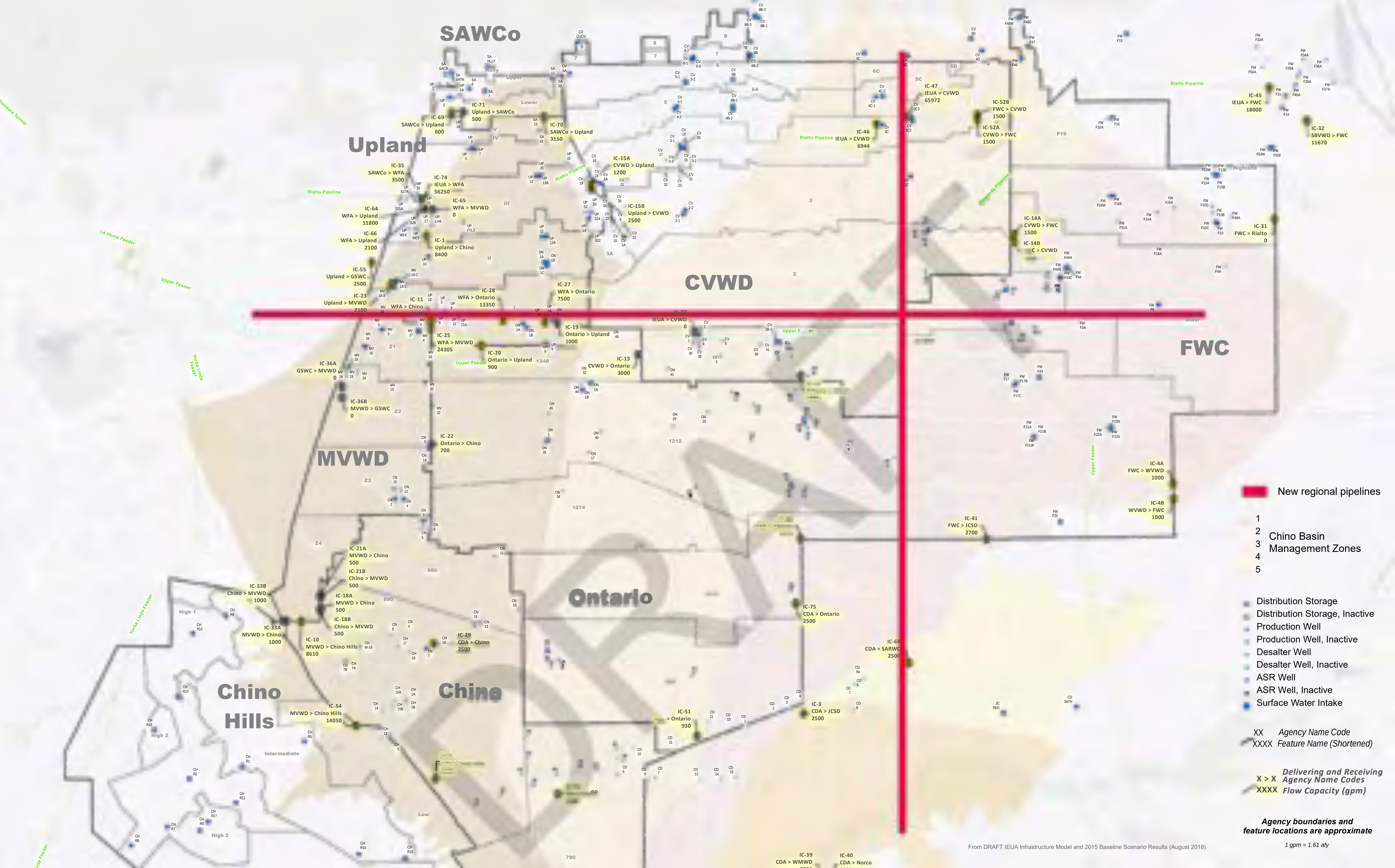

SAWCo
Upland
MVWD
CVWD
FWC
Ontario
Chino
Chino
Hills
Rialto Pipeline
Upper Feeder
La Verne Feeder
Yorba Linda Feeder
IC-47
IEUA > CVWD
65972
IC-45
IEUA > FWC
18000
IC-32
SBVWD > FWC
11670
IC-74
IEUA > WFA
56250
IC-25
WFA > MVWD
24305
IC-28
WFA > Ontario
13350
IC-54
MVWD > Chino Hills
14050
IC-10
MVWD > Chino Hills
8610
IC-1
Upland > Chino
8400
New regional pipelines
1
2
3
4
5
Chino Basin
Management Zones
Distribution Storage
Distribution Storage, Inactive
Production Well
Production Well, Inactive
Desalter Well
Desalter Well, Inactive
ASR Well
ASR Well, Inactive
Surface Water Intake
XX Agency Name Code
XXXX Feature Name (Shortened)
X > X Delivering and Receiving Agency Name Codes
XXXX Flow Capacity (gpm)
Agency boundaries and feature locations are approximate
1 gpm = 1.61 afy
From DRAFT IEUA Infrastructure Model and 2015 Baseline Scenario Results (August 2018)
DRAFT

Exhibit 18

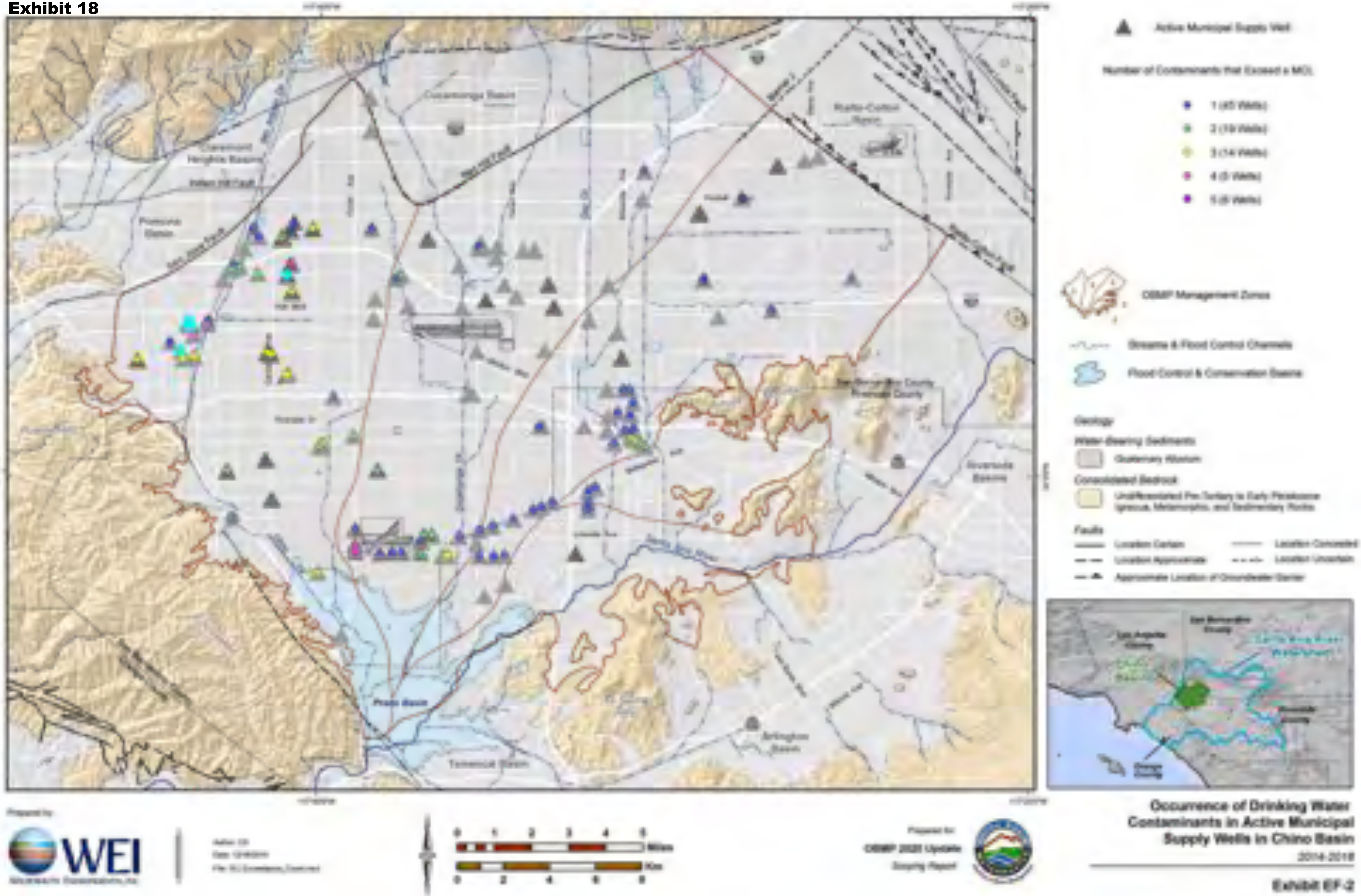
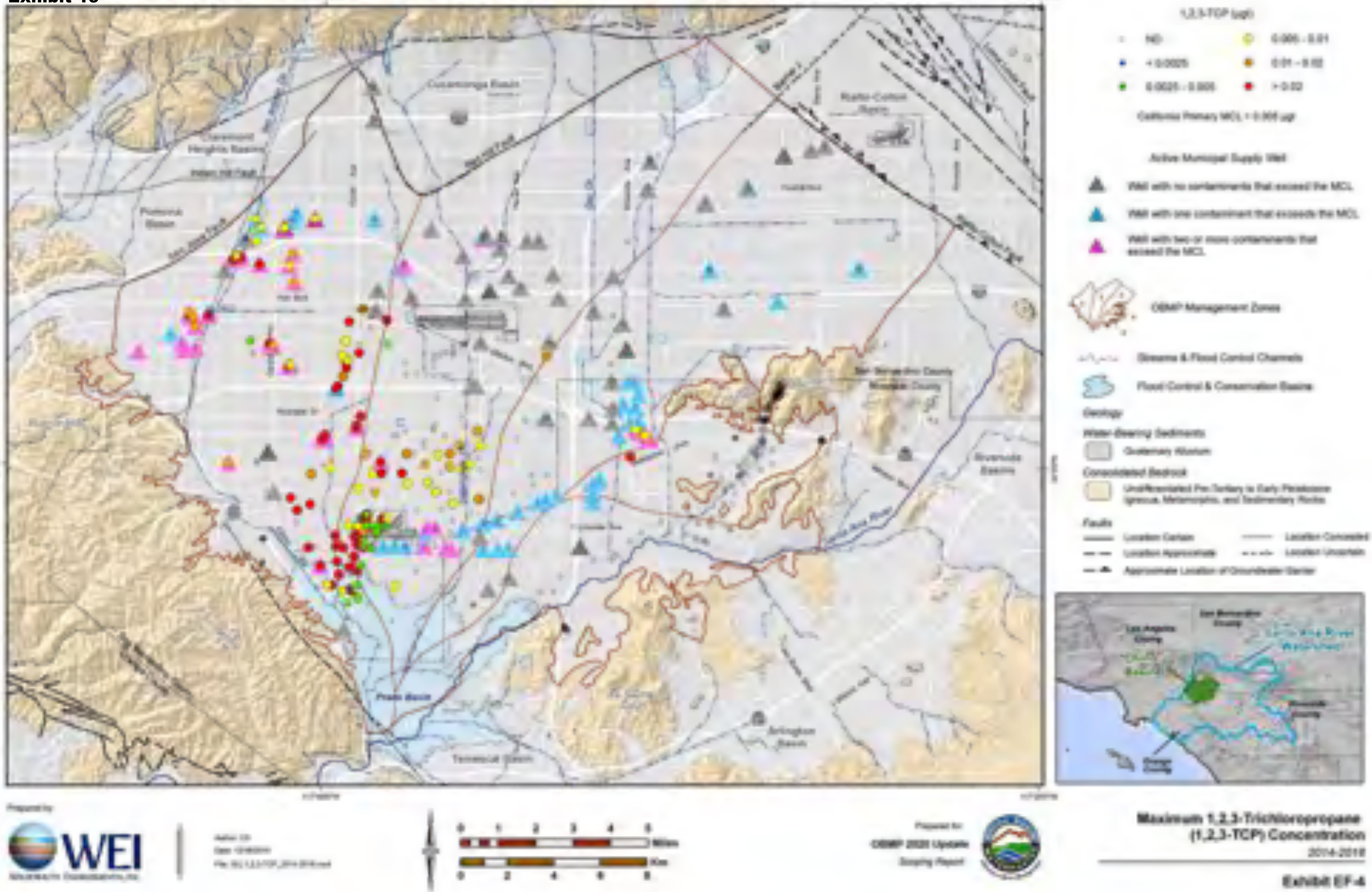
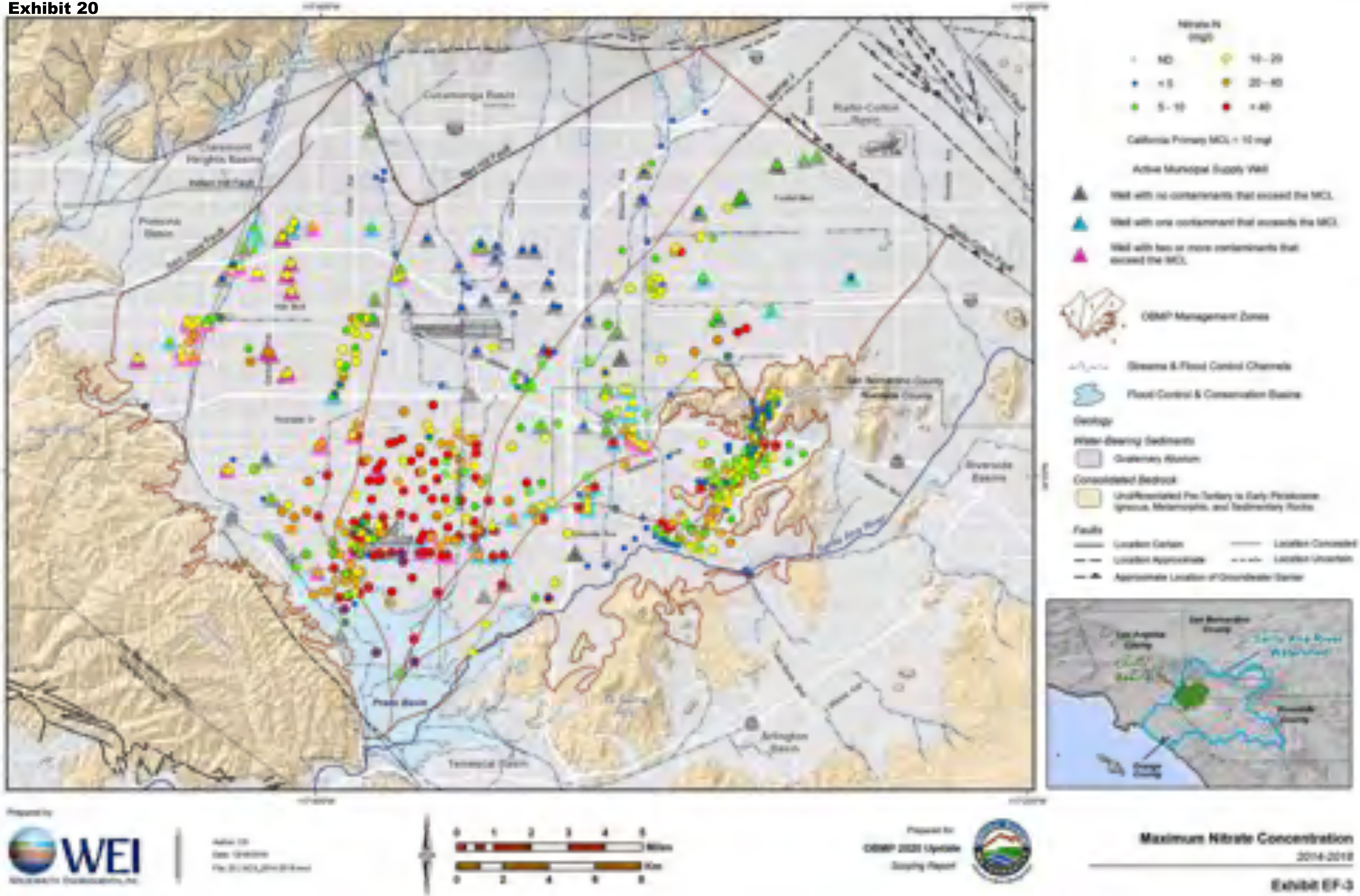

Active Municipal Supply Well
Number of Contaminants that Exceed a MCL
WEI
Prepared for
OBMP 2020 Update
Scoping Report
Occurrence of Drinking Water Contaminants in Active Municipal Supply Wells in Chino Basin
2014-2018
Exhibit EF-2

Exhibit 19



Geology
Water-Bearing Sediments
Consolidated Bedrock
Faults
WEI
Maximum 1,2,3-Trichloropropane
(1,2,3-TCP) Concentration
2014-2018
Exhibit EF-4

Exhibit 20



WEI
OBMP 2020 Update
Maximum Nitrate Concentration
2014-2018
Exhibit EF-3

Exhibit 21

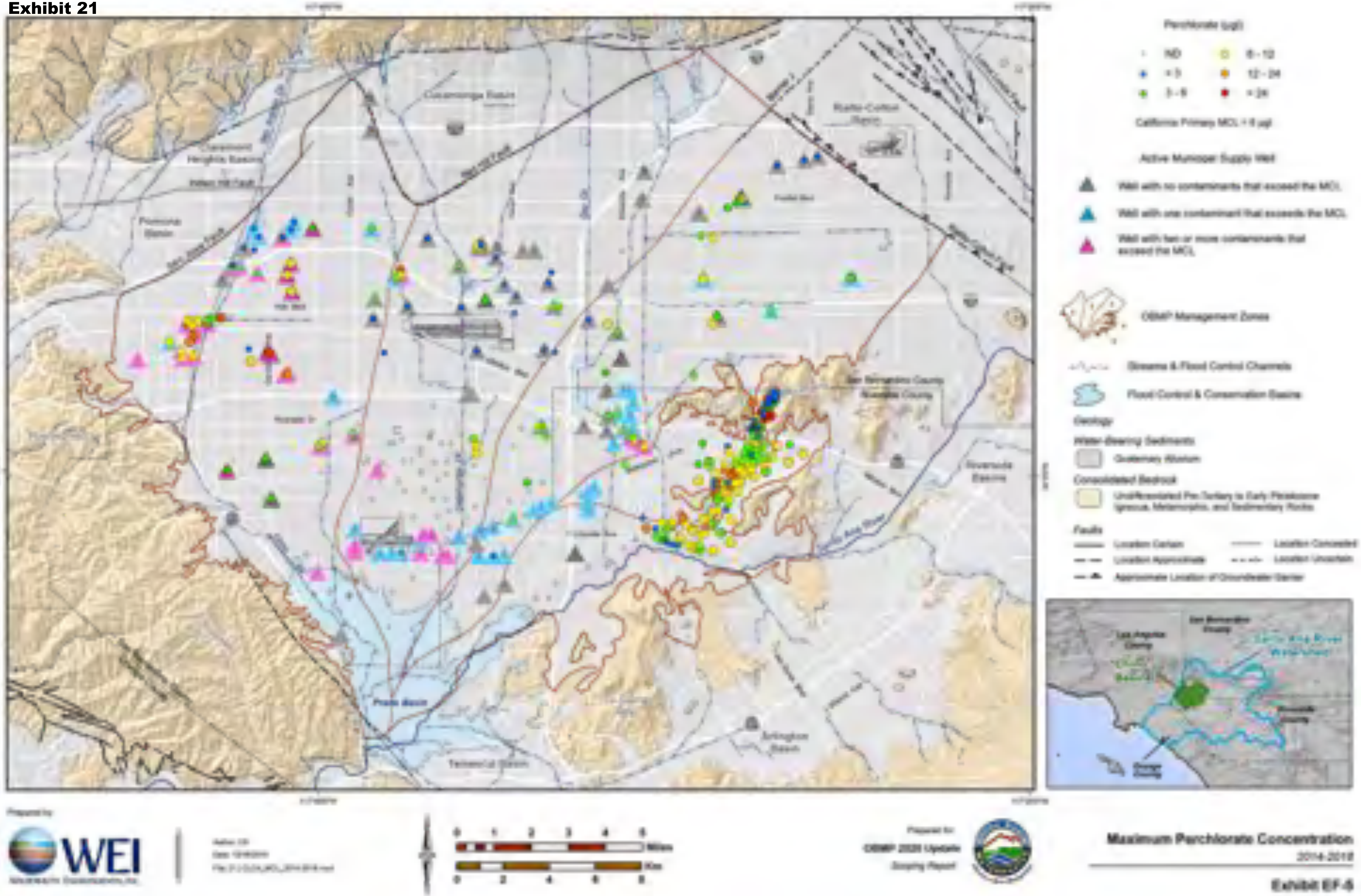
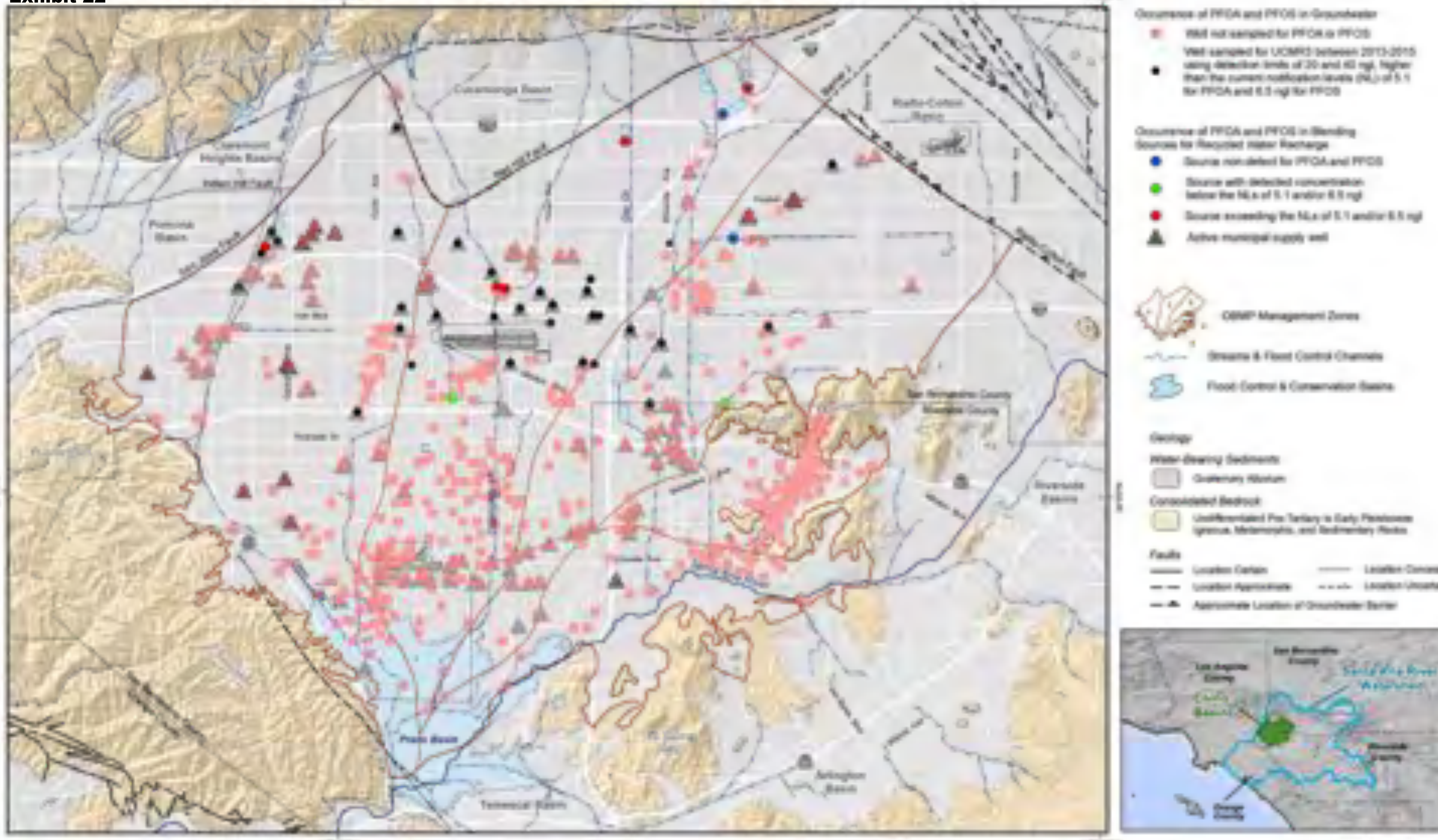

Perchlorate (µg/l)
ND
6 - 12
12 - 24
Active Municipal Supply Well
Well with no contaminants that exceed the MCL
Well with one contaminant that exceeds the MCL
Well with two or more contaminants that exceed the MCL
OBMP Management Zones
Chino Basin
Prado Basin
WEI
Prepared for:
OBMP 2020 Update
Scoping Report
Maximum Perchlorate Concentration
2014-2018
Exhibit EF-6

Exhibit 22



Prepared by

WEI

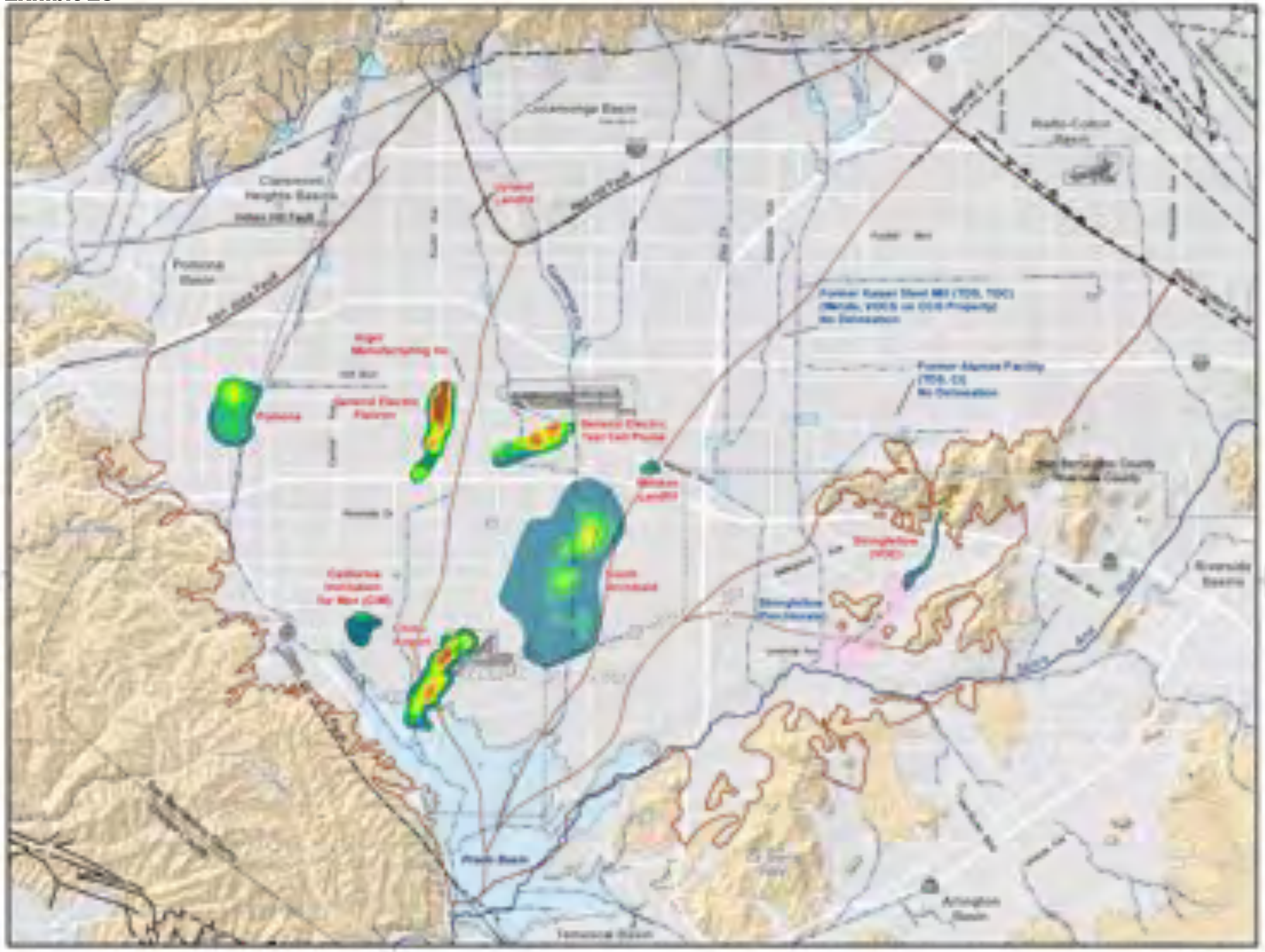
Prepared for
OBMP 2020 Update
Scoping Report

PFOA and PFOS Concentrations

Through March 2019

Exhibit EF-10

Exhibit 23



VOC Concentration (µg/l)

- > 0 to ≤ 5
- > 5 to ≤ 10
- > 10 to ≤ 20
- > 20 to ≤ 50
- > 50 to ≤ 100
- > 100 to ≤ 200
- > 200 to ≤ 500
- > 500

The VOC plumes shown on the map are generalized illustrations of the estimated spatial extent of TCE or PCE, based on the maximum concentration measured at wells over the five-year period of July 2013 to June 2018. The VOC plume illustrations were created with the grid function in Golden Software's Surfer 16 using an ordinary kriging interpolation model with model input parameter estimation and optimization performed by semivariogram analysis in Golden Software's Surfer 16. Interpretations of the plume extent and boundary delineation were made based on measured concentrations and local groundwater flow patterns as predicted by the Chino Basin groundwater flow model.

VOC Plumes Labeled in Red by Name

Other Plumes - Labeled in Blue by Name and Dominant Contaminant

The plumes characterized by color ramp represent Watermaster's most recent characterization of the primary contaminant of concern. The spatial extent of the VOC contamination was delineated by Watermaster based on the five-year maximum concentrations of the primary contaminant of concern for the period of July 2013 to June 2018. The primary VOC contaminant of concern in all of the plumes is TCE with the exception of the CIM plume, which is PCE. The VOC plumes associated with the Upland Landfill and the Alger Manufacturing Facility are of limited geographical extent at the scale of this map, so only their general locations are identified.

Other point-source contamination plumes in the Chino Basin include the former Kaiser Steel Mill, the former Alumax Facility, and the Stringfellow NPL Site, which are labeled by name and the primary contaminants associated with the sites. The former Kaiser Steel Mill TDS and total organic carbon (TOC) plume has not been delineated since 2008 (WEI, 2008b), and there are no plume delineations for the contamination associated with the former Kaiser Steel Mill CCG Property for metals and VOCs or the former Alumax Facility for TDS and chloride (Cl). The Stringfellow perchlorate plume shown here was delineated in the most recent remediation evaluation report for the site (Kleinfelder, 2018).

Prepared by:

WEI

0 1 2 3 4 5 Miles

0 2 4 6 8 Km

Prepared for:

2018 State of the Basin Report
Groundwater Quality

Delineation of Groundwater Contamination

Plumes and Point Sources of Concern

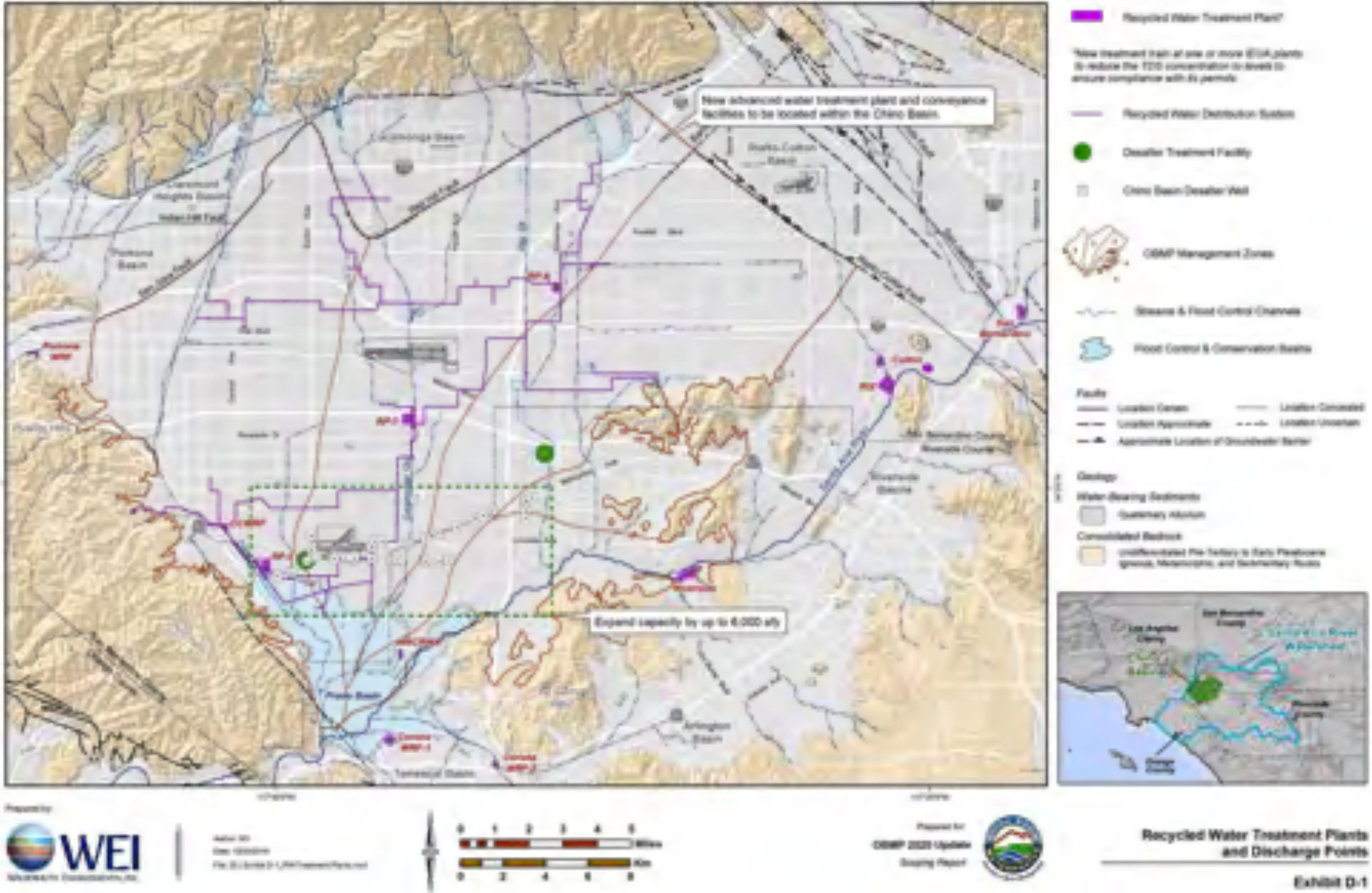
Exhibit 5-15

Exhibit 24

Exhibit 15
Limitations, Compliance Metrics, and Compliance Actions for the Chino Basin Maximum-Benefit Commitments

Source Waters with Water Quality Limitations in the Chino Basin SNMP	Water Quality Limitation	Compliance Metric	Action Limit	Required Compliance Action when Compliance Metric Exceeds the Action Limit
IEUA Recycled Water (Commitment 6)	TDS: 550 mgl	The agency-wide, 12-month running-average concentration	When the compliance metric exceeds 545 mgl for three consecutive months	Submit to the Regional Board for approval a plan and schedule to comply with the water quality limitations within 60 days.
	TIN: 8 mgl		When the compliance metric exceeds 8 mgl in any month	
Combined water sources used for managed recharge: storm, imported and recycled waters (Commitment 7)	TDS: 420 mgl Nitrate: 5 mgl	The five-year, volume-weighted running-average concentration of all sources of managed recharge	TDS: 420 mgl Nitrate: 5 mgl	Prepare a salt offset plan to mitigate salt loading from recharge greater than 420 mgl. Offsets could include desalting of recycled water or groundwater, or increased recharge of low-TDS waters.
Groundwater (Commitment 9)	TDS: 420 mgl	The volume-weighted concentration of groundwater in the Chino North GMZ (computed every three years)	TDS: 420 mgl	Reduce the TDS concentration of IEUA recycled water to comply with the maximum-benefit TDS objective or prepare a salt offset plan to mitigate loading from the use of recycled water than 420 mgl.
	Nitrate: 5 mgl		n/a	This action limit was already exceeded when the objective was established. So long as all other maximum benefit commitments are met, no compliance action is required.

Exhibit 25



New advanced water treatment plant and conveyance facilities to be located within the Chino Basin.
Expand capacity by up to 6,000 afy
Recycled Water Treatment Plant*
Recycled Water Distribution System
Desalter Treatment Facility
Chino Basin Desalter Well
OBMP Management Zones
Streams & Flood Control Channels
Flood Control & Conservation Basins
Faults
Geology
Water-Bearing Sediments
Consolidated Bedrock
Prepared by:
WEI
Prepared for:
OBMP 2020 Update
Scoping Report
Recycled Water Treatment Plants and Discharge Points
Exhibit D-1

Exhibit 26

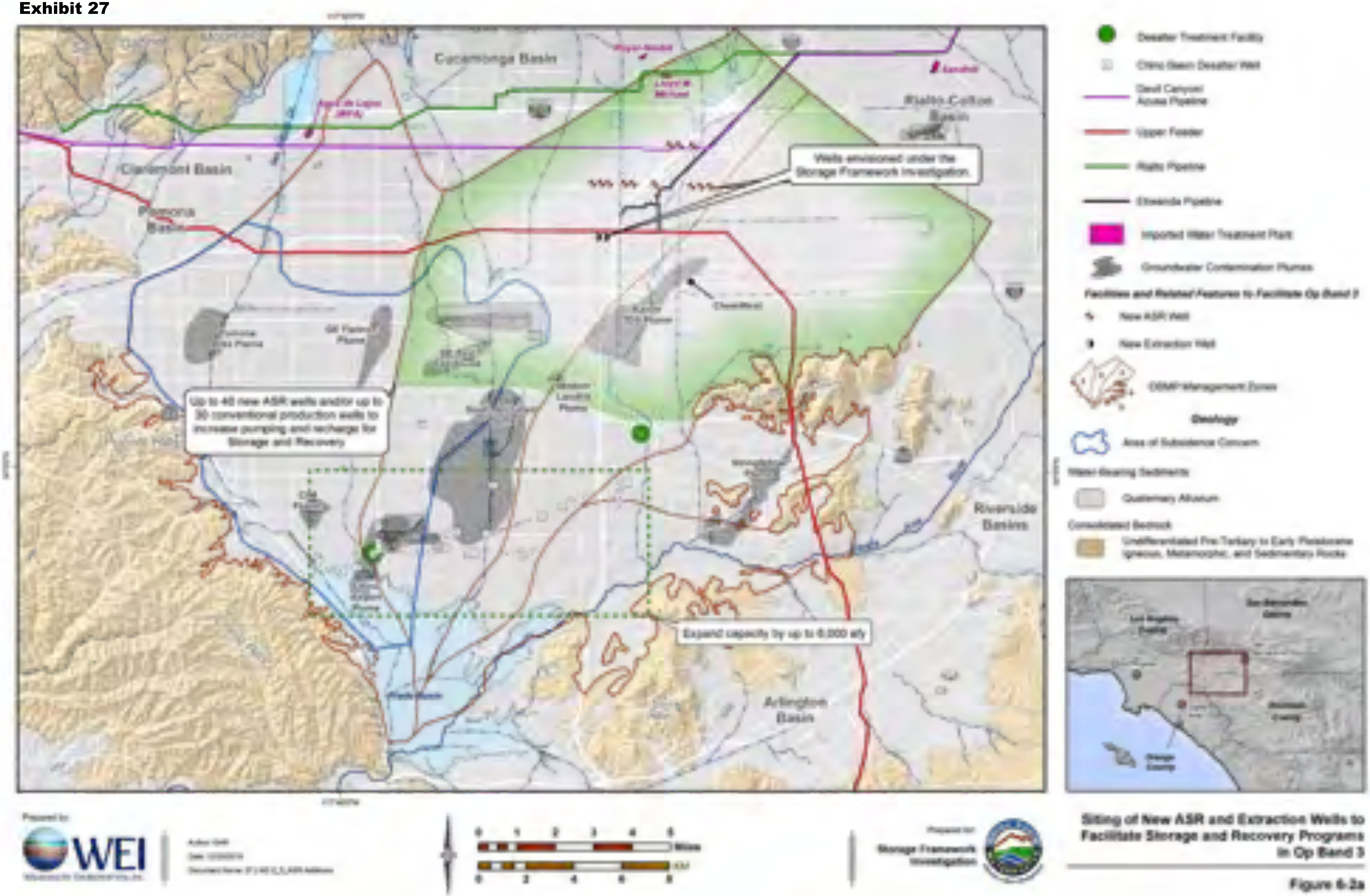
Exhibit 16

Ending Balances in Managed Storage in the Chino Basin[1]
(af)

Fiscal Year ending June 30	Appropriative Pool				Overlying Non-Agricultural Pool			Total Managed Storage by Parties	Dry Year Yield Program Storage	Total Managed Storage
	Carryover	Excess Carryover	Local Supplemental Storage	Subtotal	Carryover	Excess Carryover	Subtotal			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) = (7) + (4)	(9)	(10) = (9) + (8)
2000	28,911	170,342		199,253	6,541	31,031	37,572	236,825	0	236,825
2001	15,940	77,907	92,813	186,660	5,301	32,330	37,631	224,291	0	224,291
2002	13,521	70,103	87,801	171,425	5,285	33,727	39,012	210,437	0	210,437
2003	18,656	71,329	81,180	171,165	6,743	36,850	43,593	214,758	7,738	222,496
2004	21,204	70,503	80,963	172,670	7,177	40,881	48,058	220,728	26,300	247,028
2005	21,289	76,080	88,849	186,218	7,227	45,888	53,115	239,333	38,754	278,087
2006	32,062	56,062	86,170	174,294	7,227	49,178	56,405	230,699	58,653	289,352
2007	34,552	50,895	83,184	168,631	7,084	51,476	58,560	227,191	77,116	304,307
2008	41,626	83,962	81,520	207,108	6,819	45,248	52,067	259,175	74,877	334,052
2009	42,795	101,908	79,890	224,593	6,672	46,600	53,272	277,865	34,494	312,359
2010	41,263	120,897	90,133	252,293	6,934	47,732	54,666	306,959	8,543	315,502
2011	41,412	146,074	98,080	285,566	6,959	49,343	56,302	341,868	0	341,868
2012	42,614	209,981	116,138	368,733	6,914	13,993	20,907	389,640	0	389,640
2013	39,413	225,068	116,378	380,859	7,073	15,473	22,546	403,405	0	403,405
2014	41,708	224,496	123,484	389,688	6,478	12,812	19,290	408,978	0	408,978
2015	40,092	239,517	127,994	407,603	6,823	12,225	19,048	426,651	0	426,651
2016	39,733	248,013	131,522	419,267	7,195	9,949	17,144	436,411	0	436,411
2017	38,340	260,682	143,552	442,575	7,226	8,292	15,519	458,093	6,315	464,408
2018	34,582	254,221	155,018	443,821	7,198	10,775	17,973	461,795	41,380	503,174
2019	38,605	279,033	166,406	484,044	7,227	12,004	19,231	503,275	45,969	549,244

1 -- WEI. (2019). Draft Storage Management Plan.

Exhibit 27



Cucamonga Basin
Claremont Basin
Pomona Basin
Rialto-Colton Basin
Riverside Basin
Arlington Basin
Wells envisioned under the Storage Framework Investigation.
Up to 40 new ASR wells and/or up to 30 conventional production wells to increase pumping and recharge for Storage and Recovery
Desalter Treatment Facility
Chino Basin Desalter Well
Upper Feeder
Rialto Pipeline
Etiwanda Pipeline
Imported Water Treatment Plant
Groundwater Contamination Plumes
New ASR Well
New Extraction Well
OBMP Management Zones
Geology
Area of Subsidence Concern
Water-Bearing Sediments
Quaternary Alluvium
Consolidated Bedrock
Miles
WEI
Storage Framework Investigation
Siting of New ASR and Extraction Wells to Facilitate Storage and Recovery Programs in Op Band 3
Figure 6-2a

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

Management Zone 1
CNDDB and IPaC Lists

RareFind

OBMPU Management Zone 1

Query Summary:
Quad IS (San Dimas (3411717) OR Ontario (3411716) OR Mt. Baldy (3411726) OR Prado Dam (3311786) OR Guasti (3411715))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Abronia villosa var. aurita	chaparral sand-verbena	Dicots	PDNYC010P1	98	1	None	None	G5T2?	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Desert dunes
Accipiter cooperii	Cooper's hawk	Birds	ABNKC12040	118	1	None	None	G5	S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Cismontane woodland, Riparian forest, Riparian woodland, Upper montane coniferous forest
Agelaius tricolor	tricolored blackbird	Birds	ABPBXB0020	955	4	None	Threatened	G2G3	S1S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Marsh & swamp, Swamp, Wetland
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	Birds	ABPBX91091	235	3	None	None	G5T3	S3	null	CDFW_WL-Watch List	Chaparral, Coastal scrub
Ammodramus savannarum	grasshopper sparrow	Birds	ABPBXA0020	27	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Valley & foothill grassland
Anaxyrus californicus	arroyo toad	Amphibians	AAABB01230	139	1	Endangered	None	G2G3	S2S3	null	CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered	Desert wash, Riparian scrub, Riparian woodland, South coast flowing waters, South coast standing waters
Anniella stebbinsi	southern California legless lizard	Reptiles	ARACC01060	417	11	None	None	G3	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Broadleaved upland forest, Chaparral, Coastal dunes, Coastal scrub
Antrozous pallidus	pallid bat	Mammals	AMACC10010	420	2	None	None	G5	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive, WBWG_H-High Priority	Chaparral, Coastal scrub, Desert wash, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Riparian woodland, Sonoran desert scrub, Upper montane coniferous forest, Valley & foothill grassland

Aquila chrysaetos	golden eagle	Birds	ABNKC22010	321	3	None	None	G5	S3	null	BLM_S-Sensitive, CDF_S-Sensitive, CDFW_FP-Fully Protected, CDFW_WL-Watch List, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Broadleaved upland forest, Cismontane woodland, Coastal prairie, Great Basin grassland, Great Basin scrub, Lower montane coniferous forest, Pinon & juniper woodlands, Upper montane coniferous forest, Valley & foothill grassland
Arctostaphylos glandulosa ssp. gabrielensis	San Gabriel manzanita	Dicots	PDERI042P0	35	3	None	None	G5T3	S3	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral
Arizona elegans occidentalis	California glossy snake	Reptiles	ARADB01017	260	5	None	None	G5T2	S2	null	CDFW_SSC-Species of Special Concern	null
Asio otus	long-eared owl	Birds	ABNSB13010	48	1	None	None	G5	S3?	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Cismontane woodland, Great Basin scrub, Riparian forest, Riparian woodland, Upper montane coniferous forest
Aspidoscelis hyperythra	orange-throated whiptail	Reptiles	ARACJ02060	369	2	None	None	G5	S2S3	null	CDFW_WL-Watch List, IUCN_LC-Least Concern, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Aspidoscelis tigris stejnegeri	coastal whiptail	Reptiles	ARACJ02143	148	2	None	None	G5T5	S3	null	CDFW_SSC-Species of Special Concern	null
Astragalus brauntonii	Braunton's milk-vetch	Dicots	PDFAB0F1G0	44	1	Endangered	None	G2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Chaparral, Coastal scrub, Limestone, Valley & foothill grassland
Athene cunicularia	burrowing owl	Birds	ABNSB10010	1989	31	None	None	G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Coastal prairie, Coastal scrub, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland
Atriplex coulteri	Coulter's saltbush	Dicots	PDCHE040E0	121	1	None	None	G3	S1S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Coastal bluff scrub, Coastal dunes, Coastal scrub, Valley & foothill grassland
Batrachoseps gabrieli	San Gabriel slender salamander	Amphibians	AAAAD02110	8	3	None	None	G2G3	S2S3	null	IUCN_DD-Data Deficient, USFS_S-Sensitive	Talus slope
Berberis nevinii	Nevin's barberry	Dicots	PDBER060A0	32	4	Endangered	Endangered	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub, Riparian scrub

Bombus crotchii	Crotch bumble bee	Insects	IIHYM24480	234	5	None	Candidate Endangered	G3G4	S1S2	null	null	null
Buteo swainsoni	Swainson's hawk	Birds	ABNKC19070	2518	2	None	Threatened	G5	S3	null	BLM_S-Sensitive, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Great Basin grassland, Riparian forest, Riparian woodland, Valley & foothill grassland
California Walnut Woodland	California Walnut Woodland	Woodland	CTT71210CA	76	13	None	None	G2	S2.1	null	null	Cismontane woodland
Callophrys mossii hidakupa	San Gabriel Mountains elfin butterfly	Insects	IILEPE2206	3	3	None	None	G4T1T2	S1S2	null	USFS_S-Sensitive	Lower montane coniferous forest
Calochortus clavatus var. gracilis	slender mariposa-lily	Monocots	PMLIL0D096	143	5	None	None	G4T2T3	S2S3	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Calochortus plummerae	Plummer's mariposa-lily	Monocots	PMLIL0D150	230	14	None	None	G4	S4	4.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Valley & foothill grassland
Calochortus weedii var. intermedius	intermediate mariposa-lily	Monocots	PMLIL0D1J1	140	6	None	None	G3G4T2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Calystegia felix	lucky morning-glory	Dicots	PDCON040P0	10	6	None	None	G1Q	S1	1B.1	null	Meadow & seep, Riparian scrub
Campylorhynchus brunneicapillus sandiegensis	coastal cactus wren	Birds	ABPBG02095	156	1	None	None	G5T3Q	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Coastal scrub
Canyon Live Oak Ravine Forest	Canyon Live Oak Ravine Forest	Riparian	CTT61350CA	50	14	None	None	G3	S3.3	null	null	Riparian forest
Catostomus santaanae	Santa Ana sucker	Fish	AFCJC02190	28	2	Threatened	None	G1	S1	null	AFS_TH-Threatened, IUCN_VU-Vulnerable	Aquatic, South coast flowing waters
Centromadia pungens ssp. laevis	smooth tarplant	Dicots	PDAST4R0R4	126	1	None	None	G3G4T2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Alkali playa, Chenopod scrub, Meadow & seep, Riparian woodland, Valley & foothill grassland, Wetland
Chaetodipus fallax fallax	northwestern San Diego pocket mouse	Mammals	AMAFD05031	101	3	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Chaparral, Coastal scrub
Chorizanthe parryi var. parryi	Parry's spineflower	Dicots	PDPGN040J2	150	2	None	None	G3T2	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Cladium californicum	California saw-grass	Monocots	PMCYP04010	13	1	None	None	G4	S2	2B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Alkali marsh, Freshwater marsh, Meadow & seep, Wetland
Coccyzus	western	Birds	ABNRB02022	156	3	Threatened	Endangered	G5T2T3	S1	null	BLM_S-	Riparian forest

americanus occidentalis	yellow-billed cuckoo										Sensitive, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	
Coturnicops noveboracensis	yellow rail	Birds	ABNME01010	45	1	None	None	G4	S1S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Meadow & seep
Crotalus ruber	red-diamond rattlesnake	Reptiles	ARADE02090	192	3	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Chaparral, Mojavean desert scrub, Sonoran desert scrub
Cypseloides niger	black swift	Birds	ABNUA01010	46	1	None	None	G4	S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, NABCI_YWL-Yellow Watch List, USFWS_BCC-Birds of Conservation Concern	null
Diplectrona californica	California diplectronan caddisfly	Insects	IITRI23010	1	1	None	None	G1G2	S1S2	null	null	Aquatic
Dipodomys merriami parvus	San Bernardino kangaroo rat	Mammals	AMAFD03143	81	3	Endangered	Candidate Endangered	G5T1	S1	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Dipodomys stephensi	Stephens' kangaroo rat	Mammals	AMAFD03100	220	1	Endangered	Threatened	G2	S2	null	IUCN_EN-Endangered	Coastal scrub, Valley & foothill grassland
Dodecahema leptoceras	slender-horned spineflower	Dicots	PDPGN0V010	41	1	Endangered	Endangered	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub
Dudleya multicaulis	many-stemmed dudleya	Dicots	PDCRA040H0	154	14	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Elanus leucurus	white-tailed kite	Birds	ABNKC06010	180	3	None	None	G5	S3S4	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_LC-Least Concern	Cismontane woodland, Marsh & swamp, Riparian woodland, Valley & foothill grassland, Wetland
Empidonax traillii extimus	southwestern willow flycatcher	Birds	ABPAE33043	70	2	Endangered	Endangered	G5T2	S1	null	NABCI_RWL-Red Watch List	Riparian woodland
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1385	2	None	None	G3G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable, USFS_S-Sensitive	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San Joaquin flowing

												waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Eriastrum densifolium ssp. sanctorum	Santa Ana River woollystar	Dicots	PDPLM03035	31	1	Endangered	Endangered	G4T1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Coastal scrub
Eumops perotis californicus	western mastiff bat	Mammals	AMACD02011	296	5	None	None	G5T4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, WBWG_H-High Priority	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Falco columbarius	merlin	Birds	ABNKD06030	37	1	None	None	G5	S3S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Estuary, Great Basin grassland, Valley & foothill grassland
Gila orcuttii	arroyo chub	Fish	AFCJB13120	49	2	None	None	G2	S2	null	AFS_VU-Vulnerable, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Horkelia cuneata var. puberula	mesa horkelia	Dicots	PDROS0W045	103	6	None	None	G4T1	S1	1B.1	USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Icteria virens	yellow-breasted chat	Birds	ABPBX24010	100	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Riparian forest, Riparian scrub, Riparian woodland
Lasiurus cinereus	hoary bat	Mammals	AMACC05030	238	2	None	None	G5	S4	null	IUCN_LC-Least Concern, WBWG_M-Medium Priority	Broadleaved upland forest, Cismontane woodland, Lower montane coniferous forest, North coast coniferous forest
Lasiurus xanthinus	western yellow bat	Mammals	AMACC05070	58	2	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_H-High Priority	Desert wash
Laterallus jamaicensis coturniculus	California black rail	Birds	ABNME03041	303	1	None	Threatened	G3G4T1	S1	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_NT-Near Threatened, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Brackish marsh, Freshwater marsh, Marsh & swamp, Salt marsh, Wetland
Lepidium virginicum var. robinsonii	Robinson's pepper-grass	Dicots	PDBRA1M114	142	6	None	None	G5T3	S3	4.3	null	Chaparral, Coastal scrub
Lilium parryi	lemon lily	Monocots	PMLIL1A0J0	160	1	None	None	G3	S3	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Lower montane coniferous forest, Meadow & seep, Riparian forest, Upper montane coniferous forest, Wetland
Linanthus	San Gabriel	Dicots	PDPLM090D0	43	1	None	None	G2	S2	1B.2	SB_RSABG-	Chaparral,

concinnus	linanthus										Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Lower montane coniferous forest, Upper montane coniferous forest
Monardella australis ssp. jokerstii	Jokerst's monardella	Dicots	PDLAM18112	3	1	None	None	G4T1?	S1?	1B.1	USFS_S-Sensitive	Chaparral, Lower montane coniferous forest
Monardella macrantha ssp. hallii	Hall's monardella	Dicots	PDLAM180E1	41	4	None	None	G5T3	S3	1B.3	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Broadleaved upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest, Valley & foothill grassland
Muhlenbergia californica	California muhly	Monocots	PMPOA480A0	5	1	None	None	G4	S4	4.3	null	Chaparral, Coastal scrub, Lower montane coniferous forest, Meadow & seep
Muhlenbergia utilis	aparejo grass	Monocots	PMPOA481X0	14	1	None	None	G4	S2S3	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Marsh & swamp, Meadow & seep, Ultramafic
Navarretia prostrata	prostrate vernal pool navarretia	Dicots	PDPLM0C0Q0	60	1	None	None	G2	S2	1B.2	null	Coastal scrub, Meadow & seep, Valley & foothill grassland, Vernal pool, Wetland
Neotoma lepida intermedia	San Diego desert woodrat	Mammals	AMAFF08041	132	4	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Nyctinomops femorosaccus	pocketed free-tailed bat	Mammals	AMACD04010	90	1	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_M-Medium Priority	Joshua tree woodland, Pinon & juniper woodlands, Riparian scrub, Sonoran desert scrub
Nyctinomops macrotis	big free-tailed bat	Mammals	AMACD04020	32	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_MH-Medium-High Priority	null
Oncorhynchus mykiss irideus pop. 10	steelhead - southern California DPS	Fish	AFCHA0209J	20	1	Endangered	None	G5T1Q	S1	null	AFS_EN-Endangered	Aquatic, South coast flowing waters
Oreonana vestita	woolly mountain-parsley	Dicots	PDAPI1G030	55	2	None	None	G3	S3	1B.3	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Lower montane coniferous forest, Subalpine coniferous forest, Upper montane coniferous forest
Orobanche valida ssp. valida	Rock Creek broomrape	Dicots	PDORO040G2	12	2	None	None	G4T2	S2	1B.2	USFS_S-Sensitive	Chaparral, Pinon & juniper woodlands
Ovis canadensis nelsoni	desert bighorn sheep	Mammals	AMALE04013	46	1	None	None	G4T4	S3	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, USFS_S-Sensitive	Alpine, Alpine dwarf scrub, Chaparral, Chenopod scrub, Great Basin scrub, Mojavean desert scrub, Montane dwarf scrub, Pinon & juniper woodlands, Riparian

												woodland, Sonoran desert scrub
Perognathus longimembris brevinasus	Los Angeles pocket mouse	Mammals	AMAFD01041	70	4	None	None	G5T1T2	S1S2	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Phacelia stellaris	Brand's star phacelia	Dicots	PDHYD0C510	15	1	None	None	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Coastal dunes, Coastal scrub
Phrynosoma blainvillii	coast horned lizard	Reptiles	ARACF12100	784	5	None	None	G3G4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Chaparral, Cismontane woodland, Coastal bluff scrub, Coastal scrub, Desert wash, Pinon & juniper woodlands, Riparian scrub, Riparian woodland, Valley & foothill grassland
Polioptila californica californica	coastal California gnatcatcher	Birds	ABPBJ08081	846	22	Threatened	None	G4G5T2Q	S2	null	CDFW_SSC-Species of Special Concern, NABCI_YWL-Yellow Watch List	Coastal bluff scrub, Coastal scrub
Pseudognaphalium leucocephalum	white rabbit-tobacco	Dicots	PDAST440C0	62	3	None	None	G4	S2	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland
Rana boylii	foothill yellow-legged frog	Amphibians	AAABH01050	2468	1	None	Candidate Threatened	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened, USFS_S-Sensitive	Aquatic, Chaparral, Cismontane woodland, Coastal scrub, Klamath/North coast flowing waters, Lower montane coniferous forest, Meadow & seep, Riparian forest, Riparian woodland, Sacramento/San Joaquin flowing waters
Rana muscosa	southern mountain yellow-legged frog	Amphibians	AAABH01330	186	2	Endangered	Endangered	G1	S1	null	CDFW_WL-Watch List, IUCN_EN-Endangered, USFS_S-Sensitive	Aquatic
Rhaphiomidas terminatus abdominalis	Delhi Sands flower-loving fly	Insects	IIDIP05021	36	6	Endangered	None	G1T1	S1	null	null	Interior dunes
Riversidian Alluvial Fan Sage Scrub	Riversidian Alluvial Fan Sage Scrub	Scrub	CTT32720CA	30	5	None	None	G1	S1.1	null	null	Coastal scrub
Senecio aphanactis	chaparral ragwort	Dicots	PDAST8H060	98	1	None	None	G3	S2	2B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub
Setophaga petechia	yellow warbler	Birds	ABPBX03010	78	1	None	None	G5	S3S4	null	CDFW_SSC-Species of Special Concern, USFWS_BCC-Birds of Conservation Concern	Riparian forest, Riparian scrub, Riparian woodland
Sidalcea neomexicana	salt spring checkerbloom	Dicots	PDMAL110J0	30	3	None	None	G4	S2	2B.2	USFS_S-Sensitive	Alkali playa, Chaparral, Coastal scrub, Lower montane coniferous forest, Mojavean desert scrub, Wetland

Southern California Arroyo Chub/Santa Ana Sucker Stream	Southern California Arroyo Chub/Santa Ana Sucker Stream	Inland Waters	CARE2330CA	4	2	None	None	GNR	SNR	null	null	null
Southern Coast Live Oak Riparian Forest	Southern Coast Live Oak Riparian Forest	Riparian	CTT61310CA	246	5	None	None	G4	S4	null	null	Riparian forest
Southern Cottonwood Willow Riparian Forest	Southern Cottonwood Willow Riparian Forest	Riparian	CTT61330CA	111	3	None	None	G3	S3.2	null	null	Riparian forest
Southern Sycamore Alder Riparian Woodland	Southern Sycamore Alder Riparian Woodland	Riparian	CTT62400CA	230	14	None	None	G4	S4	null	null	Riparian woodland
Southern Willow Scrub	Southern Willow Scrub	Riparian	CTT63320CA	45	1	None	None	G3	S2.1	null	null	Riparian scrub
Spea hammondii	western spadefoot	Amphibians	AAABF02020	1213	6	None	None	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened	Cismontane woodland, Coastal scrub, Valley & foothill grassland, Vernal pool, Wetland
Symphyotrichum defoliatum	San Bernardino aster	Dicots	PDASTE80C0	102	5	None	None	G2	S2	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Valley & foothill grassland
Symphyotrichum greatae	Greata's aster	Dicots	PDASTE80U0	56	4	None	None	G2	S2	1B.3	BLM_S-Sensitive	Broadleaved upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest, Riparian woodland
Taricha torosa	Coast Range newt	Amphibians	AAAAF02032	88	2	None	None	G4	S4	null	CDFW_SSC-Species of Special Concern	null
Taxidea taxus	American badger	Mammals	AMAJF04010	592	2	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Alkali marsh, Alkali playa, Alpine, Alpine dwarf scrub, Bog & fen, Brackish marsh, Broadleaved upland forest, Chaparral, Chenopod scrub, Cismontane woodland, Closed-cone coniferous forest, Coastal bluff scrub, Coastal dunes, Coastal prairie, Coastal scrub, Desert dunes, Desert wash, Freshwater marsh, Great Basin grassland, Great Basin scrub, Interior dunes, Ione formation, Joshua tree woodland, Limestone, Lower montane coniferous forest, Marsh &

													swamp, Meadow & seep, Mojavean desert scrub, Montane dwarf scrub, North coast coniferous forest, Oldgrowth, Pavement plain, Redwood, Riparian forest, Riparian scrub, Riparian woodland, Salt marsh, Sonoran desert scrub, Sonoran thorn woodland, Ultramafic, Upper montane coniferous forest, Upper Sonoran scrub, Valley & foothill grassland
Thamnophis hammondii	two-striped gartersnake	Reptiles	ARADB36160	184	2	None	None	G4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive	Marsh & swamp, Riparian scrub, Riparian woodland, Wetland
Thysanocarpus rigidus	rigid fringepod	Dicots	PDBRA2Q070	5	1	None	None	G1G2	S1	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Pinon & juniper woodlands
Vireo bellii pusillus	least Bell's vireo	Birds	ABPBW01114	503	15	Endangered	Endangered	G5T2	S2	null	IUCN_NT-Near Threatened, NABCI_YWL-Yellow Watch List	Riparian forest, Riparian scrub, Riparian woodland
Walnut Forest	Walnut Forest	Forest	CTT81600CA	6	3	None	None	G1	S1.1	null	null	Broadleaved upland forest

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
Phone: (760) 431-9440 Fax: (760) 431-5901
http://www.fws.gov/carlsbad/

In Reply Refer To:
Consultation Code: 08ECAR00-2020-SLI-0426
Event Code: 08ECAR00-2020-E-01015
Project Name: OBMP PEIR Update MZ1

January 07, 2020

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
(760) 431-9440

Project Summary

Consultation Code: 08ECAR00-2020-SLI-0426

Event Code: 08ECAR00-2020-E-01015

Project Name: OBMP PEIR Update MZ1

Project Type: WATER SUPPLY / DELIVERY

Project Description: Optimum Basin Management Plan PEIR Update - MZ1

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/34.02331759100005N117.695348353335432W

Counties: Los Angeles, CA | Riverside, CA | San Bernardino, CA

Endangered Species Act Species

There is a total of 12 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
San Bernardino Merriam's Kangaroo Rat *Dipodomys merriami parvus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2060	Endangered

Birds

NAME	STATUS
California Condor *Gymnogyps californianus* Population: U.S.A. only, except where listed as an experimental population There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8193	Endangered
Coastal California Gnatcatcher *Polioptila californica californica* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8178	Threatened
Least Bell's Vireo *Vireo bellii pusillus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5945	Endangered
Southwestern Willow Flycatcher *Empidonax traillii extimus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6749	Endangered

Amphibians

NAME	STATUS
Arroyo (=arroyo Southwestern) Toad *Anaxyrus californicus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3762	Endangered

Fishes

NAME	STATUS
Santa Ana Sucker *Catostomus santaanae* Population: 3 CA river basins There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3785	Threatened

Insects

NAME	STATUS
Delhi Sands Flower-loving Fly *Rhaphiomidas terminatus abdominalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1540	Endangered

Flowering Plants

NAME	STATUS
Braunton's Milk-vetch *Astragalus brauntonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5674	Endangered
Nevin's Barberry *Berberis nevinii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8025	Endangered
San Diego Ambrosia *Ambrosia pumila* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8287	Endangered
Thread-leaved Brodiaea *Brodiaea filifolia* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6087	Threatened

Critical habitats

There are 3 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Least Bell's Vireo *Vireo bellii pusillus* https://ecos.fws.gov/ecp/species/5945#crithab	Final
Southwestern Willow Flycatcher *Empidonax traillii extimus* https://ecos.fws.gov/ecp/species/6749#crithab	Final
Yellow-billed Cuckoo *Coccyzus americanus* For information on why this critical habitat appears for your project, even though Yellow-billed Cuckoo is not on the list of potentially affected species at this location, contact the local field office. https://ecos.fws.gov/ecp/species/3911#crithab	Proposed

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

Management Zone 2
CNDDB and IPaC Lists

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE RareFind

OBMPU Management Zone 2

Query Summary:
Quad IS (Prado Dam (3311786) OR Ontario (3411716) OR Guasti (3411715) OR Cucamonga Peak (3411725) OR Devore (3411724) OR Corona North (3311785) OR Fontana (3411714))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Abronia villosa var. aurita	chaparral sand-verbena	Dicots	PDNYC010P1	98	2	None	None	G5T2?	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Desert dunes
Accipiter cooperii	Cooper's hawk	Birds	ABNKC12040	118	1	None	None	G5	S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Cismontane woodland, Riparian forest, Riparian woodland, Upper montane coniferous forest
Agelaius tricolor	tricolored blackbird	Birds	ABPBXB0020	955	8	None	Threatened	G2G3	S1S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Marsh & swamp, Swamp, Wetland
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	Birds	ABPBX91091	235	3	None	None	G5T3	S3	null	CDFW_WL-Watch List	Chaparral, Coastal scrub
Ambrosia monogyra	singlewhorl burrobrush	Dicots	PDAST50010	30	1	None	None	G5	S2	2B.2	null	Chaparral, Sonoran desert scrub
Ammodramus savannarum	grasshopper sparrow	Birds	ABPBXA0020	27	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Valley & foothill grassland
Anniella stebbinsi	southern California legless lizard	Reptiles	ARACC01060	417	29	None	None	G3	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Broadleaved upland forest, Chaparral, Coastal dunes, Coastal scrub
Antrozous pallidus	pallid bat	Mammals	AMACC10010	420	1	None	None	G5	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive, WBWG_H-High Priority	Chaparral, Coastal scrub, Desert wash, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Riparian woodland, Sonoran desert scrub, Upper montane coniferous forest, Valley & foothill grassland
Aquila chrysaetos	golden eagle	Birds	ABNKC22010	321	3	None	None	G5	S3	null	BLM_S-Sensitive, CDF_S-Sensitive,	Broadleaved upland forest, Cismontane woodland,

											CDFW_FP-Fully Protected, CDFW_WL-Watch List, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Coastal prairie, Great Basin grassland, Great Basin scrub, Lower montane coniferous forest, Pinon & juniper woodlands, Upper montane coniferous forest, Valley & foothill grassland
Arctostaphylos glandulosa ssp. gabrielensis	San Gabriel manzanita	Dicots	PDERI042P0	35	1	None	None	G5T3	S3	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral
Arenaria paludicola	marsh sandwort	Dicots	PDCAR040L0	16	1	Endangered	Endangered	G1	S1	1B.1	SB_SBBG-Santa Barbara Botanic Garden	Freshwater marsh, Marsh & swamp, Wetland
Arizona elegans occidentalis	California glossy snake	Reptiles	ARADB01017	260	10	None	None	G5T2	S2	null	CDFW_SSC-Species of Special Concern	null
Artemisiospiza belli belli	Bell's sage sparrow	Birds	ABPBX97021	61	2	None	None	G5T2T3	S3	null	CDFW_WL-Watch List, USFWS_BCC-Birds of Conservation Concern	Chaparral, Coastal scrub
Asio otus	long-eared owl	Birds	ABNSB13010	48	1	None	None	G5	S3?	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Cismontane woodland, Great Basin scrub, Riparian forest, Riparian woodland, Upper montane coniferous forest
Aspidoscelis hyperythra	orange-throated whiptail	Reptiles	ARACJ02060	369	5	None	None	G5	S2S3	null	CDFW_WL-Watch List, IUCN_LC-Least Concern, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Astragalus brauntonii	Braunton's milk-vetch	Dicots	PDFAB0F1G0	44	1	Endangered	None	G2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Chaparral, Coastal scrub, Limestone, Valley & foothill grassland
Athene cunicularia	burrowing owl	Birds	ABNSB10010	1989	48	None	None	G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Coastal prairie, Coastal scrub, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland
Atriplex coulteri	Coulter's saltbush	Dicots	PDCHE040E0	121	1	None	None	G3	S1S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Coastal bluff scrub, Coastal dunes, Coastal scrub, Valley & foothill grassland
Batrachoseps gabrieli	San Gabriel slender salamander	Amphibians	AAAAD02110	8	1	None	None	G2G3	S2S3	null	IUCN_DD-Data Deficient, USFS_S-Sensitive	Talus slope
Berberis nevinii	Nevin's barberry	Dicots	PDBER060A0	32	1	Endangered	Endangered	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara	Chaparral, Cismontane woodland, Coastal scrub, Riparian scrub

											Botanic Garden	
Bombus crotchii	Crotch bumble bee	Insects	IIHYM24480	234	9	None	Candidate Endangered	G3G4	S1S2	null	null	null
Buteo swainsoni	Swainson's hawk	Birds	ABNKC19070	2518	2	None	Threatened	G5	S3	null	BLM_S-Sensitive, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Great Basin grassland, Riparian forest, Riparian woodland, Valley & foothill grassland
California Walnut Woodland	California Walnut Woodland	Woodland	CTT71210CA	76	10	None	None	G2	S2.1	null	null	Cismontane woodland
Calochortus plummerae	Plummer's mariposa-lily	Monocots	PMLIL0D150	230	25	None	None	G4	S4	4.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Valley & foothill grassland
Calochortus weedii var. intermedius	intermediate mariposa-lily	Monocots	PMLIL0D1J1	140	4	None	None	G3G4T2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Calystegia felix	lucky morning-glory	Dicots	PDCON040P0	10	6	None	None	G1Q	S1	1B.1	null	Meadow & seep, Riparian scrub
Campylorhynchus brunneicapillus sandiegensis	coastal cactus wren	Birds	ABPBG02095	156	1	None	None	G5T3Q	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Coastal scrub
Catostomus santaanae	Santa Ana sucker	Fish	AFCJC02190	28	6	Threatened	None	G1	S1	null	AFS_TH-Threatened, IUCN_VU-Vulnerable	Aquatic, South coast flowing waters
Centromadia pungens ssp. laevis	smooth tarplant	Dicots	PDAST4R0R4	126	2	None	None	G3G4T2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Alkali playa, Chenopod scrub, Meadow & seep, Riparian woodland, Valley & foothill grassland, Wetland
Chaetodipus fallax fallax	northwestern San Diego pocket mouse	Mammals	AMAFD05031	101	9	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Chaparral, Coastal scrub
Chaetodipus fallax pallidus	pallid San Diego pocket mouse	Mammals	AMAFD05032	79	1	None	None	G5T34	S3S4	null	CDFW_SSC-Species of Special Concern	Desert wash, Pinon & juniper woodlands, Sonoran desert scrub
Chloropyron maritimum ssp. maritimum	salt marsh bird's-beak	Dicots	PDSCR0J0C2	30	1	Endangered	Endangered	G4?T1	S1	1B.2	SB_CRES-San Diego Zoo CRES Native Gene Seed Bank, SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Coastal dunes, Marsh & swamp, Salt marsh, Wetland
Chorizanthe parryi var. parryi	Parry's spineflower	Dicots	PDPGN040J2	150	13	None	None	G3T2	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Chorizanthe xanti var. leucotheca	white-bracted spineflower	Dicots	PDPGN040Z1	59	4	None	None	G4T3	S3	1B.2	BLM_S-Sensitive,	Coastal scrub, Mojavean desert

											SB_RSABG-Rancho Santa Ana Botanic Garden, SB_USDA-US Dept of Agriculture, USFS_S-Sensitive	scrub, Pinon & juniper woodlands
Cicindela tranquebarica viridissima	greenest tiger beetle	Insects	IICOL02201	1	1	None	None	G5T1	S1	null	null	Riparian woodland
Cladium californicum	California saw-grass	Monocots	PMCYP04010	13	1	None	None	G4	S2	2B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Alkali marsh, Freshwater marsh, Meadow & seep, Wetland
Claytonia peirsonii ssp. peirsonii	Peirson's spring beauty	Dicots	PDPOR03121	9	2	None	None	G2G3T2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Subalpine coniferous forest, Upper montane coniferous forest
Coastal and Valley Freshwater Marsh	Coastal and Valley Freshwater Marsh	Marsh	CTT52410CA	60	1	None	None	G3	S2.1	null	null	Marsh & swamp, Wetland
Coccyzus americanus occidentalis	western yellow-billed cuckoo	Birds	ABNRB02022	156	4	Threatened	Endangered	G5T2T3	S1	null	BLM_S-Sensitive, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Riparian forest
Coleonyx variegatus abbotti	San Diego banded gecko	Reptiles	ARACD01031	8	1	None	None	G5T3T4	S1S2	null	CDFW_SSC-Species of Special Concern	Chaparral, Coastal scrub
Coturnicops noveboracensis	yellow rail	Birds	ABNME01010	45	1	None	None	G4	S1S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Meadow & seep
Crotalus ruber	red-diamond rattlesnake	Reptiles	ARADE02090	192	3	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Chaparral, Mojavean desert scrub, Sonoran desert scrub
Diplectrona californica	California diplectronan caddisfly	Insects	IITRI23010	1	1	None	None	G1G2	S1S2	null	null	Aquatic
Dipodomys merriami parvus	San Bernardino kangaroo rat	Mammals	AMAFD03143	81	37	Endangered	Candidate Endangered	G5T1	S1	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Dipodomys stephensi	Stephens' kangaroo rat	Mammals	AMAFD03100	220	4	Endangered	Threatened	G2	S2	null	IUCN_EN-Endangered	Coastal scrub, Valley & foothill grassland
Dodecahema leptoceras	slender-horned spineflower	Dicots	PDPGN0V010	41	5	Endangered	Endangered	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub
Dudleya multicaulis	many-stemmed dudleya	Dicots	PDCRA040H0	154	4	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Elanus leucurus	white-tailed kite	Birds	ABNKC06010	180	3	None	None	G5	S3S4	null	BLM_S-Sensitive,	Cismontane woodland,

											CDFW_FP-Fully Protected, IUCN_LC-Least Concern	Marsh & swamp, Riparian woodland, Valley & foothill grassland, Wetland
Empidonax traillii extimus	southwestern willow flycatcher	Birds	ABPAE33043	70	3	Endangered	Endangered	G5T2	S1	null	NABCI_RWL-Red Watch List	Riparian woodland
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1385	3	None	None	G3G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable, USFS_S-Sensitive	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Eriastrum densifolium ssp. sanctorum	Santa Ana River woollystar	Dicots	PDPLM03035	31	9	Endangered	Endangered	G4T1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Coastal scrub
Eriogonum microthecum var. johnstonii	Johnston's buckwheat	Dicots	PDPGN083W5	7	2	None	None	G5T2	S2	1B.3	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Limestone, Subalpine coniferous forest, Upper montane coniferous forest
Eumops perotis californicus	western mastiff bat	Mammals	AMACD02011	296	6	None	None	G5T4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, WBWG_H-High Priority	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Gila orcuttii	arroyo chub	Fish	AFCJB13120	49	2	None	None	G2	S2	null	AFS_VU-Vulnerable, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Horkelia cuneata var. puberula	mesa horkelia	Dicots	PDROS0W045	103	10	None	None	G4T1	S1	1B.1	USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Icteria virens	yellow-breasted chat	Birds	ABPBX24010	100	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Riparian forest, Riparian scrub, Riparian woodland
Lasiurus xanthinus	western yellow bat	Mammals	AMACC05070	58	5	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_H-High Priority	Desert wash
Laterallus jamaicensis coturniculus	California black rail	Birds	ABNME03041	303	1	None	Threatened	G3G4T1	S1	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_NT-Near Threatened, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Brackish marsh, Freshwater marsh, Marsh & swamp, Salt marsh, Wetland

Lepidium virginicum var. robinsonii	Robinson's pepper-grass	Dicots	PDBRA1M114	142	8	None	None	G5T3	S3	4.3	null	Chaparral, Coastal scrub
Lepus californicus bennettii	San Diego black-tailed jackrabbit	Mammals	AMAEB03051	103	4	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Lilium parryi	lemon lily	Monocots	PMLIL1A0J0	160	2	None	None	G3	S3	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Lower montane coniferous forest, Meadow & seep, Riparian forest, Upper montane coniferous forest, Wetland
Linanthus concinnus	San Gabriel linanthus	Dicots	PDPLM090D0	43	4	None	None	G2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Lower montane coniferous forest, Upper montane coniferous forest
Lycium parishii	Parish's desert-thorn	Dicots	PDSOL0G0D0	21	1	None	None	G4	S1	2B.3	null	Coastal scrub, Sonoran desert scrub
Malacothamnus parishii	Parish's bush-mallow	Dicots	PDMAL0Q0C0	1	1	None	None	GXQ	SX	1A	null	Chaparral, Coastal scrub
Monardella australis ssp. jokerstii	Jokerst's monardella	Dicots	PDLAM18112	3	2	None	None	G4T1?	S1?	1B.1	USFS_S-Sensitive	Chaparral, Lower montane coniferous forest
Monardella pringlei	Pringle's monardella	Dicots	PDLAM180J0	2	1	None	None	GX	SX	1A	null	Coastal scrub
Muhlenbergia californica	California muhly	Monocots	PMPOA480A0	5	1	None	None	G4	S4	4.3	null	Chaparral, Coastal scrub, Lower montane coniferous forest, Meadow & seep
Muhlenbergia utilis	aparejo grass	Monocots	PMPOA481X0	14	1	None	None	G4	S2S3	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Marsh & swamp, Meadow & seep, Ultramafic
Navarretia prostrata	prostrate vernal pool navarretia	Dicots	PDPLM0C0Q0	60	1	None	None	G2	S2	1B.2	null	Coastal scrub, Meadow & seep, Valley & foothill grassland, Vernal pool, Wetland
Neotoma lepida intermedia	San Diego desert woodrat	Mammals	AMAFF08041	132	5	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Nyctinomops femorosaccus	pocketed free-tailed bat	Mammals	AMACD04010	90	2	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_M-Medium Priority	Joshua tree woodland, Pinon & juniper woodlands, Riparian scrub, Sonoran desert scrub
Nyctinomops macrotis	big free-tailed bat	Mammals	AMACD04020	32	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_MH-Medium-High Priority	null
Oncorhynchus mykiss irideus pop. 10	steelhead - southern California DPS	Fish	AFCHA0209J	20	1	Endangered	None	G5T1Q	S1	null	AFS_EN-Endangered	Aquatic, South coast flowing waters
Opuntia basilaris var. brachyclada	short-joint beavertail	Dicots	PDCAC0D053	199	1	None	None	G5T3	S3	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Joshua tree woodland, Mojavean desert scrub, Pinon & juniper woodlands

Oreonana vestita	woolly mountain-parsley	Dicots	PDAPI1G030	55	6	None	None	G3	S3	1B.3	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Lower montane coniferous forest, Subalpine coniferous forest, Upper montane coniferous forest
Ovis canadensis nelsoni	desert bighorn sheep	Mammals	AMALE04013	46	1	None	None	G4T4	S3	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, USFS_S-Sensitive	Alpine, Alpine dwarf scrub, Chaparral, Chenopod scrub, Great Basin scrub, Mojavean desert scrub, Montane dwarf scrub, Pinon & juniper woodlands, Riparian woodland, Sonoran desert scrub
Perognathus longimembris brevinasus	Los Angeles pocket mouse	Mammals	AMAFD01041	70	6	None	None	G5T1T2	S1S2	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Phacelia stellaris	Brand's star phacelia	Dicots	PDHYD0C510	15	1	None	None	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Coastal dunes, Coastal scrub
Phrynosoma blainvillii	coast horned lizard	Reptiles	ARACF12100	784	17	None	None	G3G4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Chaparral, Cismontane woodland, Coastal bluff scrub, Coastal scrub, Desert wash, Pinon & juniper woodlands, Riparian scrub, Riparian woodland, Valley & foothill grassland
Polioptila californica californica	coastal California gnatcatcher	Birds	ABPBJ08081	846	31	Threatened	None	G4G5T2Q	S2	null	CDFW_SSC-Species of Special Concern, NABCI_YWL-Yellow Watch List	Coastal bluff scrub, Coastal scrub
Pseudognaphalium leucocephalum	white rabbit-tobacco	Dicots	PDAST440C0	62	3	None	None	G4	S2	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland
Rana muscosa	southern mountain yellow-legged frog	Amphibians	AAABH01330	186	4	Endangered	Endangered	G1	S1	null	CDFW_WL-Watch List, IUCN_EN-Endangered, USFS_S-Sensitive	Aquatic
Rhaphiomidas terminatus abdominalis	Delhi Sands flower-loving fly	Insects	IIDIP05021	36	18	Endangered	None	G1T1	S1	null	null	Interior dunes
Rhinichthys osculus ssp. 3	Santa Ana speckled dace	Fish	AFCJB3705K	13	2	None	None	G5T1	S1	null	AFS_TH-Threatened, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Riversidian Alluvial Fan Sage Scrub	Riversidian Alluvial Fan Sage Scrub	Scrub	CTT32720CA	30	7	None	None	G1	S1.1	null	null	Coastal scrub
Sagittaria sanfordii	Sanford's arrowhead	Monocots	PMALI040Q0	126	1	None	None	G3	S3	1B.2	BLM_S-Sensitive	Marsh & swamp, Wetland
Senecio aphanactis	chaparral ragwort	Dicots	PDAST8H060	98	1	None	None	G3	S2	2B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub
Setophaga petechia	yellow warbler	Birds	ABPBX03010	78	1	None	None	G5	S3S4	null	CDFW_SSC-Species of Special	Riparian forest, Riparian scrub,

											Concern, USFWS_BCC-Birds of Conservation Concern	Riparian woodland
Sidalcea neomexicana	salt spring checkerbloom	Dicots	PDMAL110J0	30	3	None	None	G4	S2	2B.2	USFS_S-Sensitive	Alkali playa, Chaparral, Coastal scrub, Lower montane coniferous forest, Mojavean desert scrub, Wetland
Southern California Arroyo Chub/Santa Ana Sucker Stream	Southern California Arroyo Chub/Santa Ana Sucker Stream	Inland Waters	CARE2330CA	4	1	None	None	GNR	SNR	null	null	null
Southern Cottonwood Willow Riparian Forest	Southern Cottonwood Willow Riparian Forest	Riparian	CTT61330CA	111	3	None	None	G3	S3.2	null	null	Riparian forest
Southern Riparian Forest	Southern Riparian Forest	Riparian	CTT61300CA	20	1	None	None	G4	S4	null	null	Riparian forest
Southern Sycamore Alder Riparian Woodland	Southern Sycamore Alder Riparian Woodland	Riparian	CTT62400CA	230	10	None	None	G4	S4	null	null	Riparian woodland
Southern Willow Scrub	Southern Willow Scrub	Riparian	CTT63320CA	45	1	None	None	G3	S2.1	null	null	Riparian scrub
Spea hammondii	western spadefoot	Amphibians	AAABF02020	1213	6	None	None	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened	Cismontane woodland, Coastal scrub, Valley & foothill grassland, Vernal pool, Wetland
Sphenopholis obtusata	prairie wedge grass	Monocots	PMPOA5T030	19	1	None	None	G5	S2	2B.2	null	Cismontane woodland, Meadow & seep, Wetland
Streptanthus bernardinus	Laguna Mountains jewelflower	Dicots	PDBRA2G060	22	2	None	None	G3G4	S3S4	4.3	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Lower montane coniferous forest, Upper montane coniferous forest
Symphyotrichum defoliatum	San Bernardino aster	Dicots	PDASTE80C0	102	5	None	None	G2	S2	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Valley & foothill grassland
Thamnophis hammondii	two-striped gartersnake	Reptiles	ARADB36160	184	2	None	None	G4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive	Marsh & swamp, Riparian scrub, Riparian woodland, Wetland
Thysanocarpus rigidus	rigid fringepod	Dicots	PDBRA2Q070	5	1	None	None	G1G2	S1	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Pinon & juniper woodlands
Viola pinetorum ssp. grisea	grey-leaved violet	Dicots	PDVIO04431	90	1	None	None	G4G5T3	S3	1B.2	null	Meadow & seep, Subalpine coniferous forest, Upper montane coniferous forest
Vireo bellii pusillus	least Bell's vireo	Birds	ABPBW01114	503	22	Endangered	Endangered	G5T2	S2	null	IUCN_NT-Near Threatened,	Riparian forest, Riparian scrub,

											NABCI_YWL-Yellow Watch List	Riparian woodland

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
Phone: (760) 431-9440 Fax: (760) 431-5901
http://www.fws.gov/carlsbad/

In Reply Refer To:
Consultation Code: 08ECAR00-2020-SLI-0427
Event Code: 08ECAR00-2020-E-01019
Project Name: OBMP PEIR Update MZ2

January 07, 2020

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
(760) 431-9440

Project Summary

Consultation Code: 08ECAR00-2020-SLI-0427

Event Code: 08ECAR00-2020-E-01019

Project Name: OBMP PEIR Update MZ2

Project Type: WATER SUPPLY / DELIVERY

Project Description: Optimum Basin Management Plan PEIR Update - MZ2

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/34.037629519000035N117.60389695221778W

Counties: Riverside, CA | San Bernardino, CA

Endangered Species Act Species

There is a total of 15 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
San Bernardino Merriam's Kangaroo Rat *Dipodomys merriami parvus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2060	Endangered
Stephens' Kangaroo Rat *Dipodomys stephensi (incl. D. cascus)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3495	Endangered

Birds

NAME	STATUS
California Condor *Gymnogyps californianus* Population: U.S.A. only, except where listed as an experimental population There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8193	Endangered
Coastal California Gnatcatcher *Polioptila californica californica* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8178	Threatened
Least Bell's Vireo *Vireo bellii pusillus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5945	Endangered
Southwestern Willow Flycatcher *Empidonax traillii extimus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6749	Endangered

Amphibians

NAME	STATUS
Arroyo (=arroyo Southwestern) Toad *Anaxyrus californicus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3762	Endangered
Mountain Yellow-legged Frog *Rana muscosa* Population: Southern California DPS There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8037	Endangered

Fishes

NAME	STATUS
Santa Ana Sucker *Catostomus santaanae* Population: 3 CA river basins There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3785	Threatened

Insects

NAME	STATUS
Delhi Sands Flower-loving Fly *Rhaphiomidas terminatus abdominalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1540	Endangered

Flowering Plants

NAME	STATUS
Braunton's Milk-vetch *Astragalus brauntonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5674	Endangered
San Diego Ambrosia *Ambrosia pumila* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8287	Endangered
Santa Ana River Woolly-star *Eriastrum densifolium ssp. sanctorum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6575	Endangered
Slender-horned Spineflower *Dodecahema leptoceras* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4007	Endangered
Thread-leaved Brodiaea *Brodiaea filifolia* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6087	Threatened

Critical habitats

There are 4 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Least Bell's Vireo *Vireo bellii pusillus* https://ecos.fws.gov/ecp/species/5945#crithab	Final
San Bernardino Merriam's Kangaroo Rat *Dipodomys merriami parvus* https://ecos.fws.gov/ecp/species/2060#crithab	Final
Southwestern Willow Flycatcher *Empidonax traillii extimus* https://ecos.fws.gov/ecp/species/6749#crithab	Final
Yellow-billed Cuckoo *Coccyzus americanus* For information on why this critical habitat appears for your project, even though Yellow-billed Cuckoo is not on the list of potentially affected species at this location, contact the local field office. https://ecos.fws.gov/ecp/species/3911#crithab	Proposed

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

Management Zone 3
CNDDB and IPaC Lists

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE RareFind

OBMPU Management Zone 3

Query Summary:
Quad IS (Corona North (3311785) OR Guasti (3411715) OR Fontana (3411714) OR Devore (3411724))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Abronia villosa var. aurita	chaparral sand-verbena	Dicots	PDNYC010P1	98	1	None	None	G5T2?	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Desert dunes
Agelaius tricolor	tricolored blackbird	Birds	ABPBXB0020	955	5	None	Threatened	G2G3	S1S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Marsh & swamp, Swamp, Wetland
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	Birds	ABPBX91091	235	2	None	None	G5T3	S3	null	CDFW_WL-Watch List	Chaparral, Coastal scrub
Ambrosia monogyra	singlewhorl burrobrush	Dicots	PDAST50010	30	1	None	None	G5	S2	2B.2	null	Chaparral, Sonoran desert scrub
Anniella stebbinsi	southern California legless lizard	Reptiles	ARACC01060	417	19	None	None	G3	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Broadleaved upland forest, Chaparral, Coastal dunes, Coastal scrub
Arenaria paludicola	marsh sandwort	Dicots	PDCAR040L0	16	1	Endangered	Endangered	G1	S1	1B.1	SB_SBBG-Santa Barbara Botanic Garden	Freshwater marsh, Marsh & swamp, Wetland
Arizona elegans occidentalis	California glossy snake	Reptiles	ARADB01017	260	8	None	None	G5T2	S2	null	CDFW_SSC-Species of Special Concern	null
Artemisiospiza belli belli	Bell's sage sparrow	Birds	ABPBX97021	61	2	None	None	G5T2T3	S3	null	CDFW_WL-Watch List, USFWS_BCC-Birds of Conservation Concern	Chaparral, Coastal scrub
Aspidoscelis hyperythra	orange-throated whiptail	Reptiles	ARACJ02060	369	3	None	None	G5	S2S3	null	CDFW_WL-Watch List, IUCN_LC-Least Concern, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Athene cunicularia	burrowing owl	Birds	ABNSB10010	1989	34	None	None	G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFWS_BCC-Birds of	Coastal prairie, Coastal scrub, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland

											Conservation Concern	
Batrachoseps gabrieli	San Gabriel slender salamander	Amphibians	AAAAD02110	8	1	None	None	G2G3	S2S3	null	IUCN_DD-Data Deficient, USFS_S-Sensitive	Talus slope
Bombus crotchii	Crotch bumble bee	Insects	IIHYM24480	234	5	None	Candidate Endangered	G3G4	S1S2	null	null	null
Buteo swainsoni	Swainson's hawk	Birds	ABNKC19070	2518	1	None	Threatened	G5	S3	null	BLM_S-Sensitive, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Great Basin grassland, Riparian forest, Riparian woodland, Valley & foothill grassland
Calochortus plummerae	Plummer's mariposa-lily	Monocots	PMLIL0D150	230	16	None	None	G4	S4	4.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Valley & foothill grassland
Catostomus santaanae	Santa Ana sucker	Fish	AFCJC02190	28	5	Threatened	None	G1	S1	null	AFS_TH-Threatened, IUCN_VU-Vulnerable	Aquatic, South coast flowing waters
Centromadia pungens ssp. laevis	smooth tarplant	Dicots	PDAST4R0R4	126	1	None	None	G3G4T2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Alkali playa, Chenopod scrub, Meadow & seep, Riparian woodland, Valley & foothill grassland, Wetland
Chaetodipus fallax fallax	northwestern San Diego pocket mouse	Mammals	AMAFD05031	101	6	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Chaparral, Coastal scrub
Chaetodipus fallax pallidus	pallid San Diego pocket mouse	Mammals	AMAFD05032	79	1	None	None	G5T34	S3S4	null	CDFW_SSC-Species of Special Concern	Desert wash, Pinon & juniper woodlands, Sonoran desert scrub
Chloropyron maritimum ssp. maritimum	salt marsh bird's-beak	Dicots	PDSCR0J0C2	30	1	Endangered	Endangered	G4?T1	S1	1B.2	SB_CRES-San Diego Zoo CRES Native Gene Seed Bank, SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Coastal dunes, Marsh & swamp, Salt marsh, Wetland
Chorizanthe parryi var. parryi	Parry's spineflower	Dicots	PDPGN040J2	150	10	None	None	G3T2	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Chorizanthe xanti var. leucotheca	white-bracted spineflower	Dicots	PDPGN040Z1	59	4	None	None	G4T3	S3	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, SB_USDA-US Dept of Agriculture, USFS_S-Sensitive	Coastal scrub, Mojavean desert scrub, Pinon & juniper woodlands
Cicindela tranquebarica viridissima	greenest tiger beetle	Insects	IICOL02201	1	1	None	None	G5T1	S1	null	null	Riparian woodland
Cladium californicum	California saw-grass	Monocots	PMCYP04010	13	1	None	None	G4	S2	2B.2	SB_RSABG-Rancho Santa Ana Botanic Garden,	Alkali marsh, Freshwater marsh, Meadow & seep, Wetland

											USFS_S-Sensitive	
Coccyzus americanus occidentalis	western yellow-billed cuckoo	Birds	ABNRB02022	156	2	Threatened	Endangered	G5T2T3	S1	null	BLM_S-Sensitive, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Riparian forest
Coleonyx variegatus abbotti	San Diego banded gecko	Reptiles	ARACD01031	8	1	None	None	G5T3T4	S1S2	null	CDFW_SSC-Species of Special Concern	Chaparral, Coastal scrub
Coturnicops noveboracensis	yellow rail	Birds	ABNME01010	45	1	None	None	G4	S1S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Meadow & seep
Crotalus ruber	red-diamond rattlesnake	Reptiles	ARADE02090	192	1	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Chaparral, Mojavean desert scrub, Sonoran desert scrub
Dipodomys merriami parvus	San Bernardino kangaroo rat	Mammals	AMAFD03143	81	29	Endangered	Candidate Endangered	G5T1	S1	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Dipodomys stephensi	Stephens' kangaroo rat	Mammals	AMAFD03100	220	4	Endangered	Threatened	G2	S2	null	IUCN_EN-Endangered	Coastal scrub, Valley & foothill grassland
Dodecahema leptoceras	slender-horned spineflower	Dicots	PDPGN0V010	41	4	Endangered	Endangered	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub
Dudleya multicaulis	many-stemmed dudleya	Dicots	PDCRA040H0	154	1	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Empidonax traillii extimus	southwestern willow flycatcher	Birds	ABPAE33043	70	3	Endangered	Endangered	G5T2	S1	null	NABCI_RWL-Red Watch List	Riparian woodland
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1385	1	None	None	G3G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable, USFS_S-Sensitive	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Eriastrum densifolium ssp. sanctorum	Santa Ana River woollystar	Dicots	PDPLM03035	31	8	Endangered	Endangered	G4T1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Coastal scrub
Eumops perotis californicus	western mastiff bat	Mammals	AMACD02011	296	2	None	None	G5T4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of	Chaparral, Cismontane woodland, Coastal scrub,

											Special Concern, WBWG_H-High Priority	Valley & foothill grassland
Gila orcuttii	arroyo chub	Fish	AFCJB13120	49	2	None	None	G2	S2	null	AFS_VU-Vulnerable, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Horkelia cuneata var. puberula	mesa horkelia	Dicots	PDROS0W045	103	5	None	None	G4T1	S1	1B.1	USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Icteria virens	yellow-breasted chat	Birds	ABPBX24010	100	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Riparian forest, Riparian scrub, Riparian woodland
Lasiurus xanthinus	western yellow bat	Mammals	AMACC05070	58	4	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_H-High Priority	Desert wash
Laterallus jamaicensis coturniculus	California black rail	Birds	ABNME03041	303	1	None	Threatened	G3G4T1	S1	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_NT-Near Threatened, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Brackish marsh, Freshwater marsh, Marsh & swamp, Salt marsh, Wetland
Lepidium virginicum var. robinsonii	Robinson's pepper-grass	Dicots	PDBRA1M114	142	3	None	None	G5T3	S3	4.3	null	Chaparral, Coastal scrub
Lepus californicus bennettii	San Diego black-tailed jackrabbit	Mammals	AMAEB03051	103	3	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Lilium parryi	lemon lily	Monocots	PMLIL1A0J0	160	1	None	None	G3	S3	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Lower montane coniferous forest, Meadow & seep, Riparian forest, Upper montane coniferous forest, Wetland
Lycium parishii	Parish's desert-thorn	Dicots	PDSOL0G0D0	21	1	None	None	G4	S1	2B.3	null	Coastal scrub, Sonoran desert scrub
Malacothamnus parishii	Parish's bush-mallow	Dicots	PDMAL0Q0C0	1	1	None	None	GXQ	SX	1A	null	Chaparral, Coastal scrub
Monardella pringlei	Pringle's monardella	Dicots	PDLAM180J0	2	1	None	None	GX	SX	1A	null	Coastal scrub
Muhlenbergia californica	California muhly	Monocots	PMPOA480A0	5	1	None	None	G4	S4	4.3	null	Chaparral, Coastal scrub, Lower montane coniferous forest, Meadow & seep
Muhlenbergia utilis	aparejo grass	Monocots	PMPOA481X0	14	1	None	None	G4	S2S3	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Marsh & swamp, Meadow & seep, Ultramafic
Navarretia prostrata	prostrate vernal pool navarretia	Dicots	PDPLM0C0Q0	60	1	None	None	G2	S2	1B.2	null	Coastal scrub, Meadow & seep, Valley & foothill grassland,

												Vernal pool, Wetland
Neotoma lepida intermedia	San Diego desert woodrat	Mammals	AMAFF08041	132	2	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Nyctinomops femorosaccus	pocketed free-tailed bat	Mammals	AMACD04010	90	2	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_M-Medium Priority	Joshua tree woodland, Pinon & juniper woodlands, Riparian scrub, Sonoran desert scrub
Oncorhynchus mykiss irideus pop. 10	steelhead - southern California DPS	Fish	AFCHA0209J	20	1	Endangered	None	G5T1Q	S1	null	AFS_EN-Endangered	Aquatic, South coast flowing waters
Opuntia basilaris var. brachyclada	short-joint beavertail	Dicots	PDCAC0D053	199	1	None	None	G5T3	S3	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Joshua tree woodland, Mojavean desert scrub, Pinon & juniper woodlands
Perognathus longimembris brevinasus	Los Angeles pocket mouse	Mammals	AMAFD01041	70	5	None	None	G5T1T2	S1S2	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Phacelia stellaris	Brand's star phacelia	Dicots	PDHYD0C510	15	1	None	None	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Coastal dunes, Coastal scrub
Phrynosoma blainvillii	coast horned lizard	Reptiles	ARACF12100	784	14	None	None	G3G4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Chaparral, Cismontane woodland, Coastal bluff scrub, Coastal scrub, Desert wash, Pinon & juniper woodlands, Riparian scrub, Riparian woodland, Valley & foothill grassland
Polioptila californica californica	coastal California gnatcatcher	Birds	ABPBJ08081	846	13	Threatened	None	G4G5T2Q	S2	null	CDFW_SSC-Species of Special Concern, NABCI_YWL-Yellow Watch List	Coastal bluff scrub, Coastal scrub
Pseudognaphalium leucocephalum	white rabbit-tobacco	Dicots	PDAST440C0	62	1	None	None	G4	S2	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland
Rana muscosa	southern mountain yellow-legged frog	Amphibians	AAABH01330	186	1	Endangered	Endangered	G1	S1	null	CDFW_WL-Watch List, IUCN_EN-Endangered, USFS_S-Sensitive	Aquatic
Rhaphiomidas terminatus abdominalis	Delhi Sands flower-loving fly	Insects	IIDIP05021	36	18	Endangered	None	G1T1	S1	null	null	Interior dunes
Rhinichthys osculus ssp. 3	Santa Ana speckled dace	Fish	AFCJB3705K	13	2	None	None	G5T1	S1	null	AFS_TH-Threatened, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Riversidian Alluvial Fan Sage Scrub	Riversidian Alluvial Fan Sage Scrub	Scrub	CTT32720CA	30	3	None	None	G1	S1.1	null	null	Coastal scrub
Senecio aphanactis	chaparral ragwort	Dicots	PDAST8H060	98	1	None	None	G3	S2	2B.2	SB_RSABG-Rancho Santa	Chaparral, Cismontane

											Ana Botanic Garden	woodland, Coastal scrub
Setophaga petechia	yellow warbler	Birds	ABPBX03010	78	1	None	None	G5	S3S4	null	CDFW_SSC-Species of Special Concern, USFWS_BCC-Birds of Conservation Concern	Riparian forest, Riparian scrub, Riparian woodland
Southern California Arroyo Chub/Santa Ana Sucker Stream	Southern California Arroyo Chub/Santa Ana Sucker Stream	Inland Waters	CARE2330CA	4	1	None	None	GNR	SNR	null	null	null
Southern Cottonwood Willow Riparian Forest	Southern Cottonwood Willow Riparian Forest	Riparian	CTT61330CA	111	1	None	None	G3	S3.2	null	null	Riparian forest
Southern Riparian Forest	Southern Riparian Forest	Riparian	CTT61300CA	20	1	None	None	G4	S4	null	null	Riparian forest
Southern Sycamore Alder Riparian Woodland	Southern Sycamore Alder Riparian Woodland	Riparian	CTT62400CA	230	5	None	None	G4	S4	null	null	Riparian woodland
Spea hammondii	western spadefoot	Amphibians	AAABF02020	1213	1	None	None	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened	Cismontane woodland, Coastal scrub, Valley & foothill grassland, Vernal pool, Wetland
Sphenopholis obtusata	prairie wedge grass	Monocots	PMPOA5T030	19	1	None	None	G5	S2	2B.2	null	Cismontane woodland, Meadow & seep, Wetland
Streptanthus bernardinus	Laguna Mountains jewelflower	Dicots	PDBRA2G060	22	1	None	None	G3G4	S3S4	4.3	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Lower montane coniferous forest, Upper montane coniferous forest
Symphyotrichum defoliatum	San Bernardino aster	Dicots	PDASTE80C0	102	2	None	None	G2	S2	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Valley & foothill grassland
Vireo bellii pusillus	least Bell's vireo	Birds	ABPBW01114	503	10	Endangered	Endangered	G5T2	S2	null	IUCN_NT-Near Threatened, NABCI_YWL-Yellow Watch List	Riparian forest, Riparian scrub, Riparian woodland

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
Phone: (760) 431-9440 Fax: (760) 431-5901
http://www.fws.gov/carlsbad/

In Reply Refer To: January 07, 2020
Consultation Code: 08ECAR00-2020-SLI-0428
Event Code: 08ECAR00-2020-E-01022
Project Name: OBMP PEIR Update MZ3

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
(760) 431-9440

Project Summary

Consultation Code: 08ECAR00-2020-SLI-0428

Event Code: 08ECAR00-2020-E-01022

Project Name: OBMP PEIR Update MZ3

Project Type: WATER SUPPLY / DELIVERY

Project Description: Optimum Basin Management Plan PEIR Update - MZ3

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/34.039474964500045N117.52218800533493W

Counties: Riverside, CA | San Bernardino, CA

Endangered Species Act Species

There is a total of 14 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
San Bernardino Merriam's Kangaroo Rat *Dipodomys merriami parvus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2060	Endangered
Stephens' Kangaroo Rat *Dipodomys stephensi (incl. D. cascus)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3495	Endangered

Birds

NAME	STATUS
California Condor *Gymnogyps californianus* Population: U.S.A. only, except where listed as an experimental population There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8193	Endangered
Coastal California Gnatcatcher *Polioptila californica californica* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8178	Threatened
Least Bell's Vireo *Vireo bellii pusillus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5945	Endangered
Southwestern Willow Flycatcher *Empidonax traillii extimus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6749	Endangered

Amphibians

NAME	STATUS
Arroyo (=arroyo Southwestern) Toad *Anaxyrus californicus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3762	Endangered

Fishes

NAME	STATUS
Santa Ana Sucker *Catostomus santaanae* Population: 3 CA river basins There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3785	Threatened

Insects

NAME	STATUS
Delhi Sands Flower-loving Fly *Rhaphiomidas terminatus abdominalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1540	Endangered

Flowering Plants

NAME	STATUS
Gambel's Watercress *Rorippa gambellii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4201	Endangered
San Diego Ambrosia *Ambrosia pumila* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8287	Endangered
Santa Ana River Woolly-star *Eriastrum densifolium ssp. sanctorum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6575	Endangered
Slender-horned Spineflower *Dodecahema leptoceras* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4007	Endangered
Thread-leaved Brodiaea *Brodiaea filifolia* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6087	Threatened

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Coastal California Gnatcatcher *Polioptila californica californica* https://ecos.fws.gov/ecp/species/8178#crithab	Final

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

Management Zone 4
CNDDB and IPaC Lists

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE RareFind

OBMPU Management Zone 4

Query Summary:
Quad IS (Guasti (3411715) OR Fontana (3411714) OR Riverside West (3311784) OR Corona North (3311785))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Abronia villosa var. aurita	chaparral sand-verbena	Dicots	PDNYC010P1	98	1	None	None	G5T2?	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Desert dunes
Accipiter cooperii	Cooper's hawk	Birds	ABNKC12040	118	1	None	None	G5	S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Cismontane woodland, Riparian forest, Riparian woodland, Upper montane coniferous forest
Agelaius tricolor	tricolored blackbird	Birds	ABPBXB0020	955	5	None	Threatened	G2G3	S1S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Marsh & swamp, Swamp, Wetland
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	Birds	ABPBX91091	235	4	None	None	G5T3	S3	null	CDFW_WL-Watch List	Chaparral, Coastal scrub
Ambrosia pumila	San Diego ambrosia	Dicots	PDAST0C0M0	59	1	Endangered	None	G1	S1	1B.1	null	Chaparral, Coastal scrub, Valley & foothill grassland
Anniella stebbinsi	southern California legless lizard	Reptiles	ARACC01060	417	20	None	None	G3	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Broadleaved upland forest, Chaparral, Coastal dunes, Coastal scrub
Arenaria paludicola	marsh sandwort	Dicots	PDCAR040L0	16	1	Endangered	Endangered	G1	S1	1B.1	SB_SBBG-Santa Barbara Botanic Garden	Freshwater marsh, Marsh & swamp, Wetland
Arizona elegans occidentalis	California glossy snake	Reptiles	ARADB01017	260	5	None	None	G5T2	S2	null	CDFW_SSC-Species of Special Concern	null
Artemisiospiza belli belli	Bell's sage sparrow	Birds	ABPBX97021	61	2	None	None	G5T2T3	S3	null	CDFW_WL-Watch List, USFWS_BCC-Birds of Conservation Concern	Chaparral, Coastal scrub
Aspidoscelis hyperythra	orange-throated whiptail	Reptiles	ARACJ02060	369	7	None	None	G5	S2S3	null	CDFW_WL-Watch List, IUCN_LC-Least Concern, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Aspidoscelis tigris stejnegeri	coastal whiptail	Reptiles	ARACJ02143	148	1	None	None	G5T5	S3	null	CDFW_SSC-Species of	null

											Special Concern	
Athene cunicularia	burrowing owl	Birds	ABNSB10010	1989	34	None	None	G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Coastal prairie, Coastal scrub, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland
Bombus crotchii	Crotch bumble bee	Insects	IIHYM24480	234	4	None	Candidate Endangered	G3G4	S1S2	null	null	null
Buteo swainsoni	Swainson's hawk	Birds	ABNKC19070	2518	2	None	Threatened	G5	S3	null	BLM_S-Sensitive, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Great Basin grassland, Riparian forest, Riparian woodland, Valley & foothill grassland
Calochortus plummerae	Plummer's mariposa-lily	Monocots	PMLIL0D150	230	2	None	None	G4	S4	4.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Valley & foothill grassland
Carolella busckana	Busck's gallmoth	Insects	IILEM2X090	4	1	None	None	G1G3	SH	null	null	Coastal dunes, Coastal scrub
Catostomus santaanae	Santa Ana sucker	Fish	AFCJC02190	28	7	Threatened	None	G1	S1	null	AFS_TH-Threatened, IUCN_VU-Vulnerable	Aquatic, South coast flowing waters
Centromadia pungens ssp. laevis	smooth tarplant	Dicots	PDAST4R0R4	126	1	None	None	G3G4T2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Alkali playa, Chenopod scrub, Meadow & seep, Riparian woodland, Valley & foothill grassland, Wetland
Ceratochrysis longimala	Desert cuckoo wasp	Insects	IIHYM71040	2	1	None	None	G1	S1	null	null	null
Chaetodipus fallax fallax	northwestern San Diego pocket mouse	Mammals	AMAFD05031	101	2	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Chaparral, Coastal scrub
Chloropyron maritimum ssp. maritimum	salt marsh bird's-beak	Dicots	PDSCR0J0C2	30	1	Endangered	Endangered	G4?T1	S1	1B.2	SB_CRES-San Diego Zoo CRES Native Gene Seed Bank, SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Coastal dunes, Marsh & swamp, Salt marsh, Wetland
Chorizanthe parryi var. parryi	Parry's spineflower	Dicots	PDPGN040J2	150	2	None	None	G3T2	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Cicindela tranquebarica viridissima	greenest tiger beetle	Insects	IICOL02201	1	1	None	None	G5T1	S1	null	null	Riparian woodland
Cladium californicum	California saw-grass	Monocots	PMCYP04010	13	1	None	None	G4	S2	2B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Alkali marsh, Freshwater marsh, Meadow & seep, Wetland
Coccyzus	western	Birds	ABNRB02022	156	4	Threatened	Endangered	G5T2T3	S1	null	BLM_S-	Riparian forest

americanus occidentalis	yellow-billed cuckoo										Sensitive, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	
Coleonyx variegatus abbotti	San Diego banded gecko	Reptiles	ARACD01031	8	1	None	None	G5T3T4	S1S2	null	CDFW_SSC-Species of Special Concern	Chaparral, Coastal scrub
Coturnicops noveboracensis	yellow rail	Birds	ABNME01010	45	1	None	None	G4	S1S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Meadow & seep
Crotalus ruber	red-diamond rattlesnake	Reptiles	ARADE02090	192	4	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Chaparral, Mojavean desert scrub, Sonoran desert scrub
Dipodomys merriami parvus	San Bernardino kangaroo rat	Mammals	AMAFD03143	81	5	Endangered	Candidate Endangered	G5T1	S1	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Dipodomys stephensi	Stephens' kangaroo rat	Mammals	AMAFD03100	220	10	Endangered	Threatened	G2	S2	null	IUCN_EN-Endangered	Coastal scrub, Valley & foothill grassland
Dudleya multicaulis	many-stemmed dudleya	Dicots	PDCRA040H0	154	1	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Empidonax traillii extimus	southwestern willow flycatcher	Birds	ABPAE33043	70	3	Endangered	Endangered	G5T2	S1	null	NABCI_RWL-Red Watch List	Riparian woodland
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1385	1	None	None	G3G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable, USFS_S-Sensitive	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Eriastrum densifolium ssp. sanctorum	Santa Ana River woollystar	Dicots	PDPLM03035	31	4	Endangered	Endangered	G4T1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Coastal scrub
Eumops perotis californicus	western mastiff bat	Mammals	AMACD02011	296	3	None	None	G5T4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, WBWG_H-High Priority	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Euphydryas editha quino	quino checkerspot butterfly	Insects	IILEPK405L	127	1	Endangered	None	G5T1T2	S1S2	null	XERCES_CI-Critically Imperiled	Chaparral, Coastal scrub

Gila orcuttii	arroyo chub	Fish	AFCJB13120	49	4	None	None	G2	S2	null	AFS_VU-Vulnerable, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Horkelia cuneata var. puberula	mesa horkelia	Dicots	PDROS0W045	103	4	None	None	G4T1	S1	1B.1	USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Icteria virens	yellow-breasted chat	Birds	ABPBX24010	100	2	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Riparian forest, Riparian scrub, Riparian woodland
Lasiurus xanthinus	western yellow bat	Mammals	AMACC05070	58	5	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_H-High Priority	Desert wash
Lasthenia glabrata ssp. coulteri	Coulter's goldfields	Dicots	PDAST5L0A1	111	1	None	None	G4T2	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Alkali playa, Marsh & swamp, Salt marsh, Vernal pool, Wetland
Laterallus jamaicensis coturniculus	California black rail	Birds	ABNME03041	303	2	None	Threatened	G3G4T1	S1	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_NT-Near Threatened, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Brackish marsh, Freshwater marsh, Marsh & swamp, Salt marsh, Wetland
Lepidium virginicum var. robinsonii	Robinson's pepper-grass	Dicots	PDBRA1M114	142	3	None	None	G5T3	S3	4.3	null	Chaparral, Coastal scrub
Lepus californicus bennettii	San Diego black-tailed jackrabbit	Mammals	AMAEB03051	103	3	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Lycium parishii	Parish's desert-thorn	Dicots	PDSOL0G0D0	21	1	None	None	G4	S1	2B.3	null	Coastal scrub, Sonoran desert scrub
Malacothamnus parishii	Parish's bush-mallow	Dicots	PDMAL0Q0C0	1	1	None	None	GXQ	SX	1A	null	Chaparral, Coastal scrub
Monardella pringlei	Pringle's monardella	Dicots	PDLAM180J0	2	1	None	None	GX	SX	1A	null	Coastal scrub
Muhlenbergia californica	California muhly	Monocots	PMPOA480A0	5	1	None	None	G4	S4	4.3	null	Chaparral, Coastal scrub, Lower montane coniferous forest, Meadow & seep
Muhlenbergia utilis	aparejo grass	Monocots	PMPOA481X0	14	1	None	None	G4	S2S3	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Marsh & swamp, Meadow & seep, Ultramafic
Navarretia prostrata	prostrate vernal pool navarretia	Dicots	PDPLM0C0Q0	60	1	None	None	G2	S2	1B.2	null	Coastal scrub, Meadow & seep, Valley & foothill grassland, Vernal pool, Wetland
Neotoma lepida	San Diego	Mammals	AMAFF08041	132	2	None	None	G5T3T4	S3S4	null	CDFW_SSC-	Coastal scrub

intermedia	desert woodrat										Species of Special Concern	
Nyctinomops femorosaccus	pocketed free-tailed bat	Mammals	AMACD04010	90	3	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_M-Medium Priority	Joshua tree woodland, Pinon & juniper woodlands, Riparian scrub, Sonoran desert scrub
Oncorhynchus mykiss irideus pop. 10	steelhead - southern California DPS	Fish	AFCHA0209J	20	1	Endangered	None	G5T1Q	S1	null	AFS_EN-Endangered	Aquatic, South coast flowing waters
Perognathus longimembris brevinasus	Los Angeles pocket mouse	Mammals	AMAFD01041	70	4	None	None	G5T1T2	S1S2	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Phacelia stellaris	Brand's star phacelia	Dicots	PDHYD0C510	15	2	None	None	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Coastal dunes, Coastal scrub
Phrynosoma blainvillii	coast horned lizard	Reptiles	ARACF12100	784	8	None	None	G3G4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Chaparral, Cismontane woodland, Coastal bluff scrub, Coastal scrub, Desert wash, Pinon & juniper woodlands, Riparian scrub, Riparian woodland, Valley & foothill grassland
Polioptila californica californica	coastal California gnatcatcher	Birds	ABPBJ08081	846	18	Threatened	None	G4G5T2Q	S2	null	CDFW_SSC-Species of Special Concern, NABCI_YWL-Yellow Watch List	Coastal bluff scrub, Coastal scrub
Pseudognaphalium leucocephalum	white rabbit-tobacco	Dicots	PDAST440C0	62	1	None	None	G4	S2	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland
Rhaphiomidas terminatus abdominalis	Delhi Sands flower-loving fly	Insects	IIDIP05021	36	18	Endangered	None	G1T1	S1	null	null	Interior dunes
Rhinichthys osculus ssp. 3	Santa Ana speckled dace	Fish	AFCJB3705K	13	1	None	None	G5T1	S1	null	AFS_TH-Threatened, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Riversidian Alluvial Fan Sage Scrub	Riversidian Alluvial Fan Sage Scrub	Scrub	CTT32720CA	30	1	None	None	G1	S1.1	null	null	Coastal scrub
Senecio aphanactis	chaparral ragwort	Dicots	PDAST8H060	98	1	None	None	G3	S2	2B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Coastal scrub
Setophaga petechia	yellow warbler	Birds	ABPBX03010	78	2	None	None	G5	S3S4	null	CDFW_SSC-Species of Special Concern, USFWS_BCC-Birds of Conservation Concern	Riparian forest, Riparian scrub, Riparian woodland
Southern California Arroyo Chub/Santa Ana Sucker Stream	Southern California Arroyo Chub/Santa Ana Sucker Stream	Inland Waters	CARE2330CA	4	1	None	None	GNR	SNR	null	null	null
Southern Cottonwood Willow	Southern Cottonwood	Riparian	CTT61330CA	111	4	None	None	G3	S3.2	null	null	Riparian forest

Riparian Forest	Willow Riparian Forest											
Southern Sycamore Alder Riparian Woodland	Southern Sycamore Alder Riparian Woodland	Riparian	CTT62400CA	230	1	None	None	G4	S4	null	null	Riparian woodland
Southern Willow Scrub	Southern Willow Scrub	Riparian	CTT63320CA	45	1	None	None	G3	S2.1	null	null	Riparian scrub
Spea hammondii	western spadefoot	Amphibians	AAABF02020	1213	1	None	None	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened	Cismontane woodland, Coastal scrub, Valley & foothill grassland, Vernal pool, Wetland
Sphenopholis obtusata	prairie wedge grass	Monocots	PMPOA5T030	19	1	None	None	G5	S2	2B.2	null	Cismontane woodland, Meadow & seep, Wetland
Spinus lawrencei	Lawrence's goldfinch	Birds	ABPBY06100	4	1	None	None	G3G4	S3S4	null	IUCN_LC-Least Concern, NABCI_YWL-Yellow Watch List, USFWS_BCC-Birds of Conservation Concern	Broadleaved upland forest, Chaparral, Pinon & juniper woodlands, Riparian woodland
Symphyotrichum defoliatum	San Bernardino aster	Dicots	PDASTE80C0	102	2	None	None	G2	S2	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Valley & foothill grassland
Vireo bellii pusillus	least Bell's vireo	Birds	ABPBW01114	503	14	Endangered	Endangered	G5T2	S2	null	IUCN_NT-Near Threatened, NABCI_YWL-Yellow Watch List	Riparian forest, Riparian scrub, Riparian woodland

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
Phone: (760) 431-9440 Fax: (760) 431-5901
http://www.fws.gov/carlsbad/

In Reply Refer To: January 07, 2020
Consultation Code: 08ECAR00-2020-SLI-0429
Event Code: 08ECAR00-2020-E-01024
Project Name: OBMP PEIR Update MZ4

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
(760) 431-9440

Project Summary

Consultation Code: 08ECAR00-2020-SLI-0429

Event Code: 08ECAR00-2020-E-01024

Project Name: OBMP PEIR Update MZ4

Project Type: WATER SUPPLY / DELIVERY

Project Description: Optimum Basin Management Plan PEIR Update - MZ4

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/34.003541719000054N117.48346827371635W

Counties: Riverside, CA

Endangered Species Act Species

There is a total of 11 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
San Bernardino Merriam's Kangaroo Rat *Dipodomys merriami parvus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2060	Endangered
Stephens' Kangaroo Rat *Dipodomys stephensi (incl. D. cascus)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3495	Endangered

Birds

NAME	STATUS
Coastal California Gnatcatcher *Polioptila californica californica* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8178	Threatened
Least Bell's Vireo *Vireo bellii pusillus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5945	Endangered
Southwestern Willow Flycatcher *Empidonax traillii extimus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6749	Endangered

Fishes

NAME	STATUS
Santa Ana Sucker *Catostomus santaanae* Population: 3 CA river basins There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3785	Threatened

Insects

NAME	STATUS
Delhi Sands Flower-loving Fly *Rhaphiomidas terminatus abdominalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1540	Endangered

Flowering Plants

NAME	STATUS
Nevin's Barberry *Berberis nevinii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8025	Endangered
San Diego Ambrosia *Ambrosia pumila* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8287	Endangered
Santa Ana River Woolly-star *Eriastrum densifolium ssp. sanctorum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6575	Endangered
Thread-leaved Brodiaea *Brodiaea filifolia* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6087	Threatened

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Coastal California Gnatcatcher *Polioptila californica californica* https://ecos.fws.gov/ecp/species/8178#crithab	Final

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

Management Zone 5
CNDDB and IPaC Lists

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE RareFind

OBMPU Management Zone 5

Query Summary:
Quad IS (Corona North (3311785) OR Riverside West (3311784) OR Prado Dam (3311786))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Abronia villosa var. aurita	chaparral sand-verbena	Dicots	PDNYC010P1	98	2	None	None	G5T2?	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Desert dunes
Accipiter cooperii	Cooper's hawk	Birds	ABNKC12040	118	2	None	None	G5	S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Cismontane woodland, Riparian forest, Riparian woodland, Upper montane coniferous forest
Agelaius tricolor	tricolored blackbird	Birds	ABPBXB0020	955	7	None	Threatened	G2G3	S1S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Marsh & swamp, Swamp, Wetland
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	Birds	ABPBX91091	235	5	None	None	G5T3	S3	null	CDFW_WL-Watch List	Chaparral, Coastal scrub
Ambrosia pumila	San Diego ambrosia	Dicots	PDAST0C0M0	59	1	Endangered	None	G1	S1	1B.1	null	Chaparral, Coastal scrub, Valley & foothill grassland
Ammodramus savannarum	grasshopper sparrow	Birds	ABPBXA0020	27	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Valley & foothill grassland
Anniella stebbinsi	southern California legless lizard	Reptiles	ARACC01060	417	11	None	None	G3	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Broadleaved upland forest, Chaparral, Coastal dunes, Coastal scrub
Aquila chrysaetos	golden eagle	Birds	ABNKC22010	321	3	None	None	G5	S3	null	BLM_S-Sensitive, CDF_S-Sensitive, CDFW_FP-Fully Protected, CDFW_WL-Watch List, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Broadleaved upland forest, Cismontane woodland, Coastal prairie, Great Basin grassland, Great Basin scrub, Lower montane coniferous forest, Pinon & juniper woodlands, Upper montane coniferous forest, Valley & foothill grassland
Arizona elegans	California	Reptiles	ARADB01017	260	2	None	None	G5T2	S2	null	CDFW_SSC-	null

occidentalis	glossy snake										Species of Special Concern	
Artemisiospiza belli belli	Bell's sage sparrow	Birds	ABPBX97021	61	2	None	None	G5T2T3	S3	null	CDFW_WL-Watch List, USFWS_BCC-Birds of Conservation Concern	Chaparral, Coastal scrub
Asio otus	long-eared owl	Birds	ABNSB13010	48	1	None	None	G5	S3?	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Cismontane woodland, Great Basin scrub, Riparian forest, Riparian woodland, Upper montane coniferous forest
Aspidoscelis hyperythra	orange-throated whiptail	Reptiles	ARACJ02060	369	9	None	None	G5	S2S3	null	CDFW_WL-Watch List, IUCN_LC-Least Concern, USFS_S-Sensitive	Chaparral, Cismontane woodland, Coastal scrub
Aspidoscelis tigris stejnegeri	coastal whiptail	Reptiles	ARACJ02143	148	1	None	None	G5T5	S3	null	CDFW_SSC-Species of Special Concern	null
Astragalus brauntonii	Braunton's milk-vetch	Dicots	PDFAB0F1G0	44	1	Endangered	None	G2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Chaparral, Coastal scrub, Limestone, Valley & foothill grassland
Athene cunicularia	burrowing owl	Birds	ABNSB10010	1989	28	None	None	G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Coastal prairie, Coastal scrub, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland
Atriplex coulteri	Coulter's saltbush	Dicots	PDCHE040E0	121	1	None	None	G3	S1S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Coastal bluff scrub, Coastal dunes, Coastal scrub, Valley & foothill grassland
Bombus crotchii	Crotch bumble bee	Insects	IIHYM24480	234	2	None	Candidate Endangered	G3G4	S1S2	null	null	null
Buteo swainsoni	Swainson's hawk	Birds	ABNKC19070	2518	2	None	Threatened	G5	S3	null	BLM_S-Sensitive, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Great Basin grassland, Riparian forest, Riparian woodland, Valley & foothill grassland
California Walnut Woodland	California Walnut Woodland	Woodland	CTT71210CA	76	9	None	None	G2	S2.1	null	null	Cismontane woodland
Calochortus weedii var. intermedius	intermediate mariposa-lily	Monocots	PMLIL0D1J1	140	4	None	None	G3G4T2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Calystegia felix	lucky morning-glory	Dicots	PDCON040P0	10	6	None	None	G1Q	S1	1B.1	null	Meadow & seep, Riparian scrub
Campylorhynchus brunneicapillus sandiegensis	coastal cactus wren	Birds	ABPBG02095	156	1	None	None	G5T3Q	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Coastal scrub

Carolella busckana	Busck's gallmoth	Insects	IILEM2X090	4	1	None	None	G1G3	SH	null	null	Coastal dunes, Coastal scrub
Catostomus santaanae	Santa Ana sucker	Fish	AFCJC02190	28	7	Threatened	None	G1	S1	null	AFS_TH-Threatened, IUCN_VU-Vulnerable	Aquatic, South coast flowing waters
Centromadia pungens ssp. laevis	smooth tarplant	Dicots	PDAST4R0R4	126	2	None	None	G3G4T2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Alkali playa, Chenopod scrub, Meadow & seep, Riparian woodland, Valley & foothill grassland, Wetland
Ceratochrysis longimala	Desert cuckoo wasp	Insects	IIHYM71040	2	1	None	None	G1	S1	null	null	null
Coccyzus americanus occidentalis	western yellow-billed cuckoo	Birds	ABNRB02022	156	6	Threatened	Endangered	G5T2T3	S1	null	BLM_S-Sensitive, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Riparian forest
Coleonyx variegatus abbotti	San Diego banded gecko	Reptiles	ARACD01031	8	1	None	None	G5T3T4	S1S2	null	CDFW_SSC-Species of Special Concern	Chaparral, Coastal scrub
Coturnicops noveboracensis	yellow rail	Birds	ABNME01010	45	1	None	None	G4	S1S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Meadow & seep
Crotalus ruber	red-diamond rattlesnake	Reptiles	ARADE02090	192	6	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Chaparral, Mojavean desert scrub, Sonoran desert scrub
Dipodomys merriami parvus	San Bernardino kangaroo rat	Mammals	AMAFD03143	81	1	Endangered	Candidate Endangered	G5T1	S1	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Dipodomys stephensi	Stephens' kangaroo rat	Mammals	AMAFD03100	220	10	Endangered	Threatened	G2	S2	null	IUCN_EN-Endangered	Coastal scrub, Valley & foothill grassland
Dudleya multicaulis	many-stemmed dudleya	Dicots	PDCRA040H0	154	4	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, USFS_S-Sensitive	Chaparral, Coastal scrub, Valley & foothill grassland
Elanus leucurus	white-tailed kite	Birds	ABNKC06010	180	3	None	None	G5	S3S4	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_LC-Least Concern	Cismontane woodland, Marsh & swamp, Riparian woodland, Valley & foothill grassland, Wetland
Empidonax traillii extimus	southwestern willow flycatcher	Birds	ABPAE33043	70	3	Endangered	Endangered	G5T2	S1	null	NABCI_RWL-Red Watch List	Riparian woodland
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1385	3	None	None	G3G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable, USFS_S-Sensitive	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San

												Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Eriastrum densifolium ssp. sanctorum	Santa Ana River woollystar	Dicots	PDPLM03035	31	3	Endangered	Endangered	G4T1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Coastal scrub
Eumops perotis californicus	western mastiff bat	Mammals	AMACD02011	296	3	None	None	G5T4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, WBWG_H-High Priority	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland
Euphydryas editha quino	quino checkerspot butterfly	Insects	IILEPK405L	127	1	Endangered	None	G5T1T2	S1S2	null	XERCES_CI-Critically Imperiled	Chaparral, Coastal scrub
Gila orcuttii	arroyo chub	Fish	AFCJB13120	49	3	None	None	G2	S2	null	AFS_VU-Vulnerable, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Icteria virens	yellow-breasted chat	Birds	ABPBX24010	100	2	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Riparian forest, Riparian scrub, Riparian woodland
Lasiurus xanthinus	western yellow bat	Mammals	AMACC05070	58	3	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_H-High Priority	Desert wash
Lasthenia glabrata ssp. coulteri	Coulter's goldfields	Dicots	PDAST5L0A1	111	1	None	None	G4T2	S2	1B.1	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden, SB_SBBG-Santa Barbara Botanic Garden	Alkali playa, Marsh & swamp, Salt marsh, Vernal pool, Wetland
Laterallus jamaicensis coturniculus	California black rail	Birds	ABNME03041	303	2	None	Threatened	G3G4T1	S1	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_NT-Near Threatened, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Brackish marsh, Freshwater marsh, Marsh & swamp, Salt marsh, Wetland
Lepidium virginicum var. robinsonii	Robinson's pepper-grass	Dicots	PDBRA1M114	142	3	None	None	G5T3	S3	4.3	null	Chaparral, Coastal scrub
Lepus californicus bennettii	San Diego black-tailed jackrabbit	Mammals	AMAEB03051	103	2	None	None	G5T3T4	S3S4	null	CDFW_SSC-Species of Special Concern	Coastal scrub
Monardella australis ssp. jokerstii	Jokerst's monardella	Dicots	PDLAM18112	3	1	None	None	G4T1?	S1?	1B.1	USFS_S-Sensitive	Chaparral, Lower montane coniferous forest
Nyctinomops femorosaccus	pocketed free-tailed bat	Mammals	AMACD04010	90	2	None	None	G4	S3	null	CDFW_SSC-Species of Special Concern,	Joshua tree woodland, Pinon & juniper woodlands,

											IUCN_LC-Least Concern, WBWG_M-Medium Priority	Riparian scrub, Sonoran desert scrub
Oncorhynchus mykiss irideus pop. 10	steelhead - southern California DPS	Fish	AFCHA0209J	20	1	Endangered	None	G5T1Q	S1	null	AFS_EN-Endangered	Aquatic, South coast flowing waters
Phacelia stellaris	Brand's star phacelia	Dicots	PDHYD0C510	15	1	None	None	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Coastal dunes, Coastal scrub
Phrynosoma blainvillii	coast horned lizard	Reptiles	ARACF12100	784	3	None	None	G3G4	S3S4	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Chaparral, Cismontane woodland, Coastal bluff scrub, Coastal scrub, Desert wash, Pinon & juniper woodlands, Riparian scrub, Riparian woodland, Valley & foothill grassland
Polioptila californica californica	coastal California gnatcatcher	Birds	ABPBJ08081	846	22	Threatened	None	G4G5T2Q	S2	null	CDFW_SSC-Species of Special Concern, NABCI_YWL-Yellow Watch List	Coastal bluff scrub, Coastal scrub
Pseudognaphalium leucocephalum	white rabbit-tobacco	Dicots	PDAST440C0	62	1	None	None	G4	S2	2B.2	null	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland
Rhinichthys osculus ssp. 3	Santa Ana speckled dace	Fish	AFCJB3705K	13	1	None	None	G5T1	S1	null	AFS_TH-Threatened, CDFW_SSC-Species of Special Concern, USFS_S-Sensitive	Aquatic, South coast flowing waters
Setophaga petechia	yellow warbler	Birds	ABPBX03010	78	2	None	None	G5	S3S4	null	CDFW_SSC-Species of Special Concern, USFWS_BCC-Birds of Conservation Concern	Riparian forest, Riparian scrub, Riparian woodland
Sidalcea neomexicana	salt spring checkerbloom	Dicots	PDMAL110J0	30	1	None	None	G4	S2	2B.2	USFS_S-Sensitive	Alkali playa, Chaparral, Coastal scrub, Lower montane coniferous forest, Mojavean desert scrub, Wetland
Southern California Arroyo Chub/Santa Ana Sucker Stream	Southern California Arroyo Chub/Santa Ana Sucker Stream	Inland Waters	CARE2330CA	4	1	None	None	GNR	SNR	null	null	null
Southern Cottonwood Willow Riparian Forest	Southern Cottonwood Willow Riparian Forest	Riparian	CTT61330CA	111	6	None	None	G3	S3.2	null	null	Riparian forest
Southern Sycamore Alder Riparian Woodland	Southern Sycamore Alder Riparian Woodland	Riparian	CTT62400CA	230	5	None	None	G4	S4	null	null	Riparian woodland
Southern Willow Scrub	Southern Willow Scrub	Riparian	CTT63320CA	45	2	None	None	G3	S2.1	null	null	Riparian scrub
Spea hammondii	western spadefoot	Amphibians	AAABF02020	1213	4	None	None	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of	Cismontane woodland, Coastal scrub, Valley & foothill

											Special Concern, IUCN_NT-Near Threatened	grassland, Vernal pool, Wetland
Spinus lawrencei	Lawrence's goldfinch	Birds	ABPBY06100	4	1	None	None	G3G4	S3S4	null	IUCN_LC-Least Concern, NABCI_YWL-Yellow Watch List, USFWS_BCC-Birds of Conservation Concern	Broadleaved upland forest, Chaparral, Pinon & juniper woodlands, Riparian woodland
Symphyotrichum defoliatum	San Bernardino aster	Dicots	PDASTE80C0	102	1	None	None	G2	S2	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Valley & foothill grassland
Vireo bellii pusillus	least Bell's vireo	Birds	ABPBW01114	503	26	Endangered	Endangered	G5T2	S2	null	IUCN_NT-Near Threatened, NABCI_YWL-Yellow Watch List	Riparian forest, Riparian scrub, Riparian woodland

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
Phone: (760) 431-9440 Fax: (760) 431-5901
http://www.fws.gov/carlsbad/

In Reply Refer To: January 07, 2020
Consultation Code: 08ECAR00-2020-SLI-0430
Event Code: 08ECAR00-2020-E-01026
Project Name: OBMP PEIR Update MZ5

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
(760) 431-9440

Project Summary

Consultation Code: 08ECAR00-2020-SLI-0430

Event Code: 08ECAR00-2020-E-01026

Project Name: OBMP PEIR Update MZ5

Project Type: WATER SUPPLY / DELIVERY

Project Description: Optimum Basin Management Plan PEIR Update - MZ5

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/33.949007230000035N117.5593827708134W

Counties: Riverside, CA | San Bernardino, CA

Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Stephens' Kangaroo Rat *Dipodomys stephensi (incl. D. cascus)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3495	Endangered

Birds

NAME	STATUS
Coastal California Gnatcatcher *Polioptila californica californica* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8178	Threatened
Least Bell's Vireo *Vireo bellii pusillus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5945	Endangered
Southwestern Willow Flycatcher *Empidonax traillii extimus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6749	Endangered

Fishes

NAME	STATUS
Santa Ana Sucker *Catostomus santaanae* Population: 3 CA river basins There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3785	Threatened

Insects

NAME	STATUS
Delhi Sands Flower-loving Fly *Rhaphiomidas terminatus abdominalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1540	Endangered

Flowering Plants

NAME	STATUS
Nevin's Barberry *Berberis nevinii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8025	Endangered
San Diego Ambrosia *Ambrosia pumila* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8287	Endangered
Santa Ana River Woolly-star *Eriastrum densifolium ssp. sanctorum* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6575	Endangered
Thread-leaved Brodiaea *Brodiaea filifolia* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6087	Threatened

Critical habitats

There are 4 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Least Bell's Vireo *Vireo bellii pusillus* https://ecos.fws.gov/ecp/species/5945#crithab	Final
Santa Ana Sucker *Catostomus santaanae* https://ecos.fws.gov/ecp/species/3785#crithab	Final
Southwestern Willow Flycatcher *Empidonax traillii extimus*	Final

NAME	STATUS
https://ecos.fws.gov/ecp/species/6749#crithab	
Yellow-billed Cuckoo *Coccyzus americanus* For information on why this critical habitat appears for your project, even though Yellow-billed Cuckoo is not on the list of potentially affected species at this location, contact the local field office. https://ecos.fws.gov/ecp/species/3911#crithab	Proposed

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

USFWS Critical Habitat Overview


Legend
Google Earth

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

USFWS Critical Habitat
Management Zone 1


Legend

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

USFWS Critical Habitat
Management Zone 2

Legend
Google Earth

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

USFWS Critical Habitat
Management Zone 3


Legend
Google Earth

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

USFWS Critical Habitat
Management Zone 4


Legend
Google Earth

Program Natural Environment Study
Optimum Basin Management Program Update

Chino Basin Watermaster and Inland Empire Utilities Agency

USFWS Critical Habitat
Management Zone 5


Legend

HCP COVERED SPECIES

3.8.3 Covered Species Accounts

Slender-Horned Spineflower (*Dodecahema leptoceras*)

Current Status and Distribution

The slender-horned spineflower (*Dodecahema leptoceras*) is Federally listed as endangered, California listed as endangered, and is on the California Rare Plant Rank list. This species is found in 27 known extant occurrences throughout coastal foothill drainages of Riverside, San Bernardino, and Los Angeles Counties, ranging from the Temecula area northwestwards to Santa Clarita. One historic record was collected near Palm Springs (CNPS 2020, CCH 2014).

Within the Planning Area the known occurrences are concentrated east of San Bernardino along the Santa Ana River and along the southern portion of Cajon Creek. Smaller populations are known at the south end of the Planning Area near Lake Elsinore, at the western boundary of the Planning Area near Rancho Cucamonga, and near Yucaipa (ICF 2014).

Habitat Affinities

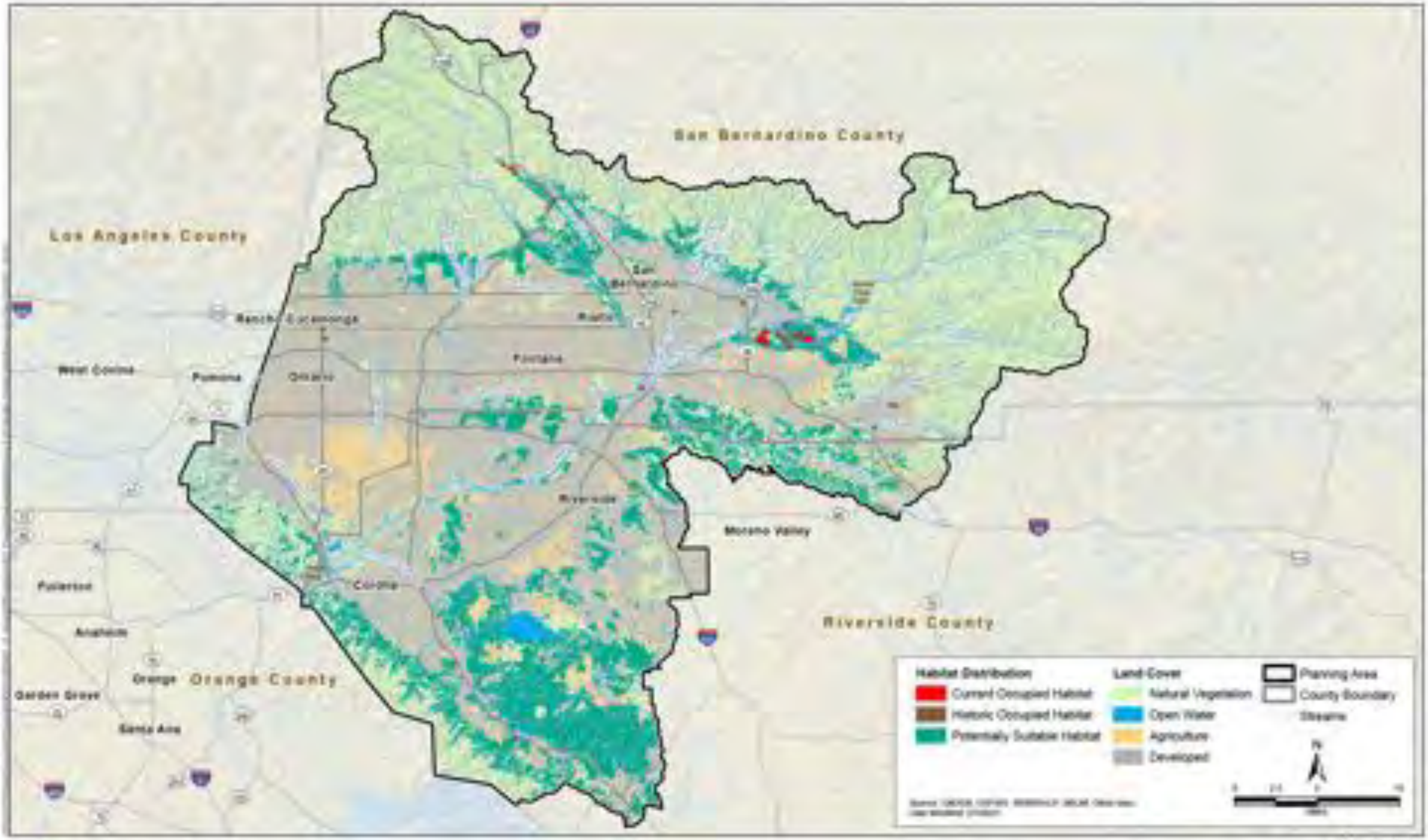
Slender-horned spineflower occurs on stable older alluvium away from active channels in areas with little flooding disturbance and infrequent surface flows between 656 and 2,493 feet in elevation (CNPS 2020). This species occurs in slightly acidic silt soil with low salinity, little organic matter, and low nutrient content, in silt-filled shallow depressions on relatively flat surfaces (Allen 1996). Its preferred habitat is transient in nature and a mid to late successional stage that requires disturbance to maintain over a larger scale. Some populations are known in denser woody habitats that are thought to arise from successional changes from past alluvial flow (USFWS 2010a).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of modeled slender-horned spineflower habitat and documented occurrences in the Planning Area are illustrated on Figure 3-26 and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat:

- **Land Cover**: California Chaparral (Chamise), California Coastal Scrub, California Coastal Scrub (Black Sage), California Coastal Scrub (Brittle Bush), California Coastal Scrub (Brittlebush), California Coastal Scrub (Bush Penstemon), California Coastal Scrub (Bush Poppy), California Coastal Scrub (California buckwheat), California Coastal Scrub (California Juniper), California Coastal Scrub (California sagebrush), California Coastal Scrub (Chamise), California Coastal Scrub (Deerweed), California Coastal Scrub (Laurel Sumac), California Coastal Scrub (Prickly Pear), California Coastal Scrub (Toyon), California Coastal Scrub (White Sage), California Coastal Scrub (Yerba Santa), Great Basin-Intermountain Xeric-Riparian Scrub, and North American Warm-Desert Xeric-Riparian Scrub; **AND**
- **Elevation**: 700–2,500 feet.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-26
Slender-horned spineflower, *Dodecahema leptoceras*
Potential Habitat Distribution and Known Occurrence Records

Current Occupied Habitat (modeled)

- Current Occupied Habitat was modeled by including areas within a 100-foot buffer around known current occurrences within Potentially Suitable Habitat. This model category highlights the potentially suitable habitat where the species has been recently documented (post-2005). Where this category of modeled Current Occupied Habitat occurs, it replaces the Potentially Suitable Habitat or Historic Occupied Habitat (below) such that there is not overlap between the model categories.

Historic Occupied Habitat (modeled)

- Historic Occupied Habitat was modeled by including areas within a 100-foot buffer around known historic occurrences, outside of Current Occupied Habitat, within Potentially Suitable Habitat. This model category highlights the potentially suitable habitat where the species has been historically documented (pre-2005) but has not recently been documented. Where this category of modeled Historic Occupied Habitat occurs, it replaces the Potentially Suitable Habitat such that there is not overlap between the model categories.

Taxonomy and Genetics

This species was first described as *Centrostegia leptoceras* in 1870 and was then published as *Chorizanthe leptoceras* in 1877. The original name is the name under which the species was listed by State and Federal agencies. Taxonomists changed the name to the current name *Dodecahema leptoceras* in 1989 based on its morphological and phylogenetic distinctiveness (IPNI 2014, USFWS 2010a). Genetic diversity is high for the entire population; however, this is due to the population in Los Angeles, which is genetically distinct from populations in Riverside and San Bernardino Counties (USFWS 2010a). Despite differences in population sizes between locations, Ferguson and Ellstrand (1999) found that there was no evidence of lack of genetic diversity or homozygosity within locations. Plants are mostly outcrossing but are also self-fertile.

Life History and Demography

This spineflower is an annual herb. The involucre number per individual varies and depends on climactic and genetic factors and has been observed to range from 1 to 169 involucres (USFWS 2010a). The typical arrangement is three flowers per involucre, one fruit per flower, and one seed per fruit (Reveal 2005).

Pollination and Seed Dispersal

Information and studies about pollination are limited on this species. Spineflower is thought to be pollinated by various small insects (USFWS 2010a). The single-seeded fruits are located in involucres with hooked spines that may attach to wildlife for dispersal. Seeds are glabrous with no dispersal mechanisms of their own (Reveal 2005).

Seasonal Phenology

This species typically germinates with a 6 to 52% survival rate in February (USFWS 2010a, Ferguson and Ellstrand 1999). The blooming period generally occurs between April and June (CNPS 2020) (Table 3-17). Seed banks are known to occur with this species and are relatively long-lasting, which helps maintain demographics and genetic diversity of the species in dry years (Ferguson and

Ellstrand 1999). Within each population there are often wide fluctuations in population size due to seasonal rainfall (USFWS 2010a).

Table 3-17. Phenology of Slender-Horned Spineflower

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blooming												
Fruiting												

Sources: CNPS 2014, USFWS 2010a

Threats and Special Management Considerations

The primary threat is habitat modification or destruction from development, mining, proposed flood control measures and other hydrologic alteration, off-highway vehicles, illegal dumping, and nonnative invasive species. The USFWS also cites inadequacy of state and local plans to fully protect this species, specifically attributing this to discretionary impacts that are allowed by state and local laws, and to the fact that most populations of this species do not occur on protected or otherwise conserved lands. Other general threats include climate change, sand and gravel mining, off-highway vehicles, nonnative invasive plants, herbivory, and the small population size present at each location (CNPS 2020, USFWS 2010a). The slender-horned spineflower is also affected by groundwater management and merits consideration by Groundwater Sustainability Agencies under the Sustainable Groundwater Management Act; however, specific threats to this species from groundwater changes have not been assessed (Rohde et al. 2019).

Due to the potential presence of long-lived propagules in the seed bank, the areas of the model indicated current or historic occurrences will be avoided and/or impacts minimized associated with implementation of Covered Activities. When possible, restoration, rehabilitation, and/or research of modeled Historic Occupied Habitat areas will be prioritized to benefit slender-horned spineflower.

Santa Ana River Woolly-Star (*Eriastrum densifolium* ssp. *sanctorum*)

Current Status and Distribution

The Santa Ana River woolly-star (*Eriastrum densifolium* ssp. *sanctorum*) is Federally listed as endangered, California listed as endangered, and on the California Rare Plant Rank list. All 27 known occurrences are highly restricted to the Santa Ana River complex, occurring along the Santa Ana River, Mill Creek, Lytle Creek, Plunge Creek, and Cajon Creek. Most known occurrences are in San Bernardino County, and the remaining extant occurrences are in Riverside County (USFWS 2010b, CNPS 2014). All known occurrences are within the Planning Area.

Habitat Affinities

This species is found on the alluvial terraces of open floodplains in chaparral or coastal scrub with intermittent flooding, light surface disturbance, on south- to west- facing aspects, and relatively low cover of annuals or perennials in areas with nutrient-poor sands between 885 and 2,625 feet in elevation (CNPS 2020, DeGroot 2016). It is most competitive in early stage habitats with 97% or greater sand particles, but can also compete with other species in moderate stage habitats with 90–97% sand particles. Woolly-star is a pioneer plant that is often outcompeted in more stable shrubby ecosystems (USFWS 2010b). This habitat type is transient in nature and is an early to mid-successional stage, which requires disturbance to maintain over a large scale.

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of Santa Ana River woolly-star modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-27 and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Californian Coastal Scrub, Great Basin-Intermountain Xeric-Riparian Scrub, North American Warm-Desert Xeric-Riparian Scrub, and Water – Seasonal (except within existing groundwater recharge basins); **AND**
- **Soil Texture**: sand, loamy sand, coarse sand, and loamy fine sand, **AND**
- **Elevation**: 0–2,100 feet.
- **Post-processing**: Excludes existing groundwater recharge basins and areas of the Devil's Creek, Etiwanda Fan, and Jurupa Hills that are known to be out of the species range.

Taxonomy and Genetics

This taxon was originally described as *Hugelia densiflorum* and changed to *Eriastrum* in 1945. Currently five total subspecies are described for this species (IPNI 2014). This species is also thought to hybridize with other subspecies, namely the subspecies *elongatum* around Cajon Creek and Lytle Creek, and the subspecies *austromontanum* in Lytle Creek and La Cadeña Drive (USFWS 2010b).

Life History and Demography

This species is a perennial subshrub that typically lives for 5 years, but some individuals are known to live for 10 years (USFWS 2010b). Each head typically produces 4 to 30 flowers, each flower has 1 fruit (a capsule), and each fruit has 6 to 33 seeds (De Groot 2014). Seeds germinate with the first major fall rainfall, and few seeds remain in the seed bank (USFWS 2010b).

Pollination and Seed Dispersal

Santa Ana River woolly-star is self-incompatible and an obligate outcrosser. Primary pollinators vary with location and include the giant flower-loving fly (*Rhaphiomidas acton* ssp. *acton*), the sphinx moth (*Hyles lineata*), two bee species (*Micranthophora flavocinata* and *Bombus californicus*) and two hummingbirds (black-chinned hummingbird [*Archilochus alexandri*] and Anna's hummingbird [*Calypte anna*]). Seeds have a smooth surface morphology with a coating that becomes mucilaginous on contact with water and attaches the seed to the soil. Most seeds drop within a foot of the plant, but some stay in the capsule, which can remain on the plant for several years. Seeds and capsules can be transported longer distances by floodwater (USFWS 2010b).

Seasonal Phenology

Blooming typically occurs between April and September but is most heavy in June (CNPS 2014) (Table 3-18). Fruiting typically occurs between mid-July and mid-October (USFWS 2010b).

Table 3-18. Phenology of Santa Ana River Woolly-Star

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blooming												
Fruiting												

Sources: CNPS 2014, USFWS 2010b

Threats and Special Management Considerations

The primary threat to Santa Ana River woolly-star is habitat alteration resulting from development, mining, hydrologic changes (specifically those resulting from operation of the Seven Oaks Dam), grading for flood control, and off-highway vehicle activity. USFWS cites the inadequacy of state and local plans to fully protect this species, specifically in that discretionary impacts are allowed by state and local laws, and most occurrences are not on conserved lands. More broadly, climate change and hybridization at one-third of the known locations could threaten this species (USFWS 2010b). The Santa Ana River woolly-star is also affected by groundwater management and merits consideration by Groundwater Sustainability Agencies under the Sustainable Groundwater Management Act; however, specific threats to this species from groundwater changes have not been assessed (Rohde et al. 2019).

Delhi Sands Flower-Loving Fly (*Rhaphiomidas terminatus abdominalis*)

Current Status and Distribution

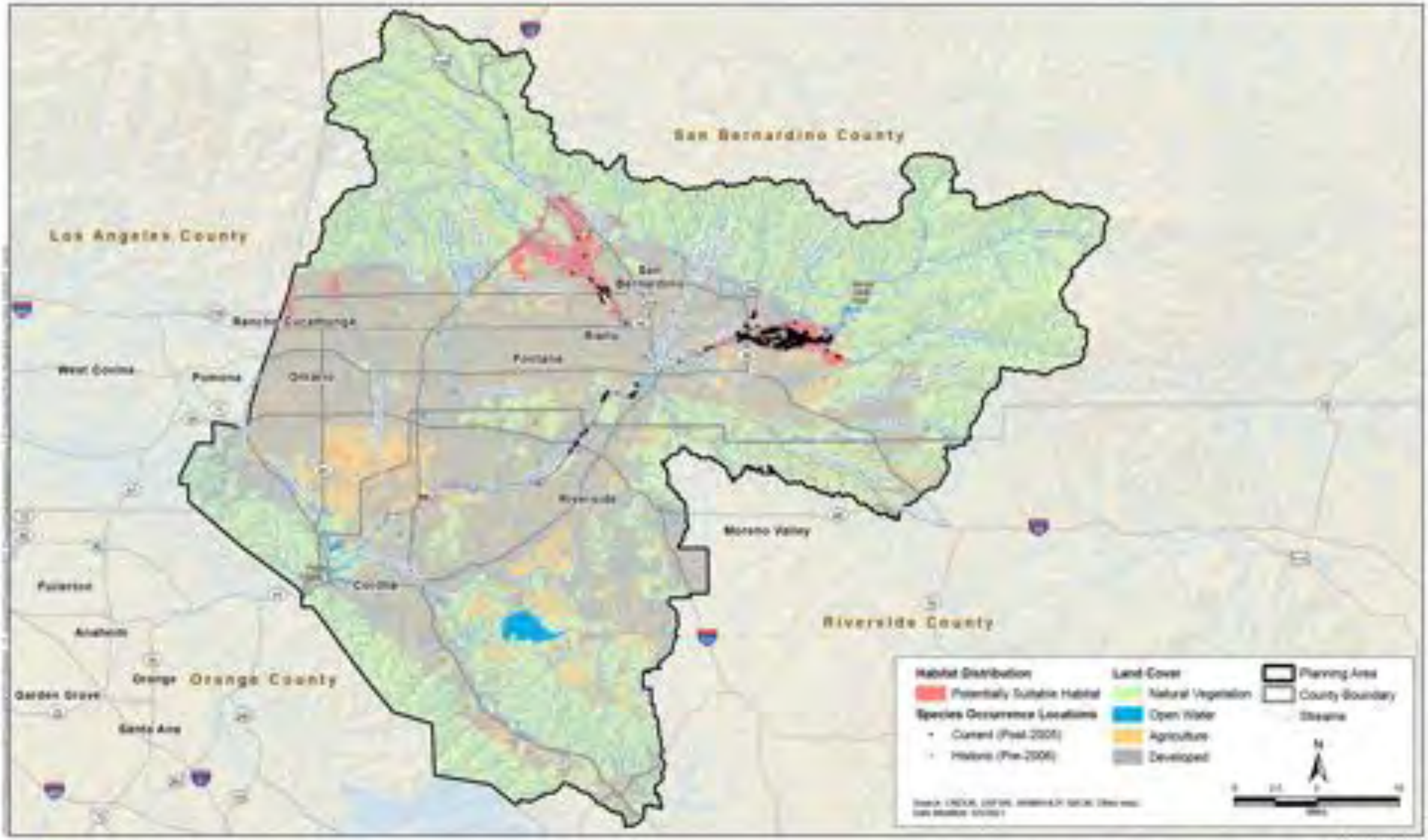
The Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*) is Federally listed as endangered. It is a subspecies endemic to the Colton Dunes Ecosystem of Southern California and is only known to occur in Riverside and San Bernardino Counties, with most of the occupied habitat located within a limited area of southwestern San Bernardino County (USFWS 2008).

Habitat Requirements

The characteristic feature of this species' occupied habitat is fine wind-blown sandy soils, often wholly or partly within sand dunes stabilized by sparse native vegetation. Plant species in the Colton Dunes include California buckwheat, California croton, deerweed, telegraph weed, and California evening primrose. Adults do not appear to use areas of dense vegetation. The fly can utilize Delhi sands in moderately disturbed areas such as abandoned vineyards or grazed lands (USFWS 1997). Larvae can be found within relatively moist soil several feet below the soil surface (Osborne and Ballmer pers. comm).

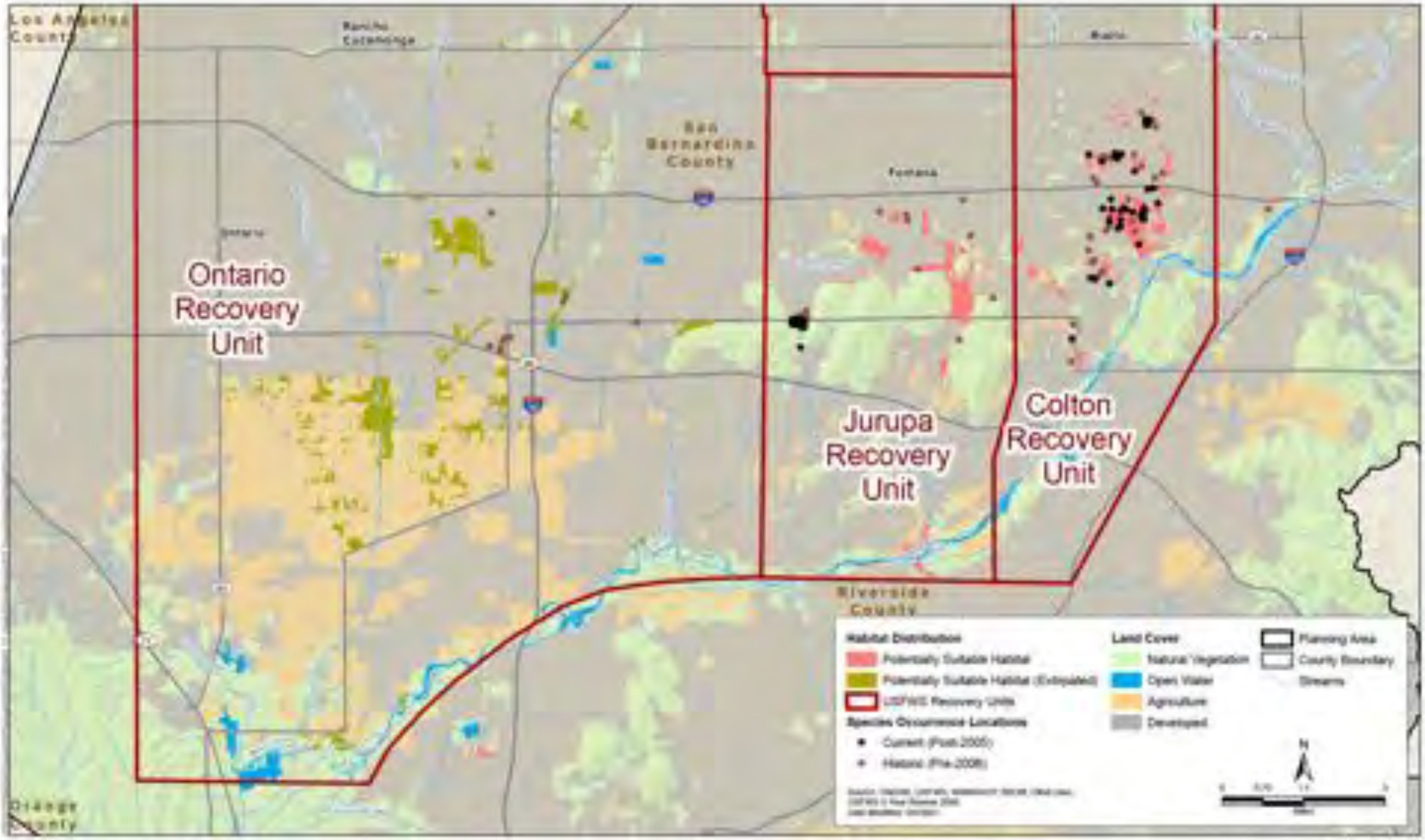
Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of Delhi Sands flower-loving fly modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-28. The following modeled habitat types are used to



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-27
Santa Ana River woolly-star, *Eriastrum densifolium* ssp. *sanctorum*
Potential Habitat Distribution and Known Occurrence Records



Upper Santa Ana River Habitat Conservation Plan

Figure 3-28
Delhi sands flower-loving fly, *Rhaphiomidas terminatus abdominalis*
Potential Habitat Distribution and Known Occurrence Records

represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: All land cover types except Developed and Agriculture; **AND**
- **Soil Component Name**: Delhi Sands.

Potentially Suitable Habitat (Extirpated)

- Potentially suitable habitat that is within the USFWS Ontario Recovery Unit.

Taxonomy and Genetics

Taxonomic studies have shown that the genus Rhaphiomidas (giant flower-loving flies) belongs in the family Mydidae (no common name) (Cazier 1985), and, as a result, some researchers believe that the Delhi Sands flower-loving fly name should be changed to the Delhi Sands giant flower-loving fly (USFWS 2008).

Reproduction

Delhi Sands flower-loving fly undergoes a complete metamorphosis from egg to larva to pupa to adult. Oviposition (egg-laying) occurs within loose, sandy soils in the late summer (Kingsley 1996). Eggs are placed 1 to 2 inches beneath the surface of the sand (Rogers and Mattoni 1993). Larval stages develop completely underground and emerge as adults from July through September (Mattoni and Ballmer 1998).

Dispersal, Territoriality, and Home Range

Dispersal distances, territorial behavior, and home range sizes have not been documented.

Daily and Seasonal Activity

This species is very difficult to observe because only the adult/flying stage occurs above ground between July and September (Table 3-19). Adults are most active during the warmest sunniest parts of the day (USFWS 2008). Larvae are capable of indeterminate development, molting two to three times per year for at least 3 years prior to pupation (Osborne and Ballmer pers. comm).

Table 3-19. Seasonal Activity of Delhi Sands Flower-Loving Fly

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Flight Season (breeding)												

Sources: USFWS 1997, USFWS 2008

Diet and Foraging

Both males and females extract nectar from California buckwheat and other plants. It is not clear if nectar feeding is essential for adult survival or reproduction (Kingsley 1996).

Threats and Special Management Considerations

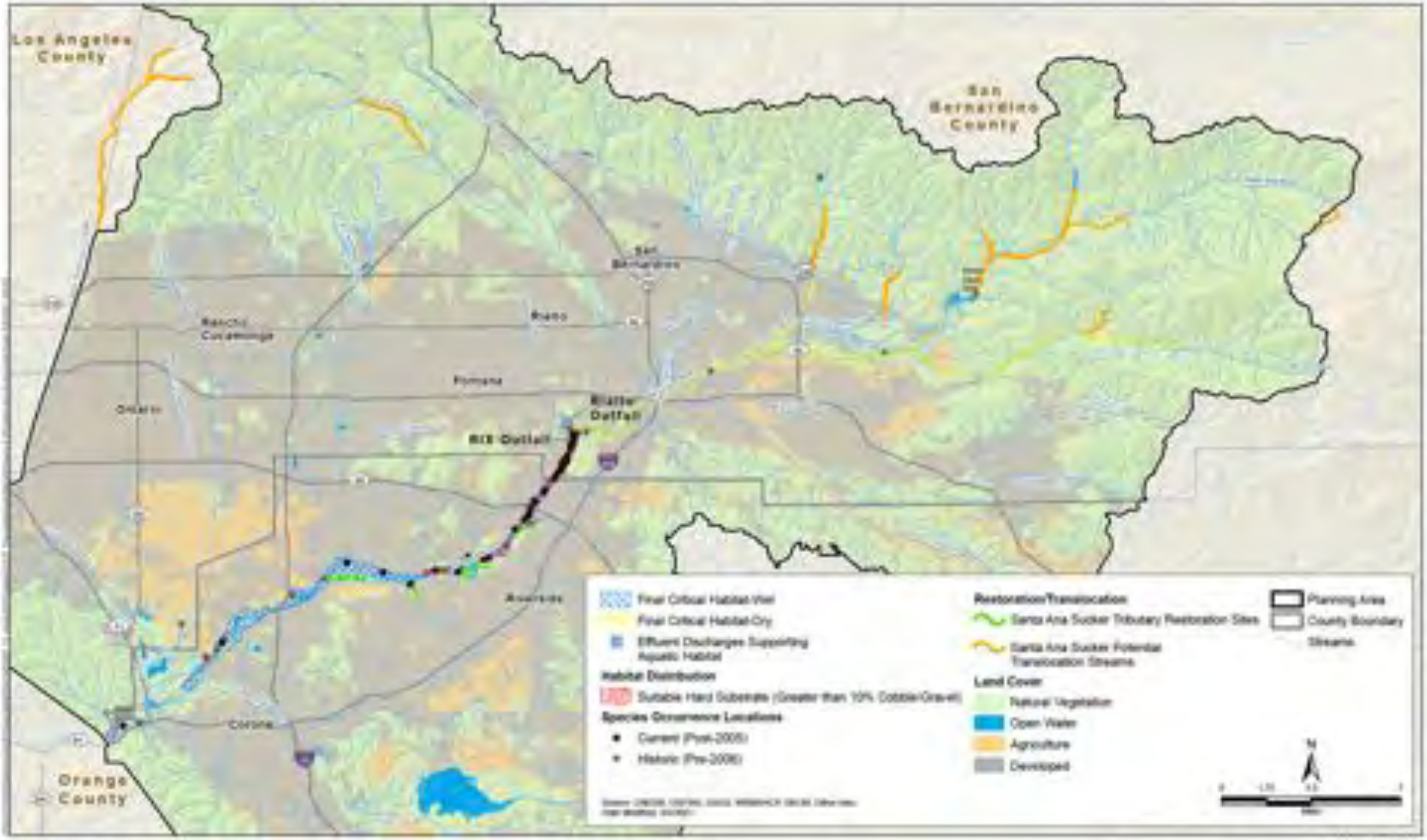
The primary threat to the Delhi Sands flower-loving fly is loss of habitat, habitat degradation, and habitat fragmentation (USFWS 2008). Activities that result in habitat degradation include grading, plowing, disking, and off-highway vehicle use. Occupied sites have become increasingly isolated by surrounding development. Nonnative invasive plants also degrade suitable habitat by increasing the vegetation cover or by altering soil conditions through dune stabilization and changes to soil moisture conditions (Western Riverside County MSHCP Biological Monitoring Program 2011).

Currently, there are only three known populations where management must be focused. The Slover/Pepper population is located east of Riverside Avenue, south of I-10, north of the Santa Ana River, and west of the cement plant. This population is partially protected through the establishment of the 7.5-acre Colton Transmission Facility Reserve and the 150-acre Vulcan Materials, Inc., Colton Dunes Conservation Bank. These conserved sites are surrounded by additional undeveloped Delhi Sands flower-loving fly habitats that are currently not protected but are needed to provide adequate protection for this population. A second population is located at Pepper Avenue adjacent to I-10 and the Pepper Avenue on- and off-ramps, which is an area partially protected within the Hospital Reserve; additional habitat in this area would need to be protected to sustain a robust population (Osborne 2016a, 2016b). The third population is the Jurupa Hills population located in the City of Jurupa Valley, north of SR-60 and south of I-10, which has been protected with conservation of 52 acres of Delhi Sands flower-loving fly habitat. There are no other conserved sites that are large enough and adequately managed to support a Delhi Sands flower-loving fly population. In 2005, USFWS estimated that approximately 2,826 acres of potential Delhi Sands flower-loving fly habitat remains (USFWS 2008).

Santa Ana Sucker (*Catostomus santaanae*)

Current Status and Distribution

The Santa Ana sucker (SAS; *Catostomus santaanae*) is Federally listed as threatened and is a California Species of Special Concern. Listed populations occur in the Santa Ana and San Gabriel Rivers and Big Tujunga Creek (USFWS 2009a). In the Santa Ana River, the species' range is officially from the Weir Canyon drop structure downstream of the Prado Dam all the way upstream to the La Cadena drop structure, and suitable habitat extends between Van Buren Boulevard in the Jurupa Valley upstream to the RIX outfall (Figure 3-29). Surveys conducted annually since 2015 by the USGS over a 5-mile stretch of the Santa Ana River noted that the highest abundance of Santa Ana sucker have recently been concentrated in the upper 1.25 miles of the perennial stream (484 [2018] to 4,983 [2015] fish per mile), from immediately downstream of the RIX facility discharge to approximately Riverside Avenue (Wulff et al. 2020). Over the USGS's approximately 5-mile survey area the mean density of SAS was stable from 2015 to 2017 (2015, 6,802 SAS; 2016, 7,208 SAS; 2017, 6,424 SAS) but the population dropped in 2018 (935 SAS) associated with several impacts on the river that occurred in late 2017 (stoppage of flow from the RIX facility). The cause of these impacts has since been alleviated by the City of San Bernardino in coordination with the USFWS, avoiding and/or minimizing future impacts on native fishes. A low-effect habitat conservation plan has been drafted by the City of San Bernardino for operation of the RIX facility to provide incidental take of Santa Ana sucker when future shutdowns of the RIX facility occur. This document is currently in review by the USFWS. It is anticipated that an ITP will be issued for this proposed low-effect HCP prior to issuance of the ITPs for the Upper SAR HCP.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-29
Santa Ana sucker, *Catostomus santaanae*
Potential Habitat Distribution and Known Occurrence Records

Habitat Requirements

Santa Ana sucker is most abundant in unpolluted, clear water, at temperatures that are typically less than 72°F (Moyle 2002). Optimal stream conditions include coarse substrates (e.g., gravel, cobble, boulders), a combination of shallow riffles and deeper pools with algae present, and consistent flow (USFWS 2011, Palenscar 2014). Adults prefer deeper habitats such as pools and runs and utilize streams with gravelly substrates for spawning; juveniles occupy primarily riffle habitats (Haglund et al. 2010, Paramo et al. 2013). No sucker have been found in reaches with greater than 7% gradient (USFWS 2010c), and sucker rarely use habitat with less than 10% gravel and cobble substrate (USFWS 2010c, Thompson et al. 2010). In-stream or bank habitat with riparian vegetation providing shade is important for larvae and juveniles as are tributary habitat inflows that create refugia (USFWS 2011). Sucker tolerate reduced flows and elevated temperatures in the summer months, and turbid conditions associated with high flows that typically occur during winter months (Moyle 2002). The USFWS description of critical habitat *Physical and Biological Features* includes a functioning hydrological system that provides sources of water and coarse sediment necessary to maintain all life stages, including adults, juveniles, larvae, and eggs (Moyle 2002, USFWS 2010c).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The existing distribution of potentially occupied Santa Ana sucker habitat in the Planning Area is based on habitat suitability modeling, aquatic surveys for native fishes and other aquatic species (Wulff et al. 2020), USGS assessments of preferred microhabitats for Santa Ana sucker, and long-term surveys (citizen science) estimating the availability of Santa Ana sucker suitable habitats with hard river bottom substrates (surveys described below). The distribution of modeled suitable habitat and documented occurrences is shown on Figure 3-29, along with designated Critical Habitat. The Critical Habitat is designated over wetted portions of the river from the confluence with Rialto Channel downstream, and designated for generally dry portions of the river upstream from Rialto Channel to protect these areas as sediment sources for transport into occupied habitat during high storm flow events. Areas with known suitable hard river bottom substrates (>10% gravel and cobble) are shown in the figure. Occurrence data are from the sources listed in Table 3-12 above, including data from the USGS SAR Native Fishes Survey, conducted annually from 2015–2019 (Wulff et al. 2020). Habitat suitability modeling for Santa Ana sucker is described later in this section.

USGS Annual Fish Surveys

The San Bernardino Valley Municipal Water District has employed the services of the USGS to conduct native fish surveys in the Santa Ana River on an annual basis since 2015. The USGS also collects physical habitat data in the same reaches where native fish surveys are carried out. Physical habitat survey data collection includes information related to channel morphology, flow rate, substrate type, and streamside vegetation. The focus of the USGS effort is centered on the native fish census; therefore, the survey area is limited in geographic scope to areas where native fish are typically encountered. The survey area includes from the Rialto Channel, in the City of Colton, downstream along the mainstem of the Santa Ana River to just downstream of Mission Boulevard, in the City of Riverside. The downstream terminus of the survey reach is approximately 2.5 miles upstream of the confluence with Anza Creek. Results from the 2019 SAR Native Fishes Survey and draft results from the 2020 Survey suggest that the majority of the Santa Ana sucker in the Santa Ana River have shifted downstream. Future SAR Native Fishes Surveys will survey a longer reach of the river in order to better assess population size and distribution of native fishes.

Riverwalk Annual Channel Morphology Surveys (Citizen Science)

The Riverwalk is a volunteer based aquatic habitat survey that takes place on an annual basis along an 18-mile stretch of the Santa Ana River. The first Riverwalk occurred in 2006. Data are collected along permanent transects spaced at 300-meter intervals in the fall from the Rialto Channel confluence with the Santa Ana River downstream to I-15 in an effort to inform the quantity, quality, and distribution of suitable habitat for the Santa Ana sucker. Basic data on channel morphology, substrate, and streamside vegetation are collected at predetermined cross-section transects. The size and location of gravel bars are also noted wherever they are encountered along the river. The areas with suitable hard river bottom substrates (>10% gravel and cobble) are shown on Figure 2-29.

Santa Ana Sucker Designated Critical Habitat

There are 6,450 acres of designated critical habitat for Santa Ana sucker in the Planning Area. The upper reaches of the mainstem Santa Ana River (above Rialto Channel) and two of its tributaries, City Creek and Mill Creek, comprise approximately 2,108 acres of the total designated critical habitat for Santa Ana sucker (75 *Federal Register* 77962). The species is extirpated from these reaches due to historic manipulation of the floodplain and surface flow; however, these areas provide essential sources of new coarse sediment (gravel and cobble) needed to maintain the balance of sediment within the occupied lower reaches of the Santa Ana River. Channel maintenance flows are necessary to maintain the process of coarse sediment transport through the river system. Areas downstream of Rialto Channel provide live-in habitat for Santa Ana sucker. Approximately 4,342 acres of designated critical habitat occurs downstream of Rialto Channel within the Planning Area.

Preferred Habitat Criteria for Habitat Distribution Modeling

The amount of modeled preferred habitat for the Santa Ana sucker in occupied reaches of the Santa Ana River was predicted using an approach that incorporated components of the USFWS Instream Flow Incremental Methodology (IFIM) (Bovee et al. 1998) and Physical Habitat Simulation System (PHABSIM) (Milhous & Waddle 2012) methodologies. The approach described below was developed in coordination with a technical advisory committee that consisted of representatives from resource agencies, nongovernmental organizations, and academic institutions. A detailed description of the approach and results are available in *Santa Ana Sucker Habitat Suitability Analysis* (Appendix E).

The Santa Ana sucker habitat suitability model predicts the amount of potentially occupied (preferred) habitat available at various flows. Three variables were used to define and quantify Santa Ana sucker preferred habitat along approximately 21 miles of the Santa Ana River between the Rialto Channel and Prado Dam: water velocity, water depth, and presence of cobble and/or gravel substrate (Table 3-20 and Figure 3-29). The area is considered preferred habitat if it meets the depth and velocity conditions, and has an average of 10% or greater cover of coarse substrate (cobble and/or gravel) as indicated by previous research on Santa Ana sucker habitat preference (Thompson et al. 2010). The sum of all the predicted preferred habitat meeting these criteria over the 21.1-mile-long study reach is 2.15 acres. Although additional portions of the stream are anticipated to be used by this species at any time, the focus of this analysis was on those habitats that meet the water depth, velocity, and substrate criteria for preferred habitat. These criteria are discussed further below.

Water velocity was collected within Santa Ana sucker use areas during native fish surveys (fall season). The minimum velocity found correlated to Santa Ana sucker use, 1.3 feet per second (Table 3-20), approximates the minimum velocity needed to transport sand (1.2 feet per second); therefore, the minimum water velocity preferred by Santa Ana sucker indicates a selection for substrates with exposed substrates larger than sand (fine gravel or larger). In fall months (typical survey period) these habitats can be rare but are vital for providing higher quality substrates for foraging. During periods of limited rainfall (drought) the exposure and/or turning of existing coarse substrate is limited. During these times, baseflow, derived from discharged wastewater, provides the majority of the foraging (year-round) and spawning (primarily late winter and spring) habitats for Santa Ana sucker in the Santa Ana River.

Water depths of habitat commonly used by Santa Ana sucker were also measured during native fish surveys (minimum, 1.3 feet, Table 3-20). Commonly, Santa Ana sucker were found to use deeper portions of the channel created by a stream width constriction or scour pool (e.g., presence of large woody debris), a vegetated stream margin with emergent vegetation or undercut bank, or the outer margin of a meander where the greatest water velocity and depth co-occur. The availability of coarse substrates in these areas and greater water depth provides forage (most commonly various algal species) and added protection from non-aquatic predators, respectively. During the spawning season, exposed coarse substrate (small to medium sized gravel) on the margins of high velocity flow areas (e.g., riffles or runs) or at the downstream end of scour pools (i.e., glide) provides opportunities for reproduction. The extended spawning period observed for Santa Ana sucker (protracted spawning) combined with the production of thousands of eggs, allows a greater opportunity for female fish to search and find multiple appropriate spawning areas throughout the spawning season. This adaptation is well-suited for successful reproduction and recruitment in an ever-changing alluvial stream like the Santa Ana River.

Channel bottom data (substrate) was collected during Riverwalk surveys as described above. Estimates of exposed coarse substrate, presented as average percent cover, were made at each of 109 transects, placed at 300-meter intervals, over approximately 14 miles of potentially occupied stream (Rialto Channel to River Road Bridge), Figure 3-29. This dataset was used to estimate the portions of the stream that consistently were found to have greater than 10% exposed coarse substrate (sum of boulder, cobble, and gravel) over the majority of the collection period of the Riverwalk, including 13 years of data from 2006 to 2018.

While there are other elements of the sucker habitat that could have been included to predict the distribution of preferred habitat (e.g., riparian cover type and amount), the depth and flow velocity are the habitat features most easily measured and integrated into a hydrology model in the context of the IFIM/PHABSIM approach, and amount of coarse substrate has been annually surveyed since 2006. Furthermore, many of the Covered Activities evaluated by this HCP directly affect flow velocity and depth such that these effects can be included in the model to analyze the effects of these Covered Activities (see Chapter 4).

Habitat use data were derived from intensive surveys conducted by USGS on the Upper Santa Ana River. Wulff et al. (2018) provided raw suitability scores for depth and water velocity. These suitability scores were based on direct observations of Santa Ana sucker habitat use over two field seasons in the Santa Ana River in the Planning Area. For this habitat distribution model the suitability scores for Santa Ana sucker habitat preferences (depth and velocity) from 2 years of data collection were combined and the higher of the values for each year was used. When calculating depth suitability, maximum values presented an appropriate use curve (Figure 3-30). However, the data on velocity values were noisy and varied between field seasons. For the purposes of estimating an appropriate velocity suitability curve, maximum values were selected for peaks and median values were inferred for valleys (Figure 3-31). The smoothing of the curve provides a conservative estimate of the preferred habitat use areas for Santa Ana sucker during the periods of sampling. Sampling was confined to daylight hours during the fall when only large young-of-the-year (YOY, 60- to 100-millimeter fork length) and adult Santa Ana sucker were present in the stream. The cohorts of Santa Ana sucker present during the fall season are generally found to overlap in use areas, with adult and YOY fish foraging side by side.

A habitat suitability matrix for water depth and velocity was created by multiplying the velocity suitability scores by the depth suitability scores derived from Wulff et al. (2018). Combined suitability scores greater than 0.50 were considered to represent habitat with suitable velocity and depth, while scores less than 0.50 represent unsuitable habitat, as is consistent with the IFIM/PHABSIM approach (Table 3-20). An assumption supporting these criteria is that flow velocities greater than 1.2 feet per second result in decreased sand deposition and the maintenance of coarser substrates on which the Santa Ana sucker is dependent (based on field observations of reaches of the Santa Ana River occupied by Santa Ana sucker; ESA 2015).

Table 3-20. Santa Ana Sucker Depth by Velocity Habitat Suitability Matrix

	Velocity (feet/second)	**0.66**	**1.31**	**1.97**	**2.62**	**3.28**	**3.94**	**4.59**	**5.25**	**5.91**
Depth (feet)	Habitat Suitability Index	0.09	0.62	0.81	1.00	0.96	0.93	0.90	0.03	0.00
0.33	0.08	0.01	0.05	0.06	0.08	0.08	0.07	0.07	0.00	0.00
0.66	0.09	0.01	0.06	0.07	0.09	0.09	0.08	0.08	0.00	0.00
0.98	0.26	0.02	0.16	0.21	0.26	0.25	0.24	0.23	0.01	0.00
1.31	0.74	0.07	0.46	**0.60**	**0.74**	**0.71**	**0.69**	**0.67**	0.02	0.00
1.64	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
1.97	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
2.30	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
2.62	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
2.95	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
3.28	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
3.61	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
3.94	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00

Combined Suitability Index Range	**Combined Depth and Velocity**
0–.49	Not Suitable
0.50–1.00	**Suitable**

ft/s = feet per second

Modeling the Distribution of Suitable Habitat

The modeling of depth and velocity conditions was performed at seven different assessment sites by applying the Santa Ana sucker habitat suitability criteria to the flow depths and flow velocities

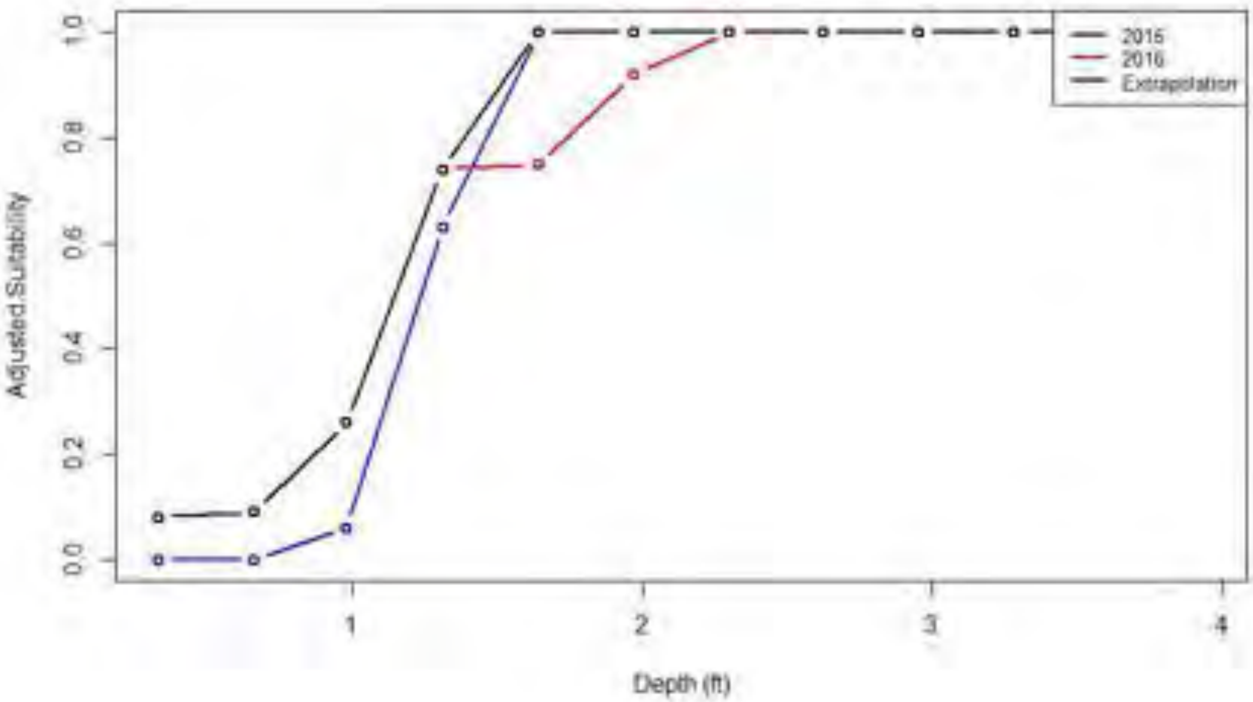


Figure 3-30
Sucker Habitat Flow Depth Suitability Curve
Upper Santa Ana River Habitat Conservation Plan

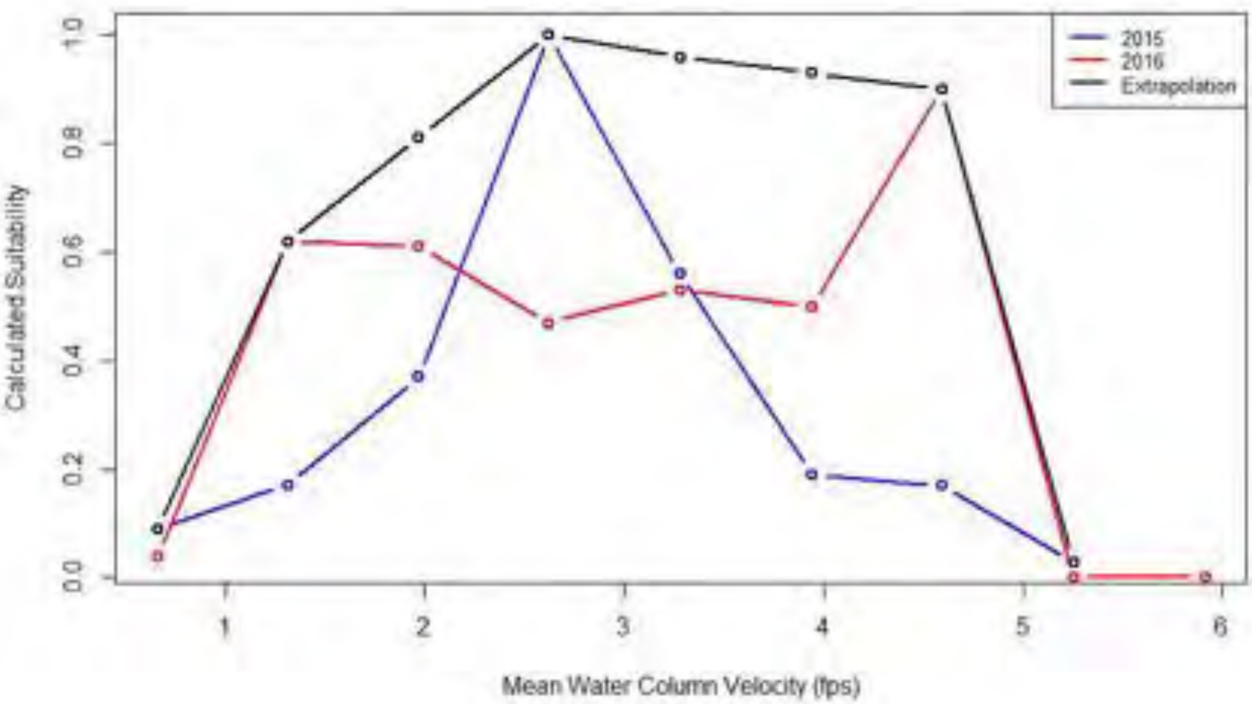


Figure 3-31
Sucker Habitat Flow Velocity Suitability Curve
Upper Santa Ana River Habitat Conservation Plan

modeled in a Two-Dimensional Sedimentation and River Hydraulics model (2D hydraulic model) that was developed for the HCP. Six of the sites are located on the Santa Ana River, from just downstream of the RIX discharge outfall (ESA Upper Reach) to the downstream site (3A) located near Prado Basin Park downstream of I-15. One site is located on the Rialto Channel downstream of the Rialto discharge outfall (see mapped locations on Figure 3-32). The total assessed channel length from the Rialto Channel to the downstream end of the Santa Ana River near Prado is 21.1 miles.

The 2D hydraulic model requires an elevation surface of channel and floodplain elevations. Elevations outside of the low-flow channel were obtained from 2015 LiDAR. All of the assessment sites have perennial flow and thus require bathymetric data of the low-flow channel to supplement the 2015 LiDAR data because LiDAR does not capture underwater elevations. Bathymetry data was available for four of the sites from studies conducted in 2015 (ESA Upper Reach, ESA Middle Reach, ESA Lower Reach, and USGS Reach 9) (ESA 2015, Wright and Minear 2019). New bathymetry surveys were conducted at Reach 3, Reach 3A, and Rialto Reach in 2017. Model elevation surfaces made from the combined bathymetry and LiDAR sources have nodes spaced typically around 3 feet from each other.

A series of flows were modeled for each site that span the range of low flows that typically occur at the sites. The model output for each model node along the continuous 2D modeling surface was queried to assess the combination of depth and velocity at each node. For each modeled flow, calculations were performed to determine the percentage of wetted area in which the combination of depth and velocity values are within the sucker habitat “preferred” range shown in the combined habitat suitability matrix in Table 3-20.

Table 3-21 summarizes the amount of preferred habitat (contains both suitable depth and velocity) determined for all seven of the 2D hydraulic model assessment sites. The table lists the August through October 95% exceedance flow (i.e., base flow conditions, or statistically the flow in the channel is equal to or greater than this magnitude 95% of the time from August through October) for the existing hydrology condition (also shown on Figure 3-33). The months of August through October were selected because this time of year typically has the lowest base flow and conversely the least amount of modeled preferred habitat (foraging habitat) for the year. Habitat quality during the spawning season is maintained by high flow events (storm flow) when sediment is re-activated and larger sediments (gravel and cobble) are turned in the active channel, creating interstitial voids. During periods of drought, storm flow is reduced and limited maintenance of spawning habitat occurs. Spawning during these periods is reliant on baseflow to winnow fine sands off of coarser substrates, exposing appropriate spawning substrates, yet spawning sediments are typically embedded with fine sediment throughout the year. USGS data suggests an increase in recruitment of sucker during years with greater precipitation. The 2015 precipitation year was lower than 2016 (USGS https://waterwatch.usgs.gov, precipitation data not presented) and the Santa Ana sucker population was found to increase from 6,802 to 7,208 fish. Draft data collected by the USFWS in cooperation with the Riverside-Corona Resource Conservation District found a large increase in larval and juvenile Santa Ana sucker in 2016 following high flow storm flow events that turned coarse sediment in active channel. Figures 3-34 through 3-40, show the resulting mapping of suitable depth and velocity for each of the seven assessment sites.

Table 3-21. Summary of Hydrologic Model Characteristics by Santa Ana Sucker Habitat Modeling Site (Upstream to Downstream)

Hydrologic Model Characteristic	Rialto Channel	ESA Upper	USGS Reach 9	ESA Middle	ESA Lower	SAR Site 3	SAR Site 3a
Low Flow Channel Length (feet)	507	1,132	975	1,195	1,048	1,032	1,099
Reach Average Bed Slope (percent)	0.77	0.32	0.39	0.36	0.38	0.25	0.24
Existing Condition Aug–Oct 95% Exceedance Flow (cfs)	9.2	49.0	49.0	31.1	31.1	87.4	63.6
Average Modeled Wetted Channel Width under Existing Condition Aug–Oct 95% Exceedance Flow (feet)	14	26	35	24	40	84	81
Area of Suitable Depth and Velocity under Existing Condition Aug–Oct 95% Exceedance Flow (acres)	0.006	0.202	0.110	0.071	0.012	0.107	0.045
Unit Area of Suitable Depth and Velocity under Existing Condition Aug–Oct 95% Exceedance Flow (acres/1,000 feet of channel length)	0.011	0.179	0.112	0.059	0.011	0.103	0.041
Suitable Depth and Velocity as percent of Total Channel Wetted Area under Existing Condition Aug–Oct 95% Exceedance Flow (percent)	3.3	30.3	14.2	11.0	1.2	5.3	2.2

cfs = cubic feet per second

The process for using the results from the individual assessment sites to interpolate suitability for the entire 21.1-mile long study reach (starting at the Rialto Outfall and extending down the Rialto Channel and then down the Santa Ana River to Prado) is described in Appendix E. The acreage of habitat with suitable depth and velocity, in acres per 1,000 feet of channel length, over the 21.1-mile long study reach is illustrated on Figure 3-41.

There are 110 transects along this 21.1-mile portion of the river that have been surveyed annually from 2006 to 2018 to quantify the amount of coarse substrate (gravel and cobble) along with several other habitat features. The mean percent of gravel and cobble over this 12-year period was calculated. When multiple transects occurred between model nodes the average of the means was taken. Areas were determined to be suitable habitat when the depth and velocity was suitable and the proportion of cobble and gravel substrate was greater than 10% (USFWS 2010c). Table 3-22 shows the acres in each reach meeting all three criteria (depth, velocity, and substrate). The sum of all the predicted preferred habitat meeting these criteria over the 21.1-mile long study reach is 2.15 acres. The reach of river that generally provides suitable habitat for Santa Ana sucker (10% or greater cover of coarse substrate) over the 21.1-mile-long study reach is approximately 6 miles of stream (Rialto channel to Tequesquite Arroyo).

Upper Santa Ana River
Habitat Conservation Plan

Figure 3-32
Santa Ana River Hydraulic & Habitat Modeling Reaches Downstream of Rialto

Upper Santa Ana River
Habitat Conservation Plan

Figure 3-33
Average August-October 95% Exceedance Flow (cfs) for the Existing Condition

Figure 3-34
Santa Ana Sucker Suitable Depth and Velocity
Rialto Reach - Modeled Flow of 9.0 cfs
Upper Santa Ana River Habitat Conservation Plan

Figure 3-35
Santa Ana Sucker Suitable Depth and Velocity
ESA Upper Reach - Downstream of RIX - Modeled Flow of 51.5 cfs
Upper Santa Ana River Habitat Conservation Plan

ICF

Figure 3-36
Santa Ana Sucker Suitable Depth and Velocity
USGS Reach 9 - Downstream of RIX - Modeled Flow of 51.5 cfs
Upper Santa Ana River Habitat Conservation Plan

ICF

Figure 3-37
Santa Ana Sucker Suitable Depth and Velocity
ESA Middle Reach - Downstream of RIX - Modeled Flow of 32.4 cfs
Upper Santa Ana River Habitat Conservation Plan

Figure 3-38
Santa Ana Sucker Suitable Depth and Velocity
ESA Lower Reach - Downstream of RIX - Modeled Flow of 32.4 cfs
Upper Santa Ana River Habitat Conservation Plan

Figure 3-39
Santa Ana Sucker Suitable Depth and Velocity
Site 3 Reach - Downstream of RIX - Modeled Flow of 67.0 cfs
Upper Santa Ana River Habitat Conservation Plan

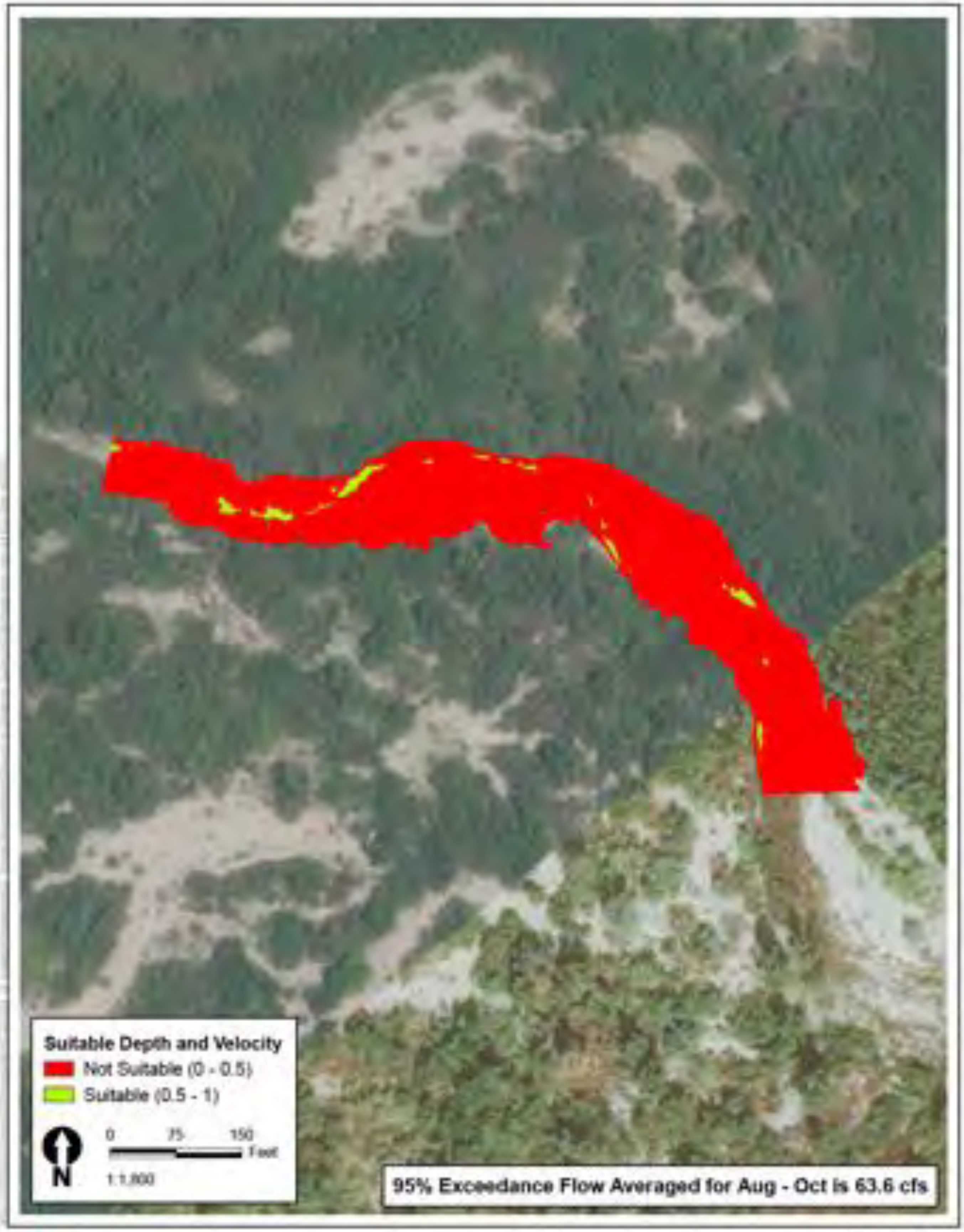


Figure 3-40
Santa Ana Sucker Suitable Depth and Velocity
Site 3a Reach - Downstream of RIX - Modeled Flow of 67.0 cfs
Upper Santa Ana River Habitat Conservation Plan

Upper Santa Ana River
Habitat Conservation Plan

Figure 3-41
Acres of Santa Ana Sucker Suitable Depth and Velocity per 1,000 ft of Channel Length under Existing Condition Average Aug-Oct 95% Exceedance Flow

Table 3-22. Acres of Existing Santa Ana Sucker Modeled Habitat in the Planning Area

Reach Description[1]	Hydro Model Node[1]	Reach Length (feet)	Acres of Area with Preferred Depth and Velocity per 1,000 feet	Acres of Area with Preferred Depth and Velocity	Suitable Habitat (>10% Gravel/Cobble Substrate per Riverwalk Surveys[2])
Reaches with Suitable Substrate (>10% Gravel/Cobble)					
Rialto Channel DS of Rialto outfall	NFRC-06	1,705	0.01	0.019	Suitable (55.2%)
SAR DS Rialto Channel & US RIX outfall	NSAR19	1,141	0.00	0.000	Suitable (51.1%)
SAR DS RIX outfall & US Riverside Ave (@ ESA Upper model site)	NSAR20	6,865	0.13	0.910	Suitable (67.6%)
SAR DS Riverside Ave & US node NSAR 22	NSAR21	3,242	0.09	0.279	Suitable (59.2%)
SAR DS node NSAR 22 & US Market St	NSAR22	5,624	0.08	0.425	Suitable (44.2%)
SAR DS Market St & US Hwy 60	NSAR23	1,576	0.06	0.093	Suitable (34.1%)
SAR DS Hwy 60 and US node NSAR 232	NSAR231	1,804	0.06	0.106	Suitable (27.8%)
SAR DS Hwy 60 & US Mission Blvd (@ ESA Middle model site)	NSAR232	4,000	0.06	0.236	Suitable (24.7%)
SAR DS Mission Blvd & US node NSAR 241 (@ ESA Lower model site)	NSAR24	5,679	0.01	0.064	Suitable (20.7%)
SAR DS node NSAR 241 & US node NSAR 242 (Tequesquite Arroyo reach)	NSAR241	7,883	0.00	0.016	Suitable (10.8%)
Total Preferred Habitat				**2.15**	
Reaches without Suitable Substrate (>90% Sand/Silt)					
SAR DS node NSAR 242 & US node NSAR 243	NSAR242	1,842	0.00	0.004	Not Suitable (7.0%)
SAR Anza Creek reach	NSAR243	1,826	0.00	0.004	Not Suitable (8.9%)
SAR DS of Anza Creek/railroad bridge & US pipeline crossing	NSAR244	3,703	0.00	0.008	Not Suitable (6.9%)
SAR DS of pipeline crossing & US RWQCP	NSAR25	4,700	0.02	0.114	Not Suitable (4.6%)
SAR DS of RWQCP & US of Van Buren Blvd	NSAR26	1,305	0.02	0.022	Not Suitable (5.3%)
SAR DS Van Buren Blvd (Hole Creek reach)	NSAR27	1,647	0.12	0.190	Not Suitable (9.2%)

Reach Description[1]	Hydro Model Node[1]	Reach Length (feet)	Acres of Area with Preferred Depth and Velocity per 1,000 feet	Acres of Area with Preferred Depth and Velocity	Suitable Habitat (>10% Gravel/Cobble Substrate per Riverwalk Surveys[2])
SAR DS node NSAR 28 & US node NSAR 29	NSAR28	1,777	0.11	0.197	Not Suitable (6.6%)
SAR DS node NSAR 29 & US node NSAR 30	NSAR29	1,010	0.11	0.107	Not Suitable (4.3%)
SAR DS node NSAR 30 & US node NSAR 301	NSAR30	2,990	0.10	0.306	Not Suitable (3.8%)
SAR DS node NSAR 301 & US node NSAR 31	NSAR301	7,793	0.10	0.741	Not Suitable (5.1%)
SAR DS node NSAR 31 & US node NSAR 311 (San Antonio Creek reach)	NSAR31	1,493	0.08	0.119	Not Suitable (3.9%)
SAR DS node NSAR 311 & US node NSAR 32	NSAR311	1,900	0.07	0.140	Not Suitable (4.3%)
SAR DS node NSAR 32 & US node NSAR 321	NSAR32	4,855	0.07	0.342	Not Suitable (2.4%)
SAR DS node NSAR 321 & US node NSAR 33 (Day Creek reach)	NSAR321	2,968	0.07	0.195	Not Suitable (1.1%)
SAR DS node NSAR 33 & US node NSAR 331	NSAR33	4,953	0.05	0.261	Not Suitable (1.6%)
SAR DS node NSAR 331 & US node NSAR 332	NSAR331	3,354	0.05	0.154	Not Suitable (0.9%)
SAR DS node NSAR 332 & US node NSAR 34 (I-15)	NSAR332	1,724	0.04	0.074	Not Suitable (0.1%)
SAR DS node NSAR 34 (I-15) & US node NSAR 35	NSAR34	1,388	0.04	0.058	Not Suitable (0.8%
SAR DS node NSAR 35 & US node NSAR 351	NSAR35	2,064	0.04	0.086	Not Suitable (0.8%)
SAR DS node NSAR 351 & US node NSAR 352	NSAR351	11,399	0.04	0.474	Not Suitable (0.7%)
SAR DS node NSAR 352 & US node NSAR 36 (entrance into Prado)	NSAR352	7,293	0.04	0.303	Not Suitable (0.0%)

[1] Defines upstream boundary of reach: DS=downstream, US=upstream; NSAR = node Santa Ana River, an identifier from the Wildermuth hydrology model; RWQCP = Regional Water Quality Control Plant.
[2] Average percent gravel/cobble substrate within reach.

Taxonomy and Genetics

Santa Ana sucker is closely related to mountain suckers. The species was originally described as *Pantosteus santaanae*. Subsequently, the genus was reduced to subgenus *Catostomus*. Santa Ana sucker exhibits higher variability in anatomical characteristics than other members of the subgenus *Pantosteus*. Santa Ana suckers hybridize with introduced Owens sucker (*Catostomus fumeiventris*) in Santa Clara River (Moyle 2002). Richmond et al. (2017) studied the metapopulation structure in

Santa Ana sucker using microsatellites and mitochondrial DNA sequence data, finding that only the population on the Santa Clara River upstream of Piru Gap is free of genetic input from *C. fumeiventris*.

Reproduction

Santa Ana sucker become reproductively mature by the first year and spawn during the first and second years (Moyle et al. 1995). Spawning takes place over gravelly riffles (Moyle 2002). Eggs are demersal and adhesive and hatch in 15 days at 55°F (Moyle 2002). Fecundity is high for a small sucker species and increases with size (Greenfield et al. 1970, Moyle 2002). Sucker are able to recolonize suitable habitat rapidly due to high reproductive rates from short generation time, high fecundity, and long spawning period (Moyle 2002, Moyle et al. 1995).

Dispersal, Territoriality, and Home Range

Santa Ana sucker is limited by dams or other impassable structures that preclude further upstream dispersal or migration (i.e., Prado Dam and La Cadena drop structure) in the Santa Ana River (USFWS 2011). The species is highly adaptable to periodic flooding that occurs in Southern California; high reproductive rates allow for recolonization of suitable habitat (Moyle 2002). Territoriality and home range are undocumented.

Daily and Seasonal Activity

Santa Ana sucker spawning typically occurs mid-February to early July, with peak activity in April (Moyle 2002) (Table 3-23).

Table 3-23. Seasonal Spawning Activity of Santa Ana Sucker

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning		■	■	■	■	■	■					

Source: Moyle 2002, amended to include February.

Diet and Foraging

Algae, diatoms, and detritus make up 98% of the diet of Santa Ana sucker, scraped from coarse substrate with a subterminal mouth. Aquatic insects are also prey as size increases (Greenfield et al. 1970). The Riverside-Corona Resource Conservation District has observed large adults taking insects from the surface on occasion.

Threats and Special Management Considerations

The primary threat to Santa Ana sucker is modification, fragmentation, and loss of habitat through hydrologic modifications (USFWS 2017b). Additional threats include ongoing negative trends in water quantity and quality through reduced availability of surface water; modification to stream processes through reduced flows inhibiting downstream transport of coarse sediments needed for habitat; spread of nonnative giant reed (*Arundo donax*) and other nonnative invasive plant species resulting in negative modification of habitat; and predation by nonnative fishes (bass, sunfish, carp, catfish, tilapia) (USFWS 2017b). Ongoing drought conditions in the Santa Ana basin are exacerbating these threats. In addition, habitat degradation through the spread of the invasive nonnative algae

Compsopogon coeruleus is a recent threat because it forms dense mats, reducing foraging opportunities for the fish (Palenscar 2014). Re-appropriation of treated water that currently provides much of the available water supply for the species is a future threat (USFWS 2011).

Habitat availability has been greatly reduced in the Santa Ana River over the last 200 years because of ongoing (1) channelization, urban runoff, and other undocumented non-point source discharges negatively affecting water quality; and (2) water abstraction for human use reducing or eliminating in-stream flows (USFWS 2011). Habitat suitability in the Santa Ana River within currently occupied reaches is declining because of modified hydrologic processes that may have reduced coarse sediment transport to downstream occupied areas (Moyle 2002). Suitable habitat upstream of Seven Oaks Dam in the upper Santa Ana River, Plunge Creek, and City Creek are being assessed as potential reintroduction sites.

Other Relevant Information

In the Planning Area, suckers concentrate in tributaries or in sections of river that are fed by high-quality effluent from sewage treatment plants (Moyle 2002). Discharged treated effluent makes up the majority of the water present in the mainstem of the Santa Ana River during the dry summer months (USFWS 2011). Santa Ana sucker abundance is predominantly concentrated around the Regional Tertiary Treatment RIX discharge location to approximately Riverside Avenue. Concentrations of all age classes are at times present in the Rialto Drain, although habitat conditions are degraded due to multiple variables such as high summer water temperatures and high abundance of aquatic predator species. Critical habitat in the Planning Area is designated in the Santa Ana River from the Orange-San Bernardino County line to Greenspot Road, City Creek from its confluence with the Santa Ana River to the East-West City Creek fork, and Mill Creek from its confluence with the Santa Ana River to Valley of the Falls Drive.

Changes in flood flows below Seven Oaks Dam result in changes to sediment transport within the Santa Ana River Wash and reaches farther downstream. The operation of Seven Oaks Dam modifies the historic flow regime of the upper Santa Ana River. The reduction in peak flows has reduced both the amount and size of sediment that is transported downstream (USACE 2000), affecting the prevalence of coarse sediment as Santa Ana sucker habitat. Furthermore, the dam creates a discontinuity in sediment transport because it traps the bedload that is transported into Seven Oaks Reservoir, resulting in a reduction in sediment supply downstream.

Arroyo Chub (*Gila orcutti*)

Current Status and Distribution

The arroyo chub (*Gila orcutti*) is a California Species of Special Concern that is native to the streams and rivers of the Los Angeles basin, including the Los Angeles, San Gabriel, San Luis Rey, Santa Ana, and Santa Margarita Rivers (Moyle 2002). Distribution in the Santa Ana River is from Prado Dam upstream past Riverside Avenue, to the RIX and Rialto outflows, where surveys for Santa Ana sucker have documented incidental occurrences (Western Riverside County MSHCP 2012a). A number of tributary streams to the Santa Ana River are also occupied at times, dependent upon flow conditions and water quality, primarily in the Riverside area. This species is scarce in its native range because it does best in lower gradient streams that have largely disappeared due to the degradation of urbanized streams near the Los Angeles metropolitan area (Swift et al. 1993).

Habitat Requirements

Arroyo chub is most common in slow-flowing or backwater areas within warm to cool (50–75°F) streams with sand or mud substrates and a depth greater than 15 inches (Moyle et al. 1995, Swift et al. 1993). This species also occurs in fairly fast-moving streams with velocities over 31 inches per second or more, and in streams with coarse bottoms (CDFG 2010, Moyle 2002, Greenfield and Deckert 1973). The species can also tolerate stream flow intermittency and is adapted to survive in fluctuating streams and shift between fast-moving turbid streams in winter and clear intermittent streams in summer. Arroyo chub can also survive in hypoxic (low oxygen) conditions and in fluctuating temperatures (Western Riverside County MSHCP 2012a).

Distribution of Modeled Preferred Habitat and Documented Occurrences in the Planning Area

Distribution of arroyo chub modeled preferred habitat and documented occurrences in the Planning Area are illustrated on Figure 3-42 and quantified in Table 3-15. The known occupied habitat was mapped directly by species experts based upon habitat preference criteria, documented occurrences, and existing conditions in the Planning Area. This species was found to occupy various habitat types, including fine and coarse substrates within the Santa Ana River (Wulff et al. 2020).

Preferred habitat was modeled for arroyo chub along the same 21.1-mile-long study reach using similar methodology as described for Santa Ana sucker (Appendix E), with the exceptions of water velocity and coarse substrate. Modeled preferred habitat for arroyo chub employed one variable: water depth (greater than 15 inches). The sum of modeled preferred habitat meeting this criterion is 3.7 acres. Although additional portions of the stream are anticipated to be used by this species at any time, the focus of this analysis was on those habitats that meet the water depth criterion for preferred habitat during the dry season low flow conditions.

Taxonomy and Genetics

Arroyo chub readily hybridize with California roach and Mojave tui chubs (Moyle 2002). This species is closely related to other Gila chub from the Southwest, including those found in the Colorado River (Simons and Mayden 1998). Arroyo chub shares the subgenus Temeculina with *Gila purpurea* from Mexico and southeastern Arizona (Western Riverside County MSHCP 2012a).

Reproduction

Females can reproduce at 1 year of age. Most spawning occurs in pools or in quiet edge water at temperatures of 57–72°F (Moyle et al. 1995). Spawning takes place in pools and edge habitat from February to August, with a peak in June and July (Moyle 2002). Eggs are adhesive and are preferentially deposited on available submerged vegetation (Western Riverside County MSHCP 2003). Eggs typically hatch in 4 days, and the fry stay on the substrate for a few days before rising to the surface to stay among plants or other cover for approximately 3 to 4 months (Moyle et al. 1995, Moyle 2002).

Dispersal, Territoriality, and Home Range

Dispersal of arroyo chub is typically up- or down-river and depends on habitat availability and connectivity. The species will disperse to downstream habitat from upstream or tributary spawning areas as it becomes available. On a broad scale, dispersal in the Santa Ana River is limited by Prado

Dam and La Cadena drop structure. On a fine scale, upstream dispersal can often be limited by natural and human-made barriers and drop structures (Western Riverside County MSHCP 2003). There is no documented information on this species' territorial behaviors or on home range size.

Daily and Seasonal Activity

Daily activity patterns are not documented widely for arroyo chub. Some behavior patterns have been documented in the Riverside-Corona Resource Conservation District captive population. Seasonally, spawning occurs from February through August (Table 3-24).

Table 3-24. Seasonal Activity of Arroyo Chub

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning												

Source: Moyle 2002

Diet and Foraging

Arroyo chub feed on plants such as algae and water fern (*Azolla* spp.), and on invertebrates including insects and mollusks, depending on the availability (Moyle 2002). Arroyo chub are typically benthic feeders; however, individuals may also forage on drifting invertebrates when they are prevalent in the water column (Krug et al. 2012).

Threats and Special Management Considerations

Arroyo chub are threatened by habitat degradation from channelization, hardbank stabilization, and flood control projects that alter hydrologic conditions (i.e., decrease flow rate or remove backwater areas). These activities may also block movement by introducing impassable barriers to upstream movement. The species is threatened by habitat degradation through the spread of invasive plant species including giant reed and tamarisk (*Tamarix* spp.) (Moyle 2002, Western Riverside County MSHCP 2003). Arroyo chub are also negatively affected by nonnative predators; for example, they can be displaced through competition with introduced nonnative species such as red shiners (*Cyprinella lutrensis*) (Moyle 2002). Water quality degradation from urban runoff and in-stream discharges also negatively affects habitat quality (Western Riverside County MSHCP 2003).

Conservation management should include maintenance of connectivity through intermediate creek stretches to facilitate exchange between populations. Population exchange and subsequent gene flow is important for long-term persistence of the species. Perennial stream refugia should be protected from nonnative invasive plant and animal species known to negatively impact chub populations. Drop structures or other barriers isolating populations from each other should be identified and assessed for possible removal. The species responds favorably to captive headstarting, and can easily be re-introduced to create new populations. Because of this, unoccupied habitat that is suitable for the species, especially above impassable drop structures, but currently unoccupied should be considered for reintroduction opportunities (Moyle 2002, Western Riverside County MSHCP 2012a).

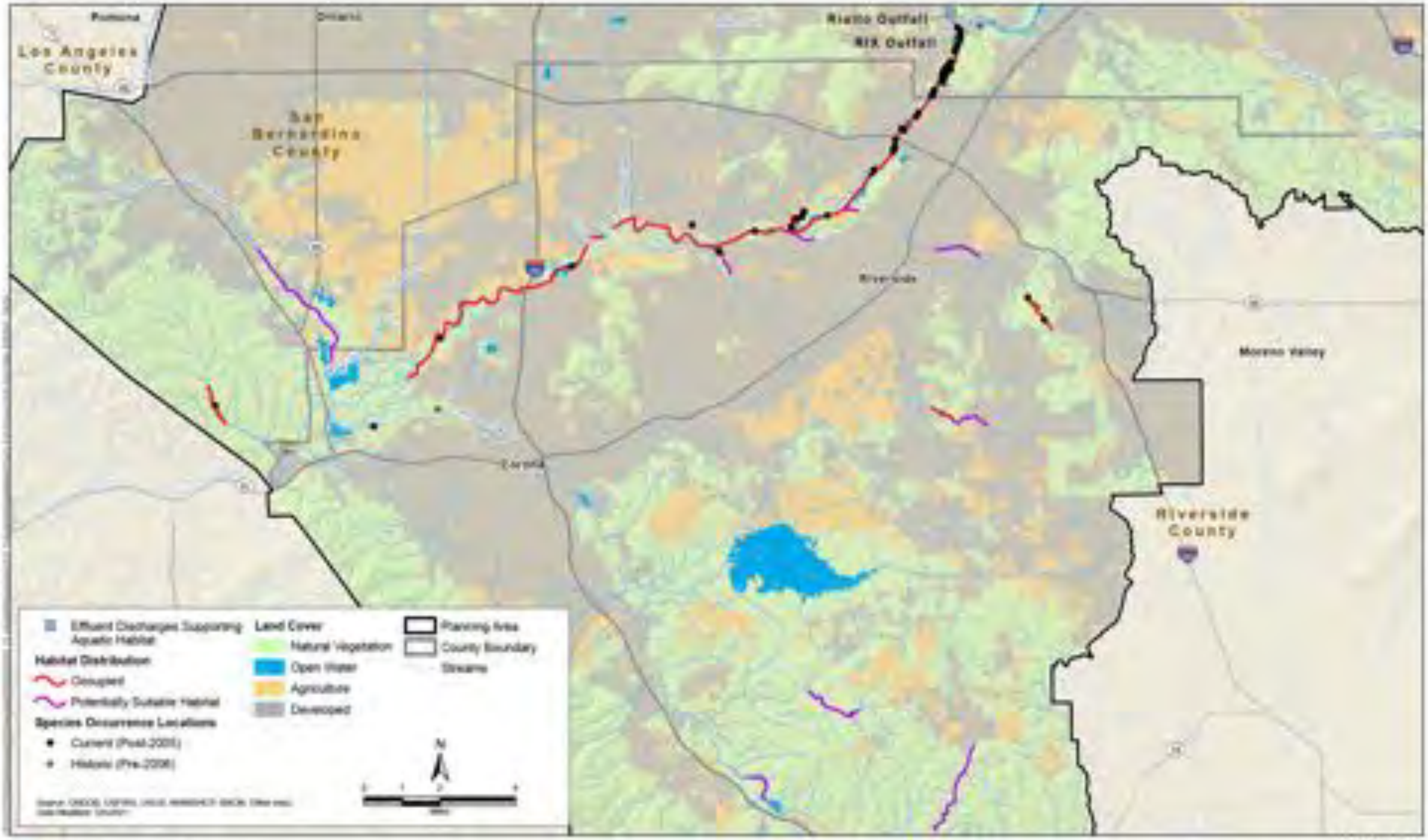


Figure 3-42
Arroyo chub, *Gila orcutti*
Potential Habitat Distribution and Known Occurrence Records

Santa Ana Speckled Dace (*Rhinichthys osculus*)

Current Status and Distribution

Santa Ana speckled dace (*Rhinichthys osculus*) is a California Species of Special Concern and historically occurred throughout the basin, foothill, and higher elevation portions of the Los Angeles, Santa Ana, and San Gabriel River systems, but currently only occurs in the headwaters of the Santa Ana and San Gabriel Rivers (Moyle et al. 1995). In the Planning Area this species is considered present in Lytle Creek, Cajon Creek, City Creek, and Plunge Creek (Pisces 2014). There are also occurrence records for Mill Creek and Strawberry Creek; however, Santa Ana speckled dace is now assumed to be extirpated from these streams (ICF International 2014, Pisces 2014). After significant winter flows, this species has been found in the mainstem Santa Ana River at the confluence of Warm Springs Creek and below the drop structure at La Cadena Drive; however, these sites do not represent suitable habitat for the species due to higher water temperatures (ICF International 2014, Russell pers. comm).

Habitat Requirements

Santa Ana speckled dace is found primarily in small perennial streams fed by cool springs that maintain summer water temperature below 68°F (Moyle 2002). This species can thrive in shallow (less than 24 inches), rocky riffles and runs with gravel and cobble substrates, which is optimal foraging habitat (Moyle 2002, Moyle et al. 1995). Numbers of dace may actually increase in streams that have been channelized or reduced in flow, providing more preferred riffle habitat (Moyle 2002). Overhanging vegetation is important for cover (Moyle et al. 1995). This species is often most abundant in streams where nonnative sculpins are absent, which compete for habitat and prey (Moyle 2002).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of the Santa Ana speckled dace in the Planning Area is defined via miles of occupied reaches, and documented occurrences (Figure 3-43). The known occupied habitat and modeled suitable habitat was mapped directly by species experts based upon habitat preference criteria, documented occurrences, and existing conditions in the Planning Area. This species is expected to be present in Fredabla Creek, downstream of the Plunge Creek confluence, Hemlock Creek, Lytle Creek, and Waterman Creek. Potential habitat exists in Strawberry Creek, East Twin Creek, and possibly Horsethief Creek (Pisces 2014, Russell pers. comm.).

Predicted Wetted Area as a Measure of Aquatic Habitat

Wetted area as a measure of aquatic habitat was estimated for Santa Ana speckled dace using the methodology described in Section 3.6.4. Less than 1 acre (0.01 acre) of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities.

Taxonomy and Genetics

The genus *Rhinicthys* is distributed throughout North America and has eight recognized species. Species are highly variable and may encompass complexes of unrecognized species or subspecies. This species has not been formally described as a subspecies, but studies indicate that it is genetically distinct (Moyle 2002).

Reproduction

Santa Ana speckled dace spawn throughout the summer with peaks in activity in June and July, likely induced by rising water temperatures. Reproduction rates have not been measured, but are probably high due to the species' ability to recolonize or repopulate areas over a few seasons, when suitable habitat exists (Moyle 2002).

Dispersal, Territoriality, and Home Range

Santa Ana speckled dace has the ability to recolonize or repopulate areas if conditions become too extreme and local populations are greatly depressed by floods, droughts, or winter freezing. Dispersal in the Planning Area is limited by available suitable habitat and by barriers to movement. Santa Ana speckled dace typically occurs in small groups while foraging and are seldom found singly; however, they avoid forming conspicuous shoals except during the breeding season (Moyle 2002).

Daily and Seasonal Activity

Santa Ana speckled dace may be active during the day or night, and activity may depend on vulnerability to avian predators. The species can be active year-round if the temperatures do not drop below 39°F, and spawning occurs March through July (Moyle 2002) (Table 3-25).

Table 3-25. Seasonal Activity of Santa Ana Speckled Dace

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning												

Source: Moyle 2002

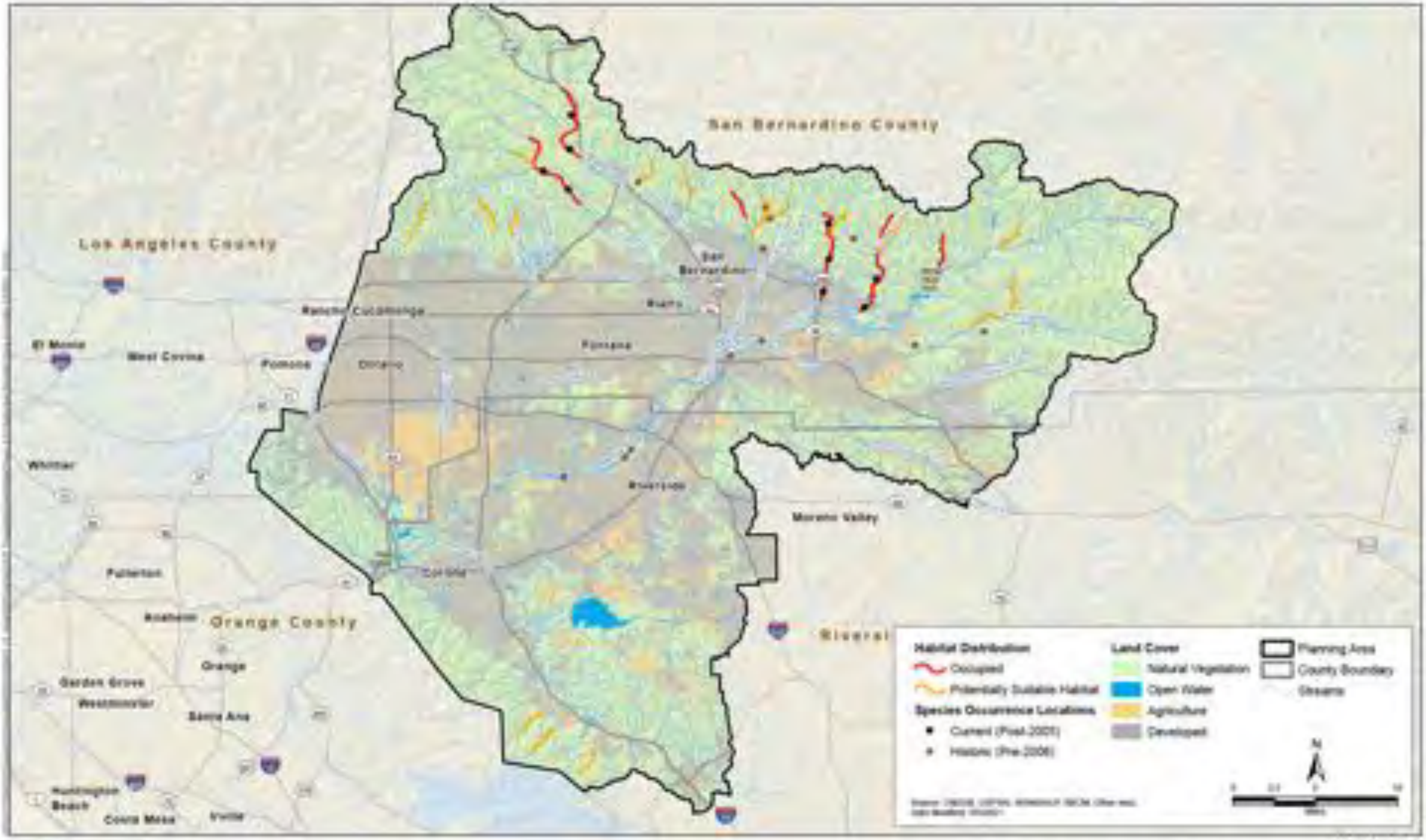
Diet and Foraging

In general, Santa Ana speckled dace forage as bottom-browsers on small invertebrates, especially those taxa found in riffles, such as insect larvae or nymphs (Moyle 2002, Pisces 2014). This species will also feed on filamentous algae (Pisces 2014). The species' diet varies with season and associated prey availability (Moyle 2002).

Threats and Special Management Considerations

Predominant threats to Santa Ana speckled dace include water diversion, urbanization of watersheds, introduction of nonnative species, habitat loss from wildfire, and habitat fragmentation. Where small populations do exist, this species is separated by dry washes most of the year and/or barriers that isolate them and make repopulation impossible. Other threats include recreational use that alters habitat or disturbs behavior, water quality degradation, and drought (Moyle et al. 1995).

Conservation management should include maintenance of connectivity through intermediate creek stretches to facilitate exchange between populations. Population exchange and subsequent gene flow is important for long-term persistence of the species. Perennial stream refugia should be protected from nonnative invasive plant and animal species known to negatively impact dace populations. Drop structures and other barriers isolating populations from each other should be identified and assessed for possible removal. The species responds favorably to captive headstarting and can easily be re-introduced to create new populations. Because of this, unoccupied habitat that is suitable for the species, especially above impassable drop structures, but currently unoccupied



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-43
Santa Ana speckleld dace, *Rhinichthys osculus* ssp.
Potential Habitat Distribution and Known Occurrence Records

should be considered for reintroduction opportunities. Surveys are needed to better understand population abundance and trends in the Santa Ana River watershed in the Planning Area. Water diversions that reduce in-stream flows and barriers to movement remain pervasive threats that isolate populations and threaten the species' existence (Moyle et al. 1995).

Arroyo Toad (*Anaxyrus californicus*)

Current Status and Distribution

The arroyo toad (*Anaxyrus* [*Bufo*] *californicus*) is Federally listed as endangered and is a California Species of Special Concern. The known range for the arroyo toad in the Planning Area is limited to San Bernardino County, where it occurs in the Upper Santa Ana River and Cajon Wash basins. It is also known to occur from the mouth of Cucamonga Canyon within and south of the San Bernardino National Forest (USFWS 2009b).

Habitat Requirements

Arroyo toad habitat includes shallow, slow-moving stream and riparian habitats that are naturally disturbed on a regular basis, primarily by flooding, including streams and washes with sandy banks free of dense vegetation with mature willow (*Salix* spp.) stands, cottonwoods (*Populus* spp.), western sycamore (*Platanus racemosa*), riparian habitats of semi-arid areas, and small cobble streambeds (USFWS 2009b). Areas of sandy or friable (readily crumbled) soils are the most important upland habitat for the species, and these soils can be interspersed with gravel or cobble deposits (USFWS 2005). USFWS description of critical habitat physical and biological features (PBFs) includes primary hydrologic regimes that supply water for space, food, and cover to maintain eggs, tadpoles, juveniles, and breeding adults, including low-gradient stream segments and alluvial streamside terraces. Groundwater conditions must support intermittent flows and persisting shallow pools into mid-summer; areas of open, sandy, and dynamic stream channels; and adjacent upland habitat (USFWS 2005, Rohde et al. 2019).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of arroyo toad modeled suitable habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-44 and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Suitable Breeding Habitat

- An average width of 20 feet around specific selected streams mapped as breeding areas or within final critical habitat; **AND**
- **Land Cover**: Water – Intermittent (except within existing groundwater recharge basins); Water – Permanent (except within existing groundwater recharge basins); Water – Seasonal (except within existing groundwater recharge basins); Western North American Freshwater Aquatic Vegetation; Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland; Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; Great

Basin-Intermountain Xeric-Riparian Scrub; North American Warm-Desert Xeric-Riparian Scrub; Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland; and Warm Southwest Riparian Forest.

Non-Breeding Upland Habitat

- Upland areas within a half-mile of Suitable Breeding Habitat (excluding developed, agriculture, disturbed).

Permeable Movement Area (Developed, Agriculture, Disturbed)

- Developed, agriculture, disturbed within a half-mile of Suitable Breeding Habitat.

Arroyo Toad Designated Critical Habitat

There are 1,777 acres of designated critical habitat for arroyo toad in the Planning Area (76 *Federal Register* 7245). The species has largely been extirpated as a result of urban development within the Planning Area and in other parts of the species range. Designated critical habitat within the Planning Area occurs within Cajon Creek, which supports a population of arroyo toad.

Taxonomy and Genetics

Arroyo toad was originally identified as part of the southwestern toad complex (*Bufo microscaphus*), and was considered a subspecies at original listing (*B. m. californicus*) (USFWS 1994). Recent genetic studies now place it in the genus *Anaxyrus* (Frost et al. 2008).

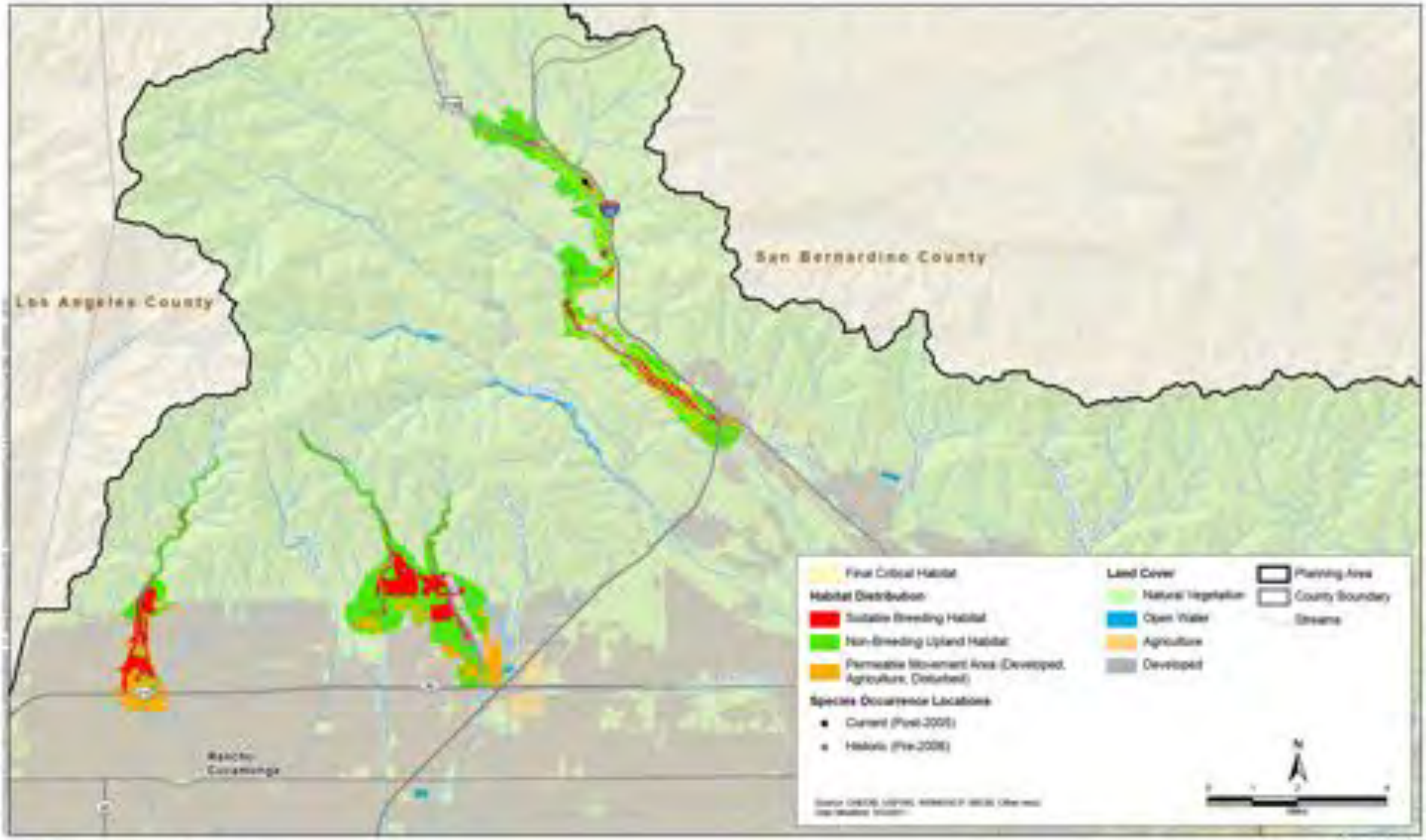
Reproduction

Arroyo toad breeding occurs from late January or February to early July, although it can be extended in some years depending on weather conditions (USFWS 1999). Breeding in mountainous habitats characteristic of the Planning Area populations may commence later (May–June) and last longer (to August) than in the coastal portion of the range. Breeding sites are typically adjacent to sandy terraces (USFWS 1994); at or near the edge of shallow pools, low-flow stream channels, and ox-bows; and along in-stream sand bars with minimal current (0–2 kilometers [1.24 miles] per hour) and have little or no emergent vegetation.

Dispersal, Territoriality, and Home Range

The arroyo toad is capable of moving 0.3 to 1.3 miles into suitable adjacent habitats and may not be constrained by topography (USFWS 1999). In a study using pitfall traps, this species was captured in upland habitats averaging more than 980 to 1,640 feet from two coastal streams; one was captured 3,940 feet beyond the edge of the riparian habitat bordering the stream (Holland and Sisk 2001). Four separate studies of inland populations (Ramirez 2002a, 2002b, 2002c, 2003) showed that this species burrowed no farther than 1,062 feet from the edge of a stream, with an overall average of 52 feet between burrow locations and the edge of the stream. These larger movements may be associated with dispersal, as additional work has shown arroyo toads to have high site fidelity, moving less than 300 feet during the breeding season (Mitrovich et al. 2011).

Home range is influenced by rainfall amounts, availability of surface water, width of streamside terraces and floodplains, vegetative cover, and topography (Griffin et al. 1999, Ramirez 2000a). Females have been documented to use riparian and upland habitats an average maximum distance of 443 feet with a maximum of more than 984 feet perpendicular to streams, while males move an



Upper Santa Ana River Habitat Conservation Plan

Figure 3-44
Arroyo toad, *Anaxyrus californicus*
Potential Habitat Distribution and Known Occurrence Records

average maximum distance of 240 feet from streams. Within-stream movement was documented up to 492 feet. Juvenile dispersal is shown to be 0.5 to 0.6 mile (Sweet 1993).

Daily and Seasonal Activity

Arroyo toad is primarily nocturnal, though activity of tadpoles often extends throughout the day. Adult activity begins after the onset of fall rains and continues through the typical breeding period (January–August) (Table 3-26). The species enters aestivation during the non-breeding season (August–January) (USFWS 1999).

Table 3-26. Seasonal Activity of Arroyo Toad

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding												

Source: USFWS 1999

Diet and Foraging

Tadpoles are highly specialized feeders on loose organic material such as detritus, interstitial algae, bacteria, and diatoms (Sweet 1992). Subadults and adults are opportunistic feeders, foraging on immediately available prey throughout both their breeding and upland habitats. Adults feed on a variety of invertebrates, including snails, Jerusalem crickets, beetles, ants, caterpillars, and moths.

Threats and Special Management Considerations

Historically, because habitats are favored sites for dams and reservoirs, roads, mining, agriculture, livestock grazing, urbanization, and recreational facilities (such as campgrounds and off-highway vehicle parks), many arroyo toad populations were reduced in size or extirpated due to extensive habitat loss that occurred from about 1920 to 1980 (USFWS 1999).

Introduced plants and predators (bullfrog, African clawed frog, crayfish, and green sunfish) have had substantial impacts on existing populations, and may have contributed to regional extirpation. Nonnative invasive plant species (e.g., tamarisk, giant reed, iceplant, pampas grass) degrade habitat by contributing to altered hydrology, eliminating sandbars and breeding pools, and restricting the quality and access to upland habitats. Active management of weeds may benefit arroyo toad populations by reducing weed cover of sandy soils that are essential refugia habitat for the species. Arroyo toads are highly vulnerable to habitat degradation resulting from changes in groundwater levels because they are so dependent on riparian vegetation for foraging and on perennial still pools for development and metamorphosis (i.e., the time it takes for this species to transform from a tadpole to frog) that span a minimum of two summer months (Rohde et al. 2019). Because native ants are a major food source for juveniles during the rapid growth stage in the weeks following metamorphosis, the spread of the nonnative Argentine ant into arroyo toad habitat may displace native ants and other macro invertebrates and thus negatively affect arroyo toad (Mitrovich et al. 2010, Stephenson and Calcarone 1999).

Other Relevant Information

The Upper Santa Ana River Basin/Cajon Wash Critical Habitat Unit (Unit 20) is the only critical habitat unit in the Planning Area, and supports a population that may represent some of the last vestiges of a much greater population that historically existed along the upper Santa Ana River Basin. Improved conservation of this location is important to maintain the current geographic extent of the species. Unit 20 contains the PBFs that are essential to the conservation of the species, including aquatic habitat for breeding and non-breeding activities (PBFs 1, 2, and 3) and upland habitat for foraging and dispersal activities (PBF 4). This habitat has been disturbed and fragmented over time; therefore, the PBFs essential to the conservation of the species in this unit may require special management considerations or protection to address threats from recreational activities (USFWS 2005).

Mountain Yellow-Legged Frog (*Rana muscosa*)

Current Status and Distribution

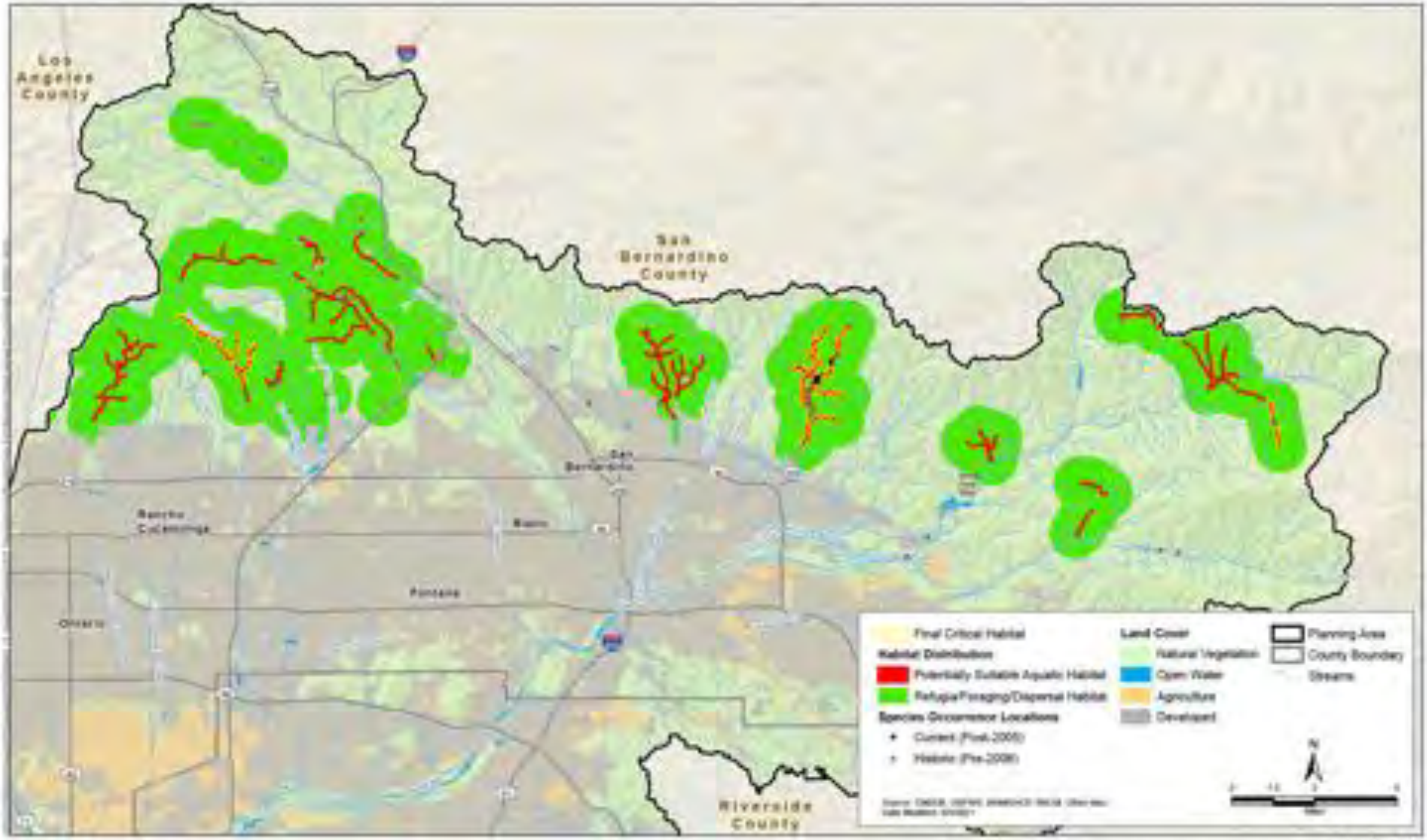
The mountain yellow-legged frog (*Rana muscosa*) is Federally and State listed as endangered and occurs in the San Gabriel, San Bernardino, and San Jacinto Mountain Ranges, in Los Angeles, Riverside, and San Bernardino Counties. In the San Gabriel Mountain Range, known populations occur in Devil's Canyon, Little Rock Creek, South Fork Big Rock Creek, Vincent Gulch, and Bear Gulch. In the San Jacinto Range, known populations occur in Fuller Mill Creek, Dark Canyon, and Tahquitz-Willow Creek (ICF 2014). The status of individuals that were previously salvaged, maintained in captivity, and then released in Indian Creek and Hall Canyon are unknown as of 2012. In the San Bernardino Mountain Range, the only known extant population occurs in East Fork City Creek. Populations occur from 370 to 2,290 meters (1,200 to 7,500 feet) in elevation (USFWS 2012).

Habitat Requirements

In Southern California, habitat typically consists of rocky and shaded streams with boulders or vegetation growing along the water's edge (USFWS 2012, Jennings and Hayes 1994) 3 feet away from water (Stebbins 2003). This species is found in creeks and streams with at least some portion with permanent water. Perennial flows are needed for reproduction, larval growth and survival, and hydration of juveniles and adults. The species is absent from the smallest creeks because these habitats lack the depth for aquatic refuge and overwintering (USFWS 2012, Jennings and Hayes 1994). Occupied habitat at City Creek consists of pools, rapids, and small waterfalls, with some structure that could function as refugia (cover from predators) such as bank overhangs, rocks, and downed logs, although aquatic vegetation is minimal (USFWS 2012). The USFWS description of critical habitat PBFs includes aquatic habitat with characteristics suitable for breeding, rearing, and non-breeding (over-wintering) as well adjacent upland areas providing feeding and movement habitat (USFWS 2006).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of mountain yellow-legged frog modeled suitable habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-45, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-45
Mountain yellow-legged frog, *Rana muscosa*
Potential Habitat Distribution and Known Occurrence Records

Potentially Suitable Aquatic Habitat

- Within 100 feet of: National Hydrography Dataset perennial streams/waterbodies or National Wetlands Inventory (NWI) permanently flooded ponds or all streams within final critical habitat or all streams with documented or possibly extirpated occurrences – removed open water to retain perimeter of larger water bodies.

Refugia/Foraging/Dispersal Habitat

- **Landcover:** All landcover except Developed and Agriculture within 4,920 feet of Potentially Suitable Aquatic Habitat.

Mountain Yellow-Legged Frog Designated Critical Habitat

There are 2,216 acres of designated critical habitat for mountain yellow-legged frog in the Planning Area (81 *Federal Register* 59045). The species is extirpated across a majority of its range, including within the Planning Area. Critical habitat is located in Day Canyon in the San Gabriel Mountains, and the East and West Forks of City Creek.

Predicted Wetted Area as a Measure of Aquatic Habitat

Wetted area as a measure of aquatic habitat was also estimated for mountain yellow-legged frog using the methodology described in Section 3.6.4. Less than 1 acre (0.2 acre) of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

Taxonomy and Genetics

Mountain yellow-legged frogs were once considered one species, *Rana muscosa* throughout its range. Vrendenburg et al. (2007) clarified the taxonomy of mountain yellow-legged frog by analyzing the mitochondrial DNA, acoustic data, and morphological characteristics. His study showed two distinct species of mountain yellow-legged frogs: *R. sierra* in the northern and central Sierra Nevada and *R. muscosa* in the southern Sierra Nevada and Southern California. Within *R. muscosa*, three clades were identified (two in the southern Sierra Nevada and one in Southern California). The Southern California clade is disjunct from the clades in the Sierra Nevada and occurs in Los Angeles, Riverside, and San Bernardino Counties (USFWS 2012).

Reproduction

In Southern California, breeding occurs from March through August. Breeding commences as soon as aquatic habitat is free of snow and ice and when high waters subside (Stebbins 2003). Oviposition occurs in shallow water and egg masses are often clustered and are generally unattached in ponds and lakes, but may be attached to underwater structures in streams (Jennings and Hayes 1994). Metamorphosis is variable and dependent upon temperature (USFWS 2012), and can occur as quickly as one season at low elevations and up to three seasons at high elevation (Jennings and Hayes 1994). For southern populations, metamorphosis likely occurs at the end of the second summer when second year tadpoles are 1.5 years old. Hibernation and aestivation occur between November and January and between July and September, respectively (USFWS 2012). Breeding typically occurs between March and August (Jennings and Hayes 1994).

Dispersal, Territoriality, and Home Range

Dispersal often takes place along available aquatic habitat, but may occur through upland habitats as well. Dispersing individuals can travel long distances (up to 1,500 meters) in search of new territories or for breeding purposes (USFWS 2012). Longer dispersals generally occur soon after emerging from hibernation in the spring or before returning to hibernacula in the winter. Longer movements may occur due to drying of habitat (Matthews 2003).

Daily and Seasonal Activity

Larvae select warmer microclimates to keep relatively high body temperatures and often congregate in shallow waters during the day to increase body temperature. Adults are generally diurnal, and hibernate during winter months beneath ice-covered streams, lakes, and ponds. Adults emerge from hibernation immediately following snowmelt. During the active season, adults maximize their body temperatures at all times of the day by basking in the sun by moving between the warmer shallows along the shoreline and rocks on the shoreline (Jennings and Hayes 1994). Adults in Southern California will aestivate during the drier periods of late summer (Matthews 2003) (Table 3-27).

Table 3-27. Seasonal Activity of Mountain Yellow-Legged Frog

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation	■	■									■	■
Aestivation (in dry conditions)							■	■	■			
Breeding			■	■	■	■	■	■				

Sources: USFWS 2012, Jennings and Hayes 1994

Diet and Foraging

Adults feed opportunistically on other amphibians, beetles, flies, ants, bees, wasps, and true bugs (Jennings and Hayes 1994). Larvae feed on algae and diatoms located along the rocky bottoms of streams (Matthews 2003).

Threats and Special Management Considerations

The decline of mountain yellow-legged frog in Southern California is severe, with loss at approximately 99% of historical sites thought to be due to chytrid fungus, predation by introduced trout, habitat degradation due to mining, public dumping, and off-road vehicles, stream channelization, fire and post-fire debris flows, and pollution (CaliforniaHerps 2014, Morey 1988). Additionally, physical isolation has caused inbreeding, resulting in genetic isolation. Catastrophic natural events such as fires or flooding increase the likelihood of extirpation of small, isolated populations (USFWS 2012). Drought can also result in large mortality events if larval habitat evaporates. Mountain yellow-legged frogs depend on perennial water sources that do not fully freeze in winter. Changes in groundwater levels that reduce the necessary depth for overwintering tadpoles or increase oxygen depletion for overwintering adults may negatively affect this species (Rohde et al. 2019).

Translocation is often discussed as a possible management tool to reestablish threatened and endangered animals to areas where they have been extirpated. However, in the case of mountain yellow-legged frogs, one study found that because they are highly philopatric, translocated adult frogs can return to their capture site following short distance translocations and possibly from longer distance translocations. Additionally, translocating adult frogs can cause stress on the animals resulting in the loss of body mass. Matthews (2003) suggests that translocation of egg masses or tadpoles may have greater success and less stress as the homing would presumably not be as developed. More information on the viability of re-introducing the species via egg masses or tadpoles is needed to assess this as a potential management tool (USFWS 2012). Trout removal in the headwaters of some systems appears to be a potential tool for expanding available habitat for the species. Additional information regarding potentially suitable reintroduction sites is needed, including the presence and distribution of perennial waters, chytrid fungus, and nonnative invasive fish species at any proposed sites (CDFG 2011).

The Southern California population is critically endangered. To increase this population, San Diego Zoo Global has a southern mountain yellow-legged frog recovery project that began approximately 13 years ago. The Los Angeles Zoo, Henry Doorly Zoo, CDFW, USFWS, USGS, and the U.S. Forest Service are also part of this collaborative effort to re-introduce captive-bred frogs in Southern California. This program has released froglets and tadpoles into the frog's historic range in Southern California. In June of 2018, San Diego Zoo Global released 250 froglets in the San Bernardino National Forest (U.S. Forest Service 2018).

Western Spadefoot (*Spea hammondii*)

Current Status and Distribution

The western spadefoot (*Spea hammondii*) is a California Species of Special Concern and is endemic to California and northern Baja California (Jennings and Hayes 1994). This species occurs in the Central Valley, Coast Ranges, and Southern California south of the Transverse Range and west of Peninsular Mountains from near sea level to around 4,500 feet above sea level (CaliforniaHerps 2014). Western spadefoot has been extirpated from much of Southern California but persists in coastal Orange, western Riverside, southwest San Bernardino, and inland San Diego Counties (Stebbins 2003). This species occurs in the central and southern portions of the Planning Area, along I-15 south of Corona, just east of I-215 near March Air Force Base, and in the Santa Ana River basin just downstream from and at scattered locations along the base of the San Bernardino Mountains (ICF 2014, Braden pers. comm).

Habitat Requirements

Western spadefoot occurs primarily in lowland areas including river floodplains, alluvial plains, playas, and alkali flats (Stebbins 2003). This species prefers habitats with sandy or gravely soils and requires slow-moving edges of rivers and streams or temporary rain pools with temperatures >48°F to <86°F in which to breed. Pools need to last at least 3 weeks to allow successful metamorphosis (CaliforniaHerps 2014, Jennings and Hayes 1994). Breeding habitat includes vernal pools and artificial impoundments such as stock ponds and pools that form at the bases of road and railroad grades, and pooled areas of ephemeral streams (Jennings and Hayes 1994). Suitable breeding habitat must be free of bullfrogs, crayfish, or fish (AmphibiaWeb 2014, CaliforniaHerps 2014). Upland habitats include grasslands, oak woodlands, coastal sage scrub, and chaparral in the vicinity of breeding pools, and the species prefers open areas with short grasses (AmphibiaWeb 2014, Stebbins 2003).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of western spadefoot modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-46, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Californian Annual and Perennial Grassland, Warm Southwest Riparian Forest, North American Warm-Desert Xeric-Riparian Scrub, Californian Chaparral, and Californian Coastal Scrub; Barren; **AND**
- **NWI and SoCal Wetlands hydrology attribute modifier**: Seasonally Flooded, Temporarily Flooded, Artificially Flooded; Upper Santa Ana River Wash Plan recharge basin; NWI freshwater pond; and SoCal Wetlands pond, detention basin; **AND**
- **Soil Texture**: sand, sandy loam, coarse sand, coarse sandy loam, fine sand, fine sandy loam, loamy sand, loamy coarse sand, loamy fine sand, river wash, very fine sandy loam, clay, and loam; **AND**
- **Landform**: alluvial flats; alluvial fans; alluvial plains; channels; floodplains, foothills, terraces, and uplands; also drainageways regardless of land cover type; **AND**
- **Elevation**: 0–2,953 feet; **AND**
- **Slope**: 0–3%; **AND**
- Must be a 536-acre block of natural contiguous open space grouped using a maximum separation distance of 25 feet.
- **Post-processing:** Removed fragmented and isolated patches surrounded by development.

Predicted Wetted Area as a Measure of Aquatic Habitat

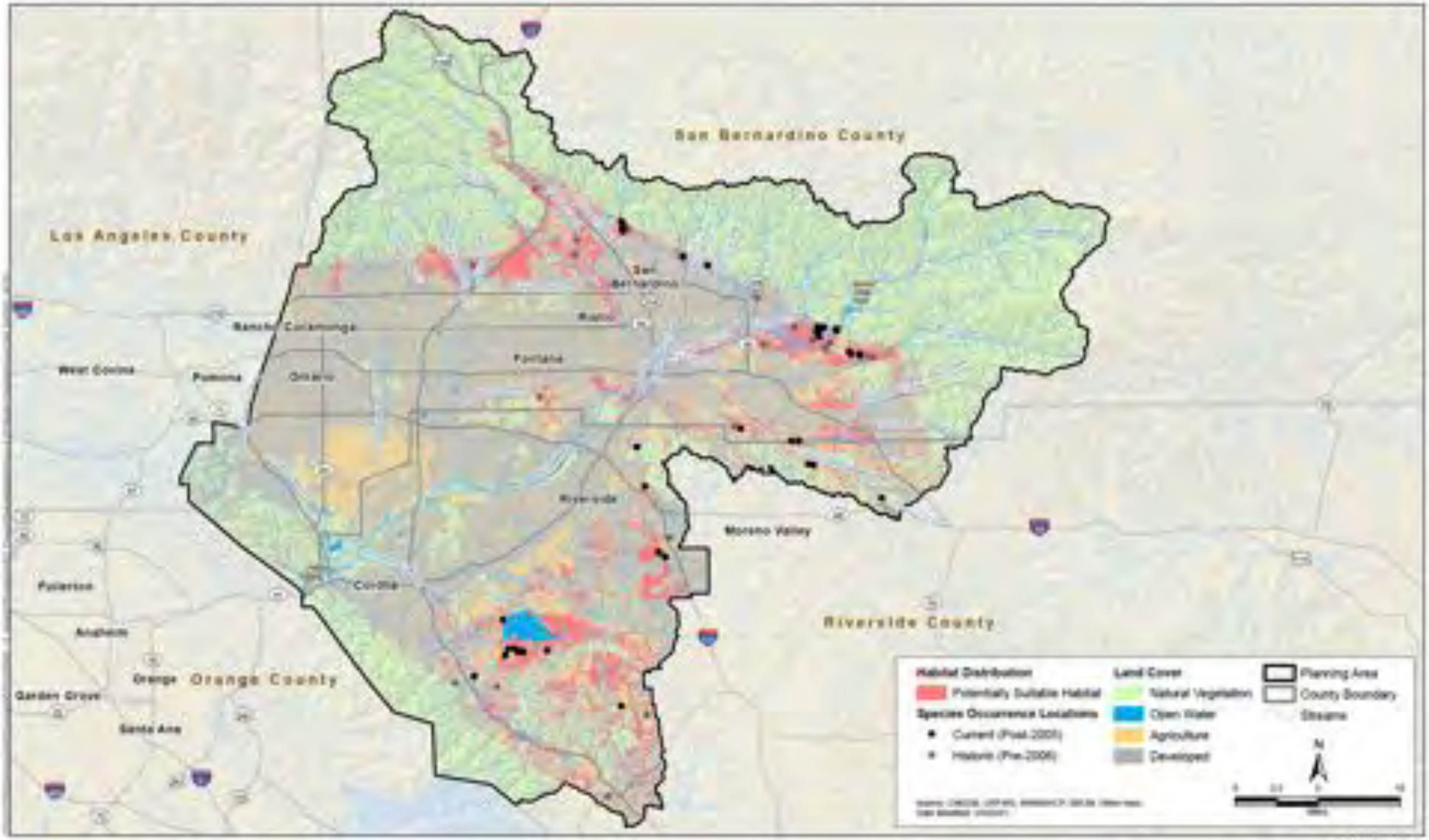
Wetted area as a measure of aquatic habitat was also estimated for western spadefoot using the methodology described in Section 3.6.4. Approximately 199 acres of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

Taxonomy and Genetics

Western spadefoot was once considered widespread through the southwestern U.S. and northern Mexico with the population in California being a subspecies, *S. hammondii hammondii* (CaliforniaHerps 2014). Past studies have proposed that populations east of California be recognized as Mexican spadefoot (*Spea multiplicata*) citing morphological differences and differences in mating calls and ecology. Since this work, *S. hammondii* has been applied to western spadefoot populations in California exclusively (Jennings and Hayes 1994, AmphibiaWeb 2014)

Reproduction

Breeding for western spadefoot is dependent on temperature and rainfall. Mating and egg laying generally occurs from late February to late May (Jennings and Hayes 1994). Females lay 300–500



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-46
Western spadefoot, *Spea hammondii*
Potential Habitat Distribution and Known Occurrence Records

eggs in small clusters of 10–42 eggs (CaliforniaHerps 2014). Egg masses are attached to submerged plant material or detritus (Jennings and Hayes 1994, CaliforniaHerps 2014). Eggs usually hatch in 3–4 days, and larval development lasts approximately 58 days, although development of larvae is flexible and positively correlated to pool duration. Larvae will delay metamorphosis in long-lasting pools with large food supply. Breeding may not occur during dry years because breeding pools may not fill (CaliforniaHerps 2014).

Dispersal, Territoriality, and Home Range

Little is known about how far individuals move to reach breeding sites (AmphibiaWeb 2014), but adults are known to travel a few meters on rainy nights. Following metamorphosis, juveniles migrate from the breeding pools. Little is known about how far the species disperses (Morey 1988). They are not territorial during most of the year; however, males keep individual space during chorusing (AmphibiaWeb 2014). Calling males do exhibit aggressive behaviors at breeding sites, suggesting some territoriality (Morey 1988).

Daily and Seasonal Activity

Western spadefoot is predominantly terrestrial, only enters the water to breed, and is rarely seen on the surface; it remains dormant for most of the year in subterranean refugia that it constructs or in mud cracks, under boards or other surface cover objects (Morey 1988). Spadefoots can dig their own burrows using the hardened spades on their hind feet. The species emerges from underground aestivation during periods of relatively warm rains from fall to early spring months, migrates to breeding pools, and emigrates from pools following breeding (Jennings and Hayes 1994, CaliforniaHerps 2014) (Table 3-28). Emergence and migration is generally synchronous (CaliforniaHerps 2014).

Table 3-28. Seasonal Activity of Western Spadefoot

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Emergence and Migration	■	■	■	■					■	■	■	■
Breeding		■	■	■	■							

Sources: Jennings and Hayes 1994, CaliforniaHerps 2014

Diet and Foraging

Larvae primarily consume plankton and algae, but may also be carnivorous and feed on other tadpoles. Adults feed on invertebrates including worms and insects (Morey 1988). Adults require annual foraging opportunities to acquire enough food to survive through seasonal dormancy (Jennings and Hayes 1994).

Threats and Special Management Considerations

The primary threat to the western spadefoot is loss of habitat. In Southern California, more than 80% of habitat once known to sustain the species has been lost due to development or incompatible conversion (Jennings and Hayes 1994, CaliforniaHerps 2014, Stebbins 2003). Introduction of bullfrogs into breeding pools has had a negative impact on some populations, as has the introduction of mosquito fish (Jennings and Hayes 1994, CaliforniaHerps 2014).

Efforts should be undertaken to protect areas with temporary rain pools and surrounding habitat. The species will readily use human-made water sources to breed, and could be subsidized through the maintenance of temporary water sources in areas where adults are known to occur. Weed management, including removal or grazing control of nonnative invasive grasses, may also provide some benefit to the species (Marty 2005). In addition to conservation of existing habitat, creation of new vernal pool habitat and subsequent translocation of western spadefoot egg masses and larvae has shown success as a conservation mitigation strategy in Orange County, California, where persistence of the species and successful reproduction was observed at mitigation sites 10 years after establishment (Baumberger et al. 2020).

California Glossy Snake (*Arizona elegans occidentalis*)

Current Status and Distribution

California glossy snake (*Arizona elegans occidentalis*) is a California Species of Special Concern and is found from California's central San Joaquin Valley south to the U.S. Mexico border and east into the Mojave and Sonoran Desert region. The Planning Area encompasses the area of intergrade between the unrecognized California and desert subspecies (Stebbins 2003, Thompson et al. 2016). Occurrences are known around the Santa Ana River from the San Bernardino Airport east toward the Seven Oaks reservoir and to the north associated with Cajon Wash and Lytle Creek.

Habitat Requirements

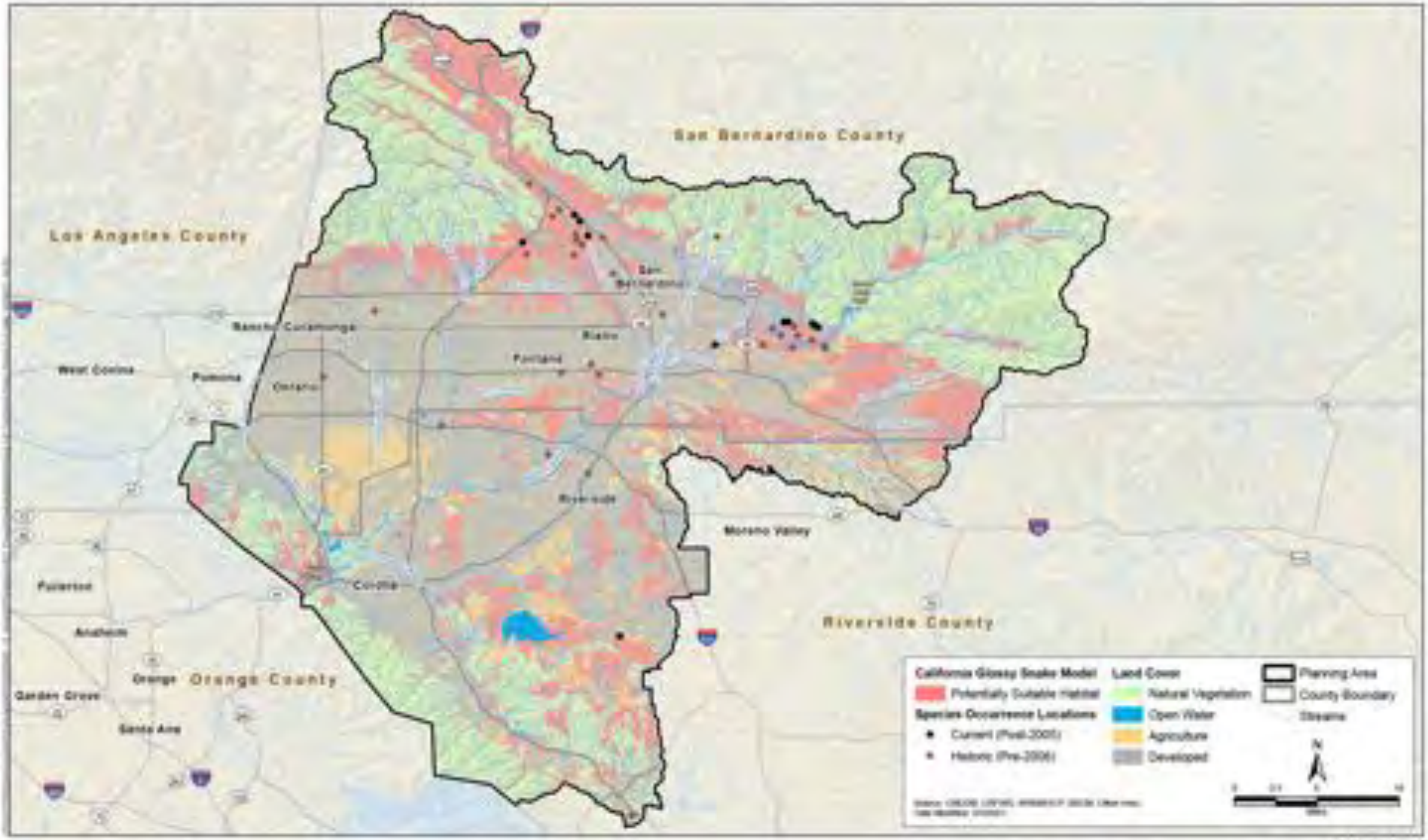
California glossy snake prefers open areas in a variety of habitats including light shrubby to barren desert, grassland, chaparral, and coastal sage scrub (Stebbins 2003, Thompson et al. 2016).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of California glossy snake modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-47, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Californian Annual and Perennial Grassland; California Chaparral; Cool Interior Chaparral; Warm Interior Chaparral; Californian Coastal Scrub; Californian Forest and Woodland; Great Basin-Intermountain Xeric-Riparian Scrub; Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland; North American Warm-Desert Xeric-Riparian Scrub; North American Warm Semi-Desert Cliff, Scree, and Rock Vegetation; Western North American Cliff, Scree, and Rock Vegetation; **AND**
- **Soil Texture**: sand, sandy loam, coarse sand, coarse sandy loam, fine sand, fine sandy loam, loam sand, loamy coarse sand, loamy fine sand, river wash, and very fine sandy loam; **AND**
- **Landform**: alluvial fans, alluvial flats, alluvial plains, channels, floodplains, foothills, terraces, uplands, and also drainageways regardless of land cover type; **AND**
- **Elevation**: 0–6,000 feet.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-47
California glossy snake, *Arizona elegans occidentalis*
Potential Habitat Distribution and Known Occurrence Records

- **Post-processing**: Excludes very small isolated habitat fragments that would not be considered viable habitat and agricultural lands near the Prado Basin, Chino, and Ontario because the disturbance regime in these areas would not be compatible with this species occurrence.

Taxonomy and Genetics

Nine subspecies have been described within this monotypic genus (Aldridge 2001). The subspecies *occidentalis* was proposed as a western subspecies but this taxonomy has not been accepted (Hammerson et al. 2007).

Reproduction

California glossy snake is oviparous; mating season is restricted to the spring (Aldridge 2001); ovulation begins in June and eggs are laid in July with clutch size of 3–23 with an average of 8.5 (Stebbins 2003, Thompson et al. 2016). Neonates emerge in September (Thompson et al. 2016).

Dispersal, Territoriality, and Home Range

The sexual and seasonal distribution observed based on a mortality study found that the mating system is consistent with Prolonged Mate Searching Polygyny (Aldridge 2001). In this mating system, males search competitively for widely distributed, spatially unpredictable females. Data on territoriality and home range behavior are not currently available.

Daily and Seasonal Activity

California glossy snake is active primarily at night and remains underground during the day (Stebbins 2003). Seasonal activity is depicted in Table 3-29.

Table 3-29. Seasonal Activity of California Glossy Snake

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Egg Laying												
Neonate Emergence												

Source: CaliforniaHerps 2014

Diet and Foraging

California glossy snake feeds primarily on diurnal lizards, which it captures while they sleep, and nocturnal mammals, such as kangaroo rats, which it ambushes (Klauber 1946, Rodriguez-Robles et al. 1999). Larger specimens are also known to take small birds and other snakes (Rodriguez-Robles et al. 1999, Stebbins 2003, Thomson et al. 2016).

Threats and Special Management Considerations

Major threats to California glossy snake include primarily anthropogenic threats caused by direct mortality from development (agricultural, commercial, and residential) and road kill, as well as pressure from collectors (NatureServe 2014). Additional threats may include light pollution and increasing frequency and intensity of fires (Thomson et al. 2016).

Relatively little is known about the ecology of this species, which makes management difficult. California glossy snakes are thought to have relatively small range sizes and a moderate degree of ecological specialization and endemism. Population declines have been documented across the species' range, caused largely by ongoing development. Habitat management is the primary management priority. Two research priorities will help inform habitat management objectives for this poorly studied species: (1) ecological studies to enhance the understanding of life history and existing population sizes, and (2) a species-wide phylogenetic study to determine whether there is intraspecific variation and to identify appropriate conservation needs (Thomson et al. 2016).

Other Relevant Information

The distribution of the California glossy snake has been reduced by 90% with only a handful of extant occurrences thought to remain in southwest San Bernardino County (Braden pers. comm.).

South Coast Garter Snake (*Thamnophis sirtalis* ssp.)

Current Status and Distribution

The south coast garter snake (*Thamnophis sirtalis* ssp.) is a Priority 1 California Species of Special Concern (Thomson et al. 2016) that is wide-ranging throughout the United States and Canada from the Pacific to the Atlantic (Stebbins 2003). Along the Southern California coast, this species has a restricted distribution from the Santa Clara River Valley (Ventura County) south coastally to the vicinity of San Pasqual (San Diego County). South coast garter snake occurs from near sea level to 2,730 feet and has been observed in the Lake Prado Basin in the Planning Area (Jennings and Hayes 1994, ICF 2014, Thomson et al. 2016).

Habitat Requirements

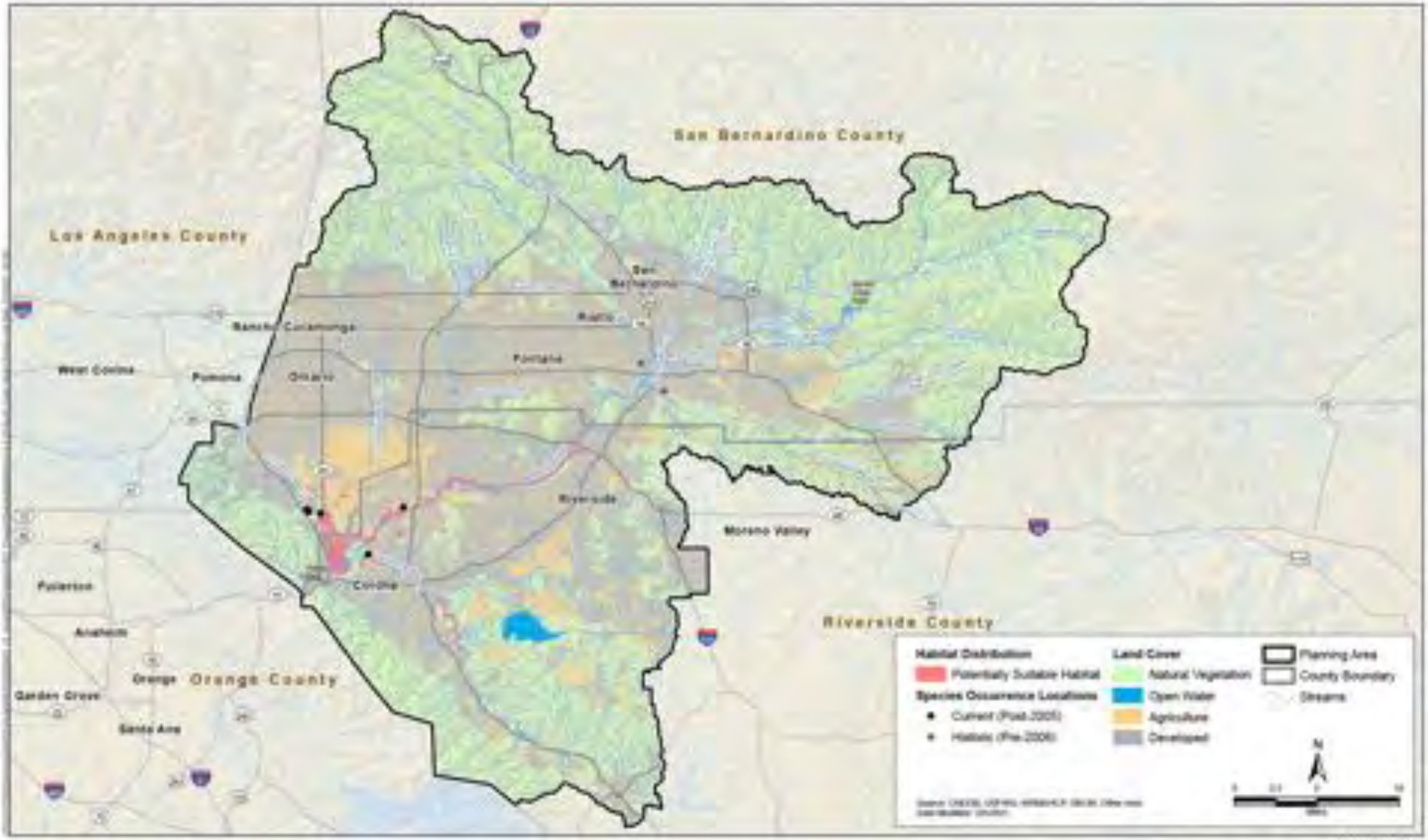
Essential habitat factors for south coast garter snake includes a permanent water source, low gradient topography, and dense multi-storied riparian vegetation (Ervin 2011). South coast garter snake is restricted to shallow freshwater aquatic habitats such as wetlands and marshes and upland riparian habitat near permanent waters (Jennings and Hayes 1994). This species is highly aquatic and needs open water for foraging; however, it generally avoids fast-flowing water (Morey 1988b, Rohde et al. 2019).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of south coast garter snake modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-48, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover:** Western North American Freshwater Aquatic Vegetation; Warm Southwest Riparian Forest; Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; **AND**
- Elevation: 0–833 feet; **AND**
- Slope: 0–3%; **AND**



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-48
South coast garter snake, *Thamnophis sirtalis* ssp.
Potential Habitat Distribution and Known Occurrence Records

- Within 500 feet of selected land cover, elevation, and slope *except for* Developed and Agriculture.

Predicted Wetted Area as a Measure of Aquatic Habitat

Wetted area as a measure of aquatic habitat was also estimated for south coast garter snake using the methodology described in Section 3.6.4. Approximately 189 acres of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

Taxonomy and Genetics

Although south coast populations of *Thamnophis sirtalis* have not been formally described as a distinct taxon (Thomson et al. 2016), consistent with earlier findings (Jennings and Hayes 1994) garter snakes in this part of the range are considered Species of Special Concern (Thomson et al. 2016). Populations from Southern California were first described as California red-sided garter snake (*Thamnophis sirtalis infernalis*) by Henri Marie Ducrotay de Blainville in 1835 (CaliforniaHerps 2014). Barry (1998) and Stebbins (2003) support description of snakes from Southern California as *Thamnophis sirtalis infernalis*, while others (Boundy and Rossman 1995, Janzen at al. 2002) refer to them as red-spotted garter snakes (*Thamnophis sirtalis concinnus*). Morphological and genetic studies that will help to clarify the status of this taxon (*Thamnophis sirtalis* ssp.) are still pending (Thomson et al. 2016).

Reproduction

South coast garter snakes mate in the spring. Several males may often attempt to mate with a single female (Morey 1988b). This species is a live-bearing snake and generally gives birth to 12 to 18 young (Stebbins 2003). Young are generally born in August but gestation can extend into late summer and early fall (Jennings and Hayes 1994).

Dispersal, Territoriality, and Home Range

Data on movement ecology for this species are limited and the nature of its home range is not well known (Jennings and Hayes 1994, Morey 1988b). Individual home ranges probably overlap with others during the summer months. Individuals can be found close together in areas of favorable habitat. Many populations of common garter snakes aggregate in large numbers during the winter, especially in cold northern climates, though it is unknown if south coast garter snakes exhibit this behavior (Morey 1988b).

Daily and Seasonal Activity

South coast garter snake is an excellent swimmer and is often found near water (Jennings and Hayes 1994, Morey 1988a). The species is most active during the daytime, mainly during the morning and late afternoon most summer days and mainly during the afternoon in spring and fall. It may retreat to hibernacula during the winter months but may emerge to bask during warmer winter days (Morey 1988a). Seasonal activity is depicted in Table 3-30.

Table 3-30. Seasonal Activity of South Coast Garter Snake

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation	■	■										■
Breeding				■	■	■	■	■	■	■	■	

Sources: Morey 1988, Stebbins 2003, Jennings and Hayes 1994

Diet and Foraging

South coast garter snake is known to primarily feed on amphibians; however, fish and invertebrates are also targeted as prey (Jennings and Hayes 1994). This species is also known to prey on adult Pacific newts (*Taricha* sp.) without suffering the effects of poison secreted from the newt's body (Stebbins 2003).

Threats and Special Management Considerations

Loss of habitat is the principal threat to south coast garter snake. Urbanization and flood control projects have greatly affected suitable habitat. Of the 24 known historic localities, 18 sites (75%) no longer support the species. The introduction of nonnative aquatic predators also threatens existing populations. Destruction of suitable aquatic habitat is the biggest threat to populations, and the species is vulnerable to habitat degradation caused by reduced water levels and quality, which affects the availability of suitable vegetation and burrows (Jennings and Hayes 1994, Rohde et al. 2019). Wetland drying in the summer months and decreased hydrology due to water transfers or drought can also reduce suitable habitat. Substitution of groundwater for surface water can degrade habitat because groundwater has lower temperatures and may contain higher concentrations of contaminants (Rohde et al. 2019). Wide-spread surveys need to be undertaken in Southern California to determine where the species still exists and to evaluate the quality of the habitat where it does exist. Studies are also necessary to identify the importance of prey resources on recruitment and reproduction. Because seasonal movement patterns and recolonization abilities are not well understood, studies to identify these attributes should also be undertaken (Jennings and Hayes 1994).

Southwestern Pond Turtle (*Emys pallida*)

Current Status and Distribution

The southwestern pond turtle (*Emys pallida*) is a California Species of Special Concern and is currently under review for listing under the Federal Endangered Species Act (FESA) by USFWS. This species was formerly considered a subspecies of the western pond turtle (*Actinemys marmorota*); however, based on recent analyses the species has been split into two distinct, geographically non-overlapping species: *E. pallida* and *E. marmorota* (Spinks et al. 2014, 2016). The range for the southwestern pond turtle includes the southern and coastal portions of the overall range from northwestern Baja California del Sur to approximately San Francisco Bay. In the Planning Area, this species is known from Chino Hills State Park in Aliso Creek from Banie Canyon to the confluence with the Santa Ana River and in Soquel Canyon; Arnold Reservoir in Tonner Canyon; in a detention basin at the southern end of Walker Canyon north of Lake Elsinore, and within a section of the Santa Ana River in the Riverside area (Wulff et al. 2020).

Habitat Requirements

The southwestern pond turtle is an aquatic turtle that occurs in ponds, lakes, marshes, rivers, streams, and irrigation ditches. This species prefers habitats with emergent basking sites such as logs, rocks, and shorelines, and with underwater refugia (Stebbins 2003, Bury and Germano 2008). Southwestern pond turtle is most abundant in slow-moving portions of streams and rivers such as plunge pools because they lack swift currents and are deep enough to allow the turtle to retreat when threatened. Densities of this species in standing or slow-moving waters are often several times higher than in swifter-moving sections of streams and rivers. Southwestern pond turtle also utilizes upland habitats near aquatic habitat to reproduce, aestivate, and overwinter (Bury and Germano 2008). Hatchlings require shallow aquatic habitat with submerged vegetation on which to feed (Jennings and Hayes 1994).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of southwestern pond turtle modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-49, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Modeled Suitable Habitat:

Aquatic Habitat

- **Land Cover**: Water-Permanent (except within existing groundwater recharge basins) and Western North American Freshwater Aquatic Vegetation; **AND**
- **Elevation**: 0–1,800 feet.

Potentially Suitable Upland Habitat

- Areas that are within 1,640 feet of Aquatic Habitat (Reese and Welsh 1997); **AND**
- **Elevation:** 0–1,800 feet; **AND**
- Contiguous with Aquatic Habitat *except for* Developed; Agriculture; California Chaparral; and Cool Interior Chaparral, Western North American Cliff, Scree, and Rock Vegetation.
- **Post-processing**: Removed fragmented and isolated patches surrounded by development and upstream of RIX Discharge.

Predicted Wetted Area as a Measure of Aquatic Habitat

Wetted area as a measure of aquatic habitat was also estimated for southwestern pond turtle using the methodology described in Section 3.6.4. Approximately 192 acres of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

Taxonomy and Genetics

Since 2011, CDFW has identified one species throughout its range (*Actinemys marmorata*) (CDFG 2011). However, four distinct mitochondrial clades have been identified: Northern, San Joaquin

Valley, Santa Barbara, and Southern California (Spinks and Shaffer 2005, Spinks et al. 2010). Additionally, some studies recommend, based on genetic differences, that populations north of San Francisco and in the Central valley be identified as *E. marmorata,* and populations in the central Coast Range south of San Francisco be identified as *E. pallida* (Spinks et al. 2014). This implies that the Tehachapi Mountains/Transverse Range are major barriers to movement in Southern California northward (Spinks et al. 2010). The pond turtle species found within the Planning Area is *Emys pallida*.

Reproduction

Southwestern pond turtle nest in terrestrial habitat in sites that can be as far as 1,312 feet from aquatic habitat; however, most are within 656 feet of aquatic habitat (Reese and Welsh 1997, Jennings and Hayes 1994). Mating typically occurs in April and May. Females emigrate from the water to upland nest sites and deposit 3–14 eggs from April through August, with timing dependent on location (Stebbins 2003). Females are highly terrestrial while they are gravid and make multiple trips onto land and burrow themselves beneath leaf litter (Reese and Welsh 1997). Incubation time ranges from 94 to 122 or more days (Bury and Germano 2008). Hatchlings in the northern portion of the species' range generally overwinter in the nest and emerge in the spring (Reese and Welsh 1997). In Southern California, hatchlings may emerge from the nest in the fall (Jennings and Hayes 1994).

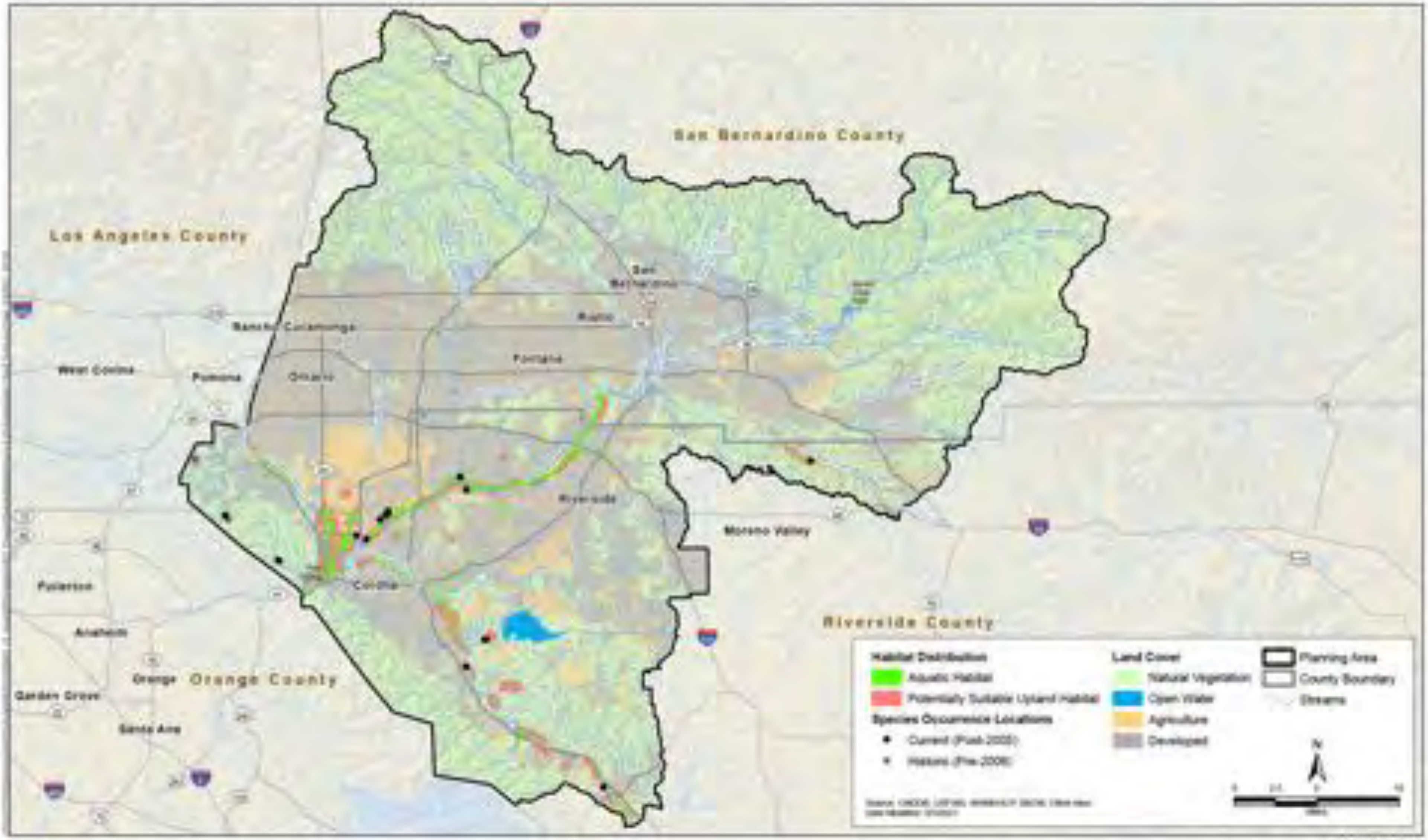
Dispersal, Territoriality, and Home Range

Home range size and dispersal distances are highly variable among individuals. Some individuals may only travel a few feet from aquatic habitat to nest, aestivate, or overwinter, while others may travel considerably farther. Southwestern pond turtle has been known to disperse farther than 1.2 miles if local aquatic habitat disappears or becomes inhospitable, and adults can tolerate at least 7 days without water. The dispersal habits of juveniles are unknown (Jennings and Hayes 1994).

Males have average home ranges of 2.4 acres, while females have average home ranges of 0.6 acre. Populations can reach densities of 215 per hectare in undisturbed stream habitats and even higher in undisturbed ponds (Buskirk 2002). As water levels drop in the summer months and during droughts, the species tends to aggregate in higher densities (Bury and Germano 2008). Basking pond turtles will engage in aggressive behaviors such as biting and ramming to ensure adequate spacing for basking (DOI 1999).

Daily and Seasonal Activity

The level of activity is greatly affected by temperature, especially when surface water temperature is above 59°F (Bury and Germano 2008). Along the southern coastal areas of California, southwestern pond turtles may be active year-round. At higher elevations and higher latitudes, pond turtles will overwinter in upland areas or in the water (Jennings and Hayes 1994). Overwintering turtles may travel up to 1,640 feet from aquatic habitat to terrestrial refuges. Some have been known to occur in terrestrial habitats up to 7 months out of the year (Reese and Welsh 1997). Seasonal activity is depicted in Table 3-31.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-49
Southwestern pond turtle, *Emys pallida*
Potential Habitat Distribution and Known Occurrence Records

Table 3-31. Seasonal Activity of Southwestern Pond Turtle

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation												
Breeding												
Hatchling Emergence												

Sources: Stebbins 2003, Jennings and Hayes 1994

Diet and Foraging

Southwestern pond turtles are omnivorous and dietary generalists (Bury and Germano 2008). Hatchlings and young juveniles feed primarily on zooplankton (Jennings and Hayes 1994). Adults feed on insect larvae, other aquatic invertebrates, fish, amphibian eggs and tadpoles, small fish, carrion, and aquatic plants (Stebbins 2003; DOI 1999).

Threats and Special Management Considerations

Overexploitation for food in the nineteenth and early twentieth centuries caused initial population declines throughout much of the southwestern pond turtle's range. Habitat destruction and alteration are now the primary threats (Bury and Germano 2008, Nicholson et al. 2020). Raccoons (*Procyon lotor*) and other native and introduced mammals may destroy nests and consume eggs and hatchlings. The introduction of largemouth bass (*Micropterus salmoides*) and bullfrogs (*Lithobates catesbeiana*) into aquatic habitats has been damaging to population recruitment (both species have been documented to eat hatchlings and juveniles) (Buskirk 2002, Nicholson et al. 2020), as has the introduction of red-eared sliders, which outcompete southwestern pond turtle for resources. Water diversions/reductions are also a threat to this species, reducing or completely drying suitable aquatic habitat.

Population declines may also be a result of female-biased mortality on roads, caused when gravid females leave aquatic habitats to nest in upland habitats (Nicholson et al. 2020). A recent study showed a strong correlational relationship between road proximity and density and increasing male population bias in this species (Nicholson et al. 2020).

Tricolored Blackbird (*Agelaius tricolor*)

Current Status and Distribution

Tricolored blackbird (*Agelaius tricolor*) is State listed as threatened. It is nearly endemic to California, with 95% of historic breeding range within the state (Western Riverside County MSHCP 2012a). Recent data shows breeding colonies occur sporadically within the Planning Area at the following locations (the most recent date and breeding colony size are given in parentheses)—San Bernardino County: pond adjacent to the Santa Ana River in Colton (2009; 100) (Feenstra 2009), wheat field near Euclid and Eucalyptus Avenues in Chino (2014; 100) (UC Davis 2014), a created wetland south of the Chino Airport (2014; 500) (UC Davis 2014), and the recently created Mill Creek Wetlands (2014; 1,000) (Pike pers. comm, eBird 2014). Breeding colonies have also been detected outside of the Planning Area within and adjacent to the San Jacinto Wildlife Area and along Salt Creek in western Riverside County.

Habitat Requirements

Habitat requirements for a tricolored blackbird breeding colony include open water; appropriate nesting substrate with cattails, bulrushes, willows, and forbs; and nearby foraging habitat (Beedy and Hamilton 1999). Foraging areas include grasslands, open fields, irrigated pasture, and agricultural areas (Beedy and Hamilton 1997, Shuford and Gardali 2008, Rohde et al. 2019). Alfalfa fields are the primary foraging area for the Mill Creek Wetlands colony (Pike pers. comm.) and is reported as the primary forage for several colonies in Riverside County (Western Riverside MSHCP 2012b). Sunflower is the only other crop known to support good foraging opportunities for this species (Meese pers. comm.). In addition to cattail/bulrush habitat, nest sites in the Planning Area have been documented in weedy areas, dominated by species such as bull thistle, mustard, nettle, and cheeseweed mallow (Western Riverside MSHCP 2012b).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of tricolored blackbird modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-50, and quantified in Table 3-15. Statewide mapping and monitoring of tricolored blackbird colony locations is coordinated through the UC Davis Tricolored Blackbird Portal. Colony locations are attributed with the habitat where the colony is located. Colonies were classified into categories based on the surrounding habitat.

- **Typical colony**: Colony located in naturally occurring emergent wetland habitats.
- **Atypical colony**: Colony located in nonnative or atypical natural habitats including: thistle or nettle colony, willow colony, agriculture colony, and urban park colony.

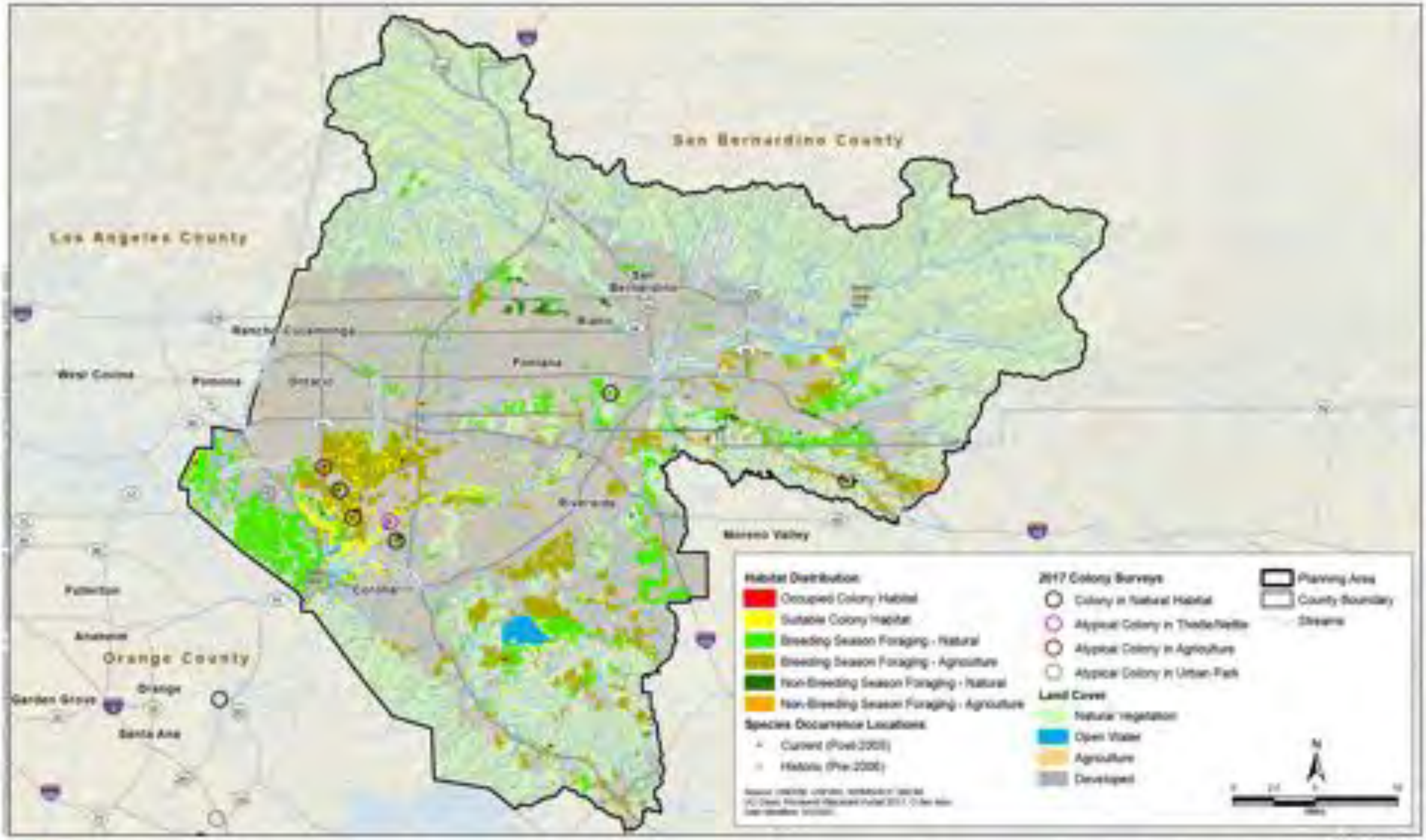
The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area, and include a listing of the data and/or parameters used to create each modeled habitat type.

Occupied Colony Habitat (suitable breeding habitat that allows colony establishment around known colony locations)

- Typical Colony Locations; **AND**
- **Land Cover:** Wetlands; **OR**
- Other natural habitats within 500 feet of atypical thistle, nettle, or willow colony locations (natural is defined as all landcover types except, agriculture, open water, and developed); **OR**
- Agricultural habitats within 500 feet of atypical agriculture colony locations (agriculture colonies are in a limited number of crop types, but all agriculture types are selected because crops are regularly rotated); **OR**
- Urban park colonies represented by the colony occurrence data alone.

Suitable Colony Habitat

- Wetlands within 500 feet of Occupied Colony Habitat.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-50
Tricolored blackbird, *Agelaius tricolor*
Potential Habitat Distribution and Known Occurrence Records

Breeding Season Foraging – Natural

- Grasslands within 5 kilometers of Occupied Colony Habitat or Suitable Colony Habitat with a minimum patch size of 20 acres.

Breeding Season Foraging – Agriculture

- Agriculture within 5 kilometers of Occupied Colony Habitat or Suitable Colony Habitat with a minimum patch size of 20 acres.

Non-Breeding Season Foraging – Natural

- Grasslands with a minimum patch size of 20 acres.

Non-Breeding Season Foraging – Agriculture

- Agriculture with a minimum patch size of 20 acres.

Taxonomy and Genetics

There are two populations of tricolored blackbird within California: (1) Southern California population and (2) Central Valley population. Banding studies have not shown evidence of individuals mixing between the two populations (UC Davis 2014, Shuford and Gardali 2008).

Reproduction

Tricolored blackbirds are synchronized, colonial nesters (Beedy and Hamilton 1997). Reproduction starts in mid-March (UC Davis 2014, Hamilton 1998) and concludes in early August (Beedy and Hamilton 1997, Shuford and Gardali 2008). Females build deep cup nests composed of leaves and grasses in which they lay 3–4 eggs. Eggs are incubated solely by the female for 12–14 days, and chicks typically fledge 10–14 days after hatching (UC Davis 2014). Young within the colony fledge no more than a few days from each other (Western Riverside County MSHCP 2012b). Both male and female feed the young (Beedy and Hamilton 1997). Once the young have fledged, they will remain with the colony (either inside or along the perimeter of the colony) for a few days while still being fed by both parents (UC Davis 2014).

Dispersal, Territoriality, and Home Range

Tricolored blackbirds are regionally philopatric, so this species tends to remain within the region where it hatched, but studies show no strong evidence of site fidelity. Populations in California may move regionally in both winter and breeding months (Shuford and Gardali 2008, Hamilton 1998), but they do not migrate. Young will disperse from the breeding colony, sometimes being led away by the parents carrying food items (UC Davis 2014).

During the breeding season, territories are relatively small, averaging 2–6 meters between nesting sites (UC Davis 2014, Beedy and Hamilton 1999). Foraging areas generally occur up to 5 kilometers from the nest site (Beedy and Hamilton 1999) but have been documented up to 13 kilometers from the nest site (Beedy and Hamilton 1997). Itinerant breeders, capable of breeding twice a year in different locations within the same region (UC Davis 2014, Hamilton 1998).

Daily and Seasonal Activity

In the non-breeding season, tricolored blackbirds form large flocks, often with other species, such as red-winged blackbirds, for foraging and roosting (Shuford and Gardali 2008). Seasonal activity is depicted in Table 3-32.

Table 3-32. Seasonal Activity of Tricolored Blackbird

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering												
Breeding												

Sources: University of California-Davis 2014, Shuford and Gardali 2008

Diet and Foraging

Tricolored blackbirds are opportunistic feeders. This species is mainly granivorous, but will consume invertebrates, such as grasshoppers, beetles, and insect larvae, during the breeding season (UC Davis 2014, Shuford and Gardali 2008, Beedy and Hamilton 1997). Young are fed exclusive insect prey (Western Riverside County MSHCP 2012b).

Threats and Special Management Considerations

Loss of habitat and fragmentation of this species' habitat is largely attributed to human development, and land alteration is considered the most significant threat (Beedy and Hamilton 1999). These anthropogenic factors include water diversion and draining of wetlands, land conversion to agricultural uses, and development of land (UC Davis 2014). Timing of agricultural harvesting can also pose a significant threat to local colonies if harvesting occurs in nesting areas prior to fledging. Conversion of productive foraging habitat to perennial, woody crops including nut trees and vines also threaten this species (Rohde et al. 2019). Severe weather conditions, such as drought, can also contribute to population decline, as it can reduce insect prey populations and cause abandonment of colonies, low reproductive success, and failure to reproduce (Beedy and Hamilton 1999, Rohde et al. 2019).

Nesting habitat within the Planning Area for tricolored blackbird consists primarily of wetland- and marsh-type habitats, but also includes weedy habitats that may be found within or adjacent to crops such as wheat. The Mill Creek Wetlands Recreation and Restoration Demonstration Project provides a management example and shows how quickly this species can occupy newly created suitable nesting habitat (with adjacent suitable foraging habitat), as construction was initiated in early 2013 and occupied in spring 2014 (UC Davis 2014). Activities that alter potential nesting habitat, including vegetation removal and changes in water flow, will be important to consider for conservation of this species in the Planning Area. The conservation and management of suitable foraging habitat within 3 miles of a breeding colony may be an equally important consideration; in the Planning Area, the primary forage appears to be alfalfa fields. There are few areas within the Planning Area that have suitable nesting and foraging habitat and are being used by breeding tricolored blackbirds, and recently occupied sites and surroundings should be the primary consideration.

Other Relevant Information

The Planning Area is within the current range of this species, and, therefore, it is dependent on patchy and somewhat unpredictable breeding and foraging habitat. As a result, it is possible that additional tricolored blackbird colonies will be documented within the Planning Area in the future.

Burrowing Owl (*Athene cunicularia*)

Current Status and Distribution

Burrowing owl (*Athene cunicularia*) is a California Species of Special Concern that is widely distributed throughout California. Riverside and San Bernardino Counties have the largest remaining numbers in the Central and South Coast region (Gervais et al. 2008). Burrowing owl have generally been documented in the lower elevations and flat portions of the Planning Area. This species is known to occur in the Santa Ana River Basin at the San Bernardino International Airport, along City Creek, along the perimeter of several flood control basins, and scattered throughout suitable habitat north and northeast of the Prado Basin. Burrowing owls are also known to occur east of the Jurupa Mountains, at Lake Mathews, at Ayala Park in Chino, scattered throughout the dairy farms in east Chino and southern Ontario, and in the business parks along I-15 and I-10 (ICF 2014).

Habitat Requirements

Burrowing owl occurs primarily in grassland habitats with few shrubs on level to gently sloping topography and well-drained soils (Poulin et al. 2011). While low vegetation is favored, burrowing owl can be found among taller shrubs where the shrubs are rather sparse. This species can also be found in habitats that are highly altered by human activity, such as agricultural fields, golf courses, parks, airports, and vacant urban lots (Gervais et al. 2008, Klute et al. 2003). The most important habitat component is the presence of small mammal burrows for roosting and nesting, and relatively short vegetation (Gervais et al. 2008, Klute et al. 2003, Poulin et al. 2011). Fossorial species whose burrows are often used by burrowing owls include: California ground squirrels (*Spermophilus beecheyi*), American badger (*Taxidea taxus*), coyote (*Canis latrans*), and kit fox (*Vulpes macrotis*). The owl will also utilize non-natural burrows such as pipes and culverts as well as rock outcrops that offer suitable holes (Gervais et al. 2008).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of burrowing owl modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-51, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Herbaceous Agricultural Vegetation; Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; and Great Basin-Intermountain Xeric-Riparian Scrub; **AND**
- **Elevation**: 0–2,000 feet; **AND**

- **Slope**: 0–20%.
- **Post-processing**: Removed patch sizes less than 100 acres.

Taxonomy and Genetics

In North America, burrowing owl is divided into two recognized subspecies; *Athene cunicularia hypugaea* in the west and *A. c. floridana* in Florida and the Bahamas (Poulin et al. 2011).

Reproduction

The breeding season for burrowing owl in California is generally March to August, but can begin in February and extend into December (Gervais et al. 2008), The peak of the breeding season occurs between April 15 and July 15, which is when most burrowing owls have active nests (eggs or young). Incubation lasts approximately 29 days, with young fledging approximately 44 days after hatching. Burrowing owl may change burrows several times during the breeding season, starting when the nestlings are about 3 weeks old (CDFG 2012). This species may attempt to re-nest if the first nest is destroyed early in the nesting season (Klute et al. 2003).

Dispersal, Territoriality, and Home Range

Dispersal distances for both juveniles (post fledging) and adults (post nesting) may be considerable, between 33 and 93 miles (Gervais et al. 2008). One study found that populations in California were indistinguishable, suggesting a high degree of dispersal and interconnectivity of populations (Klute et al. 2003).

Home range size is linked to the availability of food. Burrowing owl generally forage near a nest burrow during breeding, but have been recorded foraging up to 1.7 miles away from a burrow during the breeding season. In California, burrowing owl had a nest-site fidelity from year to year of 32–50% in areas with large expanses of grasslands and 57% in agricultural areas (Gervais et al. 2008). Wintering owls, unlike breeding owls, are not as dedicated to single burrows or a group of burrows. However, there is roost fidelity within and between winter seasons (Poulin et al. 2011).

Daily and Seasonal Activity

Many burrowing owls in California are year-round residents, often retreating from higher elevations in the winter. Migrants from other states may augment lowland populations in the winter throughout the state (Gervais et al. 2008). The species is primarily diurnal, with the greatest period of activity occurring during crepuscular hours. Seasonal activity is depicted in Table 3-33.

Table 3-33. Seasonal Activity of Burrowing Owl

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering												
Breeding												
Migration												
Molt												

Source: Poulin et al. 2011

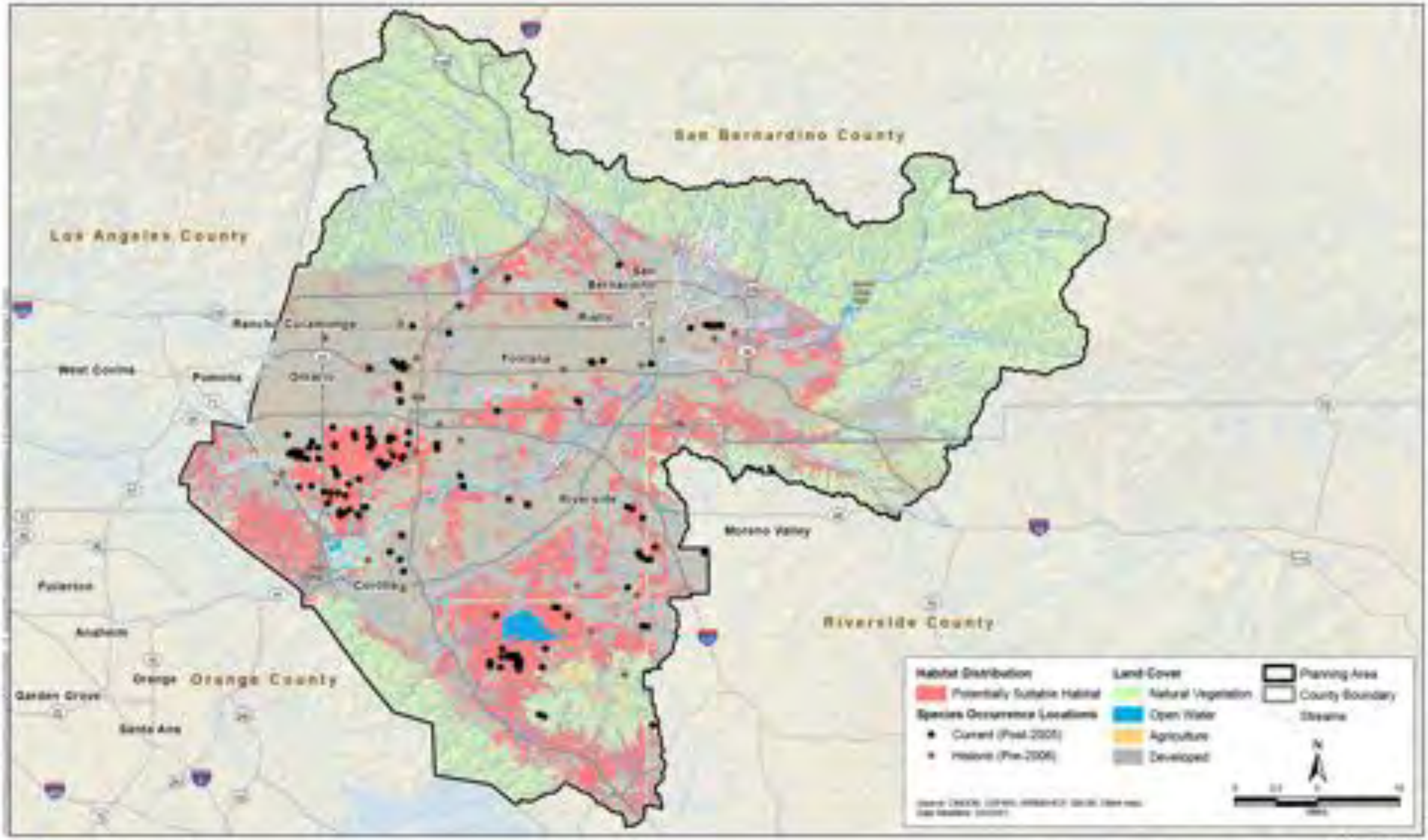


Figure 3-51
Burrowing owl, *Athene cunicularia*
Potential Habitat Distribution and Known Occurrence Records

Diet and Foraging

Burrowing owls are opportunistic foragers that will feed on a wide variety of prey depending on availability. This species readily preys upon insects such as crickets, beetles, and dragonflies. Other prey include small rodents such as voles, deer mice, harvest mice, pocket mice, and kangaroo mice. Less frequently, this species is known to consume birds such as horned larks (*Eremophila alpestris*), western meadowlarks (*Sturnella neglecta*), and shorebirds, as well as bat species (Hoetker and Gobalet 1999). Burrowing owl are generally crepuscular hunters and hunt either on the wing or by walking or hopping on the ground, and will often use elevated perches to spot prey (Poulin et al. 2011).

Threats and Special Management Considerations

Loss of habitat, degradation and fragmentation of remaining habitat, ongoing urbanization, and continuing eradication of ground squirrels are the main threats to burrowing owl in California (Gervais et al. 2008). The elimination of burrowing rodents through the use of rodenticides and other means has contributed to the decline of populations nationwide (Klute et al. 2003). The control of ground squirrels in California may affect local burrowing owl populations by reducing or eliminating ground squirrel burrows. Road and ditch maintenance and discing to control weeds in fallow fields may destroy burrows. Exposure to pesticides may also cause mortality to individuals (CDFG 2012).

Declines in Southern California have continued to occur. One study determined that the number of burrowing owl pairs in the inland portion of Southern California declined by 34% between 1993 and 2007 (Wilkerson and Siegel 2010). Retaining colonies of burrowing mammals is of upmost importance, as burrowing owls require their burrows for nesting and roosting. While burrowing owls appear to adapt fairly well to human disturbances in some cases (i.e., airport runways and other human modified open spaces), the continued presence of active mammal-created burrows is essential to its survival. Rodent eradication programs may reduce the consistent availability of high and moderate function habitat. Additionally, suitable foraging habitat near burrows is required to sustain viable populations (Gervais et al. 2008, Klute et al. 2003, Poulin et al. 2011, CDFG 2012). Because of high nest site fidelity, the disturbance of nest sites could have a dramatic impact on populations. Before artificial burrows are constructed and burrowing owls are relocated, it is important to consider the characteristics of the burrow sites previously used for nesting and mimic them as closely as possible (Botelho and Arrowood 1998). Additionally, because of high nest site fidelity, relocated nests should be installed close to the original nest burrow, ideally within 100 meters (Smith and Belthoff 2001).

Cactus Wren (*Campylorhynchus brunneicapillus*)

Current Status and Distribution

The cactus wren (*Campylorhynchus brunneicapillus*) is a California Species of Special Concern. It is found in California east to Texas, extending south through Baja California and mainland Mexico (Hamilton et al. 2011).

In the Planning Area, it occurs in southwestern San Bernardino County in washes and lower slopes flanking the urbanized area from Fontana east to Yucaipa, including the Santa Ana River, Lytle Creek, Cajon Creek, and Mill Creek. In western Riverside County occurrences are concentrated near Lake Mathews and the Santa Ana River, with small populations scattered in washes and lower hills south to the Temecula area; a disjunct population also persists in the Wilson Valley/Aguanga area (ICF 2014).

Habitat Requirements

Cactus wren typically occupies native scrub with cholla (*Cylindropuntia*) or prickly-pear (*Opuntia*) (Hamilton et al. 2011). Suitable nest sites in and near the Planning Area also include California buckwheat (*Eriogonum fasciculatum*) and California sagebrush (*Artemisia californica*), yucca (*Yucca* spp.), chamise (*Adenostoma fasciculatum*), mountain mahogany (*Cercocarpus* spp.), and juniper (*Juniperus* spp.) (Hamilton et al. 2011, San Bernardino County Museum 2014).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of cactus wren modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-52, and quantified in Table 3-15. The following modeled habitat types are used to represent cactus wren habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Known Suitable Nesting

- **Existing data**: Historical breeding habitat dataset from Cactus Wren Working Group, as well as cactus mapping conducted as part of the Wash Plan HCP buffered by 213 feet (approximate coastal average nesting territory size); **AND**
- **Land Cover** (only within Known Suitable Nesting buffer): Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; Great Basin-Intermountain Xeric-Riparian Scrub; Californian Coastal Scrub (prickly pear).

Potential Nesting and Foraging Habitat:

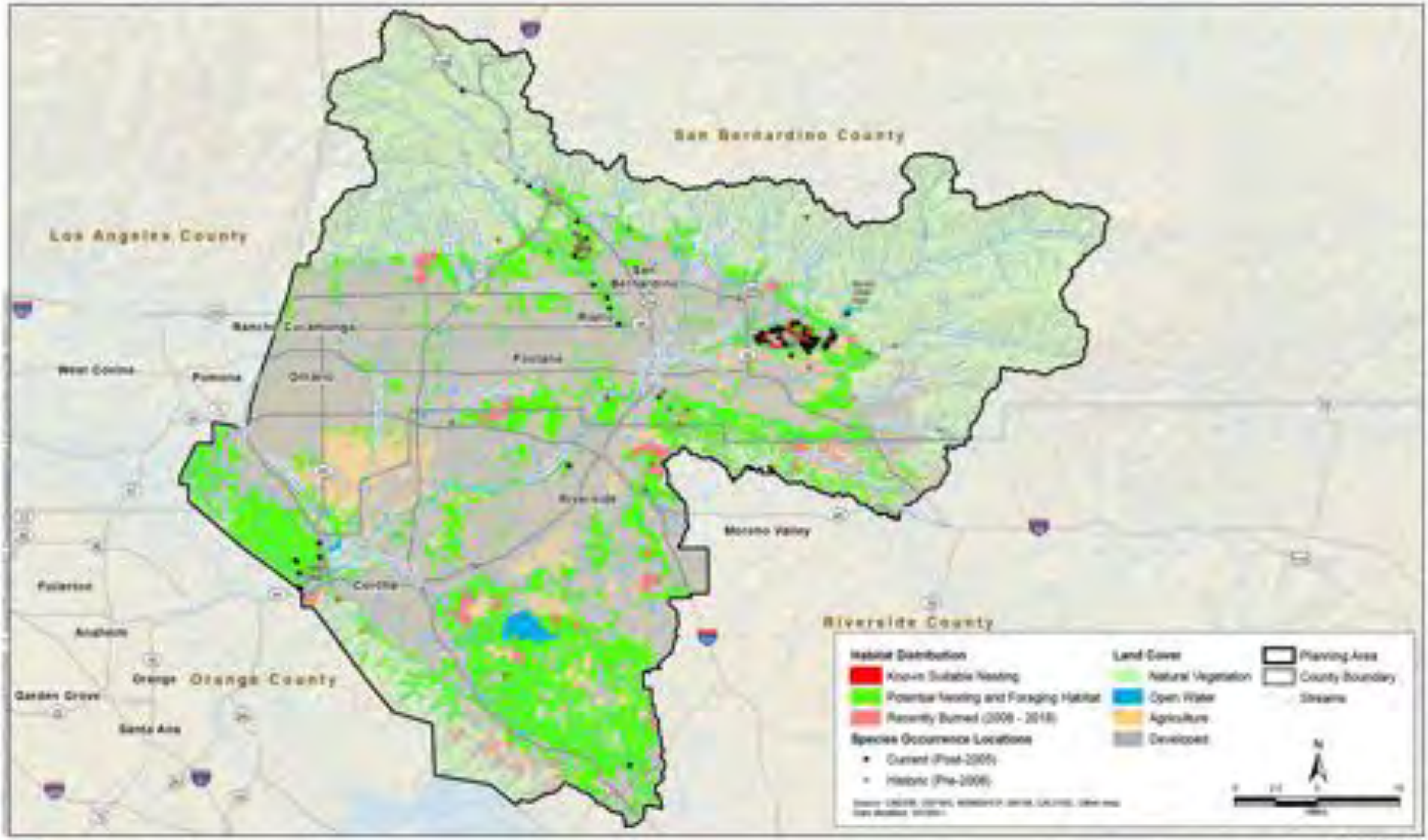
- **Land Cover**: Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; Great Basin-Intermountain Xeric-Riparian Scrub; Californian Coastal Scrub (prickly pear); **AND**
- **Elevation**: 0–2,500 feet; **AND**
- **Slope**: 0–40%.

Recently Burned (2008–2018):

- All Known Suitable Nesting and Potential Nesting and Foraging Habitat that has been burned within the last 10 years (CALFIRE 2018).

Taxonomy and Genetics

Of the eight subspecies of *Campylorhynchus brunneicapillus* (Hamilton et al. 2011), two occur within Southern California. *C. b. sandiegensis* is found in San Diego County and southern Orange County, whereas populations elsewhere on the coastal slope, which includes those within the Planning Area, are classified as *C. b. anthonyi* (Solek and Sziji 2004). Current molecular evidence does not support historical separation of gene lineages between *C. b. sandiegensis* and *C. b. anthonyi* populations



Upper Santa Ana River Habitat Conservation Plan

Figure 3-52
Cactus wren, *Campylorhynchus brunneicapillus*
Potential Habitat Distribution and Known Occurrence Records

(Teutimez 2012), but does indicate recent genetic differentiation of subpopulations, presumably due to habitat fragmentation (Barr et al. 2013).

Reproduction

Cactus wrens nest almost entirely in prickly pear or cholla between 3 and 6 feet tall (Hamilton et al. 2011), and averaging 4 to 5 feet tall within Southern California (Solek and Sziji 2004). Both male and female build the nest (Hamilton et al. 2011, ebird 2014). The female lays 3–5 eggs per clutch (Solek and Sziji 2004). Only the female incubates, which lasts for 16–17 days, and eggs hatch asynchronously (Hamilton et al. 2011, Solek and Sziji 2004). Nestlings fledge 17–23 days after hatching (Hamilton et al. 2011).

Dispersal, Territoriality, and Home Range

Adults show site fidelity to breeding areas, returning to the same area each year (Solek and Sziji 2004). Adults will lead juveniles to old breeding nests for use as roost nests, and eventually stop responding to begging calls to break dependency (Hamilton et al. 2011). Juveniles may disperse to nearby areas, within an average distance of approximately 1 mile of the natal site, but the majority will stay within the site where they were hatched and establish territories (Preston and Kamada 2012). Juveniles typically complete only short-distance dispersal that can be negatively affected by fragmented habitat and non-cactus supporting lands (Teutimez 2012).

Adults may disperse short distances to foraging areas during the non-breeding season. Adults have been documented moving between 0.19 and 0.31 mile from breeding areas (Hamilton et al. 2011). Within Southern California, territories typically range from 1.2 to 4.9 acres (Solek and Sziji 2004). Larger territories have been recorded in drought conditions, when prey populations are depressed (Hamilton et al. 2011). Territories have been recorded as large as 16.6 acres (Hamilton et al. 2011).

Daily and Seasonal Activity

Cactus wren is a year-round, non-migratory resident of the Planning Area. Individuals typically do not make long distance seasonal movements (Hamilton et al. 2011, Solek and Sziji 2004). The breeding period is February to September (Table 3-34) (Hamilton et al. 2011, Simons and Martin 1990). However, adults build nests throughout the year for roosting (Solek and Sziji 2004).

Table 3-34. Seasonal Activity of Cactus Wren

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding												
Molt												

Sources: Hamilton et al. 2011, Solek and Sziji 2004

Diet and Foraging

Cactus wren forage on the ground or in low shrubs (Hamilton et al. 2011, Solek and Sziji 2004). Their diet consists mainly of insects, such as grasshoppers, ants, beetles, and wasps (Hamilton et al. 2011). As summarized in Solek and Sziji (2004), a stomach contents analysis concluded that vegetation may be important in the diet during months when insect prey is low.

Threats and Special Management Considerations

Habitat loss and fragmentation of habitat seem to have the largest impact on cactus wren (Solek and Sziji 2004, Preston and Kamada 2012). Development has removed large tracts of cactus and has fragmented what is left, which limits dispersal between patches of suitable habitat, creating isolated populations. Decreased gene flow could weaken a population's ability to adapt to changing environmental conditions and potentially lead to localized extinction (Hamilton et al. 2011, Preston and Kamada 2012). The species appears to be affected by edge-related habitat degradation, rather than aversion to the edge per se, which suggests that restoration of cactus scrub habitat along urban edges could be beneficial (Hamilton et al. 2011). Long recovery times for cactus after fire limit the species' ability to recolonize suitable habitat for long periods after fire; use of nest boxes may speed the process (Hamilton et al. 2011). Anthropogenic increase in cover of nonnative grasses and forbs in scrub understory may decrease foraging efficiency (Hamilton et al. 2011).

Habitat throughout the Planning Area consists as a patchy distribution of sage scrub habitat with extensive stands of cactus. Vegetation removal activities will reduce the amount of suitable habitat for this resident species, and it will be important to consider avoidance/restoration of cactus patches for conservation of this species in the Planning Area.

Yellow-Breasted Chat (*Icteria virens*)

Current Status and Distribution

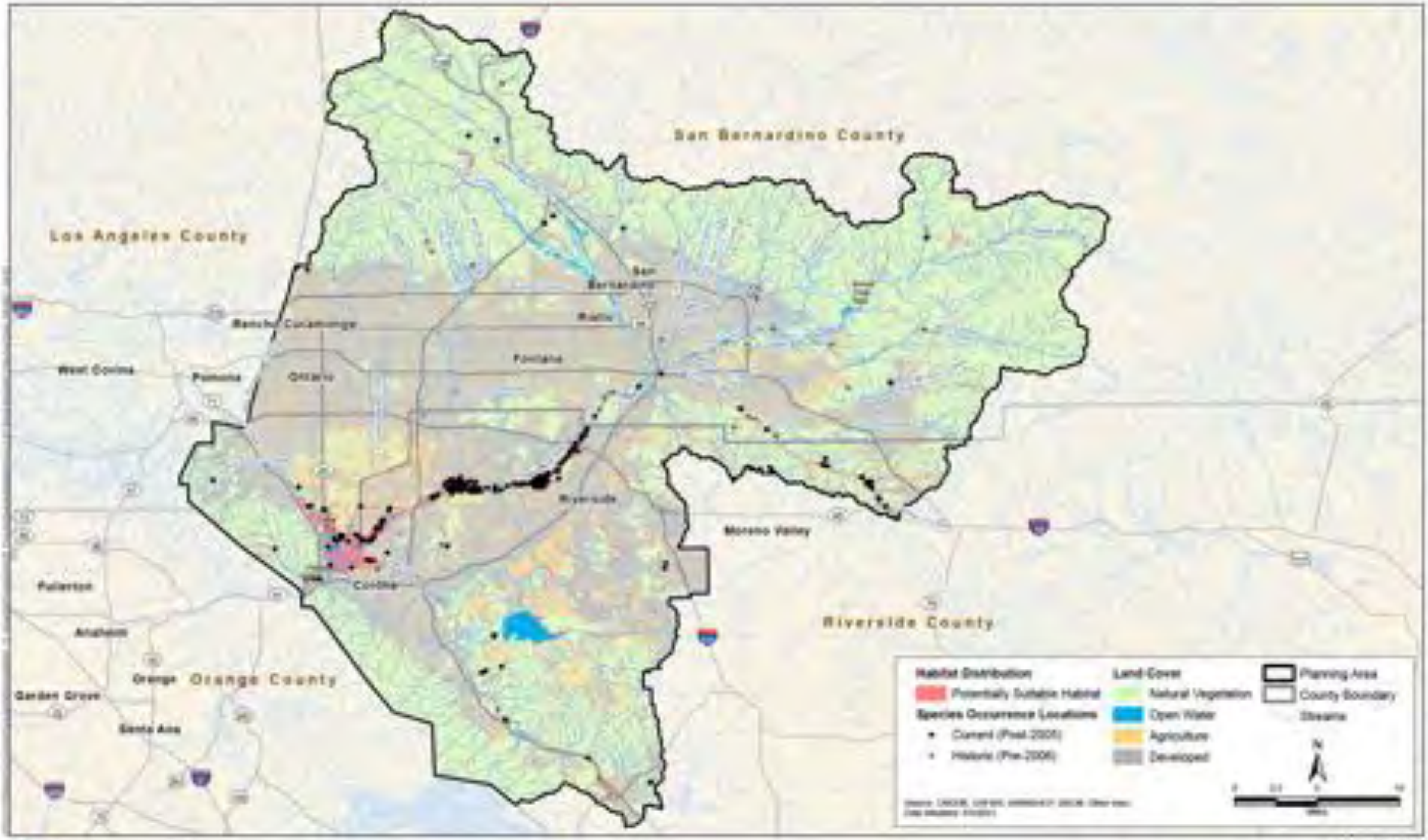
Yellow-breasted chat (*Icteria virens*) is a California Species of Special Concern. It breeds in western North America (from the Great Plains and western Texas toward the west) (Shuford and Gardali 2008, ICF International 2014) and winters in Baja California and southern Texas south through western Mexico to Guatemala (Eckerle and Thompson 2001). In Southern California, the species is known to occur during migration and summer months from the coast east to the Colorado River (Shuford and Gardali 2008). Within the Planning Area, the species occurs sporadically within Riverside and San Bernardino Counties where suitable riparian habitat is present. The largest population is present in the Santa Ana River riparian corridor.

Habitat Requirements

Yellow-breasted chat is found in early successional riparian habitats that have developed shrub layers and an open canopy (Shuford and Gardali 2008). These habitats include riparian woodland and forest, and scrub dominated by cottonwoods, mulefat, and willows (Myers n.d.). Dense thickets are required for nest placement. These often consist of shrubby willows, wild grape (Myers n.d.), and blackberry, tamarisk, and other species that form dense thickets (Shuford and Gardali 2008). Nests are usually built near waterways (Zeiner et al. 1990) along the borders of rivers, streams, and creeks (Shuford and Gardali 2008).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of yellow-breasted chat modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-53, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-53
Yellow-breasted chat, *Icteria virens*
Potential Habitat Distribution and Known Occurrence Records

Potentially Suitable Habitat

- **Land Cover**: Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Warm Southwest Riparian Forest; Warm Southwest Riparian Forest (Arroyo Willow); Warm Southwest Riparian Forest (Black Willow); Warm Southwest Riparian Forest (Elderberry); Warm Southwest Riparian Forest (Fremont Cottonwood); Warm Southwest Riparian Forest (Red Willow); Warm Southwest Riparian Forest (Sandbar Willow); Warm Southwest Riparian Forest (Shining Willow); Warm Southwest Riparian Forest (Sycamore); Warm Southwest Riparian Forest (White Alder); and Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; **AND**
- **NWI and SoCal Wetlands hydrology attribute modifier**: Semi-permanently flooded (regardless of Land Cover type).

Taxonomy and Genetics

Two subspecies exists for *Icteria virens: I. v. virens* in eastern North America and *I. v. auricollis* in western North America.

Reproduction

Adults begin building nests in early to mid-May and chicks usually fledge by early August (Eckerle and Thompson 2001, Dudek and Associates 2003a). Females construct a cup nest between 3 and 6 feet from the ground (Myers n.d.). Females incubate a single clutch of 3–6 eggs (Myers n.d.) for 11–15 days (Zeiner et al. 1990). Young are altricial, hatching without down feathers and unable to nourish themselves, and are fed by both parents until they fledge at 8–11 days (Zeiner et al. 1990, McKibbin and Bishop 2012a).

Dispersal, Territoriality, and Home Range

Literature on juvenile dispersal, territoriality, and home range is limited. As summarized in Eckerle and Thompson. (2001), studies indicate a lack of strong fidelity to return to hatch site to breed. A study found that approximately half of banded nestlings returned to their natal site to breed (McKibbin and Bishop 2012a). For those that did not return to natal site, dispersal ranged from 2.5–15.6 kilometers for males and 2.3–2.6 kilometers for females (McKibbin and Bishop 2012a). The dispersal distance for adult males that did not return to their previous territory ranged from 6.4–42.9 kilometers (McKibbin and Bishop 2012a).

Territorial responses appear to decrease as pairs tend to congregate in an area as population densities increase (Eckerle and Thompson 2001). Studies in the eastern U.S., including Indiana, report the average territory size to be 0.3–3.1 acres (Eckerle and Thompson 2001). In British Columbia, breeding territories were on average 1.5 acres based on singing male locations, but averaged 2.9 acres based on radio telemetry (McKibbin and Bishop 2012b).

Daily and Seasonal Activity

During spring migration, yellow-breasted chat arrives in Southern California early to mid-April and departs for fall migration back to wintering areas in late August into early September (Eckerle and Thompson 2001). Table 3-35 summarizes seasonal activity.

Table 3-35. Seasonal Activity of Yellow-Breasted Chat

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering	■	■	■							■	■	■
Breeding					■	■	■	■				
Migration				■				■	■			
Molt							■	■	■			

Source: Eckerle and Thompson 2001.

Diet and Foraging

Yellow-breasted chat forages by gleaning (Zeiner et al. 1990), taking invertebrates from the surface of foliage or the ground. Diet consists primarily of insects and spiders. Fruits and berries, such as elderberries, blackberries, and wild grape, may also be eaten (Shuford and Gardali 2008, Eckerle and Thompson 2001, Myers n.d.). Invertebrate prey includes beetles, ants, weevils, bees, wasps, mayflies, and caterpillars (Eckerle and Thompson 2001, Myers n.d.). Young are fed soft-bodied invertebrates, including adult and larval insects (Eckerle and Thompson 2001, Myers n.d.).

Threats and Special Management Considerations

Habitat loss and habitat degradation are the primary threats to the species. Removal of vegetation for development, agriculture, or flood control maintenance are the driving forces behind habitat removal (Myers n.d.). Nest parasitism by brown-headed cowbirds is also a contributing factor to the decline of the species (Myers n.d., Zeiner et al. 1990).

Suitable habitat for the species is found throughout the Planning Area within riparian vegetation in and along rivers, creeks, and flood control basins. The most important limiting factor of populations appears to be habitat. Consequently, the maintenance of early successional shrub-scrub habitat is essential. Mature forests with a closed canopy preclude breeding by this species due to the lack of understory. It requires thick vegetation for nesting, and this should be considered when performing activities that alter habitat. Human activity in the vicinity of a nest can cause abandonment of the egg and nestlings by the adults.

Western Yellow-Billed Cuckoo (*Coccyzus americanus*)

Current Status and Distribution

Western yellow-billed cuckoo (*Coccyzus americanus*) is Federally listed as threatened and State-listed as endangered. In California, only three core areas support breeding yellow-billed cuckoo: the Sacramento River between Colusa and Red Bluff, the South Fork of the Kern River, and the lower Colorado River (McNeil and Tracy 2013). The most recent breeding record from the Planning Area was documented in Prado Basin in 1989 (ICF 2014). There are historical occurrences documented within the Santa Ana River (1930 and 1977) and San Timoteo Creek, with sporadic migrants recorded in San Bernardino and Riverside County (USFWS 2014, ICF 2014, Dudek & Associates. 2003a). In August 2014, USFWS proposed designating critical habitat within the Prado Flood Control Basin (Unit 6) in the Planning Area and revised this designation in 2020 (85 *Federal Register* 11458).

Habitat Requirements

Breeding habitat, especially along the Lower Colorado River, has been documented to include structurally complex mature riparian habitats with tall trees and a dense woody vegetative understory, typically near waterways dominated by willows and cottonwoods (Laymon 1998, Hughes 1999). However, recent habitat restoration projects at the Palos Verde Ecological Reserve, which is located on the Lower Colorado River, documented cuckoos favoring young, 2- to 3-year-old cottonwood-willow habitat (McNeil et al. 2011). Furthermore, other studies have documented a range of habitat preferences including monotypic salt cedar with no differentiated understory, linear strips of open and mixed native and nonnative habitat, small isolated patches of mature cottonwood/willow riparian, and very open habitat without understory and small clusters of mature cottonwoods. Canopy height typically ranges from 15 to 100 feet, and the understory ranges from 3 to 20 feet (Dudek & Associates 2003). USFWS description of critical habitat PBFs includes riparian woodlands, prey base consisting of large insect fauna and tree frogs, and dynamic riverine processes that encourage sediment movement and deposits to facilitate plant growth (USFWS 2014).

Distribution of Habitat and Occurrences in the Planning Area

Distribution of western yellow-billed cuckoo modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-54, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

High Value Breeding Habitat

- **Land Cover**: Interior Warm and Cool Desert Riparian Forest; **AND**
- Patches of the above selected vegetation must be at least 328 feet in width and *at least* 200 acres in size.

Other Potentially Suitable Breeding Habitat

- **Land Cover**: Interior Warm and Cool Desert Riparian Forest; **AND**
- Patches of the above selected vegetation must be at least 328 feet in width and *less than* 200 acres in size.

Taxonomy and Genetics

Recent research on yellow-billed cuckoo genetics did not indicate sufficient genetic differences between eastern and western yellow-billed cuckoos to support two separate subspecies (USFWS 2014). However, existing DNA studies show sufficient divergence to determine that cuckoos that nest in the western North America are a biologically distinct population segment (USFWS 2014).

Reproduction

Western yellow-billed cuckoo breeding occurs from June through August but may begin as early as May. Both male and female adults construct a flat, loose platform stick nest (Hughes 1999). Nests are built on horizontal branches. Nest height varies from 2–88 feet (Hughes 1999, Dudek & Associates 2003), and on the Santa Ana River varies from 4–30 feet (14-foot average) (Laymon 1998). Incubation is shared by both adults, which lasts 9–12 days. Nestlings are fed by both parents and fledge 5–9 days after hatching (Laymon 1998, Hughes 1999). Cuckoos are an occasional nest parasite, and there is documentation of their laying eggs in other *C. americanus* nests (Hughes 1999).

Dispersal, Territoriality, and Home Range

Cuckoo adults show high breeding site fidelity and have been documented returning to the same site to breed for at least three consecutive seasons (McNeil et al. 2011, USFWS 2014). Two females dispersed 21 and 24 miles to other sites along the same reach of the Colorado River (USFWS 2014).

Home ranges are large, variable in size depending on seasonal food abundance, and overlap between neighboring pairs (McNeil and Tracy 2013). Recent radio telemetry has documented home ranges between 95 and 204 acres (McNeil and Tracy 2013).

Daily and Seasonal Activity

Western yellow-billed cuckoo migrates in the spring and arrives in California as early as mid to late May (Hughes 1999), but typically arrives in June (Laymon 1998). The species' non-breeding range is believed to be the western side of the Andes in South America (Hughes 1999). Departure for fall migration begins in August, but peaks in September (Laymon 1998). Seasonal activity is depicted in Table 3-36.

Table 3-36. Seasonal Activity of Western Yellow-Billed Cuckoo

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering	■	■	■									■
Breeding						■	■	■				
Migration					■	■		■	■	■	■	
Molt	■	■	■						■	■	■	■

Source: Hughes 1999

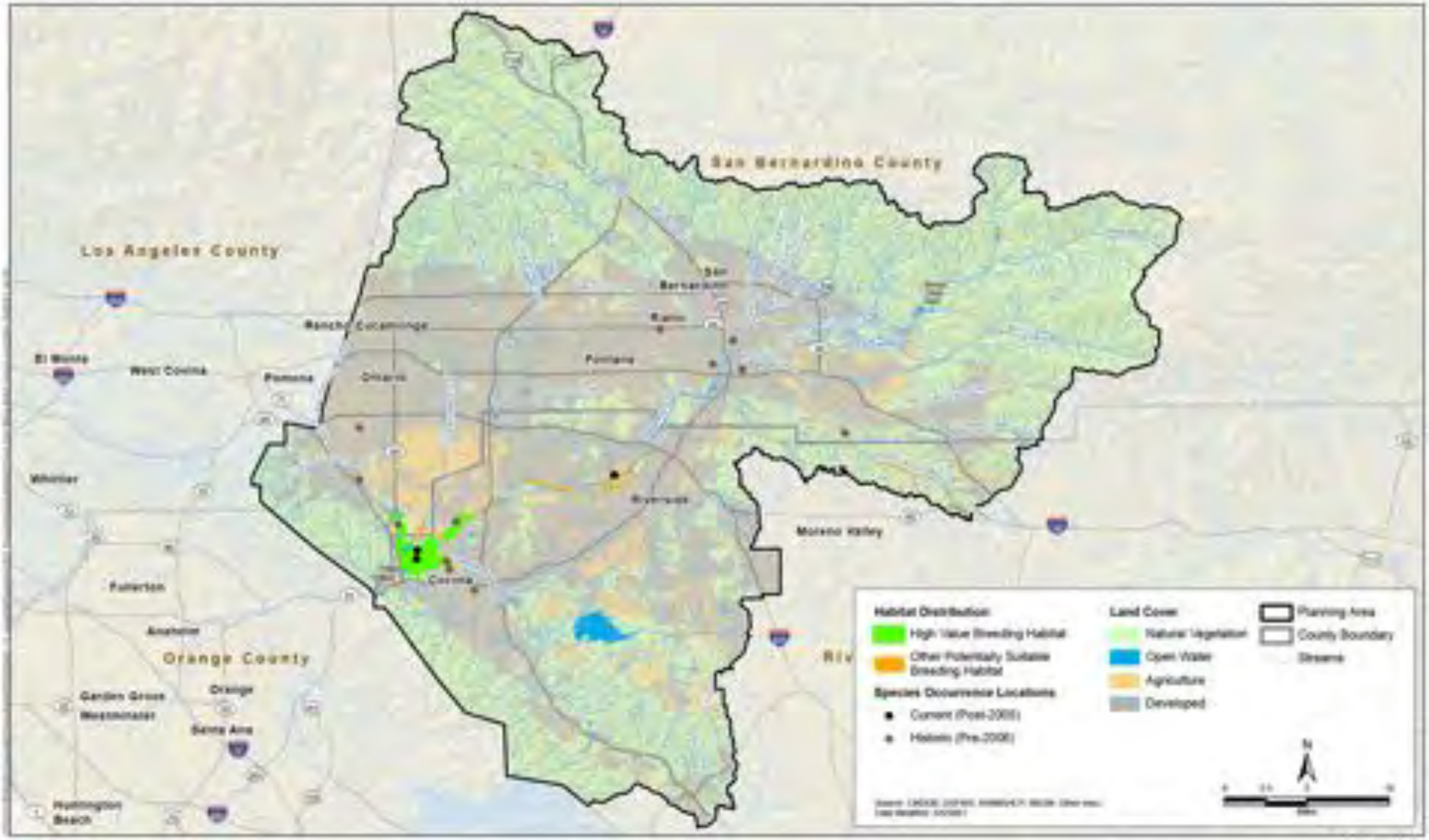
Diet and Foraging

Cuckoos are insectivorous and forage by gleaning, usually while perched (Dudek & Associates 2003, Laymon 1998), taking invertebrates from the surface of foliage. Their diet consists primarily of cicadas, katydids, grasshoppers, crickets, and caterpillars (Hughes 1999, Laymon 1998). Adults feed nestlings whole prey items, which consist primarily of caterpillars (Hughes 1999).

Threats and Special Management Considerations

Habitat loss and fragmentation due to flooding behind dams, clearing, water table lowering, and invasion by nonnative invasive vegetation are the primary threats to the species (Laymon 1998). Groundwater depletion that results in reduction of groundwater-dependent riparian vegetation (e.g., cottonwood, willow, and valley oak) can further fragment and reduce this species' available suitable habitat (Rohde et al. 2019).

Suitable nesting habitat with the appropriate acreage is limited within the Planning Area. Large-scale restoration activities have been shown to be an effective management technique for this species elsewhere within their range, with use documented within 2 years. Areas with the most



Upper Santa Ana River Habitat Conservation Plan

Figure 3-54
Yellow-billed cuckoo, *Coccyzus americanus*
Potential Habitat Distribution and Known Occurrence Records

recent documentation of occurrences, such as Prado Basin, could be considered for such restoration efforts.

Other Relevant Information

Little is known about the migration route of the western yellow-billed cuckoo. Conservation of riparian corridors within the Planning Area may be considered for this species as migration between summer and wintering areas. The most recent statewide survey (1999 to 2000) indicates a population decline with a contraction of the range to the core areas of occurrence along the Sacramento, Kern, and Colorado Rivers (McNeil and Tracy 2013). When compared to earlier statewide surveys (1977 and 1987), there was an absence of yellow-billed cuckoos at isolated sites in the Prado Flood Control Basin, the Mojave and Armargosa Rivers, and the Owens Valley in Inyo County where it had previously bred (McNeil and Tracy 2013). The lower Eel River in Humboldt County may prove to be a newly documented breeding site.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Current Status and Distribution

The southwestern willow flycatcher (*Empidonax traillii extimus*) is Federally and State listed as endangered and has a breeding range that includes Southern California; southern Nevada; southern Utah, Arizona, and New Mexico; and southwestern Colorado (Sogge et la. 2010). Occurrences recorded in the Planning Area since 2004 are in Cajon Wash, Waterman Creek, Day Canyon, Santa Ana River (north of Crafton Hills), San Timoteo Canyon, Santa Ana River (within Prado Basin), English Creek, Little Sand Canyon, and southwest of McKinley Mountain (northeast of San Bernardino) (ICF 2014, USFWS 2013).

Habitat Requirements

In Southern California, the southwestern willow flycatcher is restricted to riparian habitat along rivers, streams, or other wetlands where an adequate prey base is present (USFWS 1995). Suitable habitat typically consists of dense tree or shrub cover (≥ 10 feet) with dense twig structure and foliage, and may include interspersed patches of open habitat (USFWS 1995, Sogge et al. 2010). Vegetative composition can range from all native species to a mix of native and nonnative species or monotypic stands of nonnative species, but almost always includes willow (*Salix* spp.) and/or tamarisk (Sogge et al. 2010, USFWS 2013). Nests are located near surface water or saturated soils; water availability at a site may range from inundated to dry from year to year or within the breeding season (Sogge et al. 2010). Riparian habitats lacking suitable conditions located adjacent to territories may function as secondary habitat used for foraging.

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of southwestern willow flycatcher modeled habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-55, and quantified in Table 3-15. The habitat distribution model combines an existing regional model developed by USGS (Hatten 2016) that identifies and ranks core habitat and adds other areas of potentially suitable habitat based on wildlife habitat relationships.[3] The Hatten (2016) model was limited to the extent of potentially suitable land cover types as identified below.

Potentially Suitable Habitat

Land Cover: Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Warm Southwest Riparian Forest; Warm Southwest Riparian Forest (Arroyo Willow); Warm Southwest Riparian Forest (Black Willow); Warm Southwest Riparian Forest (Elderberry); Warm Southwest Riparian Forest (Fremont Cottonwood); Warm Southwest Riparian Forest (Red Willow); Warm Southwest Riparian Forest (Sandbar Willow); Warm Southwest Riparian Forest (Shining Willow); Warm Southwest Riparian Forest (Sycamore); Warm Southwest Riparian Forest (White Alder); Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland.

The Hatten model output is displayed within the riparian habitat as defined above.

The potentially suitable habitat was then classified into the following habitat suitability categories by ranking highest value to lowest value based on the Hatten (2016) model scores and critical habitat delineations:

- **Core Southwestern Willow Flycatcher Habitat**: Potentially suitable habitat within southwestern willow flycatcher final critical habitat
- **Very High Value Habitat**: Hatten model highest score
- **High Value Habitat**: Hatten model next highest score
- **Moderate Value Habitat**: Hatten model next highest score
- **Other Potentially Suitable Habitat**: Potentially suitable habitat not mapped in the very high, high, and moderate value habitat classes of the Hatten model.

Southwestern Willow Flycatcher Designated Critical Habitat

There are 4,431 acres of designated critical habitat for southwestern willow flycatcher in the Planning Area (78 *Federal Register* 343). Designated critical habitat is located within Bear, Mill, Oak Glen, San Timoteo, and Waterman Creeks, and the East, Middle, and West Forks of the Santa Ana River.

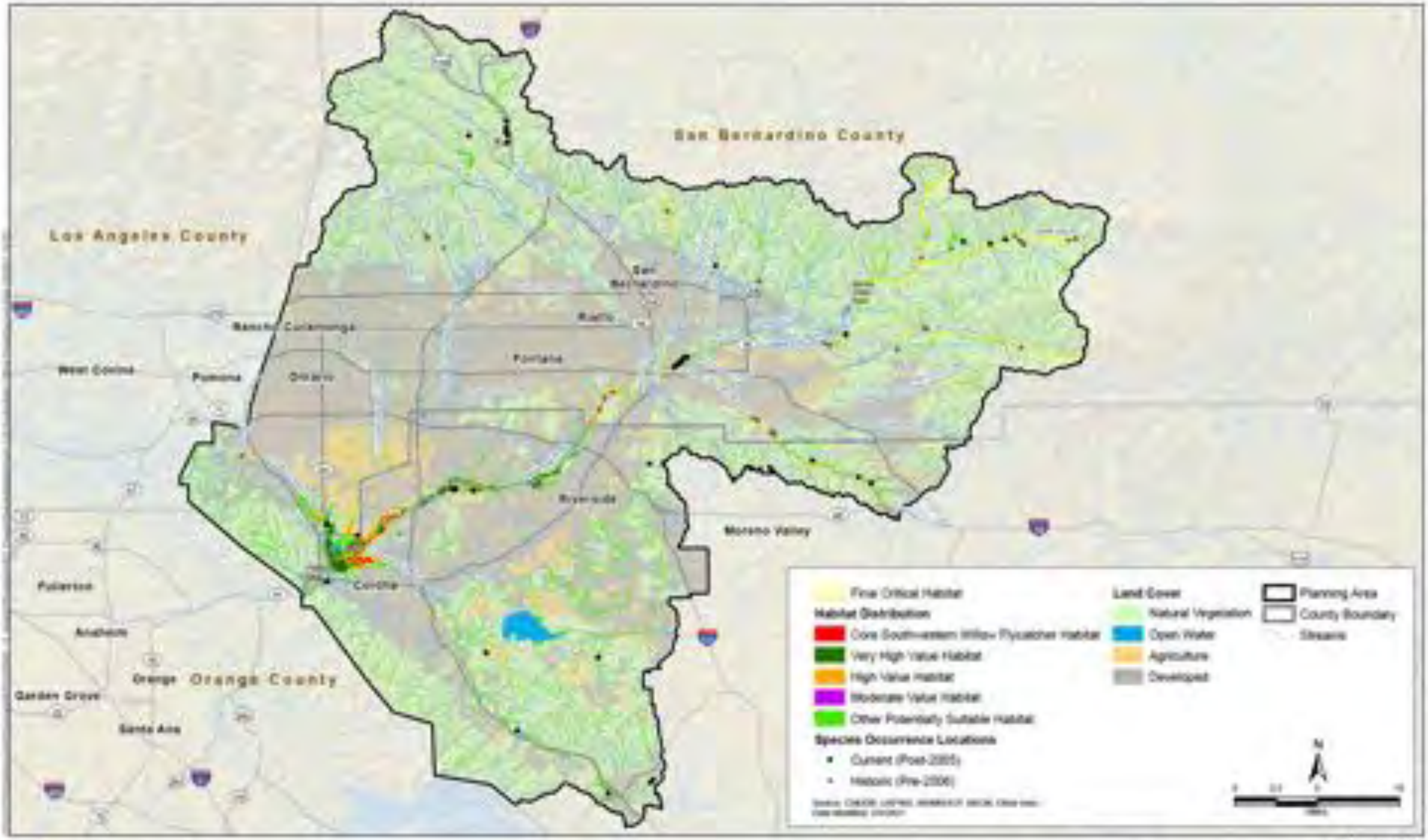
Taxonomy and Genetics

The southwestern willow flycatcher is one of four currently accepted subspecies of the willow flycatcher (*Extimus traillii*) in North America (USFWS 2002). Genetic research has determined that southwestern willow flycatcher (*E. t. extimus*) is a distinct subspecies (Paxton 2000).

Reproduction

The southwestern willow flycatcher is predominantly monogamous, although some populations have high rates of polygyny (Paxton et al. 2007). Breeding typically begins in early June (few in early

[3] The Hatten (2016) Southwestern Willow Flycatcher Model is a statistical model that integrates GIS, Landsat TM data, and logistic regression. Input variables include floodplain size, vegetation density, and variation in vegetation density and amount of dense vegetation. Output of the Hatten model is categorized and ranked into classes of habitat value. See Hatten (2016) for further information.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-55
Southwestern willow flycatcher, *Empidonax traillii extimus*
Potential Habitat Distribution and Known Occurrence Records

May). The female builds the nest with little to no assistance from the male. Up to two clutches are produced each season; re-nesting rates are higher for pairs following an unsuccessful breeding attempt (Ellis et al. 2008). Clutch size is typically 3–4 eggs and decreases with each re-nesting attempt (Sogge et al. 2010, Ellis et al. 2008). The female incubates eggs for 12–13 days after the last egg is laid. Chicks leave the nest within 12–15 days of hatching. Initially the female provides the majority of care for the young; the male's role increases with the age of the nestlings. Both parents will feed fledglings for about 2 weeks (Sogge et al. 2010).

Dispersal, Territoriality, and Home Range

Most adult flycatchers return to the same drainage from one year to the next, often near their previous breeding site; however, movement to different breeding sites from year to year is not uncommon. Dispersal can range from 0.1–450 kilometers. First year birds tend to disperse farther distances than adults, on average 11 kilometers farther (Sogge et al. 2010, Paxton et al. 2007).

Males establish and defend territories aggressively. Females usually arrive 1 or 2 weeks after males and settle on established territories; the territory is likely chosen based on the characteristics of the site rather than those of the male (Sogge et al. 2010). Territories tend to be larger early in the season and become smaller after pairing occurs (Sogge et al. 2010, Finch and Stoleson 2000). Territory sizes vary depending on the habitat quality, food availability, population density, and pairing/nesting stage. Typically, territories range from 0.2 to 5.7 acres (Sogge et al. 2010).

Daily and Seasonal Activity

Individuals typically arrive on breeding grounds by early May (very few in late April); males typically arrive a few weeks before females (USFWS 2002, Sogge et al. 2010). Pairs with fledglings may stay as late as late-August to early-September. Unpaired males may leave the breeding grounds as early as mid-July (USFWS 2002). Seasonal activity is depicted in Table 3-37.

Table 3-37. Seasonal Activity of Southwestern Willow Flycatcher

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering												
Breeding												
Migration												
Molt												

Source: USFWS 2002

Diet and Foraging

The southwestern willow flycatcher is an insectivore generalist and forages on external edges or internal canopy openings of its territory (sometime in neighboring territories), above the canopy or over open water (Finch and Stoleson 2000). Adult diets consist mainly of arthropods: bees, wasps, flies, leaf hoppers, and beetles (Durst et al. 2008), which it catches in the air, gleans from vegetation, or picks from the ground. Variations in diet can occur based on the quality of its territory or weather conditions (Durst 2004).

Threats and Special Management Considerations

The primary threat to southwestern willow flycatcher is the loss, modification, and fragmentation of suitable riparian habitat, caused primarily by dams and reservoirs, water diversion and ground water pumping, channelization, flood control, agriculture, recreation, and urbanization (Durst et al. 2008). Changes in groundwater levels can result in overall reduction in water availability during breeding and nesting seasons, which can particularly affect this species (Rohde et al. 2019). Tamarisk, which has invaded riparian habitats in part due to anthropogenic disturbances, is highly flammable and poses a threat to riparian habitat. The reduction of flow of water through riparian habitat, due to the dams and flood control, allows for the buildup of fuel in the understory, which increases the risk of fire (USFWS 2002) and reduces the natural processes of recruitment and fluvial disturbance.

Major stressors on the species, such as destruction of riparian habitat, manipulation of groundwater and surface water, livestock and other agricultural practices, and floodplain and watershed alterations, must be managed and/or minimized in areas of suitable habitat (USFWS 2002). Monitoring and surveying efforts in the Planning Area should continue in order to maintain current information regarding the population size, breeding status, and distribution of this species. Important considerations when managing and creating riparian habitat are inundation timing, plant species composition, and plant genetic variety, which can influence the arthropod prey base.

Other Relevant Information

Brown-headed cowbirds, which are obligate brood parasites, also contribute to overall nest failure for southwestern willow flycatcher; however, they are not considered a primary threat (Durst et al. 2008). Nonetheless, short-term cowbird control practices, such as trapping, as well as long-term management practices, with an emphasis on reducing conditions known to attract cowbirds, including horse stables, agricultural fields, and golf courses, should be implemented (USFWS 2002, Finch and Stoleson 2000).

Coastal California Gnatcatcher (*Polioptila californica californica*)

Current Status and Distribution

The coastal California gnatcatcher (*Polioptila californica californica*) is Federally listed as threatened and is a California Species of Special Concern. This species occurs in the following locations within the Planning Area: (1) San Bernardino County: Etiwanda Fan, Lytle Creek Wash, Cajon Wash, Cable Creek Wash, Santa Ana River Wash, Mill Creek, Reche Canyon (Jurupa Hills, Blue Mountain), and Chino Hills; and (2) Riverside County: Reche Canyon, Lake Mathews, Gavilan Hills, Norco Hills, Arroyo Del Torro-Temescal Wash (Lake Elsinore, Wasson Canyon), Alberhill/Lake Elsinore (Walker Canyon, Lake Elsinore Clay Mines), and Temescal Valley (ICF 2014, USFWS 2014, eBird 2012).

Habitat Requirements

Coastal California gnatcatcher occurs in Venturan, Riversidian, and Diegan coastal sage scrub (Atwood 1993). Suitable coastal sage scrub typically includes *Artemisia californica*, *Eriogonum fasciculatum*, *Encelia californica*, *E. farinosa*, and various species of *Salvia* (Beyers and Wirtz 1997). Nest success, fledgling survival, and adult survival are positively correlated with robust vertical and horizontal perennial structure, and suitable nest patches can be significantly different among pairs (Braden 1999). USFWS description of critical habitat PBFs includes dynamic and successional sage scrub habitats and nearby non-sage scrub habitats such as chaparral, grassland, and riparian areas to provide space for dispersal, foraging, and nesting (USFWS 2007).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of coastal California gnatcatcher modeled habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-56, and quantified in Table 3-15. As part of the San Diego Multi-Species Management Plan (SDMMP) to conduct long-term coordinated monitoring of the gnatcatcher across the species' range, a statistical habitat distribution model was developed (Preston and Kus 2015). The results of the SDMMP model were applied to areas mapped as Californian Coastal Scrub and North American Warm-Desert Xeric-Riparian Scrub land cover types within the Planning Area, and habitat value was categorized based on the scores of the SDMMP model as follows:

- Very High Value Habitat = 0.75–1.00
- High Value Habitat = 0.50–0.74
- Moderate Value Habitat = 0.25–0.49
- Low Value Habitat = 0–0.24
- **Other Suitable Habitat**: Includes the above vegetation types within the species range but *not* captured by the SDMMP model.
- **Post-processing**: Areas mapped as developed or agriculture in the Upper SAR HCP land cover data were removed from the model results.

Coastal California Gnatcatcher Designated Critical Habitat

There are 13,589 acres of designated critical habitat for coastal California gnatcatcher in the Planning Area (72 *Federal Register* 72009). Designated critical habitat occurs within the central, western, and southwestern portions of the Planning Area.

Taxonomy and Genetics

One of three subspecies of California gnatcatcher, the coastal California gnatcatcher (*P. c. californica*) is the northernmost subspecies of California gnatcatcher. Other subspecies (*P. c. pontilis* and *P. c. margaritae*) are located in Baja California (Atwood 1993).

Reproduction

The coastal California gnatcatcher is monogamous. The breeding season occurs from mid-February to August. Both males and females nest build, incubate, and care for altricial young. Egg laying is highest April through May. Incubation is 14–15 days, clutch size ranges from 2–5 eggs, and chicks fledge 16 days after hatching (USFWS 2010d). Reproductive success is dependent on habitat condition, predator populations, and food availability.

Dispersal, Territoriality, and Home Range

The coastal California gnatcatcher is a permanent resident and does not migrate. This species tends to remain in the same home range from year to year and disperses only as far as necessary to find unoccupied areas within suitable habitat patches (Atwood 1993, Braden 1999). This species' natal dispersal is largely connected with corridors of native vegetation. Juveniles generally disperse approximately 1.4 miles from their natal site depending on habitat availability and condition (Bailey and Mock 1998). The pair of gnatcatchers defends their home range. Density of shrub cover, composition of plants, habitat quality, surrounding disturbances, and adjacent gnatcatcher territories dictate the size of a territory (Kucera 1997). The size of a territory ranges between 2 and 14 acres (USFWS 2010d), typically on lower elevations along coast ranges or on gentle slopes.

Daily and Seasonal Activity

The coastal California gnatcatcher is diurnal and is active yearlong. The species' highest activity is in the morning. Daily activity is dependent on the condition of occupied coastal sage scrub. Poor quality coastal sage scrub results in an expansive home range. Foraging can occur in adjacent vegetation communities (e.g., riparian and chaparral), especially in the non-breeding season. During the breeding season, home range becomes smaller (Atwood 1993). Seasonal activity is depicted in Table 3-38.

Table 3-38. Seasonal Activity of Coastal California Gnatcatcher

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding		■	■	■	■	■	■	■				
Dispersal					■	■	■	■	■	■		
Molt	■	■	■				■	■	■			

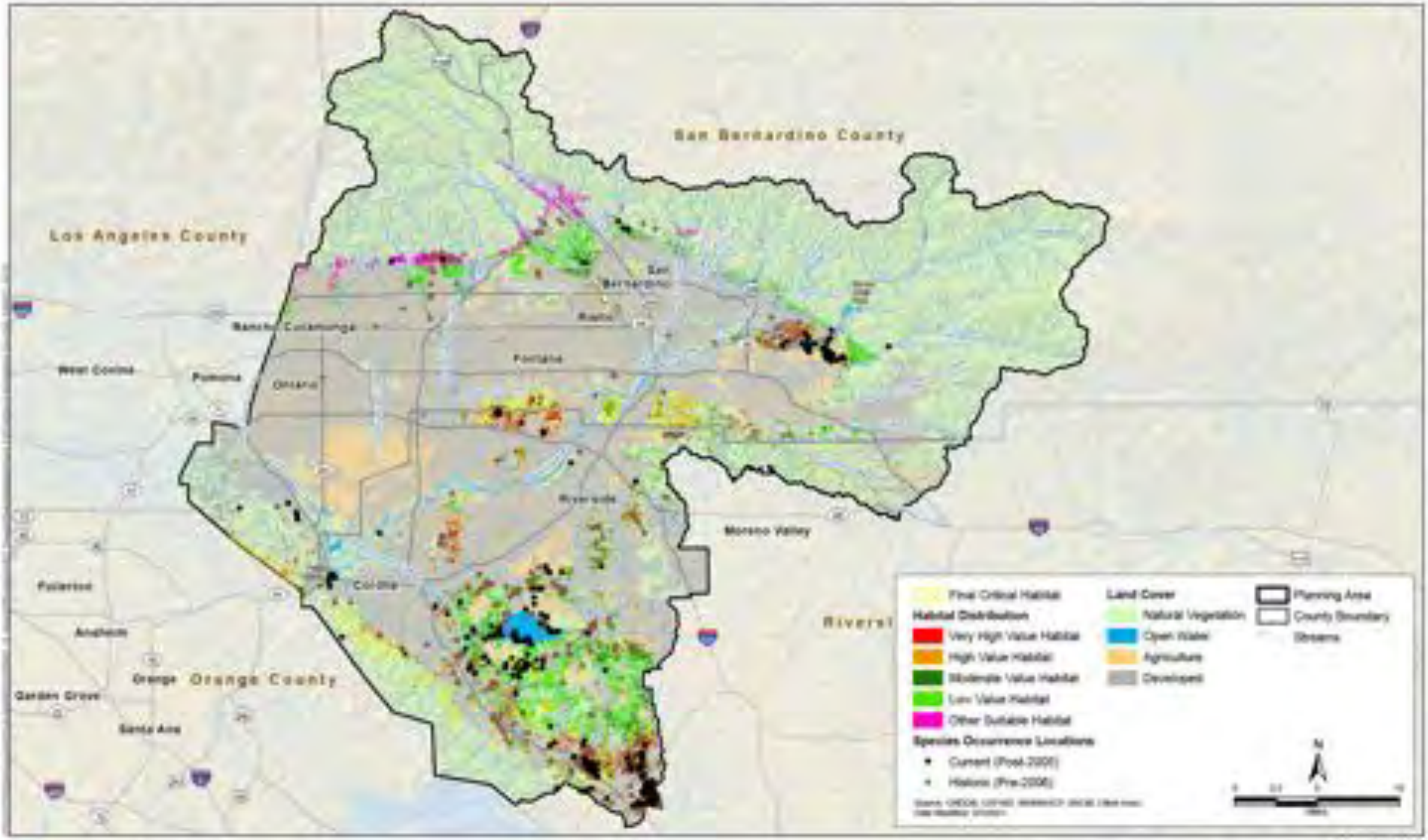
Sources: Atwood 1993, Atwood and Bontrager 2001

Diet and Foraging

Coastal California gnatcatcher typically gleans insects from vegetation, primarily *Artemisia* and *Eriogonum* (Atwood 1993) and may also eat some seeds (Kucera 1997). The species' foraging range is dependent on condition of coastal sage scrub (variation of plant species and shrub cover), food availability, and time of year (breeding season vs. non-breeding season) (Atwood 1993).

Threats and Special Management Considerations

The primary threat to coastal California gnatcatcher is loss of habitat due to urban and agricultural development. Wildfires, nest predators, and brood parasitism by brown-headed cowbirds have potential to debilitate population viability (Atwood 1993). Successful conservation of the species is dependent on restoring or enhancing areas of fragmented coastal sage scrub throughout the Planning Area so that increased shrub cover and improved habitat quality supports dispersing individuals. Expansion of corridors connecting good quality coastal sage scrub allows for a greater exchange of genetic material. Expanding/connecting areas of coastal sage scrub between Lytle Creek and the Etiwanda Fan, Lake Mathews, and other areas that are currently fragmented would promote the overall viability of the species within the Planning Area. Coastal sage scrub restoration areas should include higher density of *Artemisia californica* and *Eriogonum fasciculatum*, as there seems to be a strong correlation between these species and occupied habitat (likeliness to use as nest substrate and greater food supply). Additionally, wildfires are fueled by drought-tolerant coastal sage scrub. Fire management along the foothills of the San Bernardino and San Gabriel Mountains and areas of critical habitat throughout the Planning Area should be carefully considered.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-56
Coastal California gnatcatcher, *Polioptila californica californica*
Potential Habitat Distribution and Known Occurrence Records

Other Relevant Information

The highest densities of coastal California gnatcatcher are known to occur in the upper Santa Ana River, Lake Mathews Watershed, the foothills of the San Bernardino mountains (Etiwanda Fan, Lytle Creek, Cable Creek), and Temescal Wash. Riversidian coastal sage scrub with greater than 50% shrub cover has the highest potential to support successful nesting and high quality foraging grounds. Home ranges or territory sizes are dependent on density of shrub cover, composition of plants, habitat quality, surrounding disturbances, and adjacent gnatcatcher territories. Poor quality coastal sage scrub increases dispersal and overall home range size.

Least Bell's Vireo (*Vireo bellii pusillus*)

Current Status and Distribution

Least Bell's vireo (*Vireo bellii pusillus*) is listed as Federally and State endangered. The species is found throughout Southern California during the breeding season, from Santa Barbara County southward, with the largest populations in San Diego and Riverside Counties (USFWS 2006). The species is distributed throughout the Planning Area where suitable riparian habitat is present, with the largest core population in the Prado Basin portion of the Santa Ana River (ICF 2014).

Habitat Requirements

Suitable habitat is largely associated with early successional (5- to 10-year-old) riparian scrub and woodlands that have developed canopy layer and dense shrubs at 3–6 feet (Franzreb 1989). Habitat is typically dominated by species such as mulefat, willows, cottonwood, and Mexican elderberry (Kus 2002). Nesting habitat in California is characterized by a dense shrub layer 2–10 feet aboveground, and the species can use any age riparian habitat if such an understory is present (Franzreb 1989, Kus 2002). Breeding birds are also found in isolated riparian patches (>0.20 acre) with no discernable over-story canopy and limited understory structure (Braden 2015). USFWS description of critical habitat PBFs includes riparian woodland vegetation that generally contains both canopy and shrub layers, and some associated upland habitats (USFWS 1994).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of least Bell's vireo modeled habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-57, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Core Breeding Habitat

- **Land Cover**: Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Warm Southwest Riparian Forest; Warm Southwest Riparian Forest (Arroyo Willow); Warm Southwest Riparian Forest (Black Willow); Warm Southwest Riparian Forest (Elderberry); Warm Southwest Riparian Forest (Fremont Cottonwood); Warm Southwest Riparian Forest (Red Willow); Warm Southwest Riparian Forest (Sandbar Willow); Warm Southwest Riparian Forest (Shining Willow); Warm Southwest Riparian Forest (Sycamore); Warm Southwest

Riparian Forest (White Alder); Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; **AND**

- **NWI and SoCal Wetlands hydrology attribute modifier:** Semi-permanently flooded (regardless of Land Cover type); **AND**
- Within final critical habitat.

Other Breeding Habitat

- **Land Cover**: Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Warm Southwest Riparian Forest; Warm Southwest Riparian Forest (Arroyo Willow); Warm Southwest Riparian Forest (Black Willow); Warm Southwest Riparian Forest (Elderberry); Warm Southwest Riparian Forest (Fremont Cottonwood); Warm Southwest Riparian Forest (Red Willow); Warm Southwest Riparian Forest (Sandbar Willow); Warm Southwest Riparian Forest (Shining Willow); Warm Southwest Riparian Forest (Sycamore); Warm Southwest Riparian Forest (White Alder); Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; **AND**
- **NWI and SoCal Wetlands hydrology attribute modifier**: Semi-permanently flooded (regardless of Land Cover type).

Least Bell's Vireo Designated Critical Habitat

There are 9,900 acres of designated critical habitat for least Bell's vireo in the Planning Area (*Federal Register*, February 2, 1994). Designated critical habitat occurs within Prado Basin and along the Santa Ana River in the Planning Area.

Taxonomy and Genetics

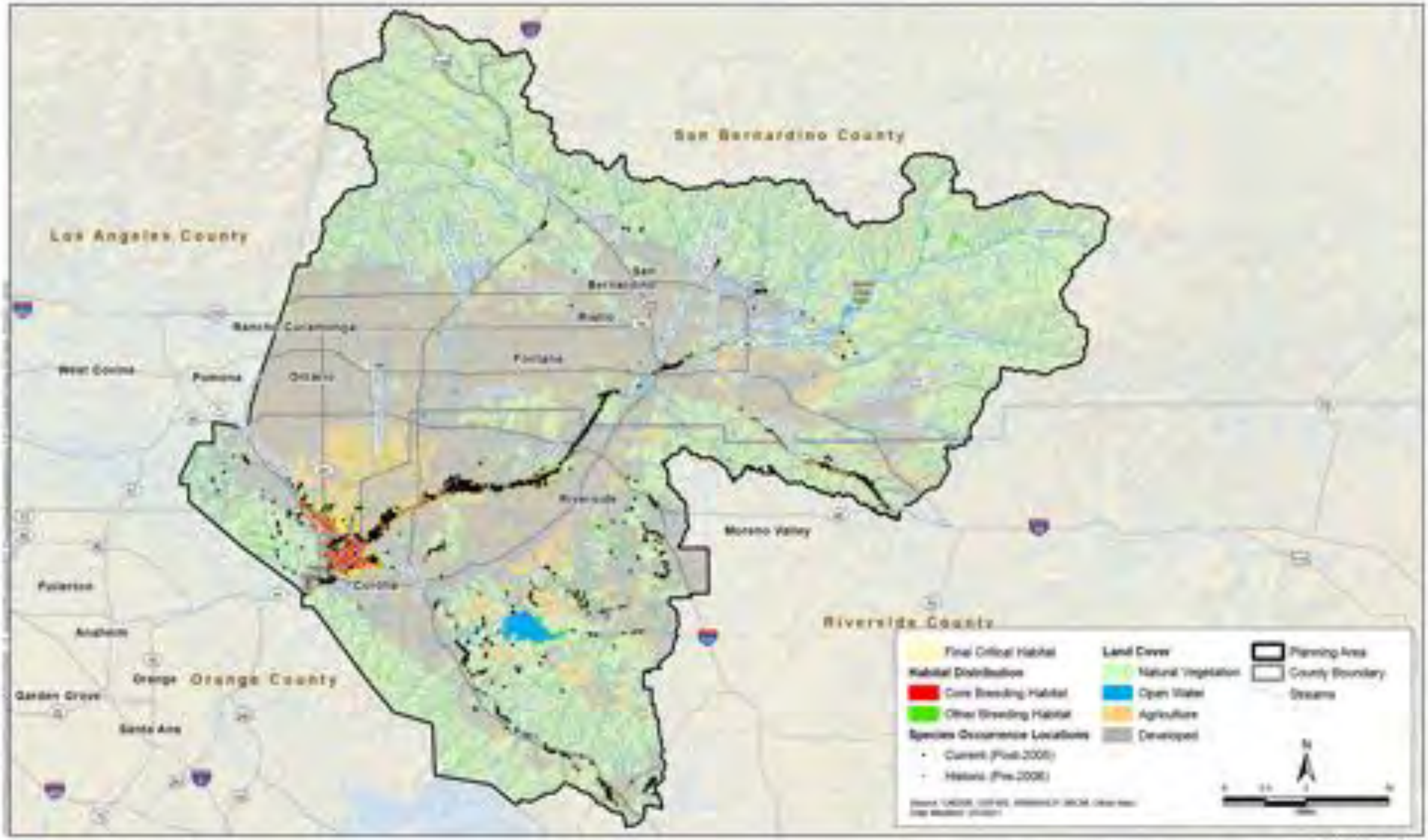
Least Bell's vireo is one of four subspecies of Bell's vireo (*Vireo belli*). All subspecies breed in different areas of the U.S. and winter in Mexico (Franzreb 1989).

Reproduction

Least Bell's vireo breeds monogamously. Males arrive mid-March to establish and defend breeding territories. Nests are built in dense shrubs along the edge of riparian habitat (USFWS 1998). Nests are typically placed below approximately 6.5 feet from the ground. In the Planning Area, nests were most common in willow species (48%) and mulefat (29%) (SAWA 2019). Courtship, pair-bonds, and nesting occurs while the male actively defends the breeding territory. Both adults incubate for 14 days and feed chicks. Clutch size is 3–5 eggs, and pairs often produce two broods (Franzreb 1989). Young fledge in 10–12 days, but are tended by adults for up to 40 days. Fledglings disperse gradually from the natal site.

Dispersal, Territoriality, and Home Range

Birds have a high breeding site fidelity in that an individual will return to breed in the same area from year to year (Franzreb 1989). Juveniles disperse from their natal site gradually: 10–100 meters between the first 14 days after fledging and approximately 1.6 kilometer from the natal site by the time of the second brood (Kus et al. 2010). Individuals are capable of long-distance dispersal, perhaps over 350 kilometers (217 miles) (Howell et al. 2010).



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-57
Least Bell's vireo, *Vireo bellii pusillus*
Potential Habitat Distribution and Known Occurrence Records

Males aggressively defend breeding territories through all reproductive stages. Breeding territories expand and contract based on the nest cycle stage, with wider territories while a male is unpaired and as fledglings begin to forage. Territories contract when a male is mated and the pair is incubating (Kus et al. 2010). Breeding territories vary from 0.37 to 4.1 acres depending on location (Franzreb 1989). Along the Santa Ana River, breeding territories range from 0.75–3.2 acres (Kus et al. 2010).

Daily and Seasonal Activity

Least Bell's vireo are mostly active during the day. Daily activity includes foraging by hopping amongst vegetation between branches while foraging (Kus 2002). Seasonal activity includes defense of breeding territory by males during the nesting season. Migration occurs in April–May and August–November from Southern California to overwintering areas in southern Baja California (Table 3-39) (Franzreb 1989, Kus et al. 2010).

Table 3-39. Seasonal Activity of Least Bell's Vireo

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering	■	■										■
Breeding			■	■	■	■	■					
Migration			■	■	■			■	■	■	■	
Molt						■	■	■	■			

Source: Kus et al. 2020

Diet and Foraging

Least Bell's vireo is an insectivore. Foraging behavior includes gleaning, hovering, and hawking (fly-catching behavior) insects from all riparian vegetation levels, up to 20 meters (65 feet) above the ground, with activity concentrated in lower to mid-canopies during breeding (Kus 2002). During the nesting season, foraging is typically restricted to the breeding territory. Non-riparian habitat adjacent to the breeding territory is utilized as foraging habitat toward the end of the nesting season (Franzreb 1989).

Threats and Special Management Considerations

Predominant threats to the species include loss of riparian habitat, degradation of riparian habitat, and brood parasitism by brown-headed cowbird (Franzreb 1989). Changes in groundwater levels can result in overall reduction in water availability during breeding and nesting seasons, which can particularly affect this species (Rohde et al. 2019). Successful conservation of the species is dependent on restoring or enhancing areas of fragmented and degraded riparian habitat so that successional habitat can support dispersing and returning individuals. In the Planning Area, areas such as the Prado Basin and Santa Ana River should continue annual brown-headed cowbird trapping to decrease brood parasitism. Establishment and recruitment of riparian habitat is dependent on natural hydrological processes, and changes to those processes can alter the distribution and species composition of riparian habitat, which in turn could affect breeding suitability and reproductive output.

Los Angeles Pocket Mouse (*Perognathus longimembris brevinasus*)

Current Status and Distribution

Los Angeles pocket mouse (*Perognathus longimembris brevinasus*) is a California Species of Special Concern. Its distribution is restricted to Southern California. Historically, it was found from San Fernando east through San Bernardino and Riverside to Cabazon, south through Temecula to Aguanga (Williams 1986, Bolster 1998). It has been documented in the northern portion of the Planning Area, almost entirely within San Bernardino County, with some occurrences in Riverside County (ICF 2014).

Habitat Requirements

Generally, habitat consists of alluvial, aeolian, or well-drained upland deposits of sandy soil in sparsely vegetated habitats (Dudek & Associates 2003). These habitats are generally lower elevation sparse grassland, alluvial sage scrub, and coastal sage scrub (Bolster 1998). Foraging occurs under shrub cover or near rock crevices (Dudek & Associates 2003). In Riverside County, trapping data suggests that habitat dominated by bare ground is more frequently occupied than habitat dominated by litter and grass thatch (WRMSHCP 2011).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

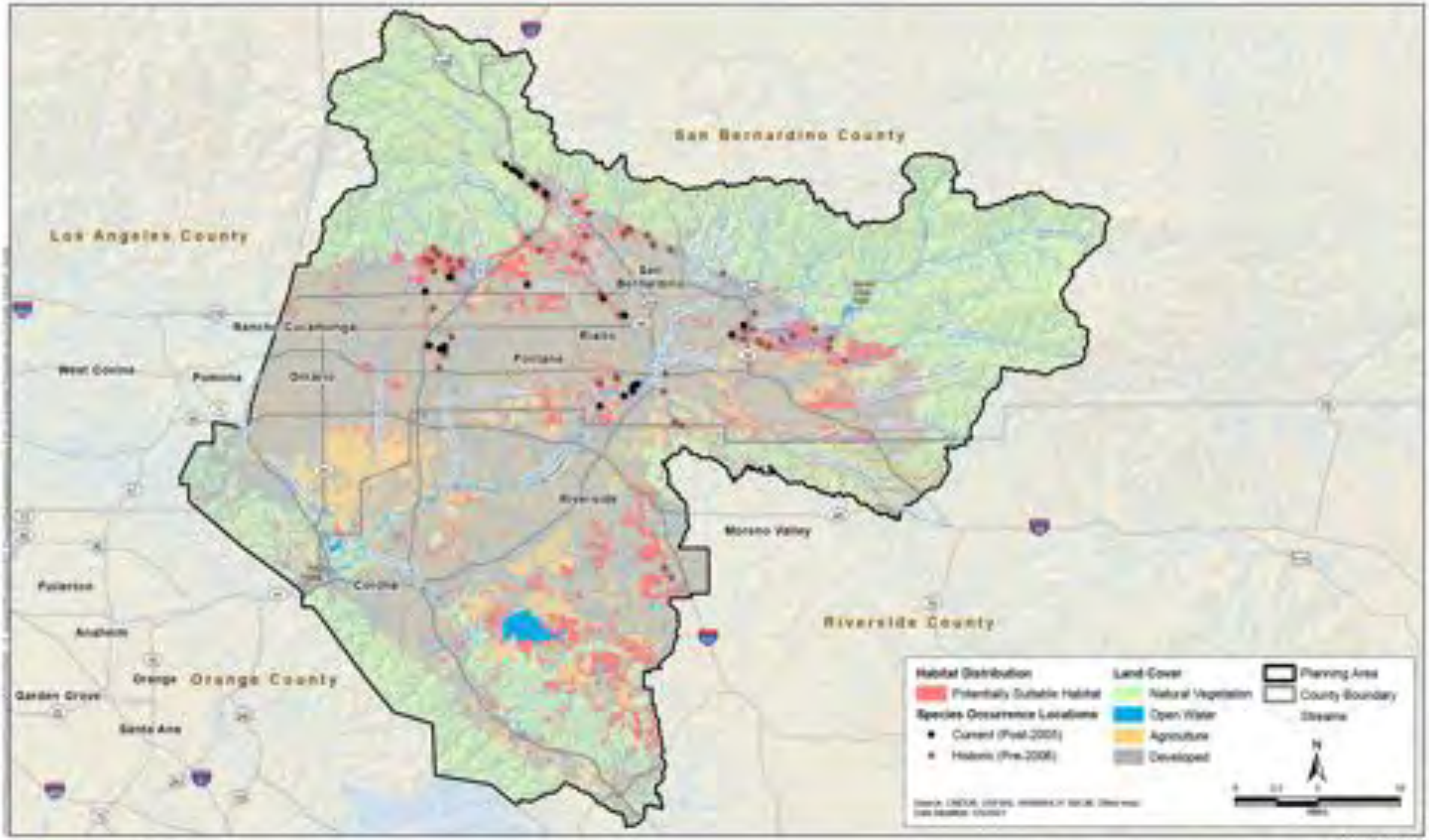
Distribution of Los Angeles pocket mouse modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-58, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; Great Basin-Intermountain Xeric-Riparian Scrub; **AND**
- **Soil Texture**: Sand; sandy loam; coarse sand; coarse sandy loam; fine sand; fine sandy loam; loamy sand; loamy coarse sand; loamy fine sand; river wash; very fine sandy loam; **AND**
- **Landform**: alluvial fans; alluvial flats; floodplains; foothills, terraces, and uplands; also drainageways regardless of land cover type; **AND**
- **Elevation**: 0–3,000 feet; **AND**
- **Slope**: 0–10%.

Taxonomy and Genetics

Los Angeles pocket mouse is one of eight subspecies of *P. longimembris* found in California. Subspecies *P. l. pacificus,* is Federally endangered. *P. l. brevinasus* is physically distinguished from other *P. longimembris* subspecies by a short rostrum (Bolster 1998).



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-58
Los Angeles pocket mouse, *Perognathus longimembris brevinasus*
Potential Habitat Distribution and Known Occurrence Records

Reproduction

Individuals breed once, typically April–June, but can extend breeding season and have more litters. Reproduction appears correlated with rainfall and seed availability, which can result in substantial population fluctuations (USFWS 2010e). Reproductive males and females have been observed as early as February and continue through September, with the peak of breeding occurring May–June (Dudek & Associates 2003). Litters consist of 3 to 4 pups.

Dispersal, Territoriality, and Home Range

The data on Los Angeles pocket mouse is limited*.* Studies done on *P. longimembris* show high site fidelity, with individuals trapped from year to year as close as 50 feet from previous detections. Studies from similar subspecies, *P. l. pacificus,* showed first year individuals dispersing a mean distance of 62 feet (Dudek & Associates 2003).

Individuals are solitary, with home ranges typically overlapping during the breeding season. A study of *P. longimembris* demonstrated that home ranges averaged 0.25–1.2 acres, with an average of 0.74 acre. Average home ranges are 1.2–7.6 acres for females and 0.7–4.7 acres for males (Dudek & Associates 2003).

Though dispersal and home ranges are relatively small (generally no more than 8 acres per individual), corridors for dispersal between populations are important for the health and survival of the species. Disconnection between populations limits gene flow, which may prevent populations from adapting to changing environmental conditions.

Daily and Seasonal Activity

Los Angles pocket mouse is primarily nocturnal, being active and emerging at night (Dudek & Associates 2003, WRMSHCP 2011). The species uses torpor to decrease body temperature and metabolic rate to conserve energy. It remains underground in burrows from September to March (USFWS 2010e). However, timing and duration of activity cycles can vary across seasons and appear to be a function of soil temperature, food availability, and ambient air temperature; aestivation (dormancy) has been recorded in June (USFWS 2010e). May and June are peak months for surface activity (WRMSHCP 2011). Seasonal activity is depicted in Table 3-40.

Table 3-40. Seasonal Activity of Los Angeles Pocket Mouse

Life Stage/Activity Period[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation												
Peak Surface Activity												
Breeding												

Sources: Dudek & Associates 2003, WRMSHCP 2011, USFWS 2010e
[1]Timing and duration of seasonal activity can vary depending upon site conditions (e.g., soil temperature, food availability, ambient air temperature)

Diet and Foraging

Los Angeles pocket mouse is primarily a granivore (seed eater), and may prefer to feed on grass and forb seeds (Dudek & Associates 2003). Although a strong seed specialist, it may seasonally eat forbs and rarely insect larva and arthropods (Bolster 1998). Los Angeles pocket mouse forages on the ground under the low canopy of shrubs and trees, using fur–lined cheek pouches to gather food. It stores seeds in underground caches (Dudek & Associates 2003).

Threats and Special Management Considerations

The main threat to the species is habitat loss due to urban and suburban development, agriculture, sand and gravel mining, and flood control projects (Bolster 1998, Dudek & Associates 2003, WRMSHCP 2011). Fragmentation of habitat caused by habitat loss creates isolated populations that limit dispersal, causing a decrease in gene flow that could lead to localized extirpation (Dudek & Associates 2003). Plant species that are food sources for Los Angeles pocket mouse may be adversely affected by changes in groundwater management regimes. Changes in groundwater levels may also affect soil substrates, which would affect the availability of forage (Rohde et al. 2019).

Suitable habitat for this species is found throughout the Planning Area. Based on occurrence information, habitat suitability appears linked to the presence of sandy terraces associated with rivers and creeks. These areas experience infrequent flood events that remove excess vegetation, grass thatch, and litter to maintain the open sandy soils preferred by this species. Any activities that might change the flood event frequency could have a negative effect on the species. The allocation and conservation of large areas of habitat should be considered to prevent continued decline in distribution and abundance. This species responds well to management activities, such as fire (WRMSHCP 2011) and presumably mechanical removal that takes out excess shrub vegetation and groundcover to expose open sandy substrates. This species has limited periods when it is active at the surface, which must be considered for any monitoring program that is established.

San Bernardino Kangaroo Rat (*Dipodomys merriami parvus*)

Current Status and Distribution

San Bernardino kangaroo rat (*Dipodomys merriami parvus*) is Federally listed as endangered and is a candidate for listing as endangered under the California Endangered Species Act (CESA). Prior to emergency listing under the CESA, the San Bernardino County Museum estimated the historic range at 28,000 acres. At the time of the final listing, USFWS determined that only about 9,797 acres appeared to be suitable in three primary locations: (1) Santa Ana River (3,861 acres), (2) Lytle Creek and Cajon Creek (5,161 acres), and (3) San Jacinto River (775 acres), with smaller amounts of habitat at City Creek, Reche Canyon, Etiwanda alluvial fan, and South Bloomington (USFWS 2009c). During the 2009, 5-year review, USFWS determined that San Bernardino kangaroo rat (SBKR) populations persisted only within the three main locations; however, these habitats were highly fragmented and included a mosaic with varying qualities of habitat that were isolated from other high-quality habitats occupied by the species (USFWS 2009c). As of 2018, it was estimated that over 85% of remaining functional SBKR occupied habitat was associated with Lytle Creek and Cajon Wash and the Santa Ana River, with the other important occupied habitat occurring along the San Jacinto River (USFWS 2009c). This species is likely extirpated from the Etiwanda Fan and Bautista Creek (USFWS 2018).

Current (post-2005) occurrences of this species are known from the northern portion of the Planning Area in San Bernardino County, Day Canyon Wash, Etiwanda Canyon, Lytle Creek, Cajon Canyon, Devil Canyon, and City Creek, and habitat along the Upper Santa Ana River from southwest of the San Bernardino International Airport east to the Crafton Hills. There is also critical habitat designated in the Planning Area.

Habitat Requirements

Primary habitat for San Bernardino kangaroo rat is Riversidian alluvial fan sage scrub (RAFSS) within alluvial floodplains (USFWS 2009c). Each successional stage of this habitat (pioneer, intermediate, and mature) is used, but highest densities are often found in pioneer-intermediate RAFSS. Mature habitat occurs within the greatest elevation from the low flow channel and provides the most protection from inundation during storm events (USFWS 2002). Sandy substrate is the best predictor of species abundance (Shier et al. 2019), while a high density of nonnative grass is most strongly correlated with negative occupancy (USFWS 2009c). USFWS description of critical habitat PBFs includes alluvial fans, washes and associated floodplains with sandy soils suitable for burrowing, and adjacent upland areas, including alluvial fan sage scrub and associated vegetation with a moderately open canopy (USFWS 2002).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of SBKR modeled habitat, documented occurrences, designated critical habitat, refugia, and areas assumed to be occupied in the Planning Area are illustrated on Figure 3-59, Figure 3-60, and 3-61 and quantified in Table 3-15. The following modeled habitat type is used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create the modeled habitat type.

The distribution of SBKR habitat in the Planning Area is based on a habitat suitability model developed by ICF with review and input from SBKR researchers at the San Diego Zoo Institute for Conservation Research.

Suitable Habitat

- **Land Cover**: Californian Coastal Scrub, California Coastal Scrub (California buckwheat), North American Warm-Desert Xeric-Riparian Scrub, Great Basin-Intermountain Xeric-Riparian Scrub, and Water – Seasonal; **AND**
- **Soil Type:** The above land cover types were then clipped to fluvent soils as identified in the U.S. Department of Agriculture (USDA) National Resource Conservation Service (NRCS) Soil Survey Geographic Database. SBKR researchers at the San Diego Zoo Institute for Conservation Research have found that SBKR often have a high association with fluvent soils (alluvial soils where repeated deposition of sediments from periodic flooding prevents the development of more mature soil characteristics) (Shier pers. comm.). The fluvent soils data were used to select model results in the GIS layer, which were retained in the final results. Areas with non-fluvent soils were removed.
- **Post-Processing**: Areas that were highly fragmented resulting in small (e.g., less than 10 acres) and isolated (e.g., greater than 1,000 feet) patches of habitat were removed from the model results. Areas that were small, fragmented, highly disturbed, and isolated by development were identified using aerial photos and removed from the model output or downgraded in habitat assessment classification, where appropriate.

  Other areas were included in the final model results if they were surrounded by modeled suitable habitat and were known to be suitable from field observations, even when the GIS model did not include them (e.g., due to fine-scale differences in the regional vegetation or soils mapping data).

- **Potential Refugia Habitat:** Areas outside of the 100-year floodplain boundary were identified as Potential Refugia Habitat (see Figure 3-60) important to temporarily support SBKR during major flood events.

San Bernardino Kangaroo Rat Assumed Occupied Habitat

- **Assumed Occupied Habitat:** Assumed Occupied is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas where SBKR may be present (Figure 3-61). All areas outside of this data layer have extremely limited potential for SBKR to occur. The layer was generated from review of available trapping data (positive and negative), known extant occurrences, and estimates of likely occupied areas where data were absent. It provides a conservative estimate of all areas where SBKR has the potential to be found. Note: because some areas known to support SBKR did not have occurrence data available in GIS format not all areas of assumed occupied habitat will have occurrences shown in Figure 3-61.

San Bernardino Kangaroo Rat Designated Critical Habitat

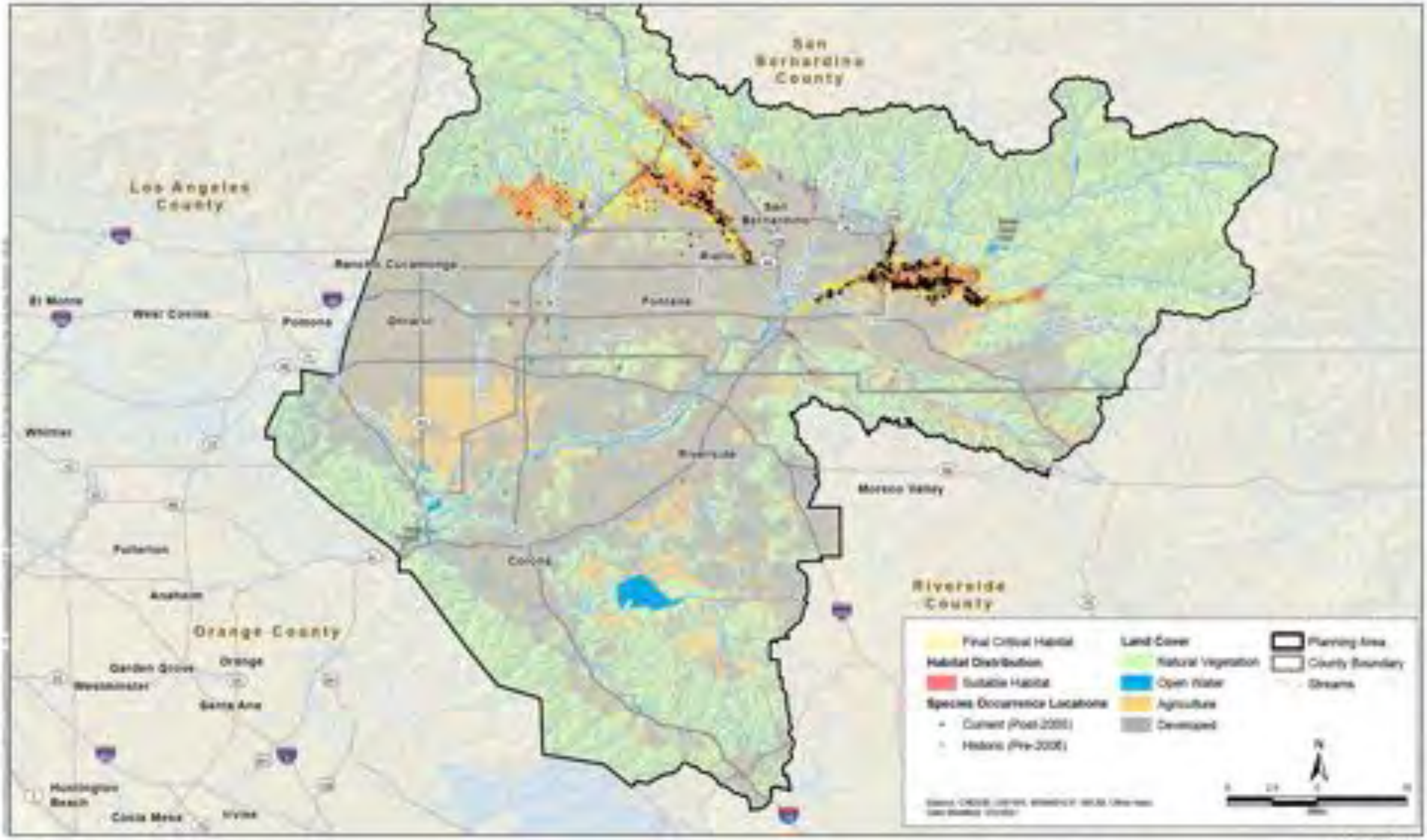
There are 27,745 acres of designated critical habitat for SBKR in the Planning Area (72 *Federal Register* 33807). Designated critical habitat occurs within the Etiwanda Fan, Lytle, and Cajon Creeks (including Cable and Devil Canyon Creeks) and the Santa Ana River Wash (including portions of Mill, Plunge, and City Creeks).

Taxonomy and Genetics

The subspecies is one of three Merriam's kangaroo rat (*Dipodomys merriami*) in California (USFWS 2009c). The species is the most highly differentiated subspecies of *Dipodomys merriami* morphologically (Lidicker 1960). A range-wide genetic study found that the three primary remaining populations (Santa Ana, Lytle-Cajon, and San Jacinto) are genetically distinct from one another with further sub-structuring among sites within the populations and little to no gene flow between sites (Hendricks et al. 2020). Sub-structuring indicates isolation or limited gene flow is occurring among sites within populations. All three remaining populations exhibit a low level of genetic diversity with low effective population sizes (Hendricks et al. 2020). Diversity within the three populations is similar to other species with fragmented distributions. Genetic evidence suggests that these three populations have been recently separated, likely within the last 100 years, which also corresponds with reduction in habitat since the 1930s (Hendricks et al. 2020). This indicates a lack of ability to adapt to environmental change, which in turn makes the populations more vulnerable to extinction as a result of stochastic (random) environmental events, such as wildfire or flooding.

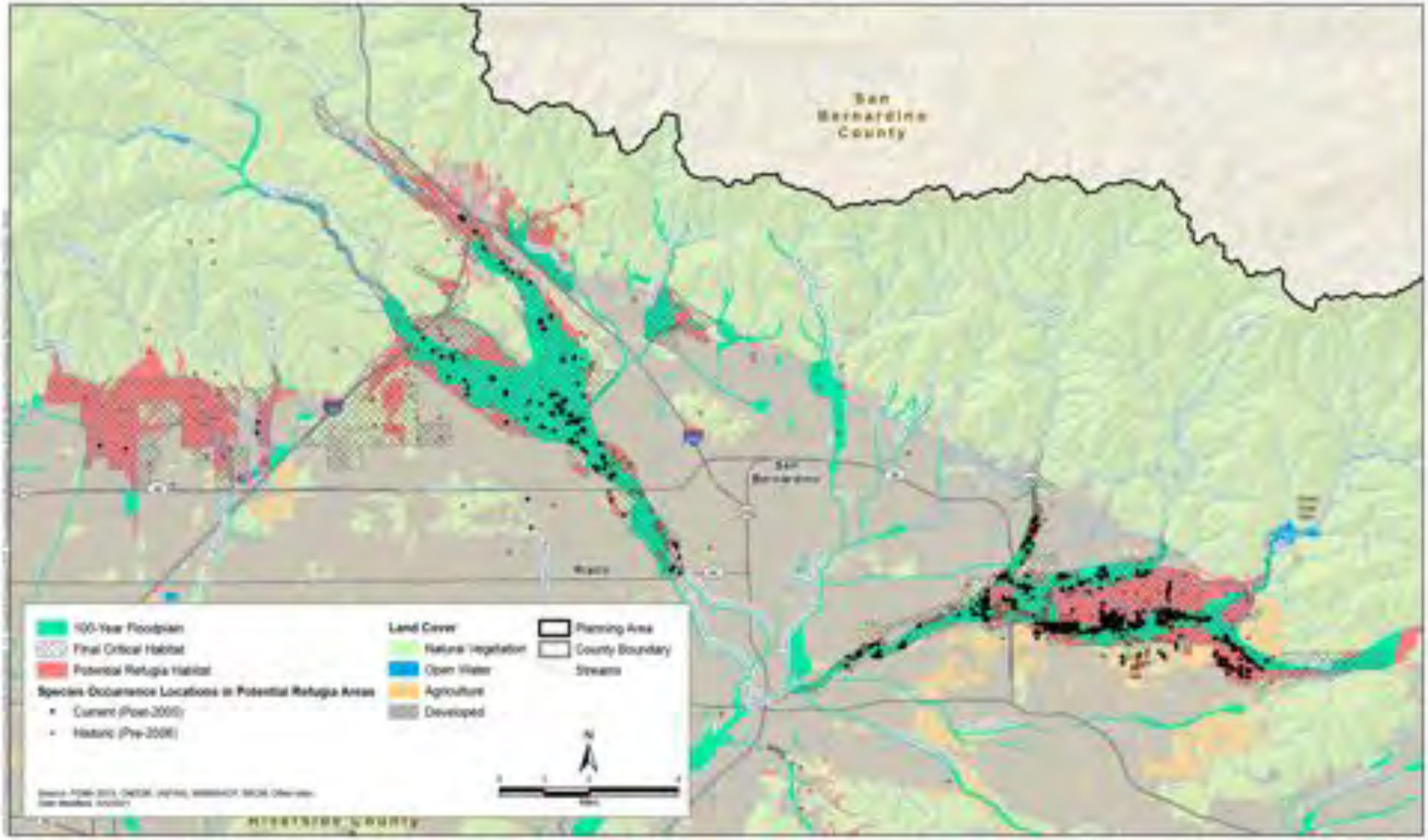
Reproduction

Reproductive activities peak in June and July (USFWS 2009c), but pregnant or lactating females can be present January–November (USFWS 1998) (Table 3-41). Females are capable of more than one litter per year and typical size is 2–3 individuals (Jones 1993). Breeding varies in relation to ecological conditions, with individuals not breeding when plant productivity is poor (Heske et al. 1993).



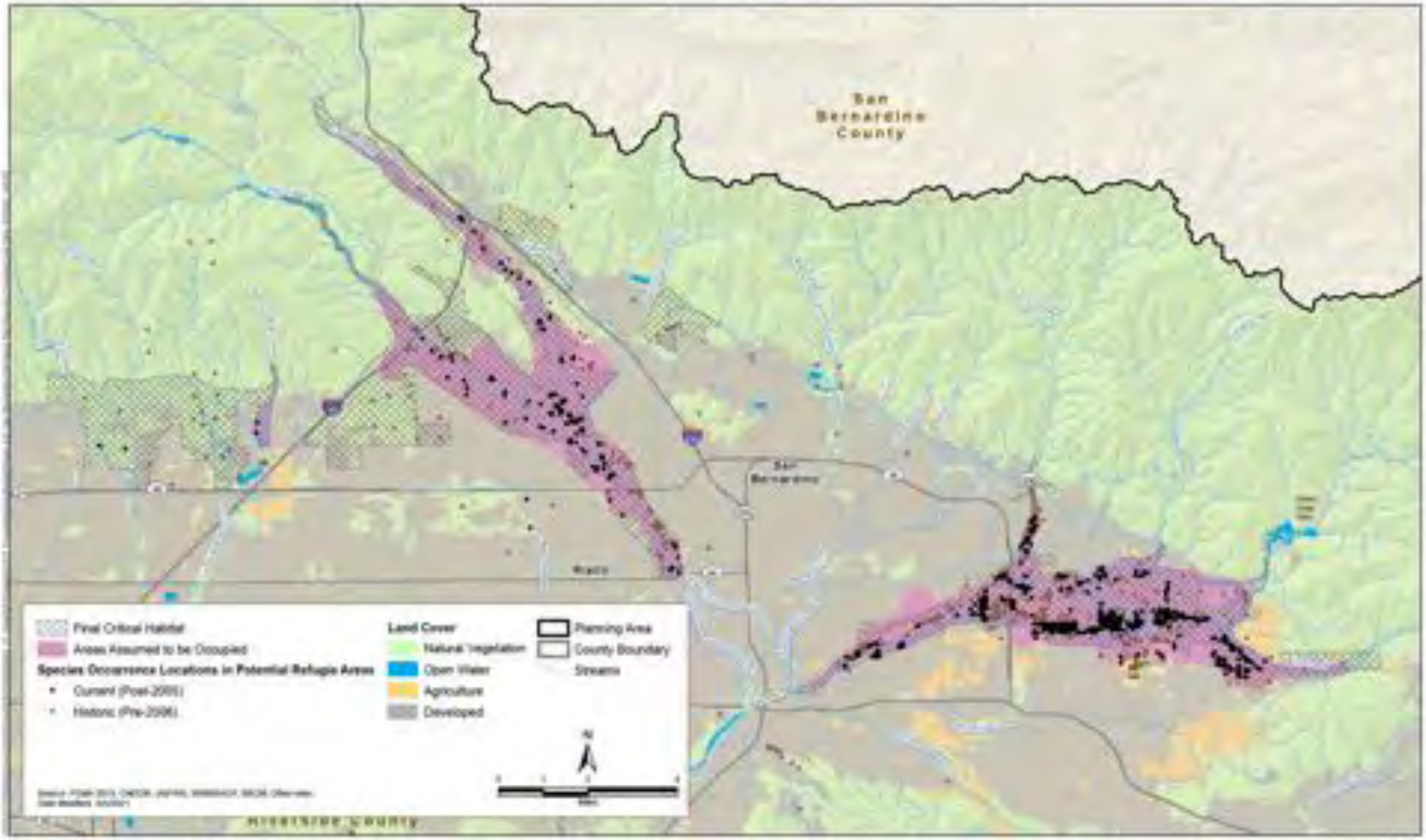
Upper Santa Ana River Habitat Conservation Plan

Figure 3-59
San Bernardino kangaroo rat, *Dipodomys merriami parvus*
Potential Habitat Distribution and Known Occurrence Records



Upper Santa Ana River Habitat Conservation Plan

Figure 3-60
Refugia Habitat and Occurrence Records for San Bernardino kangaroo rat



Upper Santa Ana River Habitat Conservation Plan

Figure 3-61
Areas Assumed to be Occupied and Occurrence Records for San Bernardino kangaroo rat

Dispersal, Territoriality, and Home Range

The species is philopatric so tends to establish home ranges close to their natal range (French 1993). Movements of 40–60 meters are common (USFWS 1998), and long-distance events can be over 240 meters (Zeng and Brown 1987) and documented up to 1.2 kilometers (Braden 2015). However, more than 85% of individuals disperse less than 125 meters (Jones 1989). Dispersal is slightly male-biased (Jones 1989). Reproductive males travel farther than females or males with regressed testes (Behrends et al. 1986).

Individuals are primarily solitary but have overlapping home ranges (Randall 1993). They tend to tolerate familiar neighbors more than strangers and may have long-term associations with the same individuals (Randall 1993). Kangaroo rats actively defend small core areas near burrows (Jones 1993). Sand baths may be important to establish familiarity between individuals (Randall 1991). Average male home ranges may be slightly larger than those of females (0.74 versus 0.26 hectare) (Jones 1989).

Daily and Seasonal Activity

The San Bernardino kangaroo rat is unable to enter a state of torpor (Brown and Harney 1993), and therefore can be active at the surface year-round. They are nocturnal, emerging from their burrows at dusk to forage and returning before dawn, and occupying their burrows during daylight hours for shelter and to avoid high temperatures. Surface activity is reduced during full moon periods (Daly et al. 1992a).

Table 3-41. Seasonal Activity of San Bernardino Kangaroo Rat

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding												

Sources: USFWS 1998, USFWS 2009c

Diet and Foraging

San Bernardino kangaroo rats are primarily granivores (seed eaters), but consume herbaceous material and insects when available (Reichman and Price 1993). They collect seeds in cheek pouches and store them in subsurface caches (Daly et al. 1992b). Water requirements are satisfied by seeds and herbaceous material consumed (French 1993).

Threats and Special Management Considerations

Major threats to the San Bernardino kangaroo rat include loss of habitat, including upland refugia habitat (Figure 3-60), habitat fragmentation due to development, and the alteration of waterways. Flood control, dams, and water conservation projects that change the hydrology of a system are indirect long-term threats to fluvial processes required for habitat.

Because existing flood control structures, roads, and dams have altered fluvial processes, long-term maintenance of high-quality habitat through vegetation management and fluvial processes will be important for conservation in the Planning Area. Pioneer- and intermediate-stage alluvial fan sage scrub, which tends to occur on the terraces above the low flow channel, provides the highest quality habitat because it is sandy and fairly open, and has low vegetation cover. The density of vegetation is particularly important as it affects the species' burrowing, locomotion, and foraging ability.

Experimental thinning of vegetation in the Santa Ana River resulted in an increase in use of the more open habitat (Price 1978). Mature-stage alluvial fan sage scrub is less suitable as primary habitat because of the typical dense vegetation cover, but is important as refugia in high flow events. Consequently, natural fluvial processes (or other mechanisms that mimic these processes), whereby cycles of flooding and dry periods result in dynamic fluctuations of terraces and habitat, are crucial.

Reduction in overall genetic diversity and lack of gene flow between populations make this species more vulnerable to stochastic events. While fluctuations in population numbers are natural for this species due to local extirpation and recolonization following flood events, increasing precipitation volatility in the form of extreme drought years followed by extreme precipitation years and flooding may have more serious consequences for this species (Hendricks et al 2020). Natural recolonization following extreme events may be impossible due to loss of adjacent refugia and habitat fragmentation as evidenced by no gene flow between sub-populations in the Planning Area aside from translocation (Hendricks et al. 2020). Successful translocation may help offset effects of habitat fragmentation, restore some level of geneflow between sub-populations, and increase genetic diversity within sub-populations (Hendricks et al. 2020).

Edge effects are also threats to remaining San Bernardino kangaroo rat populations. These effects include increased nighttime illumination, habitat degradation due to nonnative invasive plant cover (particularly nonnative grasses), disturbances from off-highway vehicles, and effects associated with trash dumping. The effects of nighttime lighting are of particular concern for nocturnal animals, including this species, because rodents alter foraging behaviors in response to the full moon, and artificial lights can result in the same responses (Wang and Shier 2017). Increased nighttime lighting can also result in increased predation (Beier 2006).

Other Relevant Information

The Planning Area supports the majority of the current known range of this species. The most stable populations remaining are present in Lytle Creek, Cajon Wash, and the Santa Ana River. Plunge Creek and City Creek also support moderate populations, although the long-term viability of these areas is likely dependent on the connectedness of suitable habitat to the more robust Santa Ana River populations. Currently, the suitable habitat connection between City Creek and the Santa Ana River is constrained at Alabama Street with a very narrow swath of habitat. Further constraints to movement may occur between 5th Street and I-210, where currently no terraced habitat is available and vegetation is lacking due to frequent scouring events. The suitable habitat connection between City Creek and Plunge Creek is constrained at I-210 and Plunge Creek where only a very narrow swath of habitat is present. The suitable habitat connection between Plunge Creek and the Santa Ana River is likely only slightly constrained by maturing vegetation characteristics and the presence of nonnative grasses.

HCP DRAFT EIR
BIOLOGICAL RESOURCES IMPACTS

Biological Resources Impact from the Upper Santa Ana River Habitat Conservation Plan Environmental Impact Report (May 2021)

Impact BIO-1: Have a Substantial Adverse Effect, Either Directly or Through Habitat Modifications, on Any Species Identified as a Candidate, Sensitive, or Special-Status Species in Local or Regional Plans, Policies, or Regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service: Impacts on Group 1 HCP Covered Species and Habitat due to Implementation of HCP.
Impacts on Group 1 Covered Species from implementation of the Proposed Project (issuance of the ITPs and implementation of the HCP conservation measures) would be beneficial. Impacts on Group 1 Covered Species from implementation of Restoration Activities would be reduced to less-than-significant levels with implementation of Conservation Strategy AMMs.

Impact BIO-2: Have a substantial Adverse Effect, Either Directly or Through Habitat Modifications, on Any Species Identified as a Candidate, Sensitive, or Special-Status Species in Local or Regional Plans, Policies, or Regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service: Impacts on Group 2 HCP Covered Species and Habitat due to Implementation of HCP.
Impacts on Group 2 Covered Species from implementation of Proposed Project (issuance of the ITPs and implementation of the HCP conservation measures) would be beneficial. Impacts on Group 2 Covered Species from implementation of Restoration Activities would be reduced to less-than-significant levels with implementation of Conservation Strategy AMMs**.**

Impact BIO-3: Have a Substantial Adverse Effect, Either Directly or Through Habitat Modifications, on Any Species Identified as a Candidate, Sensitive, or Special-Status Species in Local or Regional Plans, Policies, or Regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service: Impacts on Group 3 HCP Covered Species and Habitat due to Implementation of HCP.
Restoration activities associated with the Conservation Strategy are anticipated to benefit aquatic habitat for Santa Ana sucker through quality enhancements compared with existing conditions. Furthermore, AMMs for Santa Ana sucker will be implemented, and the HCP's Up-Front and Stay-Ahead Provisions will require that implementation of the Conservation Strategy and progress toward assembly and management of the HCP Preserve System will stay ahead of Covered Activity impacts by a minimum of 10%. However, given the threatened status of the species and consideration of the species current limited distribution within the Santa Ana River, for the purposes of this CEQA analysis, the potential impact on Santa Ana sucker is conservatively found to be significant and unavoidable. The EIR reaches this conclusion because, although the Conservation Strategy is designed and expected to result in a net beneficial effect on Santa Ana Sucker, it cannot be concluded with complete confidence that all of the proposed conservation measures (e.g., translocation) will necessarily achieve their intended result.

Impact BIO-4: Have a Substantial Adverse Effect, Either Directly or Through Habitat Modifications, on Any Species Identified as a Candidate, Sensitive, or Special-Status Species in Local or Regional Plans, Policies, or Regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service: Impacts on Non-HCP Covered Species and Habitat.
The net effect of the issuance of the ITPs and implementation of the HCP conservation measures would be an overall beneficial effect on non- covered special-status plant and wildlife species during the Permit Term. Ground-disturbing activities associated with habitat improvement activities within the Preserve System could result in the injury or death of non-covered special-status wildlife species. However, implementation of AMMs and mitigation measures would reduce impacts to less-than-significant levels.

Impact BIO-5: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service.
Implementation of the Proposed Project would have significant impacts on riparian habitats from the permanent loss of riparian woodlands. However, the net effect of the Proposed Project will be an overall beneficial effect on riparian woodlands because the Proposed Project would require the establishment of the HCP Preserve System, which would conserve 208.3 acres of new riparian woodlands and restore and enhance 216 acres of additional riparian woodlands. Additionally, implementing AMMs in the Conservation Strategy, general BMPs, and a Stormwater Pollution Prevention Plan (SWPPP) and erosion control plan would also reduce direct and indirect effects. Together, the preservation and improvement of riparian woodlands and implementation of Conservation Strategy AMMs would reduce these impacts to less-than-significant levels.

Impact BIO-6: Have a substantial adverse effect on State or Federally protected wetlands (including, but not limited to, marshes, vernal pools, coastal wetlands, etc.) through direct removal, filling, hydrological interruption, or other means.
Implementation of the Proposed Project could have significant impacts from the permanent loss of wetlands and other waters. However, the net effect of the Proposed Project will be an overall beneficial effect on wetlands and other waters because the Proposed Project would require the establishment of the HCP Preserve System, which would conserve 39.0 acres of new wetland habitats and 37.8 acres of permanent water and improve 54 acres of additional wetlands. Additionally, implementing AMMs in the Conservation Strategy, general BMPs, and a SWPPP and erosion control plan would also reduce direct and indirect effects. Together, the preservation and restoration of wetlands and implementation of Conservation Strategy AMMs would reduce these impacts to less-than-significant levels.

Impact BIO-7: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
The net effect of the Proposed Project would be an overall beneficial effect on Covered Species and other special-status species because the Proposed Project would require the establishment of the HCP Preserve System, which would prioritize the conservation and long-term management of a landscape of natural land cover types that will create, restore and/or rehabilitate, to the greatest extent practicable, migration corridors for Covered Species or other special- status species. The conserved lands planned for inclusion in the HCP Preserve System would generally be continuous with existing open spaces and protected areas within the Plan Area, thus enhancing their benefits for wildlife movement.

Impact BIO-8: Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
The net effect of the Proposed Project will be an overall beneficial effect on Covered Species, other special-status species, and natural vegetation because the Proposed Project would require the establishment of the HCP Preserve System as well as AMMs and compliance with applicable local tree policies and/or ordinances.

Impact BIO-9: Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or State habitat conservation plan.
Because the specific details are not known at this time for some activities, the exact impacts on Conservation Areas for the WRC MSHCP/NCCP, Upper Santa Ana River Wash HCP, SKR HCP, Lake Mathews HCP, and West Valley HCP resulting from construction and O&M activities cannot be predicted. Quantitative analysis of the exact areas, acreages, and protected resources under the HCPs that could be affected by each activity will be performed at a project-by-project level basis during the independent environmental review process. Implementation of the Covered Activities, including the Conservation Strategy, could have significant impacts related to temporary and permanent loss of areas within established HCPs. However, the net effect of the Proposed Project (issuance of the ITPs and implementation of the HCP conservation measures) would be an overall beneficial effect on Covered Species and other special-status species through the establishment of the HCP Preserve System. Additionally, implementation of AMMs under the Conservation Strategy as well as Mitigation Measures BIO-6 and BIO-7 would reduce the impacts to less-than- significant levels with mitigation.

BIO-1: Conduct Pre-activity Surveys to Document the Presence of Non-Covered Special-Status Plant Populations

The Alliance shall retain a qualified botanist to document the presence or absence of non-covered special-status plant species within the Preserves. Surveys for non- covered special-status plant would be conducted prior to the commencement of restoration activities to determine the presence, location, and extent of any populations of non-covered special-status plant species. If non-covered special-status plants are found, the population would be incorporated into the project or restoration design to avoid, to the extent feasible, direct or indirect impacts on those species. Special-status plant populations near habitat improvement activities shall be protected by installing environmentally sensitive area fencing around the populations.

BIO-2: Conduct Pre-activity Surveys to Document the Presence of Non-Covered Special-Status Amphibians and Reptiles

Prior to conducting any ground-disturbing activities associated with the habitat improvement, the Alliance shall conduct pre-activity surveys for special-status amphibian and reptile species. If special-status species are observed within areas that will be disturbed, they will be encouraged to move out of those areas or will be captured and relocated to suitable habitat outside of disturbance areas. A qualified biologist shall be present during ground-disturbing activities to ensure that special-status amphibian and reptile species are not adversely affected.

BIO-3. Conduct Pre-activity Surveys to Document the Presence of Bat Maternity and Hibernation Roosts

Prior to ground-disturbing activities associated with habitat improvement activities (including vegetation removal) within suitable habitat for bat species, the Alliance shall retain a qualified biologist to conduct a bat roost assessment to determine whether bat maternity roosts or hibernation roosts are likely to occur. Any locations identified as suitable bat roosting habitat shall be subject to additional nighttime surveys during the summer months (i.e., June–August) to determine roosting. Surveys will be conducted using a combination of visual inspection, exit counts, and acoustic surveys. If no maternity or hibernation roosts are detected, no further mitigation is required. If bats are found using vegetation subject to potential impacts, the species of bat(s) and number of bats will be determined.

If impacts on maternity roosts or hibernation roosts are likely, the following mitigation options are available:

- Habitat improvement activities involving vegetation removal shall occur in September through early November, after the breeding season and before the bat hibernation season. Furthermore, trees identified as suitable bat roost sites shall be removed using a two-step process that occurs over a 2-day period. On day one, branches and limbs that do not contain crevices or cavities shall be removed using hand tools or chainsaws. On day two, the remainder of the tree may be removed.
- A qualified biologist shall conduct a survey to determine presence of bats within maternity or hibernation roosts. If no roosting bats are found, no further mitigation is required. If bats are detected, a 50-foot exclusion zone shall be established around the occupied roost until roosting activities have ceased. The identified two-step process will be implemented where trees need to be removed/affected.

BIO-4: Conduct Pre-activity Surveys to Document Presence of San Diego Desert Woodrats

Within suitable habitat for the San Diego desert woodrat, the Alliance shall retain a qualified biologist to conduct surveys for San Diego desert woodrat not more than 30 days prior to the start of ground-disturbing activities (including vegetation removal). All San Diego desert woodrat nests shall be mapped and flagged for avoidance. Graphics depicting the location of all San Diego desert woodrat nests shall be provided to the Alliance to determine if those nests would be affected by habitat improvement activities. Any San Diego desert woodrat nests that cannot be avoided shall be relocated according to the following procedures.

- Each active nest shall be disturbed by the qualified biologist to the degree that San Diego desert woodrats leave the nest and seek refuge elsewhere. After the nests have been disturbed, the nest sticks shall be removed from the impact areas and placed outside of areas planned for impacts. Nests shall be dismantled during the non-breeding season (between October 1 and December 31), if possible. If a litter of young is found or suspected, nest material shall be replaced and the nest left alone for 2–3 weeks; after this time, the nest will be rechecked to verify that young are capable of independent survival before proceeding with nest dismantling.

BIO-5: Conduct Pre-activity Surveys to Document the Presence of American Badger
Within suitable habitat for the American badger, the Alliance shall retain a qualified biologist to conduct focused preconstruction surveys for potential American badger dens within areas where ground-disturbing activities will occur no more than 2 weeks prior to the initiation of those ground-disturbing activities (including vegetation removal) associated with habitat improvement activities. If no potential American badger dens are present, no further mitigation is required. If potential dens are within disturbance areas, the following measures shall be required to avoid impacts on American badgers:

- If the biologist determines that potential dens are inactive, the biologist shall excavate the burrow by hand with a shovel to prevent badgers from reusing them during construction.
- If the biologist determines that potential dens may be active, and cubs may be present in the den, no impacts will occur until the cubs are no longer reliant on the den. Following confirmation that either cubs are not present, or are no longer dependent on the den, the entrances of the dens shall be blocked with one-way doors over a 3–5 day period. The one-way doors shall be checked daily to ensure that they are in proper working order and to determine if the burrows are still active. After the biologist determines that badgers have stopped using active dens within the area potentially affected by the activity, the dens shall be hand-excavated with a shovel to prevent re-use during construction.

BIO-6: Conduct Impact Analysis to Ensure that Activities Do Not Conflict with the Provisions, Goals, and Objectives of Other HCPs within the Permit Area
Permittees with Covered Activities proposed in other HCPs within the Permit Area (i.e., Wash Plan HCP, Lake Mathews MSHCP, WRC MSHCP, SKR HCP, West Valley HCP) shall conduct an impact analysis as part of the environmental review process on a project-by-project basis prior to implementation. Should an activity impact any designated conservation lands under one of these HCPs, then a mitigation plan will be developed to ensure no net loss of HCP conservation lands. Compensation for the permanent loss of conservation lands would be accomplished through the acquisition of replacement lands at a minimum 1:1 ratio. These lands will provide equivalent or greater habitat value and be located adjacent to the existing HCP conservation lands. Restoration of temporary impact areas on HCP conservation lands will be accomplished through on-site restoration of those temporarily affected areas, including the development of a Habitat Mitigation and Monitoring Plan. The mitigation plan would be developed in consultation with the applicable HCP reserve managers and policy authorities (i.e., WRCRCA, Lake Mathews Reserve Management Committee, RCHCA, Conservation District, Riverside Land Conservancy), USFWS, and CDFW to ensure that the activity does not conflict with the provisions, goals, and objectives of the HCP and that the mitigation plan will offset any losses and is biologically equivalent.

BIO-7: Comply with Policies, Goals, Objectives, and Conservation Measures of Other HCPs Located within the Permit Area

Any activity that occurs within the boundaries of another HCP located within the Permit Area (i.e., Wash Plan HCP, Lake Mathews MSHCP, WRC MSHCP, SKR HCP, West Valley HCP) shall comply and be consistent with the policies, goals, objectives, and conservation measures of that plan to the maximum extent feasible.

RP-4 SITE SPECIFIC BIOLOGICAL RESOURCES ASSESSMENT

Biological Resources Assessment

Jacobs

Inland Empire Utilities Agency
RP-4 AWPF Project

Biological Resources Assessment

Document No. | Final
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Tom Dodson & Associates

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Jacobs Engineering Group, Inc.

2600 Michelson Dr #500
Irvine, CA 92612
United States
T +1.909.838.1333

www.jacobs.com

Contents

Executive Summary

Jacobs Engineering Group, Inc. was retained by Tom Dodson and Associates to conduct a Biological Resources Assessment and Jurisdictional Waters Assessment for the Inland Empire Utilities Agency's proposed Regional Water Recycling Plant No. 4 AWPF Project located in the City of Rancho Cucamonga, San Bernardino County, California. The Project would improve the Facility's existing wastewater treatment plant infrastructure by constructing a new advanced water purification facility. The proposed Project would involve Water Infrastructure Finance and Innovation Act of 2014 loans administered by the U.S. Environmental Protection Agency. Therefore, this Biological Resources Assessment and Jurisdictional Waters Assessment was prepared in accordance with the CEQA-Plus requirements of the Water Infrastructure Finance and Innovation Act program.

In September of 2021, Jacobs biologists conducted a Biological Resources Assessment survey to address potential effects of the Project on designated Critical Habitats and/or special status species. Data regarding biological resources in the Project vicinity were obtained through literature review and field investigation. Available databases and documentation relevant to the Project Area were reviewed for documented occurrences of sensitive species that could potentially occur in the Project vicinity, including the U.S. Fish and Wildlife Service designated Critical Habitat online mapper and Information for Planning and Consultation System, as well as the most recent versions of the California Natural Diversity Database and California Native Plant Society Electronic Inventory.

The result of the reconnaissance-level field survey was that no state or federally listed species were identified within the Project Area and none are expected to occur. The proposed Project will not affect any state or federally listed species or other special status species, including any California Fully Protected species or California rare and endangered plant species. The proposed Project will not result in the loss or adverse modification of USFWS designated Critical Habitat. Furthermore, the proposed Project will not affect any resources protected under the Coastal Barriers Resources Act, Coastal Zone Management Act, Fish and Wildlife Conservation Act, Magnuson-Stevens Fishery Conservation and Management Act, the Protection of Wetlands – Executive Order 11990 or Wild and Scenic Rivers Act, respectively.

Jacobs biologists also assessed the Project Area for the presence of state and/or federal jurisdictional waters that may potentially be impacted by the Project. The jurisdictional waters assessment was conducted in accordance with the U.S. Army Corps of Engineers *Wetlands Delineation Manual, Jurisdictional Determination Form Instructional Guidebook,* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region*. The result of the jurisdictional waters assessment is that there are no wetland or non-wetland jurisdictional waters within the Project Area. Therefore, the Project will not impact any jurisdictional waters and no state or federal jurisdictional waters permitting will be required under current regulation.

This report describes delineated resources, provides an aquatic resource delineation map, identifies state and/or federally listed species with potential to occur on site and presents representative site photographs. The delineation results and conclusions presented in this report are considered preliminary and valid under current regulatory context. Additionally, according to protocol and standard practices, the results of the habitat assessment surveys will remain valid for the period of one year, or until September 2022, after which time, if the site has not been disturbed in the interim, another survey may be required to determine the persisting absence of special status species and to verify environmental conditions on site. Regardless of survey results and conclusions given herein, if any state or federally listed species are found on site during Project-related work activities, all activities likely to affect the animal(s) should cease immediately and regulatory agencies should be contacted to determine appropriate management actions.

1. Introduction

The Inland Empire Utilities Agency (IEUA) is proposing to implement its RP-4 Advanced Water Purification Facility (AWPF) project, located in the City of Rancho Cucamonga, San Bernardino County, California. IEUA proposes to make improvements at its Regional Water Recycling Plant No. 4 (RP-4) that would consist of installing a new AWPF at its existing RP-4 facility. The proposed Project would involve Water Infrastructure Finance and Innovation Act of 2014 (WIFIA) loans administered by the U.S. Environmental Protection Agency (EPA).

On behalf of Tom Dodson and Associates (TDA), Jacobs Engineering Group, Inc. (Jacobs) has prepared this Biological Resources Assessment (BRA) report for IEUA's proposed RP-4 AWPF Project (Project), in accordance with the CEQA-Plus (California Environmental Quality Act [CEQA]) requirements of the WIFIA program. The BRA fieldwork was conducted by Jacobs biologist Daniel Smith in September 2021. The purpose of the BRA survey was to address potential effects of the Project on designated Critical Habitats and/or any species currently listed or formally proposed for listing as endangered or threatened under the federal Endangered Species Act (ESA) and/or the California Endangered Species Act (CESA), as well as any species otherwise designated as sensitive by the California Department of Fish and Wildlife (CDFW [formerly California Department of Fish and Game]) and/or the California Native Plant Society (CNPS).

The Project Area was assessed for sensitive species known to occur locally. Attention was focused on those state and/or federally listed as threatened or endangered species and California Fully Protected species that have been documented in the vicinity of the Project Area, whose habitat requirements are present within or adjacent to the Project Area. Results of the habitat assessment are intended to provide sufficient baseline information to the Project Proponent (IEUA) and, if required, to City, County or other local government planning officials and federal and state regulatory agencies, including the U.S. Fish and Wildlife Service (USFWS) and CDFW, respectively, to determine if the Project is likely to result in any adverse effects on sensitive biological resources and to identify mitigation measures to offset those effects. Additionally, Jacobs staff assessed the Project Area for the presence of State and/or federal jurisdictional waters potentially subject to regulation by the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA), Regional Water Quality Control Board (RWQCB) under Section 401 of the CWA and Porter Cologne Water Quality Control Act, and CDFW under Section 1602 of the California Fish and Game Code (FGC), respectively.

1.1 Project Description

The AWPF would be constructed within the existing RP-4 facility and would be in the vicinity of the existing wind turbine located on the western side of the plant (Figure 1). The layout of the Project incorporates a conservative minimum setback of about 25 feet from the turning radius of the turbine blades to any structures, which will be confirmed during final design. Note that the chemical facilities are located within the 25-foot setback, but outside of the 74-foot turbine blade radius. A new road would be constructed on the western edge of the plant to facilitate chemical deliveries and provide vehicle access around the entire AWPF. An equalization tank to equalize flows prior to MF is proposed in the southwest corner of the plant. The AWPF equalization/MF feed tank is assumed to be 1.2 million gallons and is shown in the southwest corner of the plant near the AWPF.

SOURCE: Tom Dodson & Associates

FIGURE 1

Site Layout
IEUA RP-4 AWPF Project

1.1.1 Area of Potential Effect

The Area of Potential Affect (APE) for the proposed Project encompasses all areas that may be affected directly and/or indirectly by the Project, including the proposed construction footprint, stockpile and staging areas, as well as immediate adjacent areas outside of the proposed Project site. It encompasses the geographic extent of environmental changes (i.e. the physical, chemical, and biotic effects) that will result directly and/or indirectly from the Project. The entire Project APE is disturbed, consisting of existing facilities and artificial landscaping within an existing wastewater treatment plant.

1.2 Project Location

The proposed Project is generally located in Section 17 of Township 1 South, Range 6 West, San Bernardino Base Meridian (SBBM), within the City of Rancho Cucamonga, San Bernardino County, California (Figures 2 & 3). The Project Area is depicted on the *Guasti* U. S. Geological Survey's (USGS) 7.5-Minute Series Quadrangle map. Specifically, the Project APE is within IEUA's existing Regional Water Recycling Plant No. 4 (RP-4) located at 12811 6th Street, on the southwest corner of Etiwanda Avenue and 6th Street; approximately 1 mile north of Interstate 10 (I-10) and 1 mile east of Interstate 15 (I-15) (Figures 3 & 4).

SOURCE: Google Earth

FIGURE 1

Regional Location
IEUA RP-4 AWPF Project

SOURCE: Google Earth

FIGURE 2

Topographic Map of Project Location

IEUA RP-4 AWPF Project

SOURCE: Google Earth

FIGURE 3

Aerial Photograph of Project Area
IEUA RP-4 AWPF Project

1.3 Environmental Setting

The Project Area lies in the geographically based ecological classification known as the Inland Valleys – Level IV ecoregion, of the Southern California/Northern Baja Coast – Level III ecoregion (Griffith et al. 2016). The goal of regional ecological classifications is to reduce variability based on spatial covariance in climate, geology, topography, climax vegetation, hydrology, and soils. The Inland Valleys ecoregion is a heavily urbanized ecoregion that historically consisted of the alluvial fans and basin floors immediately south of the San Gabriel and San Bernardino Mountains (Griffith et al. 2016). The topography of the Project Area consists of flat urban landscape, comprised of existing wastewater treatment facility. The elevation of the Project Area is approximately 1,080 feet above mean sea level (amsl).

The Rancho Cucamonga area is within a hot-summer Mediterranean climate (Csa), subject to both seasonal and annual variations in temperature and precipitation. Average annual maximum temperatures within the Project Area peak at 91.1 degrees Fahrenheit (° F) in August and fall to an average annual minimum temperature of 38.1° F in January. Average annual precipitation is greatest from November through April and reaches a peak in January (3.56 inches). Precipitation is lowest in the month of July (0.01 inches). Annual total precipitation averages 16.97 inches.

Hydrologically, the Project Area is situated within the Chino (Split) Hydrologic Sub-Area (HSA 801.21). The Chino (Split) HSA comprises a 190,515-acre drainage area, within the larger Santa Ana Watershed (HUC 18070203). The Santa Ana River is the major hydrogeomorphic feature within the Santa Ana Watershed. The nearest tributary to the Santa Ana River is the San Sevaine Channel, which is approximately 0.66 mile east of the Project site at its nearest point.

Given that the Project is entirely within an existing wastewater treatment facility, soils within the Project Area are likely comprised of fill material. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the Project Area is mapped within Delhi fine sand and Hanford coarse sandy loam, 2 to 9 percent slopes. Delhi fine sand soil type consists of fine sand and sand layers comprised of sandy alluvium derived from granite. This soil type is somewhat excessively drained, with a negligible runoff class and does not have a hydric soil rating. Hanford coarse sandy loam soil type consists of sandy loam and fine sandy loam layers comprised of alluvium derived from granite. This soil type is somewhat well drained, with a low runoff class and does not have a hydric soil rating.

The Project APE is entirely within an urban landscape comprised of existing wastewater treatment facility and artificial landscaping. Surrounding land use consists entirely of wastewater treatment facility surrounded by commercial/industrial development (Figure 4).

2. Assessment Methodology

2.1 Biological Resources Assessment

Data regarding biological resources in the Project Area were obtained through literature review and field investigation. Prior to performing the survey, available databases, and documentation relevant to the Project Area were reviewed for documented occurrences of sensitive species in the Project vicinity (approximately 1 mile). The USFWS threatened and endangered species occurrence data overlay, USFWS Information for Planning and Consultation System (IPaC) and the most recent versions of the California Natural Diversity Database (CNDDB; *Rarefind 5*) and California Native Plant Society Electronic Inventory (CNPSEI) databases were searched for sensitive species data in the *Guasti* USGS 7.5-Minute Series Quadrangle. These databases contain records of reported occurrences of state and/or federally listed species or otherwise sensitive species and habitats that may occur within the vicinity of the Project site (approximately 1 mile). Other available technical information on the biological resources of the area was also reviewed including previous surveys and recent findings.

2.1.1 Biological Resources Assessment Field Survey

Jacobs biologist Daniel Smith conducted a biological resources assessment of the Project APE on September 30, 2021. The survey area encompassed 100 percent of the entire proposed impact area (see Figure 1). Wildlife species were detected during field surveys by sight, calls, tracks, scat, or other sign. In addition to species observed, expected wildlife usage of the site was determined per known habitat preferences of regional wildlife species and knowledge of their relative distributions in the area. The focus of the faunal species survey was to identify potential habitat for special status wildlife within the Project Area.

2.2 Jurisdictional Waters Assessment

On September 30, 2021, Mr. Smith also evaluated the Project APE for the presence of riverine/riparian/wetland habitat and jurisdictional waters, i.e. Waters of the U.S. (WOTUS), as regulated by the USACE and RWQCB, and/or jurisdictional streambed and associated riparian habitat as regulated by the CDFW. Prior to the field visit, aerial photographs of the Project Area were viewed and compared with the surrounding USGS 7.5-Minute Topographic Quadrangle maps to identify drainage features within the survey area as indicated from topographic changes, blue-line features, or visible drainage patterns. The USFWS National Wetland Inventory (NWI) and Environmental Protection Agency (EPA) Water Program "My Waters" Google Earth Pro data layers were also reviewed to determine whether any hydrologic features and wetland areas had been documented within the vicinity of the site. Similarly, the United States Department of Agriculture (USDA) – Natural Resources Conservation Service (NRCS) "Web Soil Survey" was reviewed for soil types found within the Project Area to identify the soil series in the area and to check these soils to determine whether they are regionally identified as hydric soils. Upstream and downstream connectivity of waterways (if present) were reviewed on Google Earth Pro aerial photographs and topographic maps to determine jurisdictional status. The lateral extent of potential USACE jurisdiction was measured at the Ordinary High Water Mark (OHWM) in accordance with regulations set forth in 33CFR part 328 and the USACE guidance documents listed below:

- *USACE – Corps of Engineers Wetlands Delineation Manual, Wetlands Research Program Technical Report Y-87-1 (on-line edition), January 1987 - Final Report.*
- *USACE – Jurisdictional Determination Form Instructional Guidebook (JD Form Guidebook), May 30, 2007.*
- *USACE – A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States (A Delineation Manual), August 2008.*
- *USACE – Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0), September 2008.*

- *USACE – Minimum Standards for Acceptance of Aquatic Resources Delineation Reports (Minimum Standards), January 2016.*
- *The Environmental Protection Agency (EPA) and the Department of the Army's "Navigable Waters Protection Rule: Definition of 'Waters of the United States,'" April 21, 2020 (effective June 22, 2020) (85 FR 22250).*

Evaluation of CDFW jurisdiction followed guidance in the Fish and Game Code and *A Review of Stream Processes and Forms in Dryland Watersheds* (CDFW, 2010). Specifically, CDFW jurisdiction would occur where a stream has a definite course showing evidence of where waters rise to their highest level and to the extent of associated riparian vegetation.

3. Results

3.1 Existing Biological and Physical Conditions

The Project APE is within an urban landscape consisting of wastewater treatment facility surrounded by commercial/industrial development, transportation corridor (I-10, I-15), and San Bernardino County Sheriff detention center facility (Figure 4). The proposed impact area is completely disturbed, consisting of graded/ landscaped fill, paved roads, and unpaved, compacted dirt and gravel surfaces (see Appendix A – Site Photos). Although a portion of the Project site has been landscaped with native vegetation consisting of *Baccharis pilularis* Shrubland Alliance (coyote brush scrub), the Project APE no longer contains any habitat suitable to support any of the special status species known to occur in the region, and the only species expected to occur within the Project Area are those adapted to an urban environment. The only wildlife species observed or otherwise detected during the reconnaissance-level survey were California scrub-jay (*Aphelocoma californica*), rock pigeon (*Columba livia*), house finch (*Haemorhous mexicanus*), California towhee (*Melozone crissalis*), house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*), mourning dove (*Zenaida macroura*), and white-crowned sparrow (*Zonotrichia leucophrys*).

3.2 Special Status Species and Habitats

Per the IPaC, CNDDB, CNPSEI, and other relevant literature and databases, 31 sensitive species (14 plant species, 17 animal species) have been documented in the *Guasti* USGS 7.5-Minute Series Quadrangle. This list of sensitive species and habitats includes any state and/or federally listed threatened or endangered species, California Fully Protected species, CDFW designated Species of Special Concern (SSC), and otherwise Special Animals. "Special Animals" is a general term that refers to all the taxa the CNDDB is interested in tracking, regardless of their legal or protection status. This list is also referred to as the list of "species at risk" or "special status species." The CDFW considers the taxa on this list to be those of greatest conservation need.

3.2.1 Special Status Species

Of the 31 sensitive species documented within the *Guasti* quad, nine are state and/or federally listed as threatened or endangered species. However, the Project Area consists entirely of urban landscape, and the habitat requirements for these species are absent from the Project APE. Table 1 (below) provides a list of all state and/or federally listed threatened and endangered species documented within the Project vicinity (approximately 1 mile), where they are found (locally, adjacent to the Project APE, or within the Project APE), if suitable habitat for that species exists within the APE and whether the Project may affect that species.

Table 1. Listed Species Documented within the Project Vicinity

Common Name	Scientific Name	Status	Found Locally	Found Adjacent	Found Within	Suitable Habitat	Project Affect
Plants:							
San Diego ambrosia	*Ambrosia pumila*	FE	No	No	No	None	No Effect
Invertebrates:							
Crotch bumble bee	*Bombus crotchii*	SCE	Yes	No	No	None	No Effect
Monarch butterfly	*Danaus plexippus*	FC	No	No	No	None	No Effect
Delhi Sands flower-loving fly	*Rhaphiomidas terminatus abdominalis*	FE	Yes	No	No	None	No Effect

Common Name	Scientific Name	Status	Found Locally	Found Adjacent	Found Within	Suitable Habitat	Project Affect
Birds:							
Tricolored blackbird	*Agelaius tricolor*	ST	Yes	No	No	None	No Effect
California black rail	*Laterallus jamaicensis coturniculus*	ST	No	No	No	None	No Effect
Coastal California gnatcatcher	*Polioptila californica californica*	FT	Yes	No	No	None	No Effect
Mammals:							
San Bernardino kangaroo rat	*Dipodomys merriami parvus*	FE/ SCE	Yes	No	No	None	No Effect
Stephens' kangaroo rat	*Dipodomys stephensi*	FE/ST	No	No	No	None	No Effect

No state and/or federally listed threatened or endangered species, or other sensitive species were observed within the Project APE during the reconnaissance-level field survey and due to the environmental conditions on site, none are expected to occur. A complete list of all sensitive species identified by the IPaC, CNDDB and CNPSEI databases as potentially occurring in the Project vicinity is provided in Appendix C.

3.2.2 Special Status Habitats

The Project APE is not within or adjacent any sensitive habitats, including any USFWS designated Critical Habitat for any federally listed species. Therefore, the Project will not result in any loss or adverse modification of USFWS designated Critical Habitat, or any other special status habitats.

3.3 Jurisdictional Waters Assessment

The Project Area is within the Chino (Split) Hydrologic Sub-Area (HSA 801.21). The Chino (Split) HSA comprises a 190,515-acre drainage area, within the larger Santa Ana Watershed (HUC 18070203). This watershed is primarily within San Bernardino County and includes Riverside and Orange Counties with a small portion of Los Angeles Counties. The Santa Ana Watershed is bound on the north by the Mojave and Southern Mojave Watersheds, on the southeast by the Whitewater and San Jacinto Watersheds, and on the west by the San Gabriel, Seal Beach, Newport Bay, and Aliso-San Onofre Watersheds. The Santa Ana Watershed encompasses a portion of the San Gabriel and San Bernardino Mountains to the north and is approximately 3,000 square miles in area. The Santa Ana River is the major hydrogeomorphic feature within the Santa Ana Watershed. The nearest tributary to the Santa Ana River is the San Sevaine Channel, which is approximately 0.66 mile east of the Project site at its nearest point.

Waters of the U.S.

The USACE has authority to permit the discharge of dredged or fill material in WOTUS under Section 404 of the CWA. WOTUS are defined as:

> "All waters used in interstate or foreign commerce; all interstate waters including interstate wetlands; all other waters such as intrastate lakes, rivers, streams (including intermittent and ephemeral streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes or natural ponds, where the use, degradation, or destruction of which could affect interstate commerce; impoundments of these

waters; tributaries of these waters; or wetlands adjacent to these waters" (Section 404 of the CWA; 33 CFR 328.3 (a).

Therefore, CWA jurisdiction exists over the following:

1. All traditional navigable waters (TNWs);
2. All wetlands adjacent to TNWs;
3. Non-navigable tributaries of TNWs that are relatively permanent waters (RPWs) i.e., tributaries that typically flow year-round or have continuous flow at least seasonally; and
4. Every water body determined to have a significant nexus with TNWs.

Additionally, areas meeting all three wetland parameters would be designated as USACE wetlands, if they are adjacent to jurisdictional WOTUS, or otherwise determined to have a significant nexus to a TNW.

Findings: There are no wetland or non-wetland WOTUS within the Project Area. Therefore, the Project will not result in any permanent or temporary impacts to WOTUS.

State Lake/Streambed

There are no lake, river, stream or aquatic resources, stream-dependent wildlife resources or riparian habitats within the Project Area. Therefore, the Project will not result in any permanent or temporary impacts to jurisdictional waters of the State.

4. Effects Analysis

The proposed Project will not affect any state or federally listed species or other special status species, including any California Fully Protected species or California rare and endangered plant species. The proposed Project will not result in the loss or adverse modification of USFWS designated Critical Habitat. Furthermore, the proposed Project will not affect any resources protected under the Coastal Barriers Resources Act, Coastal Zone Management Act, Fish and Wildlife Conservation Act, Magnuson-Stevens Fishery Conservation and Management Act, the Protection of Wetlands – Executive Order 11990 or Wild and Scenic Rivers Act, respectively.

The proposed Project will not impact any state or federal jurisdictional waters potentially subject to regulation by the USACE under Section 404 of the CWA, the RWQCB under Section 401 of the CWA and Porter Cologne Water Quality Control Act, or CDFW under Section 1602 of the California FGC, respectively. Therefore, no CWA Section 404/401 or FGC Section 1600 permitting will be required.

Migratory Bird Treaty Act

Although the Project is within an urban environment, there is vegetation (landscaped trees and shrubs), as well as man-made structures, within the Project APE that are suitable to support nesting birds. Most native bird species are protected from unlawful take by the federal Migratory Bird Treaty Act (MBTA) (Appendix B). In December 2017, the Department of the Interior (DOI) issued a memorandum concluding that the MBTA's prohibitions on take apply "[…] only to affirmative actions that have as their purpose the taking or killing of migratory birds, their nests, or their eggs" (DOI 2017). Then in April 2018, the USFWS issued a guidance memorandum that further clarified that the take of migratory birds or their active nests (i.e., with eggs or young) that is incidental to, and not the purpose of, an otherwise lawful activity does not constitute a violation of the MBTA (USFWS 2018).

However, the State of California provides additional protection for native bird species and their nests in the FGC (Appendix B). Bird nesting protections in the FGC include the following (Sections 3503, 3503.5, 3511, 3513 and 3800):

- Section 3503 prohibits the take, possession, or needless destruction of the nest or eggs of any bird.
- Section 3503.5 prohibits the take, possession, or needless destruction of any nests, eggs, or birds in the orders Falconiformes (new world vultures, hawks, eagles, ospreys, and falcons, among others), and Strigiformes (owls).
- Section 3511 prohibits the take or possession of Fully Protected birds.
- Section 3513 prohibits the take or possession of any migratory nongame bird or part thereof, as designated in the MBTA. To avoid violation of the take provisions, it is generally required that project-related disturbance at active nesting territories be reduced or eliminated during the nesting cycle.
- Section 3800 prohibits the take of any non-game bird (i.e. bird that is naturally occurring in California that is not a gamebird, migratory game bird, or fully protected bird).

5. Conclusions and Recommendations

5.1 Sensitive Biological Resources

No sensitive species were observed within the Project APE during the reconnaissance-level field survey and due to the environmental conditions on site, none are expected to occur. The Project APE is within an urban landscape consisting of a wastewater treatment facility surrounded by commercial/industrial development (Figure 4). The proposed impact area is completely disturbed, consisting of graded/ landscaped fill, paved roads, and unpaved, compacted dirt and gravel surfaces (see Appendix A – Site Photos).

The Project Area is no suitable to support any of the state or federally listed species, or other special status species documented in the Project vicinity. Furthermore, the only native vegetation that will be impacted consists of a previously graded/filled area within the existing wastewater treatment facility that has been landscaped (planted) with coyote brush scrub. Therefore, the proposed Project will not affect any state or federally listed species, or other special status species, and the potential for any of the sensitive species identified in Appendix C to occur within the APE is low. Furthermore, the proposed Project will not impact any USFWS designated Critical Habitats or state or federal jurisdictional waters.

Nesting Birds

In general, impacts to all bird species (common and special status) can be avoided by conducting work outside of the nesting season, which is generally February 1st through August 31st. However, if all work cannot be conducted outside of nesting season, the following is recommended:

> To avoid impacts to nesting birds (common and special status) during the nesting season, a qualified Avian Biologist should conduct pre-construction nesting bird surveys prior to Project-related disturbance to identify any active nests. If no active nests are found, no further action would be required.
>
> If an active nest is found, the biologist should set appropriate no-work buffers around the nest which would be based upon the nesting species, its sensitivity to disturbance, nesting stage and expected types, intensity, and duration of disturbance. Typically, accepted nest buffer distances vary from approximately 100 feet for some cavity nesting species, to 500 feet or more for some raptor species.
>
> The nest(s) and buffer zones should be field checked weekly by a qualified biological monitor. To avoid any direct (e.g., removal of the nest) or indirect (e.g., causing nest failure) take of an active nest, the approved no-work buffer zone should be clearly marked in the field, within which no project disturbance should commence until the nest has been determined to be inactive (i.e. fledged or failed) by a qualified biologist.

6. References

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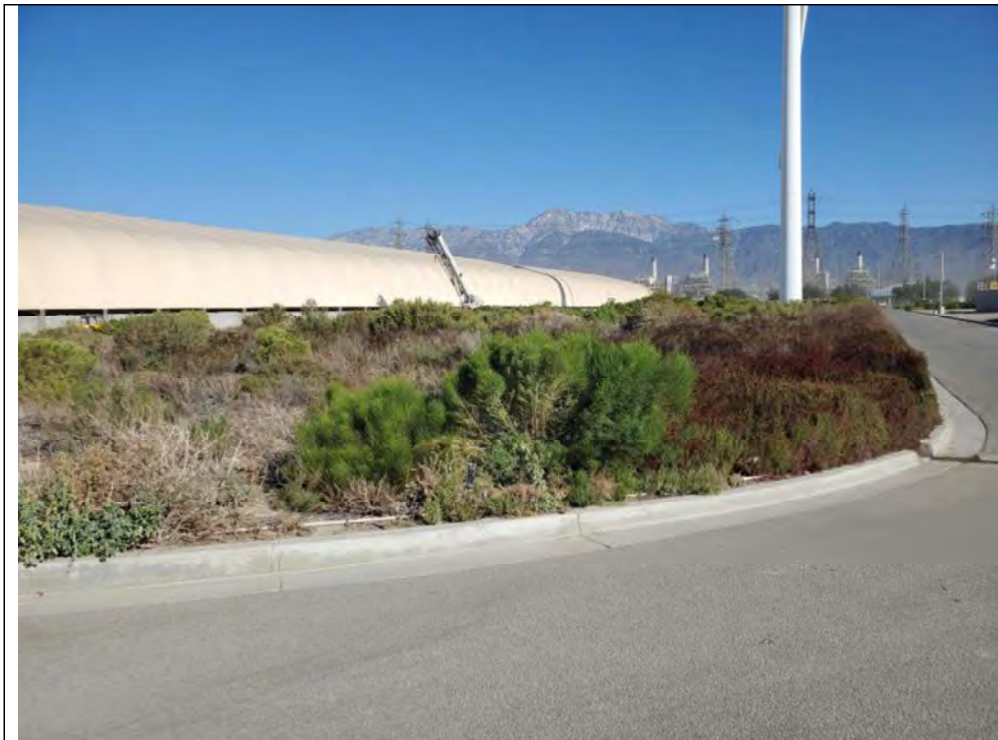
Appendix A. Site Photos

Photo Map

	Photo 1. Looking south at the existing wind turbine and proposed and proposed 100-foot setback on northeast end of the Project Limits.
	Photo 2. Looking south at the proposed Project site from northwest corner of the Project Limits.

Photo 3. Looking south along the western boundary of the proposed Project site.

Photo 4. Looking north at the proposed Project site from southwest corner of the Project Limits.

	Photo 5. Looking north at the proposed Project site from southeast corner of the Project Limits.
	Photo 6. Looking south at the proposed Project site from northeast corner of the Project Limits.

Appendix B. Regulatory Framework

Federal Regulations

Clean Water Act

The purpose of the Clean Water Act (CWA) of 1977 is to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." Section 404 of the CWA prohibits the discharge of dredged or fill material into "waters of the United States" (WOTUS) without a permit from the United States Army Corps of Engineers (USACE). The definition of waters of the United States includes rivers, streams, estuaries, territorial seas, ponds, lakes, and wetlands. Wetlands are defined as those areas "that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 Code of Federal Regulations [CFR] 328.3 7b). The U.S. Environmental Protection Agency (EPA) also has authority over wetlands and may override a USACE permit. Substantial impacts to wetlands may require an individual permit. Projects that only minimally affect wetlands may meet the conditions of one of the existing Nationwide Permits. A Water Quality Certification or waiver pursuant to Section 401 of the CWA is required for Section 404 permit actions; in California this certification or waiver is issued by the Regional Water Quality Control Board (RWQCB).

Federal Endangered Species Act (ESA)

The federal Endangered Species Act (ESA) of 1973 protects plants and wildlife that are listed by the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) as endangered or threatened. Section 9 of the ESA (USA) prohibits the taking of endangered wildlife, where taking is defined as any effort to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in such conduct" (50 CFR 17.3). For plants, this statute governs removing, possessing, maliciously damaging, or destroying any endangered plant on federal land and removing, cutting, digging up, damaging, or destroying any endangered plant on non-federal land in knowing violation of state law (16 United States Code [USC] 1538). Under Section 7 of the ESA, federal agencies are required to consult with the USFWS if their actions, including permit approvals or funding, could adversely affect an endangered species (including plants) or its critical habitat. Through consultation and the issuance of a biological opinion, the USFWS may issue an incidental take statement allowing take of the species that is incidental to an otherwise authorized activity, provided the action will not jeopardize the continued existence of the species. The ESA specifies that the USFWS designate habitat for a species at the time of its listing in which are found the physical or biological features "essential to the conservation of the species," or which may require "special Management consideration or protection…" (16 USC § 1533[a][3].2; 16 USC § 1532[a]). This designated Critical Habitat is then afforded the same protection under the ESA as individuals of the species itself, requiring issuance of an Incidental Take Permit prior to any activity that results in "the destruction or adverse modification of habitat determined to be critical" (16 USC § 1536[a][2]).

Interagency Consultation and Biological Assessments

Section 7 of ESA provides a means for authorizing the "take" of threatened or endangered species by federal agencies, and applies to actions that are conducted, permitted, or funded by a federal agency. The statute requires federal agencies to consult with the USFWS or National Marine Fisheries Service (NMFS), as appropriate, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species. If a Proposed Project "may affect" a listed species or destroy or modify critical habitat, the lead agency is required to prepare a biological assessment evaluating the nature and severity of the potential effect.

Habitat Conservation Plans

Section 10 of the federal ESA requires the acquisition of an Incidental Take Permit (ITP) from the USFWS by non-federal landowners for activities that might incidentally harm (or "take") endangered or threatened wildlife on their land. To obtain a permit, an applicant must develop a Habitat Conservation Plan that is designed to offset any harmful impacts the proposed activity might have on the species.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. Sections 661 to 667e et seq.) applies to any federal Project where any body of water is impounded, diverted, deepened, or otherwise modified. Project proponents are required to consult with the USFWS and the appropriate state wildlife agency.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (The Eagle Act) (1940), amended in 1962, was originally implemented for the protection of bald eagles (*Haliaeetus leucocephalus*). In 1962, Congress amended the Eagle Act to cover golden eagles (*Aquila chrysaetos*), a move that was partially an attempt to strengthen protection of bald eagles, since the latter were often killed by people mistaking them for golden eagles. This act makes it illegal to import, export, take (molest or disturb), sell, purchase, or barter any bald eagle or golden eagle or part thereof. The golden eagle, however, is accorded somewhat lighter protection under the Eagle Act than that of the bald eagle.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 implements international treaties between the United States and other nations created to protect migratory birds, any of their parts, eggs, and nests from activities, such as hunting, pursuing, capturing, killing, selling, and shipping, unless expressly authorized in the regulations or by permit. As authorized by the MBTA, the USFWS issues permits to qualified applicants for the following types of activities: falconry, raptor propagation, scientific collecting, special purposes (rehabilitation, education, migratory game bird propagation, and salvage), take of depredating birds, taxidermy, and waterfowl sale and disposal. The regulations governing migratory bird permits can be found in 50 CFR Part 13 General Permit Procedures and 50 CFR part 21 Migratory Bird Permits. The State of California has incorporated the protection of birds of prey in Sections 3800, 3513, and 3503.5 of the California Fish and Game Code (CFGC).

However, on December 22, 2017 the U.S. Department of the Interior (DOI) issued a memorandum concluding that MBTA's prohibitions on take apply "[…] only to affirmative actions that have as their purpose the taking or killing of migratory birds, their nests, or their eggs" (DOI 2017). Therefore, take of migratory birds or their active nests (i.e., with eggs or young) that is incidental to, and not the purpose of, an otherwise lawful activity does not constitute a violation of the MBTA. Then, on April 11, 2018, the USFWS issued a guidance memorandum that provided further clarification on their interpretation:

> "We interpret the M-Opinion to mean that the MBTA's prohibitions on take apply when the purpose of an action is to take migratory birds, their eggs, or their nests. Conversely, the take of birds, eggs or nests occurring as the result of an activity, the purpose of which is not to take birds, eggs or nests, is not prohibited by the MBTA" (USFWS 2018).

Therefore, the MBTA is currently interpreted to prohibit the take of birds, nests or eggs when the *purpose* or *intent* of the action is to take birds, eggs or nests, not when the take of birds, eggs or nests is incidental to but not the intended purpose of an otherwise lawful action.

Executive Orders (EO)

> *Invasive Species – EO 13112 (1999)*: Issued on February 3, 1999, promotes the prevention and introduction of invasive species and provides for their control and minimizes the economic, ecological, and human health impacts that invasive species cause through the creation of the Invasive Species Council and Invasive Species Management Plan.

> <u>*Migratory Bird – EO 13186 (2001)*</u>: Issued on January 10, 2001, promotes the conservation of migratory birds and their habitats and directs federal agencies to implement the Migratory Bird Treaty Act. Protection and Enhancement of Environmental Quality—EO 11514 (1970a), issued on March 5, 1970, supports the purpose and policies of the National Environmental Policy Act (NEPA) and directs federal agencies to take measures to meet national environmental goals.

Migratory Bird Treaty Reform Act

The Migratory Bird Treaty Reform Act (Division E, Title I, Section 143 of the Consolidated Appropriations Act, 2005, PL 108–447) amends the Migratory Bird Treaty Act (16 U.S.C. Sections 703 to 712) such that nonnative birds or birds that have been introduced by humans to the United States or its territories are excluded from protection under the Act. It defines a native migratory bird as a species present in the United States and its territories as a result of natural biological or ecological processes. This list excluded two additional species commonly observed in the United States, the rock pigeon (*Columba livia*) and domestic goose (*Anser domesticus*).

Birds of Conservation Concern

Birds of Conservation Concern (BCC) is a USFWS list of bird species identified to have the highest conservation priority, and with the potential for becoming candidates for listing as federally threatened or endangered. The chief legal authority for BCC is the Fish and Wildlife Conservation Act of 1980 (FWCA). Other authorities include the FESA, the Fish and Wildlife Act of 1956, and the Department of the Interior U.S Code (16 U.S.C. § 701). The 1988 amendment to the FWCA (Public Law 100-653, Title VIII) requires the Secretary of the Interior, through the USFWS, to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973" (USFWS, 2008a).

State Regulations

California Fish and Game Code Sections 1600 through 1606 of the CFGC

This section requires that a Streambed Alteration Application be submitted to the CDFW for "any activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake." The CDFW reviews the proposed actions and, if necessary, submits to the applicant a proposal for measures to protect affected fish and wildlife resources. The final proposal that is mutually agreed upon by the Department and the applicant is the Streambed Alteration Agreement. Often, Projects that require a Streambed Alteration Agreement also require a permit from the USACE under Section 404 of the CWA. In these instances, the conditions of the Section 404 permit and the Streambed Alteration Agreement may overlap.

California Endangered Species Act

The California Endangered Species Act (CESA) (Sections 2050 to 2085) establishes the policy of the state to conserve, protect, restore, and enhance threatened or endangered species and their habitats by protecting "all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation." Animal species are listed by the CDFW as threatened or endangered, and plants are listed as rare, threatened, or endangered. However, only those plant species listed as threatened or endangered receive protection under the California ESA.

CESA mandates that state agencies do not approve a Project that would jeopardize the continued existence of these species if reasonable and prudent alternatives are available that would avoid a jeopardy finding. There are no state agency consultation procedures under the California ESA. For Projects that would affect a species that is federally and State listed, compliance with ESA satisfies the California ESA if the California Department of Fish and Wildlife (CDFW) determines that the federal incidental take authorization is consistent with the California ESA under Section 2080.1. For Projects that would result in take of a species that is state listed only, the Project sponsor must apply for a take permit, in accordance with Section 2081(b).

Fully Protected Species

Four sections of the California Fish and Game Code (CFGC) list 37 fully protected species (CFGC Sections 3511, 4700, 5050, and 5515). These sections prohibit take or possession "at any time" of the species listed, with few exceptions, and state that "no provision of this code or any other law will be construed to authorize the issuance of permits or licenses to 'take' the species," and that no previously issued permits or licenses for take of the species "shall have any force or effect" for authorizing take or possession.

Bird Nesting Protections

Bird nesting protections (Sections 3503, 3503.5, 3511, 3513 and 3800) in the CFGC include the following:

- Section 3503 prohibits the take, possession, or needless destruction of the nest or eggs of any bird.
- Section 3503.5 prohibits the take, possession, or needless destruction of any nests, eggs, or birds in the orders Falconiformes (new world vultures, hawks, eagles, ospreys, and falcons, among others), and Strigiformes (owls).
- Section 3511 prohibits the take or possession of Fully protected birds.
- Section 3513 prohibits the take or possession of any migratory nongame bird or part thereof, as designated in the MBTA. To avoid violation of the take provisions, it is generally required that Project-related disturbance at active nesting territories be reduced or eliminated during the nesting cycle.
- Section 3800 prohibits the take of any non-game bird (i.e., bird that is naturally occurring in California that is not a gamebird, migratory game bird, or fully protected bird).

Native Plant Protection Act

The Native Plant Protect Act (NPPA) (1977) (CFGC Sections 1900-1913) was created with the intent to "preserve, protect, and enhance rare and endangered plants in this State." The NPPA is administered by CDFW. The Fish and Game Commission has the authority to designate native plants as endangered or rare and to protect endangered and rare plants from take. CESA (CFGC 2050-2116) provided further protection for rare and endangered plant species, but the NPPA remains part of the Fish and Game Code.

Appendix C. USFWS IPaC, CNDDB & CNPSEI Lists

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
Phone: (760) 431-9440 Fax: (760) 431-5901
http://www.fws.gov/carlsbad/

In Reply Refer To: October 04, 2021
Consultation Code: 08ECAR00-2022-SLI-0003
Event Code: 08ECAR00-2022-E-00014
Project Name: IEUA RP-4 AWPF Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Carlsbad Fish And Wildlife Office
2177 Salk Avenue - Suite 250
Carlsbad, CA 92008-7385
(760) 431-9440

Project Summary

Consultation Code: 08ECAR00-2022-SLI-0003
Event Code: Some(08ECAR00-2022-E-00014)
Project Name: IEUA RP-4 AWPF Project
Project Type: WASTEWATER FACILITY
Project Description: Existing IEUA RP-4 wastewater treatment plant improvement project.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@34.0845719,-117.52586521817223,14z

Counties: San Bernardino County, California

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
San Bernardino Merriam's Kangaroo Rat *Dipodomys merriami parvus* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2060	Endangered

Birds

NAME	STATUS
Coastal California Gnatcatcher *Polioptila californica californica* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8178	Threatened

Insects

NAME	STATUS
Delhi Sands Flower-loving Fly *Rhaphiomidas terminatus abdominalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1540	Endangered
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
San Diego Ambrosia *Ambrosia pumila* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8287	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Guasti (3411715))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G1G2	S1S2	SSC
Anniella stebbinsi Southern California legless lizard	ARACC01060	None	None	G3	S3	SSC
Arizona elegans occidentalis California glossy snake	ARADB01017	None	None	G5T2	S2	SSC
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Bombus crotchii Crotch bumble bee	IIHYM24480	None	Candidate Endangered	G3G4	S1S2	
Calochortus plummerae Plummer's mariposa-lily	PMLIL0D150	None	None	G4	S4	4.2
Chaetodipus fallax fallax northwestern San Diego pocket mouse	AMAFD05031	None	None	G5T3T4	S3S4	SSC
Chorizanthe parryi var. parryi Parry's spineflower	PDPGN040J2	None	None	G3T2	S2	1B.1
Cladium californicum California saw-grass	PMCYP04010	None	None	G4	S2	2B.2
Dipodomys merriami parvus San Bernardino kangaroo rat	AMAFD03143	Endangered	Candidate Endangered	G5T1	S1	SSC
Dipodomys stephensi Stephens' kangaroo rat	AMAFD03100	Endangered	Threatened	G2	S2	
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G4G5T4	S3S4	SSC
Horkelia cuneata var. puberula mesa horkelia	PDROS0W045	None	None	G4T1	S1	1B.1
Lasiurus xanthinus western yellow bat	AMACC05070	None	None	G4G5	S3	SSC
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Muhlenbergia californica California muhly	PMPOA480A0	None	None	G4	S4	4.3
Muhlenbergia utilis aparejo grass	PMPOA481X0	None	None	G4	S2S3	2B.2
Navarretia prostrata prostrate vernal pool navarretia	PDPLM0C0Q0	None	None	G2	S2	1B.2
Neotoma lepida intermedia San Diego desert woodrat	AMAFF08041	None	None	G5T3T4	S3S4	SSC
Perognathus longimembris brevinasus Los Angeles pocket mouse	AMAFD01041	None	None	G5T2	S1S2	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Phacelia stellaris Brand's star phacelia	PDHYD0C510	None	None	G1	S1	1B.1
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Polioptila californica californica coastal California gnatcatcher	ABPBJ08081	Threatened	None	G4G5T3Q	S2	SSC
Pseudognaphalium leucocephalum white rabbit-tobacco	PDAST440C0	None	None	G4	S2	2B.2
Rhaphiomidas terminatus abdominalis Delhi Sands flower-loving fly	IIDIP05021	Endangered	None	G1T1	S1	
Symphyotrichum defoliatum San Bernardino aster	PDASTE80C0	None	None	G2	S2	1B.2

Record Count: 26

Inventory of Rare and Endangered Plants of California

California Native Plant Society

Search Results

13 matches found. Click on scientific name for details

Search Criteria: Quad is one of [**3411715:**]

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK
Calochortus catalinae	Catalina mariposa lily	Liliaceae	perennial bulbiferous herb	(Feb)Mar-Jun	None	None	G3G4	S3S4	4.2
Calochortus plummerae	Plummer's mariposa-lily	Liliaceae	perennial bulbiferous herb	May-Jul	None	None	G4	S4	4.2
Chorizanthe parryi var. parryi	Parry's spineflower	Polygonaceae	annual herb	Apr-Jun	None	None	G3T2	S2	1B.1
Cladium californicum	California saw-grass	Cyperaceae	perennial rhizomatous herb	Jun-Sep	None	None	G4	S2	2B.2
Deinandra paniculata	paniculate tarplant	Asteraceae	annual herb	(Mar)Apr-Nov	None	None	G4	S4	4.2
Horkelia cuneata var. puberula	mesa horkelia	Rosaceae	perennial herb	Feb-Jul(Sep)	None	None	G4T1	S1	1B.1
Juglans californica	Southern California black walnut	Juglandaceae	perennial deciduous tree	Mar-Aug	None	None	G4	S4	4.2
Muhlenbergia californica	California muhly	Poaceae	perennial rhizomatous herb	Jun-Sep	None	None	G4	S4	4.3
Muhlenbergia utilis	aparejo grass	Poaceae	perennial rhizomatous herb	Mar-Oct	None	None	G4	S2S3	2B.2
Navarretia prostrata	prostrate vernal pool navarretia	Polemoniaceae	annual herb	Apr-Jul	None	None	G2	S2	1B.2
Phacelia stellaris	Brand's star phacelia	Hydrophyllaceae	annual herb	Mar-Jun	None	None	G1	S1	1B.1
Pseudognaphalium leucocephalum	white rabbit-tobacco	Asteraceae	perennial herb	(Jul)Aug-Nov(Dec)	None	None	G4	S2	2B.2
Symphyotrichum defoliatum	San Bernardino aster	Asteraceae	perennial rhizomatous herb	Jul-Nov	None	None	G2	S2	1B.2

Showing 1 to 13 of 13 entries

Suggested Citation:

California Native Plant Society, Rare Plant Program. 2021. Inventory of Rare and Endangered Plants of California (online edition, v9-01 1.0). Website https://www.rareplants.cnps.org [accessed 4 October 2021].

Send questions and comments to rareplants@cnps.org.

About the Inventory
Release Notes
Advanced Search

Glossary

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About CNPS

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The Calflora Database
The California Lichen Society

California Natural Diversity Database
The Jepson Flora Project
The Consortium of California Herbaria
CalPhotos

Developed by
Rincon Consultants, Inc.

APPENDIX 7

Cultural Memorandum

CRM TECH
1016 E. Cooley Drive, Suite A/B
Colton, CA 92324

MEMORANDUM

Date: October 17, 2021
From: Bai "Tom" Tang, Principal, CRM TECH
To: Tom Dodson, President, Tom Dodson & Associates
Subject: Cultural Resources Survey, Proposed AWPF at RP-4, City of Rancho Cucamonga

Dear Tom:

At your request, CRM TECH has conducted an intensive-level field survey on the project site for a proposed advanced water purification facility (AWPF) at the Inland Empire Utilities Agency's (IEUA) Regional Plant No. 4 (RP-4) in the City of Rancho Cucamonga, San Bernardino County, California. The project area consists of approximately 2.87 acres of vacant land in the western portion of RP-4, which is located at 12811 6th Street, on the southwestern corner of 6th Street and Etiwanda Avenue, and in the southeast quarter of Section 17, Township 1 South Range 6 West, San Bernardino Baseline and Meridian (Figures 1, 2).

As you know, the project area was partially included in the areas surveyed for cultural resources during two previous studies that our firm conducted for IEUA in 2002 and 2006 (Tang and Smallwood 2002; Encarnación et al. 2006). Both of those studies were standard Phase I cultural resources surveys completed under provisions of Section 106 of the National Historic Preservation Act. The scopes of these studies included cultural resources records searches in the California Historical Resources Information System, historical background research, consultations with Native American representatives, and intensive-level field surveys, and neither of them encountered any cultural resources (*ibid.*).

Since both of the previous studies are now well over ten years old, and since the project area lies entirely within or adjacent to the areas surveyed in 2002 and 2006, the present study is designed to be an update and an addendum to those studies. It is a part of the environmental review process for the AWPF project at RP-4, as required by the IEUA pursuant to the California Environmental Quality Act (CEQA; PRC §21000, et seq.). The purpose of the survey is to confirm that the project will not cause a substantial adverse change in the significance of any "historical resources," as defined by CEQA (PRC §5020.1(j); Title 14 CCR §15064.5(a)(1)-(3)), especially those that may have become historical in age (i.e., more than 50 years old) since 2006.

The field survey of the project area was carried out on September 22, 2021, by project archaeologist Salvadore Z. Boites, M.A. It was observed during the survey that the entire project area has been extensively disturbed in the past and is now partially occupied by a wind turbine (Figure 3). The ground surface is mostly covered by landscaping plants, including brittlebush, California buckwheat, sagebrush, stinkwort, desertbroom, and other drought-resistant native species, and by wood chips (Figure 3). The existing surface sediments clearly represent imported soil, mainly a brown, indurated silty-sandy loam mixed with ample organic decay.

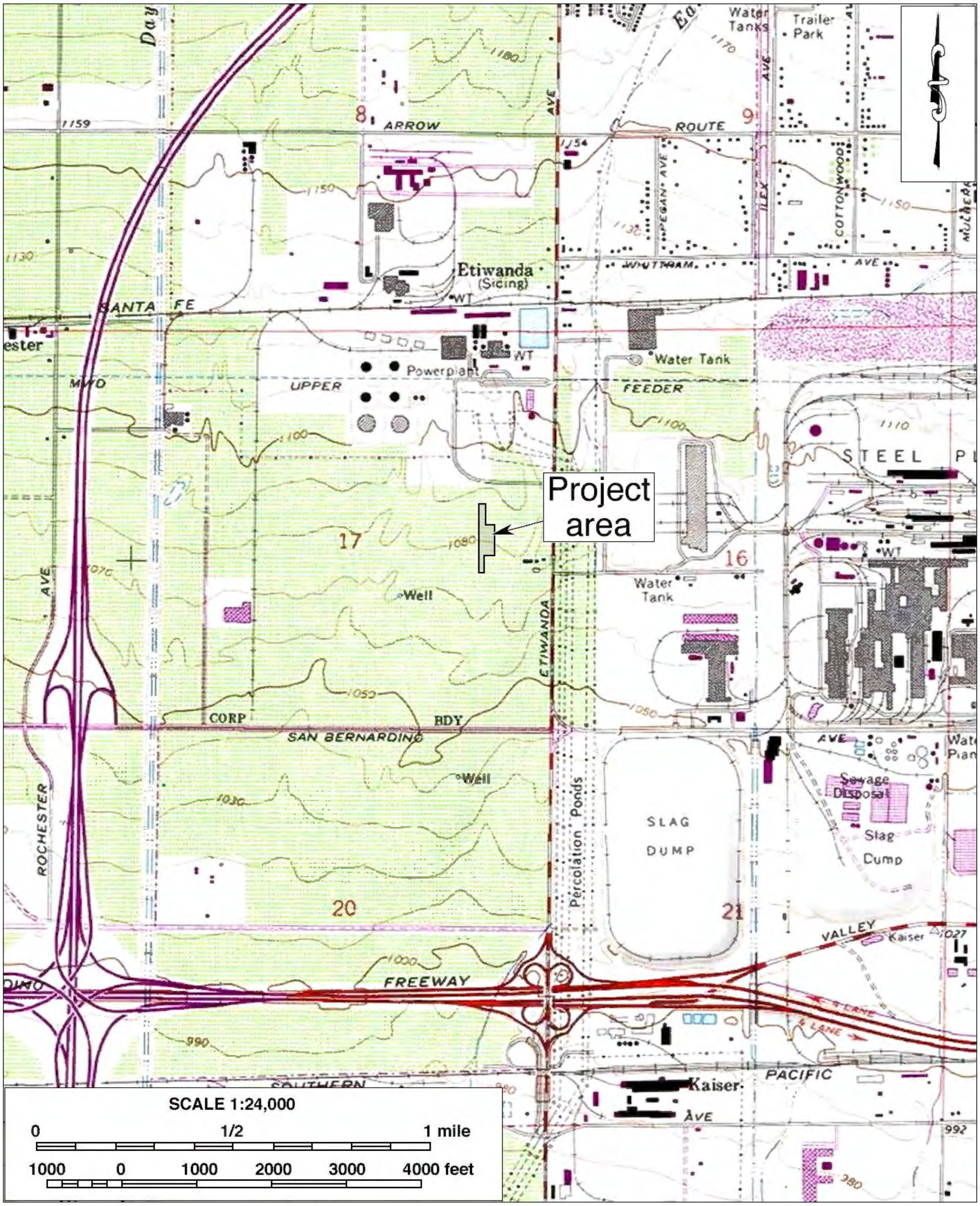


Figure 1. Project location. (Based on USGS Guasti, Calif., 7.5' quadrangle, 1981 edition)

Figure 2. Recent aerial photograph of the project area.

Figure 3. Typical landscape within the project area. (View to the south; photograph taken on September 22, 2021)

Aerial photographs taken since 1938 suggest that the project area, once part of a large expanse of farmland, became a part of RP-4 when the plant was built around 1997 (NETR Online 1938-2002; IEUA n.d.). The area was cleared, graded, and apparently used as a stock yard between 2003 and 2007, and the landscaping in place today was completed sometime between 2007 and 2009 (Google Earth 2002-2009). The wind turbine in the project area was evidently installed in 2011-2012 (Google Earth 2011; 2012).

Because of the limited size of the area and the presence of dense patches of landscaping plants, Boites completed the field survey by walking along meandering lines across accessible open land and carefully examined the ground surface for any evidence of human activities from the prehistoric or historic era. Ground visibility was roughly 50 percent in the northern portion of the project area and roughly 30 percent in the southern portion. In light of the level of past ground disturbance in the project area, the ground visibility was deemed adequate for this survey.

Throughout the course of the survey, no buildings, structures, objects, sites, features, or artifacts of prehistoric or historical origin were encountered within or adjacent to the project area. Therefore, CRM TECH recommends to the IEUA a finding of *No Impact* regarding "historical resources." No further cultural resources investigation is recommended for the project unless construction plans undergo such changes as to include areas not covered by this study. However, if buried cultural materials are discovered during earth-moving operations associated with the project, all work in that area should be halted or diverted until a qualified archaeologist can evaluate the nature and significance of the finds.

Thank you for this opportunity to be of service.

Sincerely,

Bai “Tom” Tang, M.A.

References Cited:

Encarnación, Deirdre, Thomas Melzer, and Laura H. Shaker

2006 Identification and Evaluation of Historic Properties: 1158 Zone Pipeline Project, City of Rancho Cucamonga, San Bernardino County, California. On file, South Central Coastal Information Center, California State University, Fullerton.

Google Earth

2002-2012 Aerial photographs of the project vicinity; taken in 2002-2007, 2009, 2011, and 2012. Available through the Google Earth software.

IEUA (Inland Empire Utilities Agency)

n.d. Regional Water Recycling Plant No. 4. https://www.ieua.org/facilities/regional-water-recycling-plant-no-4/.

NETR (Nationwide Environmental Title Research) Online

1938-2002 Aerial photographs of the project vicinity; taken in 1938, 1948, 1959, 1966, 1994, and 2002. http://www.historicaerials.com.

Tang, Bai, and Josh Smallwood

2002 Identification and Evaluation of Historic Properties: Recycled Water Facilities Improvement Project, Regional Plants No. 1 and No. 4, Cities of Ontario and Rancho Cucamonga, San Bernardino County, California. On file, South Central Coastal Information Center, California State University, Fullerton.

APPENDIX 8

Energy Resources Technical Report

ENERGY RESOURCES TECHNICAL REPORT

October 2021

9665 Chesapeake Drive Suite 320
San Diego, CA 92123
858.875.7400

woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

Inland Empire Utilities Agency
Chino Basin Program

TABLE OF CONTENTS

1. INTRODUCTION

This report describes environmental and regulatory setting related to energy consumption and resources in the proposed Chino Basin Program (CBP, or Proposed Project) area. The report then describes the methodology and thresholds relied upon to assess the impacts of the Proposed Project. Finally, it identifies the impacts of the Proposed Project. This report discusses the Proposed Project impacts associated with energy consumption and energy resources.

2. PROJECT DESCRIPTION

The CBP consists of an advanced water purification facility (AWPF), injection wells, extraction wells, groundwater treatment facilities, and a pipeline distribution network connecting the proposed facilities to local agencies and Metropolitan Water District of Southern California (MWD) for a water exchange with the State Water Project (SWP). The CBP AWPF and groundwater injection facilities would allow for the recharge/storage of up to 15,000 acre-feet per year (AFY) of recycled water in the Chino Basin, creating a new local supply. The AWPF would process 17,000 AFY of recycled water, which includes currently unused recycled water and 6,000 AFY of external supplies; 2,000 AFY of water will be lost through the AWPF process each year. The CBP would connect CBP potable water facilities to the region, as well as connections to MWD with the ability to pump CBP potable supplies into MWD's water distribution system. This connection would allow the CBP to make 50,000 AFY available to MWD in dry or critically dry years in exchange for the same amount of supply from the SWP. In return, 50,000 AFY that would otherwise have been exported to MWD would be stored in Lake Oroville and used to enhance instream flows in the Feather River. Figure 1 shows a proposed conceptual layout of the key facilities.

The CBP will provide for an exchange of new water supplies in the Chino Basin for SWP supplies in Lake Oroville in northern California that would otherwise be delivered to southern California. The additional Lake Oroville water would subsequently be released in the form of pulse flows in the Feather River to improve habitat conditions for native salmonids and achieve environmental benefits. The 15,000 AFY of new water supply would be produced for a period of 25 years to provide for the State exchange, to be used in blocks of up to 50,000 AFY in dry and critical years when pulse flows in the Feather River would provide the most ecosystem benefit. The term for this exchange will be fixed at 25 years for a total volume of 375,000 acre-feet, after which time the CBP will be devoted to meeting local water management needs while fulfilling commitments to improve water quality in the Chino Basin and provide a source of emergency water supply. The program would be administered through agreements with California Department of Water Resources (DWR), California Department of Fish and Wildlife (CDFW), MWD, and other project partners. For every acre-foot (AF) of water requested for north of the Delta ecosystem benefits, IEUA would pump locally stored groundwater and deliver it to MWD or use the water locally instead of taking raw imported water from MWD. MWD would then leave behind an equivalent amount of water in Lake Oroville to be dedicated and released for the requested ecosystem benefit. The 375,000 AF would be recharged over 25 years and the same amount would be extracted over 25 years.

Figure 1: Conceptual Chino Basin Program Infrastructure

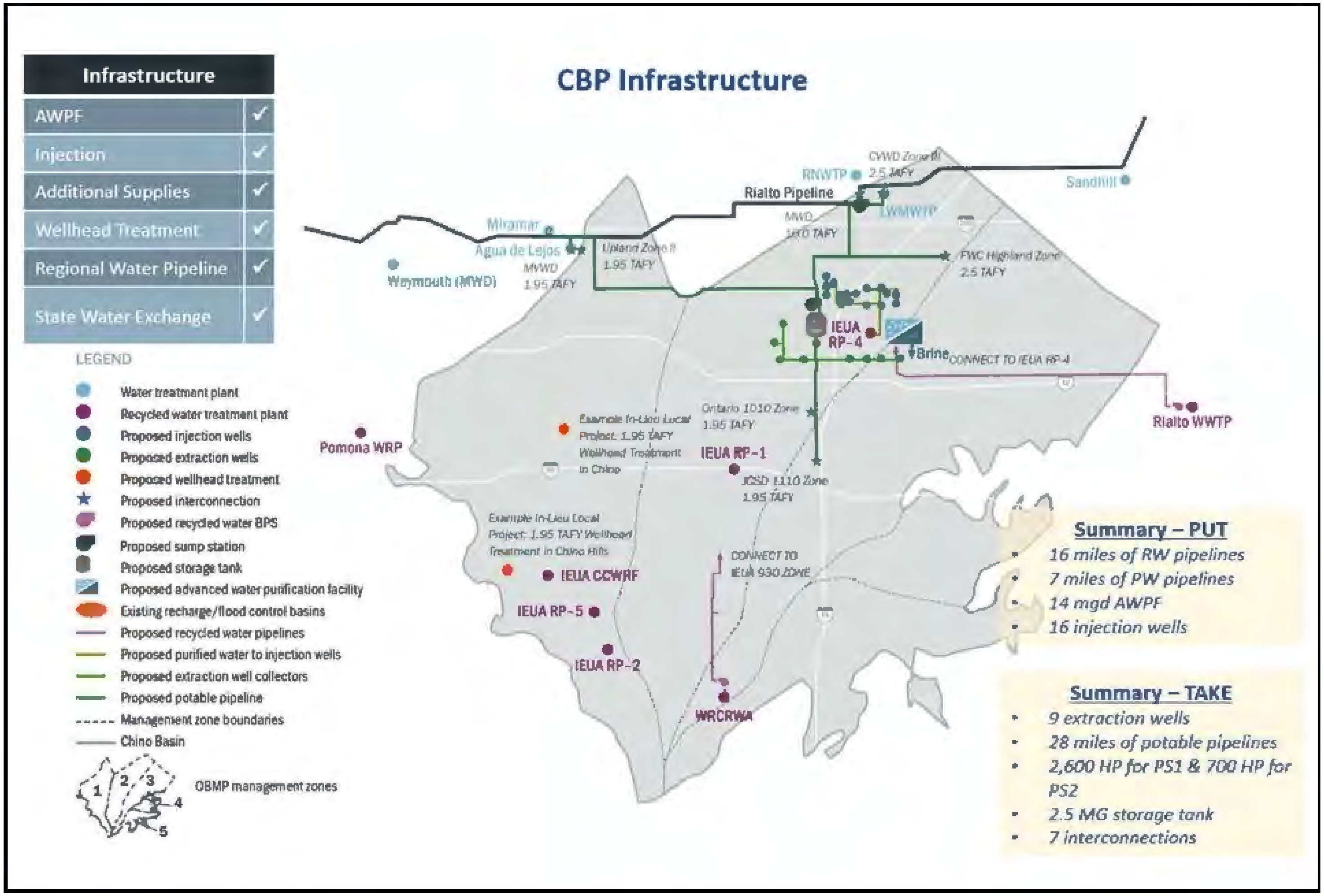


FIGURE 1

Tom Dodson & Associates
Environmental Consultants

CBP Infrastructure

The Proposed Project includes two main categories of facilities: "Put" and "Take" components. The "Put" facilities include the components to recharge purified water to the Chino Basin, while the "Take" facilities include the components to extract groundwater and convey potable water supply from the Chino Basin. These components are summarized in Table 1 and described in detail in Table 2.

Table 1: **Summary of "Put" and "Take" Components of the Chino** Basin Program

"Put" Components	**"Take"** Components
• Tertiary recycled water supply and conveyance • AWPF • Purified water pumping and conveyance • Groundwater recharge (injection wells and/or use of existing recharge basins)	• Groundwater extraction and treatment • Potable water pumping and conveyance • Potable water usage (MWD pump back or in-lieu)

Table 2: Detail of Chino Basin Program Infrastructure

Project Category	Infrastructure
Project Category 1: Well Development	16 injection wells (maximum) with max operational capacity of 830 gpm each 17 extraction wells (maximum) with max operational capacity of 2,000 gpm each 4 monitoring wells (maximum) Use of existing wells including a mix of up to 4 of the following: • Use of existing Rialto Pipeline • Use of existing member agency wells • Use of existing Agua de Lejos Water Treatment Plant (WTP) Clearwell • Use of existing Lloyd Michael WTP Clearwell
Project Category 2: Conveyance Facilities and Ancillary Facilities	Pipeline: The CBP would ultimately install a total of about 30 miles or 158,400 linear feet (LF) of various types of pipeline. Potential alignments include a mix of the following: • TAKE 1: 9 miles of 12- to 36-inch collector pipelines • TAKE 1: 5 miles of 54-inch potable northern pipeline • TAKE 3: 9 miles of 12- to 42-inch collector pipelines • TAKE 3: 8 miles of 16- through 48-in potable northern pipeline • TAKE 3: 4 miles of 12- through 24-inch potable southern pipeline • TAKE 3: In lieu Brine Disposal Inland Empire Brine Line (IEBL) 6,800 ft 8" pipeline, possible jack and bore across 300 ft under Hwy 71 and Chino Creek • TAKE 7: 7 miles of 36- to 72-inch e/w Water Facilities Authority (WFA) pipeline • TAKE 7: 4.5 miles 24-inch e/w Fontana Water Company (FWC) pipeline • TAKE 7: 4.5 miles 54- to 72-inch & 36-inch Cucamonga Valley Water District (CVWD)/ MWD pipeline • TAKE 7: 0.3 miles 54- to 72-inch MWD pipeline • TAKE 8: 6.3 miles of 48-inch CVWD pipeline • TAKE 8: 7 miles of 24-inch FWC-1 pipeline • TAKE 8: 0.7 miles of 24-inch FWC-2 pipeline • TAKE 8: 0.8 miles of 24-inch MWD pipeline • TAKE 8: 36-inch Jurupa Community Services District (JCSD) 2 miles • PUT 5: 7.1 miles of 8- to 30-inch pipeline for purified water conveyance • PUT 5: 1,400 ft (8-foot pipeline) Non-Reclaimable Wastewater System (NRWS) brine conveyance; NRWS Capacity Units required: 2,603 Reservoir: The CBP would install a storage tank with a maximum capacity of 5 MG with possible and in-conduit hydropower facility. Pump Stations: The CBP would install 4 pump stations serving various PUT and TAKE facilities. One pump station would serve PUT facilities, while up to 3 pump stations would

Project Category	Infrastructure
	support TAKE facilities. The breakdown of the types of pump stations and boosters include a mix of the following: • PUT 5: Pump station at Regional Water Recycling Plant No. 4 (RP-4) 1,500 HP • TAKE 1: Pump Station with a max 9,300 HP, and a max of 31,100 gpm, 823 ft total dynamic head (TDH) • TAKE 3: Potable Water Pump Station #1 with a max 7,000 HP, 23,300 gpm firm capacity, 823 ft TDH • TAKE 7: WFA Booster at 1,700 HP • TAKE 7: FWC Booster at 300 HP • TAKE 7: CVWD/MWD Booster at 4,800 HP • TAKE 8: Booster Station #1 at 5,300 HP • TAKE 8: MWD Booster at 650 HP • An additional TAKE pump station would have a max 650 HP Turnouts: The CBP would install a maximum of 6 turn-outs that would be between 12" and 72" in size to support TAKE facilities at various member agency locations throughout the Chino Basin
Project Category 3: Groundwater Storage Increase	The CBP contemplates a permanent increase in Safe Storage Capacity of 850,000 AF
Project Category 4: Advanced Water Purification Facility and Other Water Treatment Facilities	AWPF: The CBP would install an AWPF at RP-4, which will ultimately have a capacity of 15,000 AFY. The intake of recycled water at this facility will total 17,000 AFY, with a resulting 15,000 AFY of purified water derived from the AWPF processes. Wellhead Treatment: The CBP may install up to 3 wellhead treatment facilities at locations that have yet to be selected but would be sited at existing member agency offline wells. These wellhead treatment systems would be capable of treating up to 3,000 AFY per wellhead treatment system. Each of the 3 wellhead treatment systems would be connected to 3 existing member agency wells (total of 9 existing extraction wells used for the CBP). Wellhead treatment also includes the following brine conveyance and disposal: • Disposal Capacity: 4,900 gpd per wellhead treatment system • Pipeline Length: up to 6,800 LF (8-inch) • Disposal System: Assumed utilization of IEBL

2.1 Construction

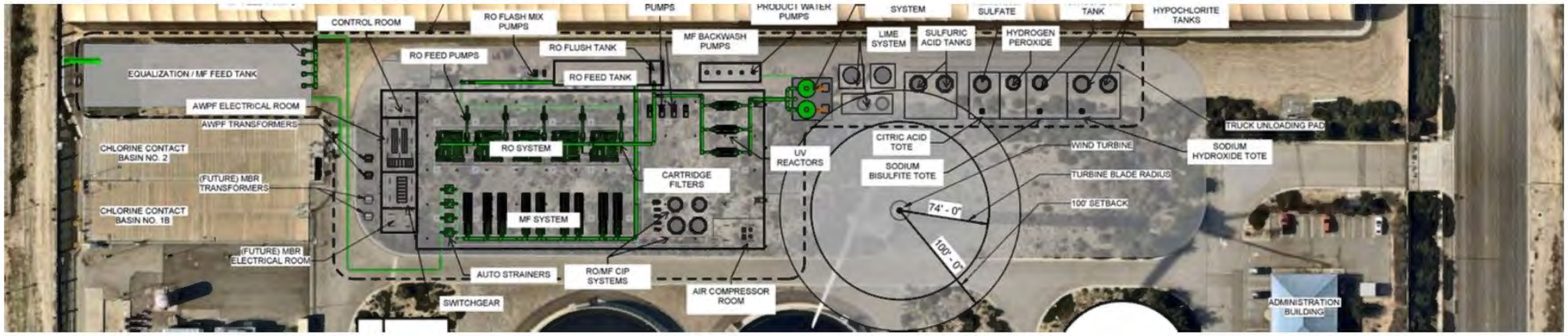
The following section summarizes the construction activity details for each Proposed Project component. The overall assumed construction vehicle fleet can be found in Table 3.

2.1.1 AWPF

The installation of the AWPF at IEUA's existing RP-4, located in the City of Rancho Cucamonga, would require approximately 12 months to construct. It is anticipated that the AWPF would be operational by 2028. The construction of the AWPF would consist of site clearing, grading, construction of facilities, installation of equipment, and site completion. Construction equipment would include the following: one bulldozer or motor grader, backhoes, loaders, dump trucks, crew trucks, concrete trucks, cranes, personal vehicles, compactor, delivery trucks, and a water truck. It is anticipated that the maximum number of construction personnel at a site on any given day will be 20 persons. The maximum number of truck deliveries is forecasted at 15 per day at 40-miles round-trip per day of construction. Materials and equipment would be delivered to the site including piping, building materials, concrete forms, roofing materials, HVAC equipment, pumps, diffusers, screens, belt presses, and screw presses. The site of the proposed AWPF is currently vacant (see Figure 2). No demolition is anticipated to be required to construct the AWPF.

Figure 2: AWPF Site

Regional Water Recycling Plant No. 4 Advanced Water Purification Facility Site Layout



Google Street view of Regional Water Recycling Plant No. 4 Advanced Water Purification Facility Site

2.1.2 Pipelines and Turnouts

With rare exceptions, all proposed pipelines would be aligned through the public right-of-way (ROW) and properties owned or to-be acquired by IEUA. Typically, pavement removal would occur, followed by excavation of the pipeline trench, installation of the pipe, then backfilling and compaction, and finally ground surface restoration or pavement reinstallation. Trenchless technologies would be required at freeway, flood channel, and railroad crossings: jack and bore for lengths less than 500 feet; and horizontal directional drilling (HDD) for lengths exceeding 500 feet. HDD involves establishing entry and exit pits, using a drill rig to create an underground bore hole, and then stringing the pipeline through the hole. Jack and bore also employs entry and exit pits but uses an auger to remove material and push a casing forward, then the pipeline is inserted in the casing. Most of the pipe would range from 10-inch to 48-inch diameter. Depending on the pipe size, the trenches may vary in depth and width. Roughly half an acre of land would be actively excavated on a given day.

An estimated 30 miles or 158,400 LF of conveyance pipeline would be installed in support of the CBP. The rate of pipeline installation would depend on whether the pipeline installation is in undeveloped areas or developed roadways. Installation of 158,400 LF of pipeline was assumed to occur over a period of 3 years, with 53,000 LF being installed each year to coincide with the opening year (2028) of the AWPF. For the purposes of analysis, it is assumed that an underground utility installation team can install an average of 200-400 LF of pipeline per day and that three teams will be installing pipelines at any given time for a maximum total of 1,200 LF per day (400 LF/team/day x 3 teams = 1,200 LF per day). It is assumed that the proposed pipeline installation will occur for a maximum of 260 days in one calendar year.

In addition to conveyance pipeline, a maximum of six turnout structures would be provided to deliver water from the main canal to the water users via a pipeline or other means. The type of turnout structure and its design requirements would depend on location. Installation of the six turnouts would occur over a period of two years, with three turnouts being installed each year to coincide with the opening year (2028) of the AWPF. For the turnouts, roughly a quarter acre of land would be actively excavated on a given day.

The daily construction fleet required to install the average 200-400 LF/day of conveyance pipelines or for each turnout consists of a pavement cutter, grinder, backhoe, crane, two dump trucks, roller/vibrator, and traffic control signage and devices operating 6 hours per day; a water truck and excavator operating 4 hours per day; and a paving machine and compacter operating 2 hours per day. In addition, the contractor may occasionally use a portable generator and welder for equipment repairs or incidental uses. Installation of pipeline in unpaved locations would require the same equipment as in paved locations, without the paving equipment (cutter, grinder, paving machine). In general, trenches would have vertical side walls to minimize the amount of soil excavated. Soils excavated from the trenches, if of suitable quality, would be stockpiled alongside the trench or in staging areas for later reuse in backfilling the trench. If not reusable, the soil would be hauled off site for disposal. Engineered backfill material would be imported to stockpiles near the trenching. During the installation of the pipelines, there would be a surplus of native soil requiring off-site export. Pipeline and turnout installation would require an estimated 10 dump/delivery trucks (40 miles round trip distance) per day, and a crew of 14 members per team (40-mile round-trip commute). For the purposes of analysis, it is assumed that each phase of pipeline construction would be occurring simultaneously at some location in the basin (i.e., one segment would be in the repaving phase while another segment begins trenching).

2.1.3 Pump Stations

Pump stations are required to pump water from areas at a lower elevation within the Basin, to areas located at a higher elevation. A total of four pump stations are anticipated to be constructed as part of the CBP. At each site, no more than 0.5 acre would be actively graded on a given day for site preparation of each pump station. Grading activities would occur over a five-day period and this phase of construction would require up to six truck trips with an average round

trip distance of 20 miles to deliver construction materials and equipment (concrete, steel, pipe, etc.). Installation of the pump station would require the use of a crane, forklift, backhoe and front loader operating four hours per day. Five workers would each commute 40 miles round-trip to the work site.

Each pump station would be housed within a block building and would require a transformer to be installed to deliver electric power to the pumps. The proposed pump station building would include a pump room, electric control room, odor control facilities, chemical tanks, and storage room. Construction of the pump station would involve installation of piping and electrical equipment, excavation and structural foundation installation, pump house construction, pump and motor installation, and final site completion.

The proposed pump stations are anticipated to be located at sites that have permanent power available for construction, as such a generator is not anticipated to be required for welding required to construct the pump stations.

2.1.4 Injection, Extraction, and Monitoring Wells

The CBP would install up to 37 new wells, (16 injection wells [12 duty, 4 stand-by], 17 extraction wells, and 4 monitoring wells). Installation of the 37 new wells would occur over a period of three years, with 12 wells being installed each year to coincide with the opening year of the AWPF, 2028. Production well, injection well, and monitoring well development have essentially the same construction impacts.

The drilling and development of each well would require drilling to—in most cases—between 250 and 1,500 feet below ground surface (bgs). The proposed schedule for constructing each well would be as follows: drilling, construction, and testing of each well would require approximately six weeks to complete (about 45 days, of which 15 to 20 days would include 24-hour, 7-day a week drill activity). For planning purposes, a construction and testing schedule duration of 60 days per well is assumed to account for unforeseen circumstances (e.g., extreme weather, equipment break downs, etc.) that could affect the drilling and testing schedule. The well casings would be welded and well development and installation would require a two week use of a diesel generator.

Development of up to 12 new wells during a given year would require the delivery and set up of the drilling rig at each site. It is anticipated the wells would be drilled at different times and the drilling equipment transported to and from the sites on separate occasions. For the purposes of this evaluation, it is assumed that delivery of the drilling equipment 12 times in a year would result in 12 50-mile round-trips for the drill rigs. It is anticipated that a crew of five persons would be on a given well site at any one time to support drilling a well: three drillers, the hydrologist inspector, and a foreman. Daily trips to complete the well would average approximately 15 round trips per day, which at various points of construction would include: two round trips for drill rigs; between six and 12 round trips for cement trucks; five trips to deliver pipe; and 10 trips per day for employees.

The average area of disturbance of each well site is estimated to be 0.5 acre or less to allow for construction, periodic well rehabilitation, and the drilling of a new well should the original well fail and need to be replaced. For analysis purposes, it is assumed that each well would be drilled using the direct rotary or fluid reverse circulation rotary drilling methods. Access to the drilling site for the drilling rig and support vehicles would be from adjacent roadways. Typically, well drilling requires only minimal earth movement or grading.

2.1.5 Wellhead Treatment Facilities

Several existing wells would require wellhead treatment in order to become operational in support of the CBP. The CBP would construct up to three wellhead treatment facilities at existing member agency wells. Two are shown in Figure 1, and a third could be constructed in the vicinity of the AWPF. The area expected to be disturbed by the construction of the proposed treatment facilities would be less than three acres for each site. A regional groundwater treatment facility would range from about one acre to two acres in size per facility. Construction of water treatment

facilities would involve site demolition; site paving; site prep/grading; excavation and installation of yard pipes; installation of treatment facilities; site finishing (landscaping, misc. curb/cutter, etc.); and site drainage (above and below grade). Construction equipment would include the following: one bulldozer or motor grader, backhoes, loaders, dump trucks, crew trucks, concrete trucks, cranes, personal vehicles, compactor, delivery trucks, and a water truck. It is anticipated that the maximum number of construction personnel at a site on any given day would be 10 persons. The maximum number of construction material truck deliveries would be approximately 10 per day at 40 miles round trip per day. Each wellhead treatment facility would require about six months to construct, with construction of two treatment systems assumed to occur simultaneously. The operational year is anticipated to coincide with the opening year of the AWPF, 2028.

2.1.6 Storage Reservoir

One 5 million gallon (MG) storage tank is anticipated to be required in support of the CBP. Overall, reservoir construction is anticipated to require about three months from start to finish. During mass grading of the site, an assumed 5,000 cubic yards (CY) of material would be imported as engineered backfill. The amount of material that would need to be exported is unspecified, but conservatively assumed to be roughly the same quantity (5,000 CY). This material would be delivered by trucks to the site in the amount of about 300 trips, assuming 50 trips maximum per day to and from the site, with a roundtrip length of no more than 50 miles. Fine grading of the site will be completed after the reservoir and piping are installed. A maximum of five to 12 workers would be on the site during grading, which would take place for about 10 days. Following mass excavation, the tank foundation would be installed. The foundation would consist of concrete, steel, and aggregate. It is assumed that a maximum of five to 12 workers would be on the site during foundation construction for a maximum of about 25 days. The new 5 MG storage tank would be constructed in the following fashion: floor; walls and columns; roof; prestressing; and appurtenances. It is assumed that a maximum of 12 employees would be on the site during reservoir construction for a maximum of about 50 days total (grading and construction).

Table 3 summarizes the overall construction vehicle fleet described above that has been assumed to be necessary for the purposes of estimating construction-related energy use. Table 4 summarizes the daily trips described above that would be made during construction of each phase to transport workers, haul material, and deliver supplies to and from the sites.

Table 3: Estimated Construction Equipment Fleet by Phase

Construction Phase	Modeled Daily Equipment Fleet	Unit Amount	Hours per Day	Hp	Load Factor
Well Development (assume mobilization, drilling, and construction and testing occurs simultaneously at some location in area)	Rubber Tired Dozers	4	6	247	0.4
	Tractors/Loaders/Backhoes	12	6	97	0.37
	Bore/Drill Rigs	1	24	221	0.5025
	Cranes	4	6	231	0.2881
	Welders	4	4	46	0.45
Pipelines (assume pavement cutting, excavation, install, and paving occurs simultaneously at some location in area)	Excavators	3	4	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	6	6	247	0.4
	Tractors/Loaders/Backhoes	3	6	97	0.37
	Crushing/Proc. Equipment	6	6	85	0.78
	Cranes	3	6	231	0.2881
	Rollers	3	6	80	0.3752
	Sweepers/Scrubbers	3	4	64	0.4556
	Paving Equipment	3	2	132	0.3551
	Generator Sets	3	1	84	0.74
Storage Reservoir – Grading phase	Excavators	1	8	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4

Construction Phase	Modeled Daily Equipment Fleet	Unit Amount	Hours per Day	Hp	Load Factor
	Tractors/Loaders/Backhoes	3	8	97	0.37
Storage Reservoir – Construction phase	Cranes	1	7	231	0.29
	Forklifts	3	8	89	0.2
	Generator Sets	1	8	84	0.74
	Tractors/Loaders/Backhoes	3	7	97	0.37
	Welders	1	8	46	0.45
Storage Reservoir – Site finishing phase	Cement and Mortar Mixers	2	6	9	0.56
	Pavers	1	8	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38
	Tractors/Loaders/Backhoes	1	8	97	0.37
Pump Stations - Grading	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4
	Tractors/Loaders/Backhoes	2	7	97	0.37
Pump Stations - Construction	Cranes	1	4	231	0.29
	Forklifts	1	4	89	0.2
	Tractors/Loaders/Backhoes	2	4	97	0.37
	Welders	1	4	46	0.45
Turnouts (assume excavation, install, and resurfacing occurs simultaneously at some location in area)	Excavators	3	4	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	6	6	247	0.4
	Tractors/Loaders/Backhoes	3	6	97	0.37
	Crushing/Proc. Equipment	6	6	85	0.78
	Cranes	3	6	231	0.2881
	Rollers	3	6	80	0.3752
	Sweepers/Scrubbers	3	4	64	0.4556
	Paving Equipment	3	2	132	0.3551
	Generator Sets	3	1	84	0.74
AWPF – Site preparation	Rubber Tired Dozers	3	8	247	0.4
	Tractors/Loaders/Backhoes	4	8	97	0.37
AWPF - Grading	Excavators	1	8	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4
	Tractors/Loaders/Backhoes	3	8	97	0.37
AWPF – Construction	Cranes	1	7	231	0.29
	Forklifts	3	8	89	0.2
	Generator Sets	1	8	84	0.74
	Tractors/Loaders/Backhoes	3	7	97	0.37
	Welders	1	8	46	0.45
AWPF - Paving	Cement and Mortar Mixers	2	6	9	0.56
	Pavers	1	8	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38
	Tractors/Loaders/Backhoes	1	8	97	0.37
Wellhead Treatment – Demolition	Concrete/Industrial Saws	2	6	81	0.73
	Rubber Tired Dozers	2	6	247	0.4
Wellhead Treatment – Grading	Graders	2	6	187	0.41
	Tractors/Loaders/Backhoes	4	6	97	0.37
Wellhead Treatment – Construction	Cranes	2	4	231	0.29
	Forklifts	2	6	89	0.2
	Generator Sets	2	4	84	0.74
	Tractors/Loaders/Backhoes	4	6	97	0.37
	Welders	2	4	46	0.45
Wellhead Treatment – Paving	Pavers	2	6	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38

Table 4: Estimated Construction Vehicle Trips

Vehicle Trip Type	Construction Phase Description	Number of Round Trips (per day)
Construction Worker Trips	Wells	10
	Pipelines	42
	Turn Outs	14
	Pump Stations	5
	Water Storage Tank	12
	Advanced Water Purification Facility	20
	Wellhead Treatment Facilities	10
Materials/ Equipment/ Backfill Delivery and Water Truck Trips	Wells	31
	Pipelines	36
	Turn Outs	12
	Pump Stations	6
	Water Storage Tank	50
	Advanced Water Purification Facility	15
	Wellhead Treatment Facilities	10
Daily Construction Vehicle Trips		263

2.1.7 Construction Schedule

Construction is expected to begin in 2025 and extend to the opening of the AWPF in 2028. Construction would be limited to daytime, with the exception of well drilling for injection and extraction wells, which would last up to 20 days per well at 24 hours per day to prevent bore hole collapse. Trenchless drilling methods (HDD and jack-and-bore) would also require round-the-clock construction to prevent borehole collapse. Construction of the wells and pipelines would occur over three years from 2025-2027; construction of the turnouts would occur over two years from 2026-2027; construction of the wellhead treatment, AWPF and the pump stations would occur over one year, 2027; and the storage reservoir would be constructed at the end of 2027.

2.1.8 Construction Best Management Practices

The Proposed Project would comply with applicable State regulations including:

- All portable diesel-powered construction equipment shall be registered with the state's portable equipment registration program or shall obtain a South Coast Air Quality Management District (SCAQMD) permit.
- Fleet owners of mobile construction equipment are subject to the California Air Resource Board (CARB) Regulation for In-Use Off-Road Diesel Vehicles (Title 13, California Code of Regulations (CCR), §2449), the purpose of which is to reduce oxides of nitrogen (NO_x), diesel particulate matter (DPM), and other criteria pollutant emissions from in-use off-road diesel-fueled vehicles. Off-road heavy-duty trucks shall comply with the State Off-Road Regulation.

- Fleet owners of mobile construction equipment are subject to the CARB Regulation for In-Use (On-Road) Heavy-Duty Diesel-Fueled Vehicles (Title 13, CCR, §2025), the purpose of which is to reduce DPM, NO_x and other criteria pollutants from in-use (on-road) diesel-fueled vehicles. On-road heavy-duty trucks shall comply with the State On-Road Regulation.
- All commercial off-road and on-road diesel vehicles are subject, respectively, to Title 13, CCR, §2449(d)(3) and §2485, limiting engine idling time. Idling of heavy-duty diesel construction equipment and trucks during loading and unloading shall be limited to five minutes; electric auxiliary power units should be used whenever possible.

The Project would be subject to SCAQMD Rule 403, Fugitive Dust. Rule 403 requires the implementation of best available dust control measures during activities capable of generating fugitive dust.

2.2 Operation

Operations and maintenance (O&M) for each of the Proposed Project's key facilities is briefly described below.

Wells: The injection wells would recharge up to 15,000 AFY per year, while the new extraction wells would pump up to 50,000 AFY of water from the Basin in call years, or 10,000 AFY in non-call years (only 7.5 call years are anticipated over a 25-year period). After the 25-year period in which the CBP would be active, IEUA member agencies could utilize the water purified at the AWPF in the amount of 15,000 AFY. The 16 injection wells would have a maximum operational capacity of 830 gpm each. The 17 extraction wells would have a maximum operational capacity of 2,000 gpm each. All energy demands would be met by electricity supplied by Southern California Edison. The four monitoring wells would be visited by a field technician on a monthly to quarterly frequency. There would be negligible energy consumption in obtaining groundwater levels from the monitoring wells. Ongoing operation and maintenance of the wells may involve periodic backwash and inspection.

AWPF: The AWPF would include various processes and facilities, including an MF System, RO System, Equalization Tank, UV-AOP System, Chemical Facilities, Post Treatment, and CIP Systems. It is assumed that the AWPF would involve daily inspections and maintenance of treatment processes, daily backflush and maintenance cleans, more rigorous weekly to monthly cleans, and weekly deliveries of chemicals and supplies to the AWPF. The Reverse Osmosis (RO) system would require chemical cleaning and inspection monthly and membranes would be replaced every five years. All energy demands would be met by electricity supplied by Southern California Edison or from onsite sources at the RP-4; the Proposed Project would not consume natural gas.

Other Well Treatment Facilities: The CBP may install up to three wellhead treatment facilities at locations that have yet to be selected but would be sited at existing member agency offline wells. These wellhead treatment systems would be capable of treating up to 3,000 AFY per wellhead treatment system. Each of the three wellhead treatment systems would be connected to three existing member agency wells (total of nine existing extraction wells used for the CBP). The Wellhead treatment facilities would require routine inspection and maintenance of the treatment processes. Wellhead treatment would also include the following brine conveyance and disposal:

- Disposal Capacity: 4,900 gpd per wellhead treatment system
- Pipeline Length: up to 6,800 LF (8-inch)
- Disposal System: Assumed utilization of IEBL

Brine Disposal: The additional brine stream flow from the AWPF at RP-4 would be 1,027,300 gpd. The brine stream flow from the AWPF would ultimately need to be treated by the Los Angeles County Sanitation District (LACSD) through the Joint Outfall System (JOS) or by the Orange County Sanitation District (OCSD).

Pipelines and Turnouts: Once a pipeline or turnout is installed, operations would not require any operations and maintenance visits unless unforeseen circumstances arise that would require maintenance or repair of the pipelines. In the event of routine maintenance, one vehicle trip per maintenance event would be required.

Pump Stations: A total of four pump stations will be installed. It is assumed that the three TAKE Pump stations would range between 650 HP to 9,300 HP, with the booster pumps averaging 4,200 HP each. The PUT pump station would operate at 1,500 HP. All energy demands would be met by electricity supplied by Southern California Edison. The pump stations would require routine inspection and maintenance.

Water Storage Tank: Once the reservoirs are installed, operation of the reservoir would not require any shifts or employees as it would be monitored and controlled remotely. Scheduled maintenance visits would occur in the future with one trip per maintenance event. Reservoirs typically do not directly consume energy as water or recycled water is pumped into reservoirs directly from wells or through booster pump stations.

Renewable Energy: In-conduit hydropower facilities may be considered in locations of the potable water distribution system where the system pressure needs to be reduced and energy can be produced. Current renewable on-site generation at RP-4, which shares the same Southern California Edison (SCE) meter with the Inland Empire Regional Composting Facility (IERCF), is about 20%. In addition to the 1 MW wind turbine and 1.5 MW battery at RP-4, additionally, there is a potential for use of a 2.5 MW solar at the IERCF. As the Proposed Project has not undergone site specific design, at this time, alternative energy options would be explored when design has been further specified.

According to the IEUA Facilities Management Plan, over the course of the next 15 years, IEUA intends to procure 100 percent of its electricity needs from carbon neutral sources, so in that period of time, IEUA will slowly begin to use less carbon sourced energy for greater operational demands. Additionally, the Proposed Project would create a source of local water supply within the Chino Basin, which would offset the energy required to transfer water from MWD from the Sacramento-San Joaquin Delta to IEUA's service area.

3. ENVIRONMENTAL SETTING

California has a diverse portfolio of energy resources, including crude oil, natural gas, and renewable resources, such as geothermal, solar, and wind. According to the U.S. Energy Information Administration, in 2021 California's net electricity generation by source consisted of 8,662 thousand MWh of natural gas fired sources, 1,544 of hydroelectric, 1,634 of nuclear, and 6,423 MWh of non-hydroelectric renewables; no electricity was sourced from coal or petroleum-fired sources. Energy efficiency efforts have dramatically reduced statewide per capita energy consumption relative to historical averages. In 2018, per capita energy consumption in California was the fourth-lowest in the country (U.S. Energy Information Administration 2021). Additionally, with the passage of California Senate Bill (SB) 100 in 2018, California will be required to obtain 100 percent of its retail electricity from renewable sources by 2045. Despite reductions in per-capita energy consumption, overall demand is expected to go up in the next decade (California Energy Commission [CEC] 2021).

The CBP electricity demand would be served by SCE. SCE provides electric power to more than 15 million persons in 15 counties and in 180 incorporated cities, within a service area encompassing approximately 50,000 square miles. Based on SCE's 2019 Power Content Label (SCE 2020), SCE derives electricity from varied energy resources including: fossil fuels, hydroelectric generators, nuclear power plants, geothermal power plants, solar power generation, and wind farms. SCE also purchases from independent power producers and utilities, including out-of-state suppliers. The table below summarizes SCE's Power Content Label, compared to the California Power Mix.

Table 5: SCE and California 2019 Power Content Mix

Energy Resources	SCE Power Mix	CA Power Mix
Renewable:	35.1%	31.7%
Biomass & Biowaste	0.6%	2.4%
Geothermal	5.9%	4.8%
Eligible Hydroelectric	1.0%	2.0%
Solar	16.0%	12.3%
Wind	11.5%	10.2%
Coal	0.0%	3.0%
Large Hydroelectric	7.9%	14.6%
Natural Gas	16.1%	34.2%
Nuclear	8.2%	9.0%
Other	0.1%	0.2%
Unspecified*	32.6%	7.3%
Total	100%	100%
*Unspecified power is electricity that has been purchased through open market transactions and is not traceable to a specific generation source.		

3.1 Regulatory Setting

This section discusses applicable federal, state, regional, and local rules and regulations surrounding energy use and energy resources.

3.1.1 Federal Regulations

National Energy Conservation Policy Act. The National Energy Conservation Policy Act serves as the underlying authority for federal energy management goals and requirements. Signed into law in 1978, it is regularly updated and amended by subsequent laws and regulations. This act is the foundation of most federal energy requirements.

National Energy Policy Act of 2005. The National Energy Policy Act of 2005 sets equipment energy efficiency standards and seeks to reduce reliance on nonrenewable energy resources and provide incentives to reduce current demand on these resources. For example, under the Act, consumers and businesses can attain federal tax credits for purchasing fuel-efficient appliances and products, including hybrid vehicles; constructing energy-efficient buildings; and improving the energy efficiency of commercial buildings. Additionally, tax credits are available for the installation of qualified fuel cells, stationary microturbine power plants, and solar power equipment. Executive Order 13423 (Strengthening Federal Environmental, Energy, and Transportation Management), signed in 2007, strengthens the key energy management goals for the federal government, and sets more challenging goals than the Energy Policy Act of 2005. The energy reduction and environmental performance requirements of Executive Order 13423 were expanded upon in Executive Order 13514 (Federal Leadership in Environmental, Energy, and Economic Performance) signed in 2009 (Federal Register 2009).

U.S. Department of Energy Integral Horsepower Motor Rule (10. CFR Part 431). The U.S. Department of Energy (DOE) Integral Horsepower Motor Rule, effective as of June 1, 2016, establishes efficiency requirements that cover 1-500 HP (0.75 370 kW) three phase electric motors. This law superseded the existing Energy Independence and Security Act of 2007. Several categories of motors were previously covered at lower efficiency levels or exempt. The motors regulated under the expanded scope meet the following nine characteristics: 1) Is a single speed motor; 2) Is rated for continuous duty (MG 1) operation or for duty type S1 (IEC); 3) Contains a squirrel-cage (MG 1) or cage (IEC) rotor; 4) Operated on polyphase alternating current (AC) 60-hertz sinusoidal line power; 5) Has 2-, 4-, 6-, or 8-pole configuration; 6) Is rated 600 volts or less; 7) Have a three or four-digit NEMA frame size (or IEC metric equivalent), including those designs between two consecutive NEMA frame sizes (or IEC metric equivalent) or an enclosed 56 NEMA Frame size (or IEC metric equivalent); 8) Has no more than 500 HP, but greater than or equal to 1 HP (or kilowatt equivalent); 9) Meets all the performance requirements of a NEMA design A, B or C electric motor or an IEC design N or H electric motor. As indicated above, the voltage range for motors covered by the scope of the policy includes those less than 600 volts, and less than 500 HP. Submersible motors are not covered under this rule (CFR 2019).

Corporate Average Fuel Economy (CAFE) Standards. The Corporate Average Fuel Economy standards were first enacted by Congress in 1975, requiring vehicle manufacturers to comply with the gas mileage or fuel economy standards. These standards are set and regulated by the National Highway Traffic Safety Administration, with testing and data support from the United States Environmental Protection Agency (EPA). The issued rules include fuel economy standards for light-, medium- and heavy-duty vehicles.

For light-duty vehicles, National Highway Traffic Safety Administration (NHTSA) and EPA issued a joint final rulemaking on October 15, 2012, to establish coordinated standards to improve fuel economy for vehicle model years 2017 through 2025 (77 FR 62624). EPA established standards that are projected to require, on an average industry fleet wide basis, 54.5 miles per gallon; the NHTSA standards are projected to require, on an average industry fleet wide basis, a range from 40.3-41.0 miles per gallon. For medium- and heavy-duty vehicles, EPA and NHTSA issued a final rule on December 27, 2016 on Greenhouse Gas (GHG) standards and fuel consumption standards for engines and vehicles model years 2018 through 2029 (81 FR 73478).

On April 2, 2018, the EPA issued the Mid-term Evaluation Final Determination, finding that the GHG standards for model years 2022-2025 should be revised, and that EPA and NHTSA should further consider appropriate standards for model year 2022-2025 light-duty vehicles. In September 2019, NHTSA and the EPA released the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part 1, which revoked California's waiver under the Clean Air Act allowing it to establish stricter emissions standards. In March 2020, EPA and NHTSA released SAFE Part 2, which set new fuel economy and emissions standards for model years 2021-2026 (increasing the stringency of emissions standards by 1.5 percent each year for model years 2021-2026, as compared with the standards issued in 2012, which would have required about 5 percent annual increases). In January 2021, the Biden administration directed EPA and NHTSA to review SAFE Part 1 and SAFE Part 2. NHTSA's CAFE Preemption Rule and EPA's reconsideration notice, issued in April 2021, dealt with SAFE Part 1, rescinding NHTSA's preemption determination and reconsidering EPA's waiver revocation. The waiver withdrawal reconsideration is still pending. New CAFE standards were proposed in August 2021, which would set standards for passenger cars and light trucks for model years 2024-2026.

Clean Power Plan and Affordable Clean Energy. In 2012, the EPA proposed performance standards for carbon dioxide (CO_2) emissions for new electricity generation from fossil fuels. New sources greater than 25 megawatts were required to meet the standard of 1,000 pounds of CO_2 per megawatt-hour. However, in 2016 a stay of this rule was ordered due to pending litigation. The 2015 Clean Power Plan, which also aimed to reduce power sector emissions, never took effect due to legal action, and was officially repealed in June 2019 when EPA issued the Affordable Clean Energy rule, which established new emission guidelines for power sector emissions. In January 2021, the D.C. Circuit Court vacated the Affordable Clean Energy Rule and remanded to EPA for reconsideration.

3.1.2 State Regulations

California Energy Action Plan. California's Energy Action Plan II, developed by the California Public Utility Commission (CPUC) and the CEC, is the state's principal energy planning and policy document (CPUC and CEC 2008). The plan describes a coordinated implementation plan for state energy policies and refines and strengthens California's original Energy Action Plan I published in 2003. California Energy Action Plan II identifies specific action areas to ensure that

California's energy is adequate, affordable, technologically advanced, and environmentally sound. It adopts a loading order of preferred energy resources to meet the state's needs and reduce reliance on natural gas and other fossil fuels. The plan identifies energy efficiency and demand response as the primary ways to meet the energy needs of California's growing population, and it identifies renewable energy and distributed generation as the best ways on the supply side. To the extent that energy efficiency, demand response, renewable resources, and distributed generation are unable to satisfy increasing energy and capacity needs, CEC supports clean and efficient fossil fuel-fired generation. The 2008 Energy Action Plan Update provided a status update to the 2005 Energy Action Plan II and continues the goals of the original California Energy Action Plan (CPUC and CEC 2008).

Integrated Energy Policy Report. Senate Bill 1389 (Bowen, Chapter 568, Statutes of 2002) requires the CEC to, "[C]onduct assessments and forecasts of all aspects of energy industry supply, production, transportation, delivery and distribution, demand, and prices. The CEC shall use these assessments and forecasts to develop energy policies that conserve resources, protect the environment, ensure energy reliability, enhance the state's economy, and protect public health and safety" (Public Resources Code § 25301a). The CEC adopts an Integrated Energy Policy Report (IEPR) every two years and an update every other year. The 2021 IEPR, the draft of which will be released October 2021, will address four major topics: energy reliability over the next five years; natural gas outlook and assessments; building decarbonization and energy efficiency; and energy demand.

California Renewables Portfolio Standard and Senate Bill 100. In September 2002, SB 1078 was enacted, establishing the Renewables Portfolio Standard (RPS) program. The RPS requires retail sellers of electricity, including electrical corporations, community choice aggregators, and electric service providers, to purchase a specified minimum percentage of electricity generated by eligible renewable energy resources such as wind, solar, geothermal, small hydroelectric, biomass, anaerobic digestion, and landfill gas. The targets for the minimum percentage of renewable energy have increased with subsequent pieces of legislation, with the most recent being set by SB 100 in 2018. SB 100 revised previous renewable portfolio standards for electricity retail sales. SB 100 requires that 50 percent of power must come from renewable resources by December 31, 2026 and that 60 percent of power must come from renewable sources by December 31, 2030. The legislation also establishes a State policy that eligible renewable energy resources and zero-carbon resources supply 100 percent of retail sales of electricity to California end-use customers and 100 percent of electricity procured to serve all state agencies by December 31, 2045.

The Proposed Project would be served by SCE. SCE has historically met the RPS targets. The CPUC enforces compliance of all utilities in the state with the RPS and tracks progress toward meeting targets for renewable energy production to ensure that 100 percent of the state's electricity comes from renewable and carbon-free sources by 2045. The CPUC imposes fines for non-compliance with program requirements. In its 2020 California Renewables Portfolio Standard Annual Report, the CPUC reported that the three large utilities in the state (Pacific Gas & Electric, SCE and San Diego Gas & Electric) "are on track to meet their 60 percent 2030 RPS procurement mandate." The 2019 target for renewable energy was 31 percent and in 2019, SCE had achieved 38 percent renewable energy; SCE has thus already exceeded the 33 percent requirement for 2020 (CPUC 2020). Given the progress to date, the CPUC states that all three large utilities "are currently forecasted to continue to surpass RPS requirements and have excess procurement for the next seven years" (CPUC 2020). SCE is meeting its renewable energy requirements using a mix of biopower, geothermal power, small hydroelectric power, solar photovoltaic power, solar thermal power, and wind power (CPUC 2020).

Senate Bill 350. The Clean Energy and Pollution Reduction Act (Senate Bill 350) established clean energy, clean air, and GHG reduction goals, including reducing GHG to 40 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2050. SB 350 also requires the state to double statewide energy efficiency savings in electricity and natural gas end uses by 2030. To help meet these goals and reduce GHG emissions, large utilities will be required to develop and submit integrated resource plans (IRPs). These plans detail how utilities will meet their customers' resource needs, reduce GHG emissions, and ramp up the use of clean energy resources.

EO N-79-20. In September 2018, the Governor issued EO N-79-20, requiring that all new passenger cars and trucks sold in the state be zero-emission by 2035. A further goal is that all medium- and heavy-duty vehicles in California be zero-emission by 2045 for all operations where feasible, and that all off-road vehicles and equipment be zero-emission by 2035 where feasible.

Assembly Bill 1493. AB 1493 (2002) required the California Air Resources Board (CARB) to develop and implement regulations to reduce automobile and light truck GHG emissions. These stricter emissions standards, referred to as "Pavley" standards, apply to automobiles and light trucks beginning with the 2009 model year. Litigation was filed by automakers, challenging these regulations. EPA initially denied California's related request for a waiver to allow California to regulate vehicle emissions beyond EPA requirements, but a waiver subsequently was granted. Pavley I regulates model years from 2009 to 2016 and Pavley II, which is now referred to as "LEV (Low Emission Vehicle) III GHG," regulates model years from 2017 to 2025. The Advanced Clean Cars I program coordinates the goals of the LEV, Zero Emissions Vehicles (ZEV), and Clean Fuels Outlet programs. The Advanced Clean Cars Program is projected to lower GHG emissions from new automobiles by 40 percent compared to 2012 model years in 2025 (CARB 2019). In 2021, CARB began a series of public workshops to solicit input on the development of the Advanced Clean Cars II regulations. The Advanced Clean Cars II regulations will seek to reduce criteria pollutant and GHG emissions from new light- and medium-duty vehicles beyond the 2025 model year, and increase the number of ZEVs for sale.

In-Use Off-Road Diesel Vehicle Regulation. In 2007, CARB adopted a regulation to reduce diesel particulate matter and nitrogen oxide (NOx) emissions from in-use (existing) off-road heavy-duty diesel vehicles in California. The regulation imposes limits on unnecessary vehicle idling to five minutes and requires fleets to reduce emissions by retiring, replacing, repowering, or installing exhaust retrofits to older engines. The restrictions on adding older vehicles into fleets vary by fleet size. Heavy-duty diesel vehicle fleets may not add a vehicle with a Tier 0 or Tier 1 engine. For large and medium fleets, and in January 2023 for small fleets, a fleet may not add a vehicle with a Tier 2 engine, rather the engine must be Tier 3 or higher. By 2029, all fleets' vehicles must have Tier 2 or higher engines. This regulation would apply to vehicles used in construction of the Proposed Project.

Truck and Bus Regulation. On December 12, 2008, CARB approved a new regulation to substantially reduce emissions of diesel particulate matter, NOx, and other pollutants from existing on-road diesel vehicles operating in California. The regulation requires affected trucks and buses to meet performance standards and requirements between 2011 and 2023. By January 1, 2023, nearly all trucks and buses will be required to have 2010 or newer model year engines. Affected vehicles included on-road, heavy-duty, diesel-fueled vehicles with a gross vehicle weight rating greater than 14,000 pounds. The regulation was updated in 2011, with revisions that provide more compliance flexibility and reflect the impact of the economic recession on vehicle activity and emissions. Heavy-duty trucks used in Proposed Project activities would have to comply with this regulation.

Commercial Vehicle Idling Regulation. The Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling was initially adopted by CARB in 2004 and subsequently amended in 2005, 2009, and 2013. This regulation requires that drivers of diesel-fueled commercial motor vehicles with gross vehicle weight ratings greater than 10,000 pounds, including buses and sleeper berth equipped trucks, not idle the vehicle's primary diesel engine longer than five minutes at any location. There are exceptions if a truck engine meets the optional low-NOx idling emission standard, and the truck is located more than 100 feet from any restricted area (clean idle label required), which include: housing units, schools, hotels, motels, hospitals, senior care facilities, or childcare facilities. Trucks used for vendor delivery and material hauling for Proposed Project activities would be required to comply with the commercial vehicle idling regulatory requirements.

Heavy-Duty On-Board Diagnostic System Regulations. In 2016, CARB approved the latest version of the Heavy-Duty On-Board Diagnostic systems regulations to reduce emissions by establishing standards and other requirements for onboard diagnostic systems that are installed in 2010 and subsequent model-year engines. The systems, through the use of an onboard computer, monitor emission systems in-use for the actual life of the engine and must be capable of detecting malfunctions of the monitored emission systems, illuminating a malfunction indicator light to notify the vehicle operator of detected malfunctions, and storing fault codes identifying the detected malfunctions. The use and operation of On-Board Diagnostic systems reduces in-use motor vehicle and motor vehicle engine emissions through improvements of emission system durability and performance. Heavy-duty trucks used for Proposed Project activities would be required to comply with the On-Board Diagnostic systems regulatory requirements.

Heavy-Duty Diesel Vehicle Enforcement. The CARB's Heavy-Duty Vehicle Inspection Program requires heavy-duty trucks and buses to be inspected for excessive smoke and tampering, and engine certification label compliance. Any heavy-duty vehicle (i.e., vehicles with a gross vehicle weight rating greater than 6,000 pounds) traveling in California, including vehicles registered in other states and foreign countries, may be tested. Tests are performed by CARB inspection teams at border crossings, California Highway Patrol weigh stations, fleet facilities, and randomly selected roadside locations. The related Periodic Smoke Inspection Program requires that diesel fleet owners conduct annual smoke opacity inspections of their vehicles and repair those with excessive smoke emissions to ensure compliance. CARB randomly audits fleets, maintenance and inspection records and tests a representative sample of vehicles. All vehicles that do not pass the test must be repaired and retested. In July 2018, CARB approved amendments to the regulations, which require heavy-duty vehicles to meet a more stringent opacity limit of 5 percent opacity for most vehicles. The new opacity limit went into effect July 1, 2019. In addition, each vehicle operating in California - including those in transit from Mexico, Canada, or any other state - must be equipped with engines that meet California and/or EPA or equivalent emission standards and must maintain an Emission Control Label. Heavy-duty trucks used for Proposed Project activities would be subject to these inspection programs.

California Diesel Fuel Program. The California diesel fuel program set stringent standards for California diesel that produced cost-effective emission reductions from diesel-powered vehicles. The diesel fuel program set specifications for aromatic hydrocarbons and sulfur and also established a lubricity standard.

Title 24. California's energy code is designed to reduce wasteful and unnecessary energy consumption in newly constructed and existing buildings. The CEC updates the Building Energy Efficiency Standards (Title 24, Parts 6 and 11) every three years. The 2019 Building Energy Efficiency Standards took effect on January 1, 2020. The updates focused on four key areas: smart residential photovoltaic systems, updated thermal envelope standards (preventing heat transfer from the interior to exterior and vice versa), residential and nonresidential ventilation requirements, and nonresidential lighting requirements. The 2019 standards also establish requirements for newly constructed healthcare facilities. The Building Energy Efficiency Standards would apply to the facilities of the Proposed Project.

Model Water Efficient Landscape Ordinance. Water use and energy use are highly interconnected, meaning that water use efficiency often results in energy savings. New development and retrofitted landscape water efficiency standards are governed by the Model Water Efficient Landscape Ordinance (MWELO). All agencies must adopt, implement, and enforce the MWELO or a more stringent ordinance. Projects that include landscape areas of 500 square feet or more are subject to the MWELO. The MWELO sets requirements related to irrigation, grading, recycled water, stormwater, and public education.

4. METHODOLOGY

This impact analysis is based on relevant Project information and consideration of applicable state and local regulations for renewable energy or energy efficiency. The Project would consume energy from both construction and operation. Energy consumption can also be considered in terms of direct and indirect impacts, where direct impacts would be, for example, the fuel for construction vehicles, and indirect impacts would come from the demand for electricity from SCE. The Proposed Project energy use and energy demands were developed based on information in the Project Description chapter of the PEIR. This Project information is summarized in detail in Sections 2.1.1 through 2.1.6. This analysis also relied on default values from the California Emissions Estimator Model (CalEEMod) version 2020.4.0 computer program for information that was not available in the Project Description, such as construction equipment HP and load factor values. As explained in Section 2.1.7, it was assumed that construction of the Proposed Project would commence in 2025 and proceed through the start of operations of the AWPF in 2028.

5. SIGNIFICANCE THRESHOLDS

The criteria used to determine the significance of potential Project-related energy impacts are taken from the Initial Study Checklist in Appendix G of the State CEQA Guidelines (14 California Code of Regulations §§15000, et seq.). In addition, Appendix F of the State CEQA Guidelines states that EIRs may include a discussion of the potential energy impacts of proposed projects and presents a list of items that may be considered in the EIR impact analysis. Based on these thresholds, the Project would result in a significant impact related to energy if it would:

a) Result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation.

b) Conflict with or obstruct existing energy standards, or a state or local plan for renewable energy or energy efficiency.

6. PROJECT IMPACTS

6.1 Proposed Project Energy Consumption

6.1.1 Construction

During construction, the Proposed Project would use energy primarily as fuel for the construction vehicle fleet, and trips to transport workers, materials, and supplies to and from the sites. The estimated construction vehicle fleet and trips are described in Sections 2.1.1 through 2.1.6 and summarized in Table 3 and Table 4. Consumption of fuel during construction would be temporary, and would not represent an ongoing, long-term demand. The Proposed Project would adhere to applicable regulations for reducing criteria air pollutant emissions and consequently conserve energy, including the in-use, off-road vehicle regulation, which limits unnecessary vehicle idling to five minutes and requires older, and less fuel-efficient, construction equipment to be retired and, heavy-duty diesel vehicle enforcement which requires any vehicle operating in California to be equipped with an engine that meets California emissions standards. Construction would involve equipment and trips that are typical for the type of facilities being constructed and would not involve excessive or unnecessary consumption of fuel. With compliance with existing applicable regulations, Proposed Project construction energy consumption would not be considered inefficient, wasteful or unnecessary.

6.1.2 Operation

The Proposed Project would be energy intensive. It would require electricity for treatment, conveyance, injection, and extraction. The Project would not consume natural gas. A summary of the estimated annual energy usage of operation of each component of the Proposed Project, based on similar projects in Southern California (Carpinteria Valley Water District 2019, Sanchez elec. comm. 2020), is presented below:

- Injection well: 5 kWh per AF per well
- Extraction well: 100 kWh per AF per well
- AWPF: 1,665 kWh per AF
- Pump station: 600 kWh per AF
- Wellhead treatment: 10 kWh per AF
- Brine treatment and disposal: 625 kWh per AF

Energy consumption from the groundwater monitoring wells would be negligible. The Storage Reservoir would not directly consume energy, as water would be pumped into it directly from wells or through booster pump stations. The pipelines and turnouts would not consume energy once constructed.

Long-term operation of the Proposed Project would also involve occasional vehicle trips for operations and maintenance of the Proposed Project facilities. However, these activities are assumed to result in a negligible amount of energy consumption because the Project facilities would be largely monitored remotely. The Proposed Project facilities would require no more than five to six trips per day, on average, for inspections, testing, and maintenance and these trips would be largely incorporated into existing IEUA operations activities.

The approximate energy requirements from the Proposed Project are summarized in Table 6 for operations of the Proposed Project in a "call year" and "non-call year."

Table 6: Proposed Project Annual Energy Use

Project Component	kWh/ AF	Qty	Call Year		Non-Call Year	
			AFY	MWh/ year	AFY	MWh/ year
Injection wells	5	16	15,000	75	15,000	75
Extraction wells	100	17	50,000	5,000	10,000	1,000
Pump stations	600	4	50,000	30,000	10,000	6,000
AWPF	1,665	1	17,000	28,305	17,000	28,305
Wellhead treatment	10	3	17,000	170	17,000	170
Brine disposal	625	1	1,167	730	1,167	730

Although the Proposed Project would require the consumption of energy, it would not do so in an inefficient or wasteful manner. The Project would be in compliance with existing regulations for building energy efficiency. In addition, the CBP would explore options for new, on-site energy generation facilities, such as in-conduit hydropower facilities in locations of the potable water distribution system where the system pressure needs to be reduced and energy can be produced. Furthermore, in "call years" water that would otherwise have been transported to MWD via the SWP would remain in northern California, which would save a substantial amount of energy. The amount of electricity required to supply, treat, and distribute water in Southern California is approximately 11,111 kWh/million gallons (California Air Pollution Control Officers Association [CAPCOA] 2010), or 3,621 kWh/AF. Thus, in "call years" when the CBP would avoid import of 50,000 AFY of water from the SWP, it would conserve approximately up to 181,000 MWh of electricity.

Finally, investment in local water supplies that offsets the need for imported water is seen as necessary to begin to reduce the amount of energy associated with water conveyance in the State. The 2017 Climate Change Scoping Plan (CARB 2017) recognizes that about two percent of the total energy used in the state is related to water conveyance; it calls for, "increased water conservation and efficiency, improved coordination and management of various water supplies, greater understanding of the water-energy nexus, deployment of new technologies in drinking water treatment, groundwater remediation and recharge, and potentially brackish and seawater desalination." With compliance with existing applicable regulations, Proposed Project operational energy consumption would not be considered inefficient, wasteful or unnecessary. Impacts would be less than significant and no mitigation would be required.

6.2 Consistency with Plans and Standards

The Proposed Project would develop a local water supply and would reduce the demand for energy required to import water from the SWP to Southern California. In this way, the Proposed Project would be consistent with Statewide plans that address the energy-intensity of the State's water delivery systems. An overarching goal of the 2017 Climate

Change Scoping Plan is to "make conservation a California way of life by using and reusing water more efficiently through greater water conservation, drought tolerant landscaping, stormwater capture, water recycling, and reuse to help meet future water demands and adapt to climate change." The 2017 Climate Change Scoping Plan notes recycled water has the potential to reduce overall energy use and GHGs if it replaces (rather than serves as an alternative to) an existing water supply with higher GHG emissions. The Proposed Project would replace imported SWP water, which is energy-intensive, with a local, recycled water source in "call years." Furthermore, the Project would procure energy from SCE, which has historically achieved the RPS and anticipates meeting the RPS of 60 percent renewable energy by 2030. IEUA would explore options for additional on-site renewable energy, including use of a 2.5 MW solar at the IERCF and in-conduit hydropower facilities in locations of the potable water distribution system where the system pressure needs to be reduced and energy can be produced. As such, the Proposed Project would not obstruct a plan for renewable energy or energy efficiency. Impacts would be less than significant and no mitigation would be required.

6.3 CEQA Guidelines Appendix F Considerations

Most of the Proposed Project's energy needs would be met by SCE, although the proposed AWPF may receive a portion of its energy needs from onsite sources at the RP-4. SCE (2021) provides electric power to more than 15 million people in 15 counties and in 180 incorporated cities, within a service area encompassing approximately 50,000 square miles. In 2015, SCE delivered more than 87 billion kWh of electricity. SCE maintains an electrical system with 12,635 miles of transmission lines, 720,800 distribution transformers, and 2,959 substation transformers. The CBP annual electricity demand in "call years" (approximately 64,280 MWh/year) would be roughly 0.07% of SCE's total annual electricity service (87 million MWh/year). In "non-call years" the CBP annual electricity demand (approximately 36,280 MWH/year) would be roughly 0.04% of SCE's total annual electricity deliveries. Thus, the Proposed Project's energy demand is minimal compared to SCE's overall total annual electricity service. IEUA, as part of Project planning, would coordinate with SCE to ensure adequate electrical service capacity and distribution facilities are available. If necessary, IEUA would coordinate and develop additional sources of supply to meet the CBP's energy needs, and thus would not be expected to impact local and regional energy supplies, including peak and base period supplies.

6.4 Cumulative Impacts

The geographic scope of the cumulative impact analysis for energy is the SCE service area because the Proposed Project would procure electricity primarily from SCE. A substantial cumulative impact would occur if the Project were to impact SCE's energy supplies, require additional capacity, or exceed SCE's ability to meet peak demand. Cumulative growth in the Project Area would affect regional energy demand. SCE energy demand planning is based in future growth predictions based on the general plans of local jurisdictions. For this reason, development consistent with the applicable general plan would also be consistent with SCE demand planning. Cumulative development within the SCE service area is not anticipated to result in a significant impact in terms of impacting energy supplies because the majority of cumulative projects would be consistent with their respective general plans and the growth anticipated by SCE. The Proposed Project and cumulative projects would also be required to comply with the California Energy Code. The CBP would serve water supply needs for existing and planned water demand and would not result in or accommodate unplanned growth. Therefore, the CBP, in combination with other cumulative projects, impacts would not be cumulatively considerable with respect to energy impacts.

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APPENDIX 9

Greenhouse Gas Technical Report

GREENHOUSE GAS TECHNICAL REPORT

October 2021

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Inland Empire Utilities Agency
Chino Basin Program

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ATTACHMENTS

1. INTRODUCTION

This report describes environmental and regulatory setting related to greenhouse gases and climate change in the proposed Chino Basin Program (CBP, or Proposed Project) area. The report then describes the methodology and thresholds relied upon to assess the impacts of the Proposed Project. Finally, it identifies the impacts of the Proposed Project. This report discusses the Proposed Project impacts associated with emissions of greenhouse gases.

2. PROJECT DESCRIPTION

The CBP consists of an advanced water purification facility (AWPF), injection wells, extraction wells, groundwater treatment facilities, and a pipeline distribution network connecting the proposed facilities to local agencies and Metropolitan Water District of Southern California (MWD) for a water exchange with the State Water Project (SWP). The CBP AWPF and groundwater injection facilities would allow for the recharge/storage of up to 15,000 acre-feet per year (AFY) of recycled water in the Chino Basin, creating a new local supply. The AWPF would process 17,000 AFY of recycled water, which includes currently unused recycled water and 6,000 AFY of external supplies; 2,000 AFY of water will be lost through the AWPF process each year. The CBP would connect CBP potable water facilities to the region, as well as connections to MWD with the ability to pump CBP potable supplies into MWD's water distribution system. This connection would allow the CBP to make 50,000 AFY available to MWD in dry or critically dry years in exchange for the same amount of supply from the SWP. In return, 50,000 AFY that would otherwise have been exported to MWD would be stored in Lake Oroville and used to enhance instream flows in the Feather River. Figure 1 shows a proposed conceptual layout of the key facilities.

The CBP will provide for an exchange of new water supplies in the Chino Basin for SWP supplies in Lake Oroville in northern California that would otherwise be delivered to southern California. The additional Lake Oroville water would subsequently be released in the form of pulse flows in the Feather River to improve habitat conditions for native salmonids and achieve environmental benefits. The 15,000 AFY of new water supply would be produced for a period of 25 years to provide for the State exchange, to be used in blocks of up to 50,000 AFY in dry and critical years when pulse flows in the Feather River would provide the most ecosystem benefit. The term for this exchange will be fixed at 25 years for a total volume of 375,000 acre-feet, after which time the CBP will be devoted to meeting local water management needs while fulfilling commitments to improve water quality in the Chino Basin and provide a source of emergency water supply. The program would be administered through agreements with California Department of Water Resources (DWR), California Department of Fish and Wildlife (CDFW), MWD, and other project partners. For every acre-foot (AF) of water requested for north of the Delta ecosystem benefits, IEUA would pump locally stored groundwater and deliver it to MWD or use the water locally instead of taking raw imported water from MWD. MWD would then leave behind an equivalent amount of water in Lake Oroville to be dedicated and released for the requested ecosystem benefit. The 375,000 AF would be recharged over 25 years and the same amount would be extracted over 25 years.

Figure 1: Conceptual Chino Basin Program Infrastructure

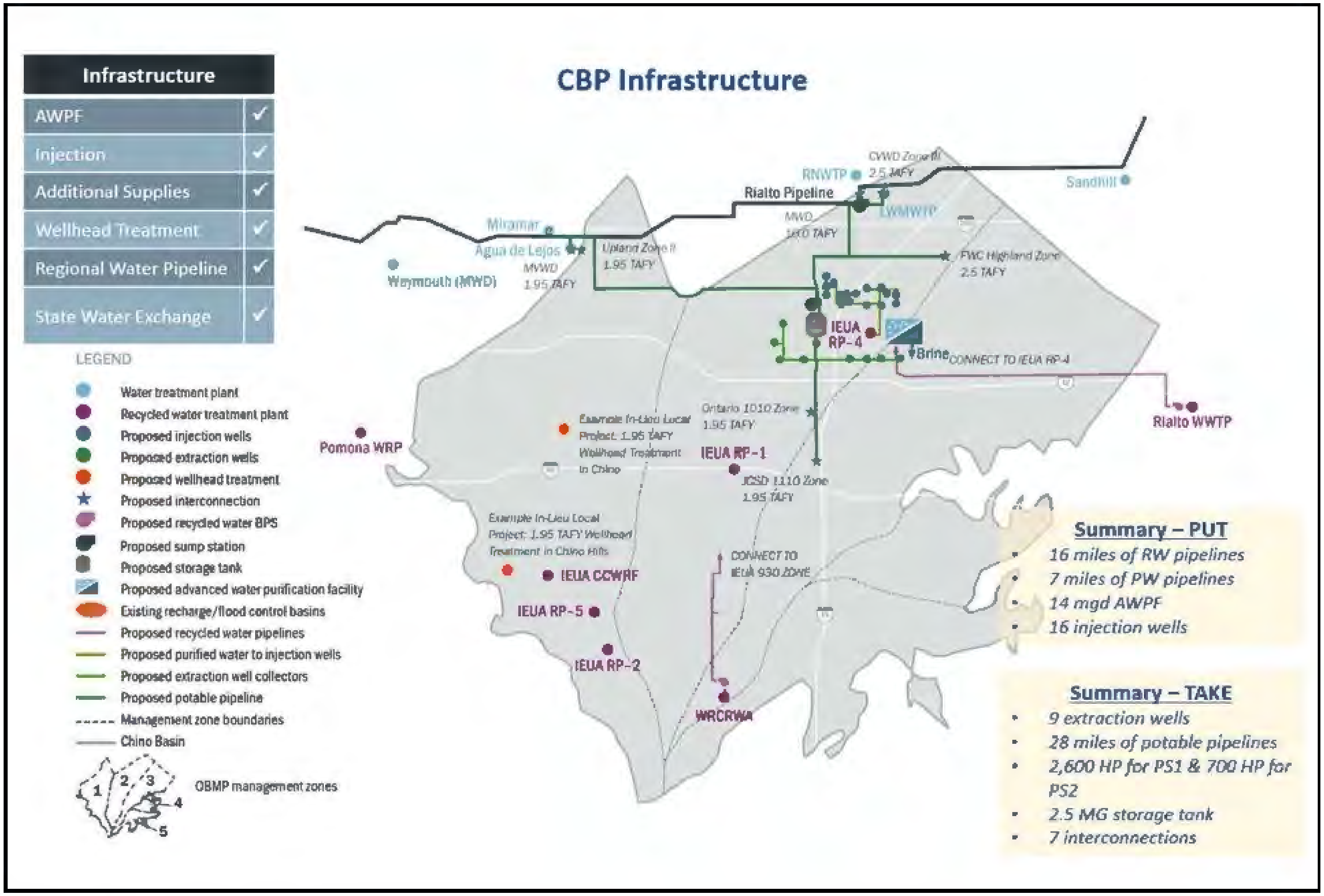


FIGURE 1

Tom Dodson & Associates *Environmental Consultants*	**CBP Infrastructure**

The Proposed Project includes two main categories of facilities: "Put" and "Take" components. The "Put" facilities include the components to recharge purified water to the Chino Basin, while the "Take" facilities include the components to extract groundwater and convey potable water supply from the Chino Basin. These components are summarized in Table 1 and described in detail in Table 2.

Table 1: Summary **of "Put" and "Take" Components of the Chino Basin Program**

"Put" Components	**"Take"** Components
• Tertiary recycled water supply and conveyance • AWPF • Purified water pumping and conveyance • Groundwater recharge (injection wells and/or use of existing recharge basins)	• Groundwater extraction and treatment • Potable water pumping and conveyance • Potable water usage (MWD pump back or in-lieu)

Table 2: Detail of Chino Basin Program Infrastructure

Project Category	Infrastructure
Project Category 1: Well Development	16 injection wells (maximum) with max operational capacity of 830 gpm each 17 extraction wells (maximum) with max operational capacity of 2,000 gpm each 4 monitoring wells (maximum) Use of existing wells including a mix of up to 4 of the following: • Use of existing Rialto Pipeline • Use of existing member agency wells • Use of existing Agua de Lejos Water Treatment Plant (WTP) Clearwell • Use of existing Lloyd Michael WTP Clearwell
Project Category 2: Conveyance Facilities and Ancillary Facilities	<u>Pipeline</u>: The CBP would ultimately install a total of about 30 miles or 158,400 linear feet (LF) of various types of pipeline. Potential alignments include a mix of the following: • TAKE 1: 9 miles of 12- to 36-inch collector pipelines • TAKE 1: 5 miles of 54-inch potable northern pipeline • TAKE 3: 9 miles of 12- to 42-inch collector pipelines • TAKE 3: 8 miles of 16- through 48-in potable northern pipeline • TAKE 3: 4 miles of 12- through 24-inch potable southern pipeline • TAKE 3: In lieu Brine Disposal Inland Empire Brine Line (IEBL) 6,800 ft 8" pipeline, possible jack and bore across 300 ft under Hwy 71 and Chino Creek • TAKE 7: 7 miles of 36- to 72-inch e/w Water Facilities Authority (WFA) pipeline • TAKE 7: 4.5 miles 24-inch e/w Fontana Water Company (FWC) pipeline • TAKE 7: 4.5 miles 54- to 72-inch & 36-inch Cucamonga Valley Water District (CVWD)/ MWD pipeline • TAKE 7: 0.3 miles 54- to 72-inch MWD pipeline • TAKE 8: 6.3 miles of 48-inch CVWD pipeline • TAKE 8: 7 miles of 24-inch FWC-1 pipeline • TAKE 8: 0.7 miles of 24-inch FWC-2 pipeline • TAKE 8: 0.8 miles of 24-inch MWD pipeline • TAKE 8: 36-inch Jurupa Community Services District (JCSD) 2 miles • PUT 5: 7.1 miles of 8- to 30-inch pipeline for purified water conveyance • PUT 5: 1,400 ft (8-foot pipeline) Non-Reclaimable Wastewater System (NRWS) brine conveyance; NRWS Capacity Units required: 2,603 <u>Reservoir</u>: The CBP would install a storage tank with a maximum capacity of 5 MG with possible and in-conduit hydropower facility. <u>Pump Stations</u>: The CBP would install 4 pump stations serving various PUT and TAKE facilities. One pump station would serve PUT facilities, while up to 3 pump stations would

Project Category	Infrastructure
	support TAKE facilities. The breakdown of the types of pump stations and boosters include a mix of the following: • PUT 5: Pump station at Regional Water Recycling Plant No. 4 (RP-4) 1,500 HP • TAKE 1: Pump Station with a max 9,300 HP, and a max of 31,100 gpm, 823 ft total dynamic head (TDH) • TAKE 3: Potable Water Pump Station #1 with a max 7,000 HP, 23,300 gpm firm capacity, 823 ft TDH • TAKE 7: WFA Booster at 1,700 HP • TAKE 7: FWC Booster at 300 HP • TAKE 7: CVWD/MWD Booster at 4,800 HP • TAKE 8: Booster Station #1 at 5,300 HP • TAKE 8: MWD Booster at 650 HP • An additional TAKE pump station would have a max 650 HP Turnouts: The CBP would install a maximum of 6 turn-outs that would be between 12" and 72" in size to support TAKE facilities at various member agency locations throughout the Chino Basin
Project Category 3: Groundwater Storage Increase	The CBP contemplates a permanent increase in Safe Storage Capacity of 850,000 AF
Project Category 4: Advanced Water Purification Facility and Other Water Treatment Facilities	AWPF: The CBP would install an AWPF at RP-4, which will ultimately have a capacity of 15,000 AFY. The intake of recycled water at this facility will total 17,000 AFY, with a resulting 15,000 AFY of purified water derived from the AWPF processes. Wellhead Treatment: The CBP may install up to 3 wellhead treatment facilities at locations that have yet to be selected but would be sited at existing member agency offline wells. These wellhead treatment systems would be capable of treating up to 3,000 AFY per wellhead treatment system. Each of the 3 wellhead treatment systems would be connected to 3 existing member agency wells (total of 9 existing extraction wells used for the CBP). Wellhead treatment also includes the following brine conveyance and disposal: • Disposal Capacity: 4,900 gpd per wellhead treatment system • Pipeline Length: up to 6,800 LF (8-inch) • Disposal System: Assumed utilization of IEBL

2.1 Construction

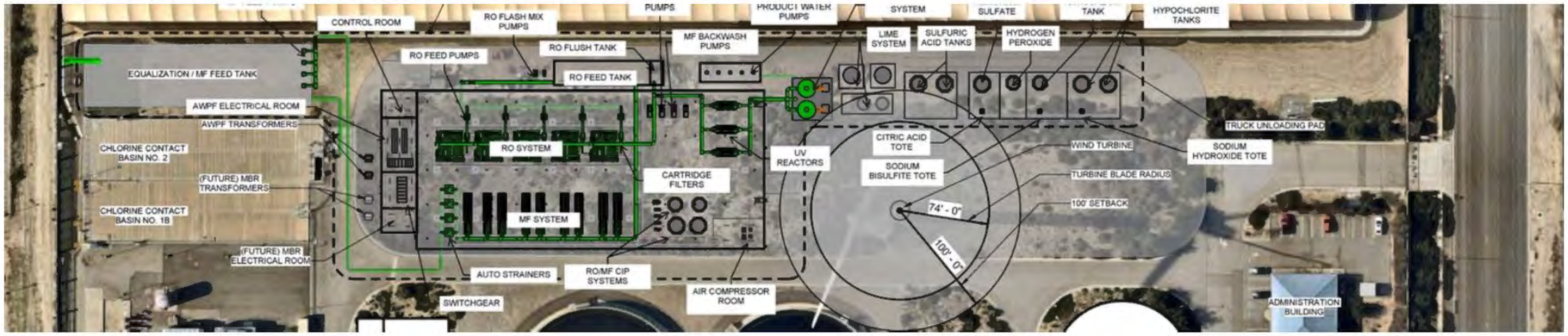
The following section summarizes the construction activity details for each Proposed Project component. The overall assumed construction vehicle fleet can be found in Table 3.

2.1.1 AWPF

The installation of the AWPF at IEUA's existing RP-4, located in the City of Rancho Cucamonga, would require approximately 12 months to construct. It is anticipated that the AWPF would be operational by 2028. The construction of the AWPF would consist of site clearing, grading, construction of facilities, installation of equipment, and site completion. Construction equipment would include the following: one bulldozer or motor grader, backhoes, loaders, dump trucks, crew trucks, concrete trucks, cranes, personal vehicles, compactor, delivery trucks, and a water truck. It is anticipated that the maximum number of construction personnel at a site on any given day will be 20 persons. The maximum number of truck deliveries is forecasted at 15 per day at 40-miles round-trip per day of construction. Materials and equipment would be delivered to the site including piping, building materials, concrete forms, roofing materials, HVAC equipment, pumps, diffusers, screens, belt presses, and screw presses. The site of the proposed AWPF is currently vacant (see Figure 2). No demolition is anticipated to be required to construct the AWPF.

Figure 2: AWPF Site

Regional Water Recycling Plant No. 4 Advanced Water Purification Facility Site Layout



Google Street view of Regional Water Recycling Plant No. 4 Advanced Water Purification Facility Site

2.1.2 Pipelines and Turnouts

With rare exceptions, all proposed pipelines would be aligned through the public right-of-way (ROW) and properties owned or to-be acquired by IEUA. Typically, pavement removal would occur, followed by excavation of the pipeline trench, installation of the pipe, then backfilling and compaction, and finally ground surface restoration or pavement reinstallation. Trenchless technologies would be required at freeway, flood channel, and railroad crossings: jack and bore for lengths less than 500 feet; and horizontal directional drilling (HDD) for lengths exceeding 500 feet. HDD involves establishing entry and exit pits, using a drill rig to create an underground bore hole, and then stringing the pipeline through the hole. Jack and bore also employs entry and exit pits but uses an auger to remove material and push a casing forward, then the pipeline is inserted in the casing. Most of the pipe would range from 10-inch to 48-inch diameter. Depending on the pipe size, the trenches may vary in depth and width. Roughly half an acre of land would be actively excavated on a given day.

An estimated 30 miles or 158,400 LF of conveyance pipeline would be installed in support of the CBP. The rate of pipeline installation would depend on whether the pipeline installation is in undeveloped areas or developed roadways. Installation of 158,400 LF of pipeline was assumed to occur over a period of 3 years, with 53,000 LF being installed each year to coincide with the opening year (2028) of the AWPF. For the purposes of analysis, it is assumed that an underground utility installation team can install an average of 200-400 LF of pipeline per day and that three teams will be installing pipelines at any given time for a maximum total of 1,200 LF per day (400 LF/team/day x 3 teams = 1,200 LF per day). It is assumed that the proposed pipeline installation will occur for a maximum of 260 days in one calendar year.

In addition to conveyance pipeline, a maximum of six turnout structures would be provided to deliver water from the main canal to the water users via a pipeline or other means. The type of turnout structure and its design requirements would depend on location. Installation of the six turnouts would occur over a period of two years, with three turnouts being installed each year to coincide with the opening year (2028) of the AWPF. For the turnouts, roughly a quarter acre of land would be actively excavated on a given day.

The daily construction fleet required to install the average 200-400 LF/day of conveyance pipelines or for each turnout consists of a pavement cutter, grinder, backhoe, crane, two dump trucks, roller/vibrator, and traffic control signage and devices operating 6 hours per day; a water truck and excavator operating 4 hours per day; and a paving machine and compacter operating 2 hours per day. In addition, the contractor may occasionally use a portable generator and welder for equipment repairs or incidental uses. Installation of pipeline in unpaved locations would require the same equipment as in paved locations, without the paving equipment (cutter, grinder, paving machine). In general, trenches would have vertical side walls to minimize the amount of soil excavated. Soils excavated from the trenches, if of suitable quality, would be stockpiled alongside the trench or in staging areas for later reuse in backfilling the trench. If not reusable, the soil would be hauled off site for disposal. Engineered backfill material would be imported to stockpiles near the trenching. During the installation of the pipelines, there would be a surplus of native soil requiring off-site export. Pipeline and turnout installation would require an estimated 10 dump/delivery trucks (40 miles round trip distance) per day, and a crew of 14 members per team (40-mile round-trip commute). For the purposes of analysis, it is assumed that each phase of pipeline construction would be occurring simultaneously at some location in the basin (i.e., one segment would be in the repaving phase while another segment begins trenching).

2.1.3 Pump Stations

Pump stations are required to pump water from areas at a lower elevation within the Basin, to areas located at a higher elevation. A total of four pump stations are anticipated to be constructed as part of the CBP. At each site, no more than 0.5 acre would be actively graded on a given day for site preparation of each pump station. Grading activities would occur over a five-day period and this phase of construction would require up to six truck trips with an average round

trip distance of 20 miles to deliver construction materials and equipment (concrete, steel, pipe, etc.). Installation of the pump station would require the use of a crane, forklift, backhoe and front loader operating four hours per day. Five workers would each commute 40 miles round-trip to the work site.

Each pump station would be housed within a block building and would require a transformer to be installed to deliver electric power to the pumps. The proposed pump station building would include a pump room, electric control room, odor control facilities, chemical tanks, and storage room. Construction of the pump station would involve installation of piping and electrical equipment, excavation and structural foundation installation, pump house construction, pump and motor installation, and final site completion.

The proposed pump stations are anticipated to be located at sites that have permanent power available for construction, as such a generator is not anticipated to be required for welding required to construct the pump stations.

2.1.4 Injection, Extraction, and Monitoring Wells

The CBP would install up to 37 new wells, (16 injection wells [12 duty, 4 stand-by], 17 extraction wells, and 4 monitoring wells). Installation of the 37 new wells would occur over a period of three years, with 12 wells being installed each year to coincide with the opening year of the AWPF, 2028. Production well, injection well, and monitoring well development have essentially the same construction impacts.

The drilling and development of each well would require drilling to—in most cases—between 250 and 1,500 feet below ground surface (bgs). The proposed schedule for constructing each well would be as follows: drilling, construction, and testing of each well would require approximately six weeks to complete (about 45 days, of which 15 to 20 days would include 24-hour, 7-day a week drill activity). For planning purposes, a construction and testing schedule duration of 60 days per well is assumed to account for unforeseen circumstances (e.g., extreme weather, equipment break downs, etc.) that could affect the drilling and testing schedule. The well casings would be welded and well development and installation would require a two week use of a diesel generator.

Development of up to 12 new wells during a given year would require the delivery and set up of the drilling rig at each site. It is anticipated the wells would be drilled at different times and the drilling equipment transported to and from the sites on separate occasions. For the purposes of this evaluation, it is assumed that delivery of the drilling equipment 12 times in a year would result in 12 50-mile round-trips for the drill rigs. It is anticipated that a crew of five persons would be on a given well site at any one time to support drilling a well: three drillers, the hydrologist inspector, and a foreman. Daily trips to complete the well would average approximately 15 round trips per day, which at various points of construction would include: two round trips for drill rigs; between six and 12 round trips for cement trucks; five trips to deliver pipe; and 10 trips per day for employees.

The average area of disturbance of each well site is estimated to be 0.5 acre or less to allow for construction, periodic well rehabilitation, and the drilling of a new well should the original well fail and need to be replaced. For analysis purposes, it is assumed that each well would be drilled using the direct rotary or fluid reverse circulation rotary drilling methods. Access to the drilling site for the drilling rig and support vehicles would be from adjacent roadways. Typically, well drilling requires only minimal earth movement or grading.

2.1.5 Wellhead Treatment Facilities

Several existing wells would require wellhead treatment in order to become operational in support of the CBP. The CBP would construct up to three wellhead treatment facilities at existing member agency wells. Two are shown in Figure 1, and a third could be constructed in the vicinity of the AWPF. The area expected to be disturbed by the construction of the proposed treatment facilities would be less than three acres for each site. A regional groundwater treatment facility would range from about one acre to two acres in size per facility. Construction of water treatment

facilities would involve site demolition; site paving; site prep/grading; excavation and installation of yard pipes; installation of treatment facilities; site finishing (landscaping, misc. curb/cutter, etc.); and site drainage (above and below grade). Construction equipment would include the following: one bulldozer or motor grader, backhoes, loaders, dump trucks, crew trucks, concrete trucks, cranes, personal vehicles, compactor, delivery trucks, and a water truck. It is anticipated that the maximum number of construction personnel at a site on any given day would be 10 persons. The maximum number of construction material truck deliveries would be approximately 10 per day at 40 miles round trip per day. Each wellhead treatment facility would require about six months to construct, with construction of two treatment systems assumed to occur simultaneously. The operational year is anticipated to coincide with the opening year of the AWPF, 2028.

2.1.6 Storage Reservoir

One 5 million gallon (MG) storage tank is anticipated to be required in support of the CBP. Overall, reservoir construction is anticipated to require about three months from start to finish. During mass grading of the site, an assumed 5,000 cubic yards (CY) of material would be imported as engineered backfill. The amount of material that would need to be exported is unspecified, but conservatively assumed to be roughly the same quantity (5,000 CY). This material would be delivered by trucks to the site in the amount of about 300 trips, assuming 50 trips maximum per day to and from the site, with a roundtrip length of no more than 50 miles. Fine grading of the site will be completed after the reservoir and piping are installed. A maximum of five to 12 workers would be on the site during grading, which would take place for about 10 days. Following mass excavation, the tank foundation would be installed. The foundation would consist of concrete, steel, and aggregate. It is assumed that a maximum of five to 12 workers would be on the site during foundation construction for a maximum of about 25 days. The new 5 MG storage tank would be constructed in the following fashion: floor; walls and columns; roof; prestressing; and appurtenances. It is assumed that a maximum of 12 employees would be on the site during reservoir construction for a maximum of about 50 days total (grading and construction).

Table 3 summarizes the overall construction vehicle fleet that has been assumed to be necessary for the purposes of estimating construction-related air pollutant emissions.

Table 3: Estimated Construction Equipment Fleet by Phase

Construction Phase	Modeled Daily Equipment Fleet	Unit Amount	Hours per Day	Hp	Load Factor
Well Development (assume mobilization, drilling, and construction and testing occurs simultaneously at some location in area)	Rubber Tired Dozers	4	6	247	0.4
	Tractors/Loaders/Backhoes	12	6	97	0.37
	Bore/Drill Rigs	1	24	221	0.5025
	Cranes	4	6	231	0.2881
	Welders	4	4	46	0.45
Pipelines (assume pavement cutting, excavation, install, and paving occurs simultaneously at some location in area)	Excavators	3	4	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	6	6	247	0.4
	Tractors/Loaders/Backhoes	3	6	97	0.37
	Crushing/Proc. Equipment	6	6	85	0.78
	Cranes	3	6	231	0.2881
	Rollers	3	6	80	0.3752
	Sweepers/Scrubbers	3	4	64	0.4556
	Paving Equipment	3	2	132	0.3551
	Generator Sets	3	1	84	0.74
Storage Reservoir – Grading phase	Excavators	1	8	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4
	Tractors/Loaders/Backhoes	3	8	97	0.37
Storage Reservoir – Construction phase	Cranes	1	7	231	0.29
	Forklifts	3	8	89	0.2

Construction Phase	Modeled Daily Equipment Fleet	Unit Amount	Hours per Day	Hp	Load Factor
	Generator Sets	1	8	84	0.74
	Tractors/Loaders/Backhoes	3	7	97	0.37
	Welders	1	8	46	0.45
Storage Reservoir – Site finishing phase	Cement and Mortar Mixers	2	6	9	0.56
	Pavers	1	8	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38
	Tractors/Loaders/Backhoes	1	8	97	0.37
Pump Stations - Grading	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4
	Tractors/Loaders/Backhoes	2	7	97	0.37
Pump Stations - Construction	Cranes	1	4	231	0.29
	Forklifts	1	4	89	0.2
	Tractors/Loaders/Backhoes	2	4	97	0.37
	Welders	1	4	46	0.45
Turnouts (assume excavation, install, and resurfacing occurs simultaneously at some location in area)	Excavators	3	4	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	6	6	247	0.4
	Tractors/Loaders/Backhoes	3	6	97	0.37
	Crushing/Proc. Equipment	6	6	85	0.78
	Cranes	3	6	231	0.2881
	Rollers	3	6	80	0.3752
	Sweepers/Scrubbers	3	4	64	0.4556
	Paving Equipment	3	2	132	0.3551
	Generator Sets	3	1	84	0.74
AWPF – Site preparation	Rubber Tired Dozers	3	8	247	0.4
	Tractors/Loaders/Backhoes	4	8	97	0.37
AWPF - Grading	Excavators	1	8	158	0.38
	Graders	1	8	187	0.41
	Rubber Tired Dozers	1	8	247	0.4
	Tractors/Loaders/Backhoes	3	8	97	0.37
AWPF – Construction	Cranes	1	7	231	0.29
	Forklifts	3	8	89	0.2
	Generator Sets	1	8	84	0.74
	Tractors/Loaders/Backhoes	3	7	97	0.37
	Welders	1	8	46	0.45
AWPF - Paving	Cement and Mortar Mixers	2	6	9	0.56
	Pavers	1	8	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38
	Tractors/Loaders/Backhoes	1	8	97	0.37
Wellhead Treatment – Demolition	Concrete/Industrial Saws	2	6	81	0.73
	Rubber Tired Dozers	2	6	247	0.4
Wellhead Treatment – Grading	Graders	2	6	187	0.41
	Tractors/Loaders/Backhoes	4	6	97	0.37
Wellhead Treatment – Construction	Cranes	2	4	231	0.29
	Forklifts	2	6	89	0.2
	Generator Sets	2	4	84	0.74
	Tractors/Loaders/Backhoes	4	6	97	0.37
	Welders	2	4	46	0.45
Wellhead Treatment – Paving	Pavers	2	6	130	0.42
	Paving Equipment	2	6	132	0.36
	Rollers	2	6	80	0.38

2.1.7 Construction Schedule

Construction is expected to begin in 2025 and extend to the opening of the AWPF in 2028. Construction would be limited to daytime, with the exception of well drilling for injection and extraction wells, which would last up to 20 days per well at 24 hours per day to prevent bore hole collapse. Trenchless drilling methods (HDD and jack-and-bore) would also require round-the-clock construction to prevent borehole collapse. Construction of the wells and pipelines would occur over three years from 2025-2027; construction of the turnouts would occur over two years from 2026-2027; construction of the wellhead treatment, AWPF and the pump stations would occur over one year, 2027; and the storage reservoir would be constructed at the end of 2027.

2.1.8 Construction Best Management Practices

The Proposed Project would comply with applicable State regulations including:

- All portable diesel-powered construction equipment shall be registered with the state's portable equipment registration program or shall obtain a South Coast Air Quality Management District (SCAQMD) permit.
- Fleet owners of mobile construction equipment are subject to the California Air Resource Board (CARB) Regulation for In-Use Off-Road Diesel Vehicles (Title 13, California Code of Regulations (CCR), §2449), the purpose of which is to reduce oxides of nitrogen (NO_x), diesel particulate matter (DPM), and other criteria pollutant emissions from in-use off-road diesel-fueled vehicles. Off-road heavy-duty trucks shall comply with the State Off-Road Regulation.
- Fleet owners of mobile construction equipment are subject to the CARB Regulation for In-Use (On-Road) Heavy-Duty Diesel-Fueled Vehicles (Title 13, CCR, §2025), the purpose of which is to reduce DPM, NO_x and other criteria pollutants from in-use (on-road) diesel-fueled vehicles. On-road heavy-duty trucks shall comply with the State On-Road Regulation.
- All commercial off-road and on-road diesel vehicles are subject, respectively, to Title 13, CCR, §2449(d)(3) and §2485, limiting engine idling time. Idling of heavy-duty diesel construction equipment and trucks during loading and unloading shall be limited to five minutes; electric auxiliary power units should be used whenever possible.

2.2 Operation

Operations and maintenance (O&M) for each of the Proposed Project's key facilities is briefly described below.

Wells: The injection wells would recharge up to 15,000 AFY per year, while the new extraction wells would pump up to 50,000 AFY of water from the Basin in call years, or 10,000 AFY in non-call years (only 7.5 call years are anticipated over a 25-year period). After the 25-year period in which the CBP would be active, IEUA member agencies could utilize the water purified at the AWPF in the amount of 15,000 AFY. The 16 injection wells would have a maximum operational capacity of 830 gpm each. The 17 extraction wells would have a maximum operational capacity of 2,000 gpm each. All energy demands would be met by electricity supplied by Southern California Edison. The four monitoring wells would be visited by a field technician on a monthly to quarterly frequency. There would be negligible energy consumption in obtaining groundwater levels from the monitoring wells. Ongoing operation and maintenance of the wells may involve periodic backwash and inspection.

AWPF: The AWPF would include various processes and facilities, including an MF System, RO System, Equalization Tank, UV-AOP System, Chemical Facilities, Post Treatment, and CIP Systems. It is assumed that the AWPF would involve daily inspections and maintenance of treatment processes, daily backflush and maintenance cleans, more rigorous weekly to monthly cleans, and weekly deliveries of chemicals and supplies to the AWPF. The Reverse Osmosis (RO) system would require chemical cleaning and inspection monthly and membranes would be replaced every five years. All energy demands would be met by electricity supplied by Southern California Edison or from onsite sources at the RP-4; the Proposed Project would not consume natural gas.

Other Well Treatment Facilities: The CBP may install up to three wellhead treatment facilities at locations that have yet to be selected but would be sited at existing member agency offline wells. These wellhead treatment systems would be capable of treating up to 3,000 AFY per wellhead treatment system. Each of the three wellhead treatment systems would be connected to three existing member agency wells (total of nine existing extraction wells used for the CBP). The Wellhead treatment facilities would require routine inspection and maintenance of the treatment processes. Wellhead treatment would also include the following brine conveyance and disposal:

- Disposal Capacity: 4,900 gpd per wellhead treatment system
- Pipeline Length: up to 6,800 LF (8-inch)
- Disposal System: Assumed utilization of IEBL

Brine Disposal: The additional brine stream flow from the AWPF at RP-4 would be 1,027,300 gpd. The brine stream flow from the AWPF would ultimately need to be treated by the Los Angeles County Sanitation District (LACSD) through the Joint Outfall System (JOS) or by the Orange County Sanitation District (OCSD).

Pipelines and Turnouts: Once a pipeline or turnout is installed, operations would not require any operations and maintenance visits unless unforeseen circumstances arise that would require maintenance or repair of the pipelines. In the event of routine maintenance, one vehicle trip per maintenance event would be required.

Pump Stations: A total of four pump stations will be installed. It is assumed that the three TAKE Pump stations would range between 650 HP to 9,300 HP, with the booster pumps averaging 4,200 HP each. The PUT pump station would operate at 1,500 HP. All energy demands would be met by electricity supplied by Southern California Edison. The pump stations would require routine inspection and maintenance.

Water Storage Tank: Once the reservoirs are installed, operation of the reservoir would not require any shifts or employees as it would be monitored and controlled remotely. Scheduled maintenance visits would occur in the future with one trip per maintenance event. Reservoirs typically do not directly consume energy as water or recycled water is pumped into reservoirs directly from wells or through booster pump stations.

Renewable Energy: In-conduit hydropower facilities may be considered in locations of the potable water distribution system where the system pressure needs to be reduced and energy can be produced. Current renewable on-site generation at RP-4, which shares the same SCE meter with the Inland Empire Regional Composting Facility (IERCF), is about 20%. In addition to the 1 MW wind turbine and 1.5 MW battery at RP-4, additionally, there is a potential for use of a 2.5 MW solar at the IERCF. As the Proposed Project has not undergone site specific design, at this time, alternative energy options would be explored when design has been further specified.

According to the IEUA Facilities Management Plan, over the course of the next 15 years, IEUA intends to procure 100 percent of its electricity needs from carbon neutral sources, so in that period of time, IEUA will slowly begin to use less carbon sourced energy for greater operational demands. Additionally, the Proposed Project would create a source of local water supply within the Chino Basin, which would offset the energy required to transfer water from MWD from the Sacramento-San Joaquin Delta to IEUA’s service area.

3. ENVIRONMENTAL SETTING

Pollutants that are known to increase the greenhouse effect in the earth's atmosphere, thereby adding to global climate change impacts, are referred to as greenhouse gases (GHG). A number of pollutants have been identified as GHGs. The State of California definition of GHGs in the Health & Safety Code, Section 38505(g) includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Some GHGs, such as CO_2, occur naturally and are emitted to the atmosphere through natural processes. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. The most common GHGs that result from human activity are CO_2 e followed by (CH_4) and (N_2O).

- Carbon Dioxide (CO_2): Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and as a result of other chemical reactions (e.g., manufacture of cement). CO_2 is also removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- Methane (CH_4): CH_4 is emitted during the production and transport of coal, natural gas, and oil. CH_4emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- Nitrous Oxides (N_2O): Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- Fluorinated Gases: Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances (i.e., chlorofluorocarbons, [CFCs], hydrochlorofluorocarbons [HCFCs], and halons). Fluorinated gases are typically emitted in smaller quantities, but because they are potent GHGs, they are sometimes referred to as high global warming potential gases (high GWP gases).
  - HFCs are manmade chemicals that have historically replaced chlorofluorocarbons used in refrigeration and semi-conductor manufacturing.
  - PFCs are manmade chemicals that are by-products of aluminum smelting and uranium enrichment.
  - SF_6 is a manmade chemical that is largely used in heavy industry to insulate high voltage equipment and to assist in the manufacturing of cable cooling systems.

The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of CO_2. The larger the GWP, the more that a given gas warms the Earth compared to CO_2 over that time period. The time period usually used for GWPs is 100 years. GWPs provide a common unit of measure, which allows analysts to add up emissions estimates of different gases (e.g., to compile a national GHG inventory), and allows policymakers to compare emissions reduction opportunities across sectors and gases.

- CO_2, by definition, has a GWP of 1 regardless of the time period used, because it is the gas being used as the reference. CO_2 remains in the climate system for a very long time: CO_2 emissions cause increases in atmospheric concentrations of CO_2 that will last thousands of years.
- CH_4 is estimated to have a GWP of 28–36 over 100 years. CH_4 emitted today lasts about a decade on average, which is much less time than CO_2. But CH_4 also absorbs much more energy than CO_2. The net effect of the shorter lifetime and higher energy absorption is reflected in the GWP. The CH_4 GWP also accounts for some indirect effects, such as the fact that CH_4 is a precursor to ozone, and ozone is itself a GHG.
- N_2O has a GWP 265–298 times that of CO_2 for a 100-year timescale. N_2O emitted today remains in the

atmosphere for more than 100 years, on average.

- CFCs, HFCs, HCFCs, PFCs, and SF6 are sometimes called high-GWP gases because, for a given amount of mass, they trap substantially more heat than CO_2. (The GWPs for these gases can be in the thousands or tens of thousands).

3.1 Regulatory Setting

This section discusses applicable federal, state, regional, and local rules and regulations, including emission standards and ambient air quality standards.

3.1.1 Federal Regulations

U.S. Supreme Court and Endangerment Ruling. The U.S. Supreme Court ruled in 2007 that GHG emissions are air pollutants, covered under the Clean Air Act, in Massachusetts v. The Environmental Protection Agency. The Court found that the United States Environmental Protection Agency (EPA) has a mandatory duty to enact rules regulating mobile GHG emissions pursuant to the federal Clean Air Act. The Court held that GHGs fit the definition of an air pollutant causing and contributing to air pollution, which reasonably may be anticipated to endanger public health or welfare. In 2009, the EPA Administrator determined that existing and projected concentrations of GHGs threaten public health and welfare of present-day and future generations, and that combined emissions from motor vehicles contribute to GHG pollution. EPA's endangerment finding covers emissions of six GHGs: CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6.

Corporate Average Fuel Economy (CAFE) Standards. The Corporate Average Fuel Economy standards were first enacted by Congress in 1975, requiring vehicle manufacturers to comply with the gas mileage or fuel economy standards. These standards are set and regulated by the National Highway Traffic Safety Administration, with testing and data support from EPA. The issued rules include fuel economy standards for light-, medium- and heavy-duty vehicles. More fuel-efficient vehicles result in lower emissions of GHG.

For light-duty vehicles, National Highway Traffic Safety Administration (NHTSA) and EPA issued a joint final rulemaking on October 15, 2012, to establish coordinated standards to improve fuel economy and reduce GHG emissions for vehicle model years 2017 through 2025 (77 FR 62624). EPA established standards that are projected to require, on an average industry fleet wide basis, 54.5 miles per gallon; the NHTSA standards are projected to require, on an average industry fleet wide basis, a range from 40.3-41.0 miles per gallon. For medium- and heavy-duty vehicles, EPA and NHTSA issued a final rule on December 27, 2016 on GHG standards and fuel consumption standards for engines and vehicles model years 2018 through 2029 (81 FR 73478).

On April 2, 2018, the EPA issued the Mid-term Evaluation Final Determination, finding that the GHG standards for model years 2022-2025 should be revised, and that EPA and NHTSA should further consider appropriate standards for model year 2022-2025 light-duty vehicles. In September 2019, NHTSA and the EPA released the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part 1, which revoked California's waiver under the Clean Air Act allowing it to establish stricter emissions standards. In March 2020, EPA and NHTSA released SAFE Part 2, which set new fuel economy and emissions standards for model years 2021-2026 (increasing the stringency of emissions standards by 1.5% each year for model years 2021-2026, as compared with the standards issued in 2012, which would have required about 5% annual increases). In January 2021, the Biden administration directed EPA and NHTSA to review SAFE Part 1 and SAFE Part 2. NHTSA's Corporate Average Fuel Economy (CAFE) Preemption Rule and EPA's reconsideration notice, issued in April 2021, dealt with SAFE Part 1, rescinding NHTSA's preemption determination and reconsidering EPA's waiver revocation. The waiver withdrawal reconsideration is still pending. New CAFE standards were proposed in August 2021, which would set standards for passenger cars and light trucks for model years 2024-2026.

Mandatory Reporting of GHGs. In 2009, the EPA issued the Final Mandatory Reporting of Greenhouse Gases Rule which requires mandatory reporting of GHG emissions from large sources in the U.S. Since January 1, 2010, manufacturers of vehicles and engines, suppliers of fossil fuels or industrial GHGs, and facilities that emit at least 25,000 metric tons of GHGs per year have been required to submit annual reports to EPA.

Clean Power Plan and Affordable Clean Energy. In 2012, the EPA proposed performance standards for CO_2 emissions for new electricity generation from fossil fuels. New sources greater than 25 megawatts were required to meet the standard of 1,000 pounds of CO_2 per megawatt-hour. However, in 2016 a stay of this rule was ordered due to pending litigation. The 2015 Clean Power Plan, which also aimed to reduce power sector emissions, never took effect due to legal action, and was officially repealed in June 2019 when EPA issued the Affordable Clean Energy rule, which established new emission guidelines for power sector emissions. In January 2021, the D.C. Circuit Court vacated the Affordable Clean Energy Rule and remanded to EPA for reconsideration.

New Source Review. New Source Review is a permitting process created under the Clean Air Act in 1977 requiring pre-construction review for environmental controls for new facilities or any modifications to existing facilities that would create a significant increase of a regulated pollutant. In 2010, EPA issued the GHG Tailoring Rule, which provided an approach to permitting GHG emissions under Prevention of Significant Deterioration (PSD) and Title V Operating Permit. A subsequent Supreme Court decision clarified that a stationary source is not required to obtain a PSD or Title V permit solely because the source emits or has the potential to emit GHGs above the applicable major source thresholds. PSD permits may still require limitations on GHG emissions based on the application of Best Available Control Technology.

Paris Climate Accords. The Paris Climate Accords (also known as the Paris Agreement or Paris Accords) is an international treaty on climate change adopted in 2015 covering climate change adaptation, mitigation, and finance. As of April 2021, the U.S. is targeting a national reduction in GHG emissions of 50 to 52 percent below 2005 levels by 2030.

3.1.2 State Regulations

Executive Order (EO) S-3-05. The Governor issued Executive Order (EO) S-3-05 in 2005 which set GHG emission reduction targets: reduce GHG emissions to 2000 levels by 2010; reduce GHG emissions to 1990 levels by 2020; and reduce GHG emissions to 80% below 1990 levels by 2050.

Assembly Bill (AB) 32. In 2006, California passed the California Global Warming Solutions Act of 2006. It required California Air Resources Board (CARB) to design and implement emission limits, regulations, and other measures to reduce statewide GHG emissions to 1990 levels by 2020 (representing a 25% reduction in emissions). AB 32 establishes an enforceable statewide cap on global warming emissions and reduction measures phased in by 2012, and through discrete early action measures that could be made effective by 2010. AB 32 established a timeframe for CARB to adopt emissions limits, rules, and regulations, but did not provide thresholds or methodologies for analyzing a project's impacts on global climate change.

CARB Scoping Plan. CARB adopted the Scoping Plan in December 2008 and a Scoping Plan Update in December 2017. The State intends to achieve GHG reductions in California required by AB 32 and Senate Bill 32 (SB 32) (described below). The Scoping Plan contains the strategies California will implement to achieve reduction of 40% below 1990 levels by 2030 and 80% below 1990 levels by 2050. In the Scoping Plan, "CARB recommends that lead agencies prioritize on-site design features that reduce emissions, especially from vehicle miles travelled (VMT), and direct investments in GHG reductions within the project's region that contribute potential air quality, health, and economic co-benefits locally."

GHG reductions targeted in the Scoping Plan would be shared across California's energy, transportation, industrial, water, waste management, and agricultural sectors. The water sector's fair share contribution to the Statewide GHG reduction goals may be more or less than the overall Statewide target because they would be combined with the measures taken by all of the other sectors. For the purposes of this analysis, the GHG reduction goal for the water sector has been interpreted from the 2017 Climate Change Scoping Plan. One of the "potential actions" included in the 2017 Climate Change Scoping Plan (page 95, CARB 2017), reads: "Where technically feasible and cost-effective, local water and wastewater utilities should adopt a long-term goal to reduce GHGs by 80 percent below 1990 levels by 2050 (consistent with DWR's Climate Action Plan), and thereafter move toward low carbon or net-zero carbon water management systems." Another "potential action" focuses on creating new sources of renewable energy: "Local water and wastewater utilities should develop distributed renewable energy where feasible."

The 2017 Climate Change Scoping Plan recognizes that GHG emissions from the water sector result primarily from the fossil fuel-based energy consumed for water end uses (e.g., heating, cooling, pressurizing, and industrial processes), and the fossil fuel-based energy used to "produce" water (e.g., pump, convey, treat). Therefore, emissions reductions strategies in the 2017 Climate Change Scoping Plan are primarily associated with reducing the energy intensity of the water sector. CARB notes that, "in the future, the ability to meet most new demand for water will come from sources such as increased conservation and water use efficiency, improved coordination of management of surface and groundwater, recycled water, new technologies in drinking water treatment, groundwater remediation, and brackish and seawater desalination" (CARB 2017). The 2017 Climate Change Scoping Plan further notes that replacement of potable water with recycled water does not automatically translate into GHG reductions. Recycled water has the potential to reduce GHGs if it replaces (rather than serves as an alternative to) an existing water supply with higher GHG emissions. Nevertheless, an overarching goal of the 2017 Climate Change Scoping Plan is to "make conservation a California way of life by using and reusing water more efficiently through greater water conservation, drought tolerant landscaping, stormwater capture, water recycling, and reuse to help meet future water demands and adapt to climate change."

As of 2021, CARB is preparing a 2022 Scoping Plan Update. Beginning in mid-2021, CARB hosted a series of workshops to support the Scoping Plan Update. Key objectives for the 2022 Scoping Plan Update include assessing progress toward achieving the 2030 target, laying out a path for achieving carbon neutrality no later than 2045. This will be the longest planning horizon of any Scoping Plan to date.

California Renewables Portfolio Standard and Senate Bill 100. In September 2002, SB 1078 was enacted, establishing the Renewables Portfolio Standard (RPS) program. The RPS requires retail sellers of electricity, including electrical corporations, community choice aggregators, and electric service providers, to purchase a specified minimum percentage of electricity generated by eligible renewable energy resources such as wind, solar, geothermal, small hydroelectric, biomass, anaerobic digestion, and landfill gas. The targets for the minimum percentage of renewable energy have increased with subsequent pieces of legislation, with the most recent being set by SB 100 in 2018. SB 100 revised previous renewable portfolio standards for electricity retail sales. SB 100 requires that 50 percent of power must come from renewable resources by December 31, 2026 and that 60 percent of power must come from renewable sources by December 31, 2030. The legislation also establishes a State policy that eligible renewable energy resources and zero-carbon resources supply 100 percent of retail sales of electricity to California end-use customers and 100 percent of electricity procured to serve all state agencies by December 31, 2045.

The Proposed Project would be served by Southern California Edison (SCE). SCE has historically met the RPS targets. The California Public Utilities Commission (CPUC) enforces compliance of all utilities in the state with the RPS and tracks progress toward meeting targets for renewable energy production to ensure that 100 percent of the state's electricity comes from renewable and carbon-free sources by 2045. The CPUC imposes fines for non-compliance with program requirements. In its 2020 California Renewables Portfolio Standard Annual Report, the CPUC reported that the three large utilities in the state (Pacific Gas & Electric, SCE and San Diego Gas & Electric) "are on track to meet their 60 percent 2030 RPS procurement mandate." The 2019 target for renewable energy was 31 percent and in 2019, SCE had achieved 38 percent renewable energy; SCE has thus already exceeded the 33 percent requirement for 2020 (CPUC 2020). Given the progress to date, the CPUC states that all three large utilities "are currently forecasted to continue to surpass RPS requirements and have excess procurement for the next seven years" (CPUC 2020). SCE is meeting its renewable energy requirements using a mix of biopower, geothermal power, small hydroelectric power, solar photovoltaic power, solar thermal power, and wind power (CPUC 2020).

EO B-30-15 / Senate Bill 32. In April 2015, the Governor issued EO B-30-15 which sets the State's GHG emissions target for 2030 at 40% below 1990 levels. Similarly, SB 32 (2016) requires that CARB, in its next update to the AB 32 Scoping Plan, "ensure that statewide GHG emissions are reduced to at least 40% below the statewide GHG emissions limit no later than December 31, 2030."

EO B-55-18. In September 2018, the Governor issued EO B-55-18, which set a statewide goal to achieve carbon neutrality as soon as possible, and no later than 2045, and achieve and maintain net negative emissions thereafter.

EO N-79-20. In September 2018, the Governor issued EO N-79-20, requiring that all new passenger cars and trucks sold in the state be zero-emission by 2035. A further goal is that all medium- and heavy-duty vehicles in California be zero-emission by 2045 for all operations where feasible, and that all off-road vehicles and equipment be zero-emission by 2035 where feasible.

Assembly Bill 1493. AB 1493 (2002) required CARB to develop and implement regulations to reduce automobile and light truck GHG emissions. These stricter emissions standards, referred to as "Pavley" standards, apply to automobiles and light trucks beginning with the 2009 model year. Litigation was filed by automakers, challenging these regulations. EPA initially denied California's related request for a waiver to allow California to regulate vehicle emissions beyond EPA requirements, but a waiver subsequently was granted. Pavley I regulates model years from 2009 to 2016 and Pavley II, which is now referred to as "LEV (Low Emission Vehicle) III GHG," regulates model years from 2017 to 2025. The Advanced Clean Cars I program coordinates the goals of the LEV, Zero Emissions Vehicles (ZEV), and Clean Fuels Outlet programs. The Advanced Clean Cars Program is projected to lower GHG emissions from new automobiles by 40 percent compared to 2012 model years in 2025 (CARB 2019). In 2021, CARB began a series of public workshops to solicit input on the development of the Advanced Clean Cars II regulations. The Advanced Clean Cars II regulations will seek to reduce criteria pollutant and GHG emissions from new light- and medium-duty vehicles beyond the 2025 model year and increase the number of ZEVs for sale.

Cap and Trade. California's Cap-and-Trade Program sets a statewide limit on sources responsible for 85 percent of California's GHG emissions and establishes a price signal needed to drive long-term investment in cleaner fuels and more efficient use of energy. The program is designed to provide covered entities the flexibility to seek out and implement the lowest cost options to reduce emissions. The program began in 2013 for electricity generators and large industrial facilities emitting 25,000 metric tons of CO_2 equivalent or more annually, and began in 2015 for distributors of transportation, natural gas, and other fuels. CO2 from the combustion of digester and landfill gas does not count towards the cap; therefore, there are no municipal wastewater treatment plants in California that have compliance obligations under the cap-and-trade program. In 2014, California's program linked with Quebec's cap-and-trade system, and the program is designed to link with similar trading programs in other states and regions. The cap was set in 2013 at about 2 percent below the emissions level forecast for 2012 at the time, declined about 2 percent in 2014, 3 percent annually from 2015-2020, and 4 percent for 2021 and beyond.

Senate Bill 350. The Clean Energy and Pollution Reduction Act (Senate Bill 350) established clean energy, clean air, and GHG reduction goals, including reducing GHG to 40 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2050. SB 350 also requires the state to double statewide energy efficiency savings in electricity and natural gas end uses by 2030. To help meet these goals and reduce GHG emissions, large utilities will be required to develop and submit integrated resource plans (IRPs). These plans detail how utilities will meet their customers' resource needs, reduce GHG emissions, and ramp up the use of clean energy resources.

Title 24. California's energy code is designed to reduce wasteful and unnecessary energy consumption in newly constructed and existing buildings. The California Energy Commission updates the Building Energy Efficiency Standards (Title 24, Parts 6 and 11) every three years. The 2019 Building Energy Efficiency Standards took effect on January 1, 2020. The updates focused on four key areas: smart residential photovoltaic systems, updated thermal envelope standards (preventing heat transfer from the interior to exterior and vice versa), residential and nonresidential ventilation requirements, and nonresidential lighting requirements. The 2019 standards also establish requirements for newly constructed healthcare facilities.

Model Water Efficient Landscape Ordinance. Water use and energy use are highly interconnected, meaning that water use efficiency often results in energy savings and associated avoided GHG emissions. New development and retrofitted landscape water efficiency standards are governed by the Model Water Efficient Landscape Ordinance (MWELO). All agencies must adopt, implement, and enforce the MWELO or a more stringent ordinance. Projects that include landscape areas of 500 square feet or more are subject to the MWELO. The MWELO sets requirements related to irrigation, grading, recycled water, stormwater, and public education.

3.1.3 Regional Regulations

IEUA and the Proposed Project lie within the jurisdiction of the SCAQMD. On December 5, 2008, the SCAQMD Board approved interim CEQA GHG significance thresholds for stationary sources, rules, and plans using a tiered approach for determining significance (SCAQMD 2008). No additional guidance has been issued since the release of this interim guidance in 2008. Although the SCAQMD Board has not approved the thresholds, they can serve as useful guidance for lead agencies as they set their own significance thresholds. The thresholds are structured in tiers, summarized below:

- Tier 1 consists of evaluating whether or not the project qualifies for any applicable exemption under CEQA. If the project qualifies for an exemption, no further action is required. If the project does not qualify for an exemption, it would move to Tier 2.

- Tier 2 consists of determining whether or not the project is consistent with a GHG reduction plan that may be part of a local general plan, for example. The GHG reduction plan must meet minimum requirements further detailed in the interim guidance; the requirements include compliance with AB 32 GHG reduction goals, analysis under CEQA, and GHG inventory tracking and monitoring provisions, and others. If the project is consistent with the qualifying local GHG reduction plan, it is not significant for GHG emissions. If the project is not consistent with a local GHG reduction plan, there is no approved plan, or the GHG reduction plan does not include all of the required components, the project would move to Tier 3.

- Tier 3 establishes screening significance thresholds and is the primary tier the SCAQMD board uses for determining significance for projects where it is the lead agency. SCAQMD has set a screening significance threshold of 10,000 MTCO2e/year for determining whether a stationary source project would have a less than significant cumulative GHG impact (SCAQMD 2008b). The threshold for new residential or commercial projects is 3,000 MTCO2e/year. Because IEUA is the lead agency for the Proposed Project, it would not be required to use SCAQMD's significance thresholds.

- Tier 4 provides three compliance options for the lead agency based on performance standards. These include: reducing Business-As-Usual (BAU) admissions by a certain percentage (the percentage is currently undefined); early compliance with AB 32 through early implementation of CARB's Scoping Plan Measures; and establishing sector-based performance standards. If performance standards on the compliance options in Tier 4 cannot be achieved, GHG emissions would be considered significant.

- Tier 5 includes off-site mitigation to reduce GHG emission impacts less than the proposed screening level.

If the project includes stationary sources of emissions (such as emergency backup generators), SCAQMD permits may be required for construction and operation. Permitted equipment would be subject to applicable SCAQMD rules and regulations.

SCAQMD Regulation XXVII addresses climate change with the following rules:

- Rule 2700 provides definitions of key terms and background information on global warming potential of various gases.
- Rule 2701 establishes the SoCal Climate Solutions Exchange, a voluntary program to encourage, quantify, and certify voluntary, high quality certified GHG reductions within SCAQMD's jurisdiction.
- Rule 2702 establishes a GHG Reduction Program, under which SCAQMD will fund projects through contracts in response to requests for proposals or purchase reductions from other parties.

Metropolitan Water District Climate Action Plan: MWD is currently developing a Climate Action Plan which is expected to be adopted in spring of 2022. The Climate Action Plan will establish a GHG reduction target; however, no draft targets have been released to date. To date, MWD has invested in renewable energy resources, including buying and generating hydroelectric power to help meet much of its electricity needs. MWD has built 15 in-stream hydroelectric plants throughout its distribution system with a total capacity of about 130 megawatts. MWD has also installed 5.5 megawatts of photovoltaic solar power at its facilities and plans to add battery energy storage to store green energy when power rates are low and discharge that energy when rates are higher (MWD 2021).

California Department of Water Resources Climate Action Plan: The Climate Action Plan is DWR's guide to addressing climate change in the programs, projects, and activities over which it has authority. The Climate Action Plan is divided into three phases to address mitigation, adaptation, and consistency in the analysis of climate change. Phase I is the GHG Emissions Reduction Plan, which lays out DWR's GHG emissions reduction goals for the near term (present to 2030) and long-term (2045). Phase II is the Climate Change Analysis Guidance, which develops a framework and guidance for consistent incorporation and alignment of analysis for climate change impacts in DWR's project and program planning activities. Phase III, Climate Change Vulnerability Assessment, describes, evaluates, and quantifies the vulnerabilities of DWR's assets in business to potential climate change impacts. Phase III also includes the Adaptation Plan to help prioritize resiliency efforts. DWR's GHG Emission reduction targets are consistent with State targets. The mid-term goal is to reduce GHG emissions to at least 60 percent below the 1990 level by 2030, and the long-term goal is to supply 100 percent of electricity load with zero-carbon resources and achieve carbon neutrality by 2045.

DWR's Phase I GHG Emissions Reduction Plan sets construction emissions thresholds to distinguish between typical construction projects and "extraordinary construction projects." Typical construction projects can rely on the Climate Action Plan for streamlined CEQA review. Extraordinary construction projects are not eligible for streamlined review if the project emits more than 25,000 metric tons of CO_2 equivalent in total during the construction phase of the project, or if the project emits more than 12,500 MTCO2e in any single year of construction. These thresholds represent a level of GHG emissions that by themselves could potentially adversely affect DWR's ability to achieve its GHG emissions reduction goals. DWR notes that these construction emissions thresholds are not established as thresholds of significance for CEQA purposes and should not be considered to constitute a determination by DWR that these thresholds are generally applicable as thresholds of significance for CEQA purposes. To demonstrate consistency with the Climate Action Plan, projects must complete a series of steps, including quantifying GHG emissions from the d project using DWR internal guidance, incorporating all project level GHG emissions reduction measures listed in Chapter VI of the Climate Action Plan (or explaining why measures that have not been incorporated do not apply to the project), determining that the project does not conflict with DWR's ability to implement any of the specific project GHG emissions reduction measures listed in Chapter VI, and obtaining additional review if the project would increase energy demands of the State Water Project system by 15 gigawatts per year or more. Required project level GHG emissions reduction measures are focused on implementation of BMPs and compliance with existing regulations. The reduction measures aim to reduce GHG emissions from construction projects by minimizing fuel use by construction equipment, reducing fuel consumption for transportation of construction materials, reducing the amount of landfill material, and reducing emissions from the production of cement.

3.1.4 Local Regulations

IEUA has voluntarily reported and verified its GHG emissions since 2013, and adopted a *Climate Change Action Plan* in 2019 (CCAP). IEUA aims to balance regional sustainability efforts with environmentally conscious energy management strategies to identify projects and objectives that holistically address climate change efforts. The CCAP's GHG reduction goals are listed below:

- Reduce GHGs to AB 32 Levels: IEUA will follow AB 32 standards using the oldest emission baseline data available to reduce GHG levels to 2007 levels by 2020, 40 percent below 2007 levels by 2030, and 80 percent below 2007 levels by 2050.
- Strive toward Carbon Neutrality: IEUA's current renewable portfolio can meet approximately 50 percent of agency-wide power needs. Increasing this capacity will reduce IEUA's impact on climate change and enhance environmental sustainability.
- Report GHG emissions: Continue to report GHG emissions to the Climate Registry. Rather than focusing on lowering IEUA's direct GHG emissions, potential projects will be evaluated on their potential to reduce global GHG emissions.
- Increase energy efficiency: Optimizing facility processes and retrofitting equipment can result in less power demand on the electrical grid.
- Reduce methane emissions: Pursue projects that beneficially use the methane generated in the digestion process as a renewable source of heat and/or power generation.

The CCAP also establishes goals and objectives to guide development of future projects. IEUA has identified key areas that should be addressed to create a resilient water and wastewater management system that also contributes to GHG emission reductions. These goals and objectives are listed below:

- Goal: Maximize recycled water production and usage.
    - Objective: Expand infrastructure at IEUA sites, within the region, or surrounding areas to enhance capabilities for end user application, storage, or groundwater replenishment of recycled water.
    - Objective: Upgrade and/or modernize facilities to ensure effective water treatment and continued compliance with all regulatory requirements.
- Goal: Maintain health of the groundwater aquifer.
    - Objective: Improve stormwater capture through improvements to the groundwater replenishment system infrastructure.
    - Objective: Enhance groundwater replenishment capabilities within the Chino Basin through infrastructure upgrades.
    - Objective: Treat groundwater effectively to remove harmful contaminants and ensure a healthy aquifer.
    - Objective: Protect the groundwater quality by properly maintaining and upgrading infrastructure to prevent system failures that may contaminate the groundwater.

- Objective: Enhance storage capabilities of storm, recycled, or imported water through expansion of existing infrastructure or collaboration with surrounding water systems.

- Goal: Maximize system efficiencies.
  - Objective: Improve energy efficiencies at IEUA facilities.
  - Objective: Develop water use efficiency and/or conservation programs within the region.
  - Objective: Strive for carbon neutrality through implementation of renewable power generation and beneficial use of resources
- Goal: Measure performance.
  - Objective: Report GHG emissions annually through The Climate Registry.
  - Objective: Track key performance indicators for recycled, storm, and imported water usage within IEUA's management system.

The CCAP does not include thresholds of significance for GHG emissions from IEUA's projects, nor does the CCAP establish mechanisms for the review of GHG emissions of specific projects.

4. METHODOLOGY

GHG emissions occur from construction-source and operational-source emissions, and through direct and indirect emissions. For construction-source emissions, pollutants result from onsite (i.e., off-road) sources, and off-site (i.e., mobile) sources. GHG emissions from construction of the Proposed Project were estimated using the California Emissions Estimator Model (CalEEMod) version 2020.4.0, consistent with guidance from SCAQMD (SCAQMD 2021). In July 2021, the SCAQMD in conjunction with the California Air Pollution Control Officers Association (CAPCOA) and other California air districts, released the latest version of CalEEMod Version 2020.4.0. The model has been used to calculate construction-source GHGs and convert them to $MTCO_2e$. The latest version of CalEEMod, which incorporates the latest vehicle emissions standards, construction fleet mix standards, and other applicable regulations has been used to estimate construction air quality emissions. Output from the model is provided in Appendix A of this report.

Model inputs were developed based on information in the Project Description chapter of the PEIR, which are summarized in detail in Section 2 Project Description of this document, and default values from the CalEEMod computer program. As explained in Section 2.1.7, it was assumed that construction of the Proposed Project would commence in 2025 and proceed through the start of operations of the AWPF in 2028. It was assumed that the Proposed Project would comply with applicable regulations, such as vehicle idling restrictions and vehicle emission standards.

5. SIGNIFICANCE THRESHOLDS

The California Supreme Court has stated that "because of the global scale of climate change, any one project's contribution is unlikely to be significant by itself," and that "[t]he challenge for CEQA purposes is [therefore] to determine whether the impact of the project's emissions of greenhouse gases is cumulatively considerable[.]" (Newhall Ranch, supra, 62 Cal.4th at p. 219.). This analysis relies on Appendix G of the State CEQA Guidelines, which presents the following two questions related to determining the significance of GHG emissions, but has modified them to make the questions more specific. Based on these thresholds, the Project would result in a significant impact related to greenhouse gas if it would:

- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment (by failure to achieve carbon neutral electricity sources by no later than 2045 and by not meeting the project's fair share of GHG reductions required on a statewide basis by 2030); and/or

- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs (i.e., IEUA's CCAP and CARB's 2017 Scoping Plan).

6. PROJECT IMPACTS

6.1 Greenhouse Gas Emissions

6.1.1 Construction

The Proposed Project would emit GHGs during construction, which is assumed to last from 2025 through the beginning of operation of the AWPF in 2028. Construction-related GHG emissions would be associated with operation of off-road construction equipment, worker and vendor vehicle trips, and truck hauling trips. Estimated annual GHG emissions are summarized in Table 4.

Table 4: Proposed Project GHG Emissions from Construction ($MTCO_2e$/year)

Construction Year	$MTCO_2e$/year
2025	3,842
2026	5,670
2027	7,394
Total	16,906
Average Annual	5,635

Construction is expected to be finished by 2028, or before 2030, which is when the State has set a mid-term target to achieve a reduction of 40 percent below 1990 levels. IEUA has not developed numerical screening levels to determine individual projects' consistency with the mid-term targets. DWR has set a mid-term target to achieve a reduction of 60 percent below 1990 levels by 2030 in its Climate Action Plan. To evaluate construction projects' GHG emissions, DWR has identified 25,000 $MTCO_2e$ in total during the construction phase of the project, or 12,500 $MTCO_2e$ in any single year of construction as a level that could impede DWR's progress towards achieving its goal. Therefore, based on the results shown in Table 4, the Proposed Project's total construction phase GHG emissions and single year GHG emissions would be well below DWR's screening level thresholds. However, as noted in Section 3.1.3, these screening thresholds are not established as thresholds of significance for CEQA purposes. Therefore, they are presented here for comparison purposes only.

IEUA has not developed numerical screening levels based on a baseline GHG inventory that can be used to evaluate whether a Proposed Project would conflict with achieving the Statewide 2030 GHG reduction goals. SCAQMD published interim CEQA GHG significance thresholds for stationary sources in 2008. SCAQMD set a screening significance threshold of 10,000 $MTCO_2e$/year for determining whether a stationary source project would have a less than significant cumulative GHG impact. Based on the results shown in Table 4, the Proposed Project's average annual GHG emissions would not exceed the SCAQMD significance threshold. However, these significance thresholds were meant to apply to industrial projects where SCAQMD is the lead agency, and therefore are only used in this analysis for comparison purposes. These thresholds were also adopted before the Statewide 2030 GHG reduction targets were set and are intended to evaluate whether a project would be consistent with the 2020 GHG reduction target of achieving 1990 levels by 2020, Statewide. SCAQMD has not yet proposed or adopted thresholds for GHG reduction targets beyond 2020.

To determine whether the Proposed Project emissions from construction would hinder the GHG reductions required on a Statewide basis by 2030 (40 percent below 1990 levels), this analysis has approximated a SCAQMD screening threshold for 2030. An annual GHG emission level of 6,000 $MTCO_2e$ would be 40 percent lower than the 10,000 $MTCO_2e$ threshold SCAQMD set to evaluate a project's consistency with achieving 1990 Statewide GHG levels. The Proposed Project's annual emissions in each year of construction between 2025 and 2028 would be lower than the calculated 6,000 $MTCO_2e$/year threshold on average. However, they could exceed 6,000 $MTCO_2e$/year in the most intensive year of construction activities.

The Proposed Project could adopt GHG reduction measures for construction activities, identified by the CAPCOA in its 2010 report, *Quantifying Greenhouse Gas Mitigation Measures*, which was developed with the support and cooperation of the SCAQMD.

> Construction GHG Reduction Measures. IEUA shall implement all feasible GHG reduction measures during construction. These may include, but shall not be limited to, the following measures identified in the California Air Pollution Control Officers Association 2010 report, "Q*uantifying Greenhouse Gas Mitigation Measures*," which was developed with the support and cooperation of the South Coast Air Quality Management District:
>
> - Use alternative fuels for construction equipment;
> - Use electric and hybrid construction equipment;
> - Limit construction equipment idling beyond regulation requirements;
> - Institute a heavy-duty off-road vehicle plan; and
> - Implement a construction vehicle inventory tracking system.
>
> Furthermore, where cost effective, IEUA shall mitigate the Project's temporary construction-related GHG emissions through the one-time purchase of accredited carbon offsets (current price is approximately \$0.50/$MTCO_2e$ for international offsets, \$3.50/$MTCO_2e$ for offsets within the United States, and \$8.50/$MTCO_2e$ for in-state offsets)

With incorporation of mitigation, annual construction GHG emissions from the Proposed Project would potentially hinder Statewide GHG reduction targets for 2030 because the timing of future construction phasing and sequencing, and the feasibility of implementing mitigation are uncertain. The Proposed Project's construction GHG emissions would be potentially significant and cumulatively considerable.

6.1.2 Operation

The Proposed Project is expected to be operational in 2028. At that time, it would provide up to 50,000 AFY of advanced treated water available to MWD in dry or critically dry years in exchange for the same amount of supply from the SWP. In return, 50,000 AFY of SWP water that would otherwise have been exported to MWD would be stored in Lake Oroville and used to enhance instream flows in the Feather River. Avoiding exporting SWP water to MWD would have energy savings, and an associated reduction in indirect GHG emissions. The amount of electricity required to supply, treat, and distribute water in Southern California is approximately 11,111 kWh/million gallons (CAPCOA 2010), or 3,621 kWh/AF. The GHG emissions from the SWP are approximately 0.15 $MTCO_2e$/MWh (Verma elec. comm. 2016). Thus, in years when the Proposed Project avoids 50,000 AFY of SWP water from being imported to MWD, it would avoid the generation of approximately 27,154 $MTCO_2e$ per year associated with operation of the SWP.

The Proposed Project would be energy intensive. It would require electricity for treatment, conveyance, injection, and extraction. A summary of the estimated annual energy usage of operation of each component of the Proposed Project, based on similar projects in Southern California (Carpinteria Valley Water District 2019, Sanchez elec. comm. 2020), and model default values from CalEEMod v. 2020.4.0 is presented below:

- Injection well: 5 kWh per AF per well
- Extraction well: 100 kWh per AF per well
- AWPF: 1,665 kWh per AF
- Pump station: 600 kWh per AF
- Wellhead Treatment: 10 kWh per AF
- Brine treatment and disposal: 625 kWh per AF

Energy consumption from the groundwater monitoring wells would be negligible. The Storage Reservoir would not directly consume energy, as water would be pumped into it directly from wells or through booster pump stations. The pipelines and turnouts would not consume energy once constructed.

Long-term operation of the Proposed Project would also involve occasional vehicle trips for operations and maintenance of the Proposed Project facilities activities. However, these emissions are assumed to be negligible because the Project facilities would be largely monitored remotely. The Proposed Project facilities would require no more than five to six trips per day, on average, for inspections, testing, and maintenance and these trips would be largely incorporated into existing operations activities.

At the AWPF (the most energy-consuming component of the Proposed Project), IEUA would explore supplying a portion of the electricity from the onsite 1 MW wind turbine and 1.5 MW battery at RP-4, and potentially use a 2.5 MW solar at the IERCF. However, for the purposes of this analysis, it was conservatively assumed that energy demands would be met by electricity supplied by SCE. The Proposed Project would not consume natural gas. As explained in Section 3.1.2, SCE has achieved 38 percent renewables and is on track to achieve 60 percent renewables by 2030. SCE's current carbon intensity factor is 390.983 lbs./MWh CO_2, 0.033 lbs./MWh N_2O, and 0.004 lbs./MWh CH_4, which equates to 0.178 $MTCO_2e$/MWh. Assuming SCE achieves 60 percent renewables by 2030, it would then have a carbon intensity factor of approximately 0.114 $MTCO_2e$/MWh.

The annual GHG emissions of the Proposed Project would depend on whether it is operating during a "call year" or a "non-call year." During "call years" the Proposed Project would extract, pump, and convey 50,000 AFY but it would also offset 50,000 AFY of imported water from the SWP. During "non-call years" the Proposed Project would only extract, pump, and convey 10,000 AFY, but it would not offset any imported SWP water. Under the scenario in which the Proposed Project operates in a "call year" and SCE has its current portfolio of 38 percent carbon-neutral electricity sources, the Project would emit an estimated 11,401$MTCO_2e$. In this scenario, the Project could potentially offset more GHG emissions than it would emit by avoiding SWP imported water, which generates GHG emissions of 27,154 $MTCO_2e$ per year, as stated previously. Under a scenario in which the Proposed Project operates in a "call year" and SCE has achieved 60 percent renewables, the Proposed Project would emit an estimated 7,355 $MTCO_2e$. In this scenario, the Project could potentially result in net-negative GHG emissions due to avoiding SWP imported water.

For "non-call year" scenarios, under the scenario in which SCE has its current portfolio of 38 percent carbon-neutral electricity sources, the Project would emit an estimated 6,435$MTCO_2e$. Under the scenario in which SCE achieves a portfolio with 60 percent renewables, the Project would emit an estimated 4,151$MTCO_2e$. Both of these scenarios represent "non-call years" in which the energy requirements of the Proposed Project, and associated GHG emissions, would not be offset by avoiding the import of SWP water.

As demonstrated by the estimates in the "call-years" scenarios, the Proposed Project could achieve net-neutral GHG emissions during "call-years" when it offsets an equivalent amount of imported water from the SWP. However, the ability to achieve carbon neutrality would depend on the carbon intensity of the electricity supply of the Proposed Project. The relative carbon intensity factor of the SWP versus that of SCE is an important factor; currently, SCE has a carbon intensity factor around 0.178 $MTCO_2e$/MWh, whereas the carbon intensity factor of the SWP is around 0.15 $MTCO_2e$/MWh. When the Proposed Project operates in non-call years, and when it operates after the 25-year term of the agreement, it would not have an equivalent SWP offset. In these years, the electricity use and GHG emissions would be net-positive. Until SCE achieves a 100% carbon-neutral electricity supply (expected in 2045), or until IEUA supplies the Proposed Project with a carbon-neutral electricity source, the Proposed Project operations would have net-positive GHG emissions in "non-call years." Over the 25-year term of the CBP, at least 17.5 years would be non-call years.

As stated in Section 5, for the purposes of CEQA, the Proposed Project would have a significant impact if it would generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment by failing to procure its electricity from carbon neutral electricity sources by 2045, or not meet its fair share of GHG reductions required on a Statewide basis by 2030. The Proposed Project, by procuring electricity from SCE, which is on-track to achieve 60 percent renewables by 2030, would not generate indirect GHG emissions associated with electricity consumption that exceed the Statewide 2030 targets. Furthermore, if IEUA were to use its own renewable energy for the Proposed Project's demands, it would accelerate the efforts toward carbon-neutral electricity supply. Therefore, operation of the Proposed Project would meet its fair share of GHG reductions required to achieve the Statewide 2030 GHG reduction targets, and impacts would be less than significant.

The Renewable Portfolio Standard for 2045, according to SB 100, which was signed into law in September 2018, is for California to obtain 100 percent of its electricity from carbon neutral sources by 2045. Although it is projected that SCE would have a 100 percent carbon neutral power supply by 2045, it is impossible to say with complete certainty that this will be achieved in the future. Likewise, it is impossible to say with certainty that IEUA will achieve its goal of carbon neutrality for all its facilities in the next 15 years. In "call years," when the Proposed Project energy use is offset by an equivalent amount of avoided imported SWP supply, the Proposed Project would likely have no net GHG emissions. However, the carbon-intensity of the SWP is also likely to fall in the future, which would reduce the amount of GHG the Proposed Project would offset. Because of the uncertainty surrounding the future power mix and energy demands of the Proposed Project, the long-term, indirect impacts of the Proposed Project's operational GHG emissions could be potentially significant and cumulatively considerable in call and non-call years.

To reduce indirect, operational GHG emissions from the Proposed Project, IEUA could adopt GHG reduction measures and/or purchase carbon offsets. However, because of the uncertainty surrounding the Proposed Project's future GHG emissions beyond 2030, with incorporation of mitigation, impacts would be potentially significant and cumulatively considerable.

Operational GHG Reduction Measures. IEUA shall implement all feasible GHG reduction measures during operations. These may include, but shall not be limited to, the following measures identified in the California Air Pollution Control Officers Association 2010 report, "Q*uantifying Greenhouse Gas Mitigation Measures*," which was developed with the support and cooperation of the South Coast Air Quality Management District:

- Exceed Title 24 Building energy efficiency standards
- Establish on-site renewable energy systems
- Utilize electric or hybrid vehicles and/or encourage operations and maintenance employees to carpool or otherwise commute using a method other than a single-occupancy fossil-fuel powered vehicle

Furthermore, where cost effective, IEUA shall mitigate the project's GHG emissions through the one-time purchase of accredited carbon offsets (current price is approximately \$0.50/$MTCO_2e$ for international offsets, \$3.50/$MTCO_2e$ for offsets within the United States, and \$8.50/$MTCO_2e$ for in-state offsets)

6.2 Consistency with Plans

6.2.1 CARB 2017 Climate Change Scoping Plan

The 2017 Climate Change Scoping Plan focuses primarily on reducing GHG emissions that result from mobile sources and land use development. The Proposed Project would not involve a considerable increase in new vehicle trips or land use changes that would result in an increase in vehicle trips, such as urban sprawl. The 2017 Climate Change Scoping Plan also recognizes that about 2 percent of the total energy used in the state is related to water conveyance; it calls for, "increased water conservation and efficiency, improved coordination and management of various water supplies, greater understanding of the water-energy nexus, deployment of new technologies in drinking water treatment, groundwater remediation and recharge, and potentially brackish and seawater desalination." By augmenting local water supplies, the Proposed Project would offset energy demands associated with imported water supplies. Therefore, the Proposed Project would not conflict with an applicable plan, policy or regulation adopted for the purpose of reducing GHG emissions. Impacts would be less than significant, and no mitigation would be required.

6.2.2 IEUA CAP

The IEUA CCAP sets goals which are listed above in Section 3.1.4. The Proposed Project directly supports the CCAP objective to expand infrastructure to enhance capabilities for end user application, storage, or groundwater replenishment of recycled water. It also directly supports the CCAP objective of enhancing groundwater replenishment capabilities through infrastructure upgrades, and the expansion of groundwater storage of recycled water. The Proposed Project has components that intentionally lower the power demand on the electrical grid, such as the consideration of in-conduit hydropower facilities in locations of the potable water distribution system where the system pressure needs to be reduced and energy can be produced. During "call-years" the Proposed Project would offset imported water from the SWP, which would save energy and avoid SWP-related GHG emissions. The Proposed Project would incorporate the use of available renewable on-site generation at RP-4 if possible, including the 1 MW wind turbine and 1.5 MW battery at RP-4, if possible. IEUA would also consider use of a 2.5 MW solar at the IERCF. Therefore, it would support the CCAP objective to pursue renewable power generation at IEUA facilities. The Proposed Project would not conflict with the CCAP.

6.3 Cumulative Impacts

GHG emissions are, by definition, cumulative impacts because they affect the worldwide accumulation of GHGs in the atmosphere. Because climate change is not a local problem, the cumulative worldwide and statewide effects of GHG emissions are significant. For GHG, CEQA focuses on whether the incremental contribution of a proposed project is cumulatively considerable, and thus significant in and of itself. The Proposed Project would be consistent with applicable land use and zoning designations and would be consistent with many of the goals of the applicable State and local plans and programs designed to reduce GHG emissions. However, GHG emissions associated with the Proposed Project have the potential to be net-positive by 2045 because there may not be enough renewable energy sources available to off-set the GHGs generated by the Proposed Project. This would result in the Proposed Project not meeting the GHG reduction goals suggested by the applicable State plan (2017 Climate Change Scoping Plan), and thus be considered a cumulatively considerable impact. However, the Project would support the State with adapting to climate change by developing new local supplies that beneficially reuse wastewater and avoid imported water from the SWP. This is a necessary improvement to mitigate the impacts of climate change on water supply reliability, especially during critically dry years, which are expected to increase in frequency and intensity due to climate change. As climate changes, the State needs to adapt to climate change by improving water management resilience to account for warmer temperatures and declining snowpack. The new infrastructure of the Proposed Project would help manage water supply variability, thereby stabilizing water reliability in areas with limited water supply.

7. REFERENCES

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ATTACHMENT A: CALEEMOD OUTPUT SHEETS

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Chino Basin Program - Construction

South Coast Air Basin, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Refrigerated Warehouse-No Rail	1,354.00	1000sqft	31.08	1,354,000.00	0
Other Asphalt Surfaces	1,056.00	1000sqft	24.24	1,056,000.00	0
Unrefrigerated Warehouse-No Rail	163.00	1000sqft	3.74	163,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	31
Climate Zone	10			**Operational Year**	2028
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	390.98	**CH4 Intensity (lb/MWhr)**	0.033	**N2O Intensity (lb/MWhr)**	0.004

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - CalEEMod has limited choices for land use types. Industrial Refrigerated Warehouse - no rail chosen for most CBP components because allows for project-specific entries for energy use, and construction. Parking Other Asphalt Surfaces chosen for pipes, turnouts because allows for project-specific entries on construction equipment, etc., and doesn't have operational energy usage.

Construction Phase - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment -

Off-road Equipment - see project description

Off-road Equipment - see project description

Off-road Equipment - see project description

Grading - see project description

Demolition -

Trips and VMT - see project description.

Vehicle Trips - construction only

Area Coating - construction only

Landscape Equipment - construction only

Energy Use - construction only

Water And Wastewater - construction only

Solid Waste - construction only

Construction Off-road Equipment Mitigation - rule 403 and 90-percent Tier 4

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EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

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EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

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tblTripsAndVMT	VendorTripNumber	0.00	30.00
tblTripsAndVMT	VendorTripNumber	0.00	28.00
tblTripsAndVMT	VendorTripNumber	0.00	30.00
tblTripsAndVMT	VendorTripNumber	0.00	12.00
tblTripsAndVMT	VendorTripNumber	422.00	0.00
tblTripsAndVMT	WorkerTripLength	14.70	20.00
tblTripsAndVMT	WorkerTripLength	14.70	20.00
tblTripsAndVMT	WorkerTripLength	14.70	20.00
tblTripsAndVMT	WorkerTripLength	14.70	20.00
tblTripsAndVMT	WorkerTripLength	14.70	20.00
tblTripsAndVMT	WorkerTripLength	14.70	40.00
tblTripsAndVMT	WorkerTripLength	14.70	40.00
tblTripsAndVMT	WorkerTripLength	14.70	40.00
tblTripsAndVMT	WorkerTripLength	14.70	40.00
tblTripsAndVMT	WorkerTripLength	14.70	40.00
tblTripsAndVMT	WorkerTripNumber	73.00	80.00
tblTripsAndVMT	WorkerTripNumber	15.00	40.00
tblTripsAndVMT	WorkerTripNumber	1,081.00	40.00
tblTripsAndVMT	WorkerTripNumber	15.00	20.00
tblTripsAndVMT	WorkerTripNumber	1,081.00	20.00
tblTripsAndVMT	WorkerTripNumber	15.00	24.00
tblTripsAndVMT	WorkerTripNumber	1,081.00	24.00
tblTripsAndVMT	WorkerTripNumber	20.00	24.00
tblTripsAndVMT	WorkerTripNumber	23.00	40.00

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

tblTripsAndVMT	WorkerTripNumber	100.00	84.00
tblTripsAndVMT	WorkerTripNumber	100.00	84.00
tblTripsAndVMT	WorkerTripNumber	100.00	28.00
tblTripsAndVMT	WorkerTripNumber	10.00	20.00
tblTripsAndVMT	WorkerTripNumber	18.00	40.00
tblTripsAndVMT	WorkerTripNumber	100.00	84.00
tblTripsAndVMT	WorkerTripNumber	1,081.00	10.00
tblVehicleTrips	ST_TR	2.12	0.00
tblVehicleTrips	ST_TR	1.74	0.00
tblVehicleTrips	SU_TR	2.12	0.00
tblVehicleTrips	SU_TR	1.74	0.00
tblVehicleTrips	WD_TR	2.12	0.00
tblVehicleTrips	WD_TR	1.74	0.00
tblWater	IndoorWaterUseRate	313,112,500.00	0.00
tblWater	IndoorWaterUseRate	37,693,750.00	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2025	1.0004	12.2408	9.1795	0.0402	3.9319	0.3782	4.3101	1.8993	0.3527	2.2520	0.0000	3,740.045 4	3,740.045 4	0.5180	0.2993	3,842.171 5
2026	1.9686	21.4846	17.3031	0.0604	7.7330	0.7544	8.4874	3.9158	0.7050	4.6208	0.0000	5,543.159 7	5,543.159 7	0.8750	0.3526	5,670.108 6
2027	2.7281	28.4829	24.2305	0.0791	9.0371	1.0053	10.0424	4.5176	0.9393	5.4568	0.0000	7,233.787 6	7,233.787 6	1.1735	0.4380	7,393.635 1
Maximum	**2.7281**	**28.4829**	**24.2305**	**0.0791**	**9.0371**	**1.0053**	**10.0424**	**4.5176**	**0.9393**	**5.4568**	**0.0000**	**7,233.787 6**	**7,233.787 6**	**1.1735**	**0.4380**	**7,393.635 1**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2025	0.3909	5.8051	10.1665	0.0402	2.1222	0.0894	2.2116	0.9618	0.0850	1.0468	0.0000	3,740.043 5	3,740.043 5	0.5180	0.2993	3,842.169 6
2026	0.6480	7.9647	19.3371	0.0604	3.9248	0.1389	4.0637	1.8964	0.1329	2.0293	0.0000	5,543.156 2	5,543.156 2	0.8750	0.3526	5,670.105 1
2027	0.9528	10.1932	27.0765	0.0791	4.6576	0.1750	4.8326	2.2105	0.1679	2.3784	0.0000	7,233.782 9	7,233.782 9	1.1735	0.4380	7,393.630 4
Maximum	**0.9528**	**10.1932**	**27.0765**	**0.0791**	**4.6576**	**0.1750**	**4.8326**	**2.2105**	**0.1679**	**2.3784**	**0.0000**	**7,233.782 9**	**7,233.782 9**	**1.1735**	**0.4380**	**7,393.630 4**

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	65.04	61.48	-11.57	0.00	48.29	81.14	51.37	50.95	80.68	55.76	0.00	0.00	0.00	0.00	0.00	0.00

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	1-1-2025	3-31-2025	4.6240	1.8897
2	4-1-2025	6-30-2025	2.8001	1.3729
3	7-1-2025	9-30-2025	2.8309	1.3880
4	10-1-2025	12-31-2025	2.8667	1.4237
5	1-1-2026	3-31-2026	7.1350	2.4807
6	4-1-2026	6-30-2026	5.3345	1.9659
7	7-1-2026	9-30-2026	5.3932	1.9875
8	10-1-2026	12-31-2026	5.4368	2.0311
9	1-1-2027	3-31-2027	8.8421	2.9687
10	4-1-2027	6-30-2027	7.1033	2.5546
11	7-1-2027	9-30-2027	7.5547	2.7174
		Highest	8.8421	2.9687

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	5.5499	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**5.5499**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	5.5499	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**5.5499**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Wells	Grading	1/1/2025	12/31/2027	5	783	Wells
2	Pipelines25	Grading	1/1/2025	3/3/2025	5	44	Pipelines25
3	Pipelines26	Grading	1/1/2026	3/3/2026	5	44	Pipelines26

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

4	Turnouts	Grading	1/1/2026	12/31/2027		5	522	Turnouts
5	WellheadDemo	Demolition	1/1/2027	1/28/2027		5	20	WellheadDemo
6	AWPFSiteprep	Site Preparation	1/1/2027	1/7/2027		5	5	AWPFSiteprep
7	Pipelines27	Grading	1/1/2027	3/3/2027		5	44	Pipelines27
8	PumpStationsGrading	Grading	1/1/2027	12/31/2027		5	261	PumpStationsGrading
9	PumpStationsConstruct	Building Construction	1/1/2027	12/31/2027		5	261	PumpStationsConstruct
10	AWPFGrading	Grading	1/8/2027	1/19/2027		5	8	AWPFGrading
11	AWPFConstruction	Building Construction	1/20/2027	12/7/2027		5	230	AWPFConstruction
12	WellheadGrading	Grading	1/29/2027	2/25/2027		5	20	WellheadGrading
13	WellheadConstruct	Building Construction	2/26/2027	12/3/2027		5	201	WellheadConstruct
14	StorageResGrading	Grading	8/2/2027	8/13/2027		5	10	StorageResGrading
15	StorageResConstruct	Building Construction	8/16/2027	11/26/2027		5	75	StorageResConstruct
16	StorageResPaving	Paving	11/29/2027	12/10/2027		5	10	StorageResPaving
17	WellheadPaving	Paving	12/6/2027	12/31/2027		5	20	WellheadPaving
18	AWPFPaving	Paving	12/8/2027	12/31/2027		5	18	AWPFPaving

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 18.5

Acres of Paving: 24.24

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Wells	Rubber Tired Dozers	4	6.00	247	0.40
Wells	Tractors/Loaders/Backhoes	12	6.00	97	0.37
Wells	Bore/Drill Rigs	1	24.00	221	0.50
Wells	Cranes	4	6.00	231	0.29
Wells	Welders	4	4.00	46	0.45

Pipelines25	Excavators	3	4.00	158	0.38
Pipelines25	Graders	1	8.00	187	0.41
Pipelines25	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines25	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines25	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines25	Cranes	3	6.00	231	0.29
Pipelines25	Rollers	3	6.00	80	0.38
Pipelines25	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines25	Paving Equipment	3	2.00	132	0.36
Pipelines25	Generator Sets	3	1.00	84	0.74
Pipelines26	Excavators	3	4.00	158	0.38
Pipelines26	Graders	1	8.00	187	0.41
Pipelines26	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines26	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines26	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines26	Cranes	3	6.00	231	0.29
Pipelines26	Rollers	3	6.00	80	0.38
Pipelines26	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines26	Paving Equipment	3	2.00	132	0.36
Pipelines26	Generator Sets	3	1.00	84	0.74
Pipelines27	Excavators	3	4.00	158	0.38
Pipelines27	Graders	1	8.00	187	0.41
Pipelines27	Rubber Tired Dozers	6	6.00	247	0.40
Pipelines27	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Pipelines27	Crushing/Proc. Equipment	6	6.00	85	0.78
Pipelines27	Cranes	3	6.00	231	0.29
Pipelines27	Rollers	3	6.00	80	0.38
Pipelines27	Sweepers/Scrubbers	3	4.00	64	0.46
Pipelines27	Paving Equipment	3	2.00	132	0.36

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Pipelines27	Generator Sets	3	1.00	84	0.74
Turnouts	Excavators	3	4.00	158	0.38
Turnouts	Graders	1	8.00	187	0.41
Turnouts	Rubber Tired Dozers	6	6.00	247	0.40
Turnouts	Tractors/Loaders/Backhoes	3	6.00	97	0.37
Turnouts	Crushing/Proc. Equipment	6	6.00	85	0.78
Turnouts	Cranes	3	6.00	231	0.29
Turnouts	Rollers	3	6.00	80	0.38
Turnouts	Sweepers/Scrubbers	3	4.00	64	0.46
Turnouts	Paving Equipment	3	2.00	132	0.36
Turnouts	Generator Sets	3	1.00	84	0.74
AWPFSiteprep	Rubber Tired Dozers	3	8.00	247	0.40
AWPFSiteprep	Tractors/Loaders/Backhoes	4	8.00	97	0.37
AWPFGrading	Excavators	1	8.00	158	0.38
AWPFGrading	Graders	1	8.00	187	0.41
AWPFGrading	Rubber Tired Dozers	1	8.00	247	0.40
AWPFGrading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
AWPFConstruction	Cranes	1	7.00	231	0.29
AWPFConstruction	Forklifts	3	8.00	89	0.20
AWPFConstruction	Generator Sets	1	8.00	84	0.74
AWPFConstruction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
AWPFConstruction	Welders	1	8.00	46	0.45
AWPFPaving	Cement and Mortar Mixers	2	6.00	9	0.56
AWPFPaving	Pavers	1	8.00	130	0.42
AWPFPaving	Paving Equipment	2	6.00	132	0.36
AWPFPaving	Rollers	2	6.00	80	0.38
AWPFPaving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
PumpStationsGrading	Graders	1	8.00	187	0.41
PumpStationsGrading	Rubber Tired Dozers	1	8.00	247	0.40

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

PumpStationsGrading	Tractors/Loaders/Backhoes	2	7.00	97	0.37
PumpStationsConstruct	Cranes	1	4.00	231	0.29
PumpStationsConstruct	Forklifts	1	4.00	89	0.20
PumpStationsConstruct	Tractors/Loaders/Backhoes	2	4.00	97	0.37
PumpStationsConstruct	Welders	1	4.00	46	0.45
WellheadDemo	Concrete/Industrial Saws	2	6.00	81	0.73
WellheadDemo	Rubber Tired Dozers	2	6.00	247	0.40
WellheadGrading	Graders	2	6.00	187	0.41
WellheadGrading	Tractors/Loaders/Backhoes	4	6.00	97	0.37
WellheadConstruct	Cranes	2	4.00	231	0.29
WellheadConstruct	Forklifts	2	6.00	89	0.20
WellheadConstruct	Generator Sets	2	4.00	84	0.74
WellheadConstruct	Tractors/Loaders/Backhoes	4	6.00	97	0.37
WellheadConstruct	Welders	2	4.00	46	0.45
WellheadPaving	Pavers	2	6.00	130	0.42
WellheadPaving	Paving Equipment	2	6.00	132	0.36
WellheadPaving	Rollers	2	6.00	80	0.38
StorageResGrading	Excavators	1	8.00	158	0.38
StorageResGrading	Graders	1	8.00	187	0.41
StorageResGrading	Rubber Tired Dozers	1	8.00	247	0.40
StorageResGrading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
StorageResConstruct	Cranes	1	7.00	231	0.29
StorageResConstruct	Forklifts	3	8.00	89	0.20
StorageResConstruct	Generator Sets	1	8.00	84	0.74
StorageResConstruct	Tractors/Loaders/Backhoes	3	7.00	97	0.37
StorageResConstruct	Welders	1	8.00	46	0.45
StorageResPaving	Cement and Mortar Mixers	2	6.00	9	0.56
StorageResPaving	Pavers	1	8.00	130	0.42
StorageResPaving	Paving Equipment	2	6.00	132	0.36

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

StorageResPaving	Rollers	2	6.00	80	0.38
StorageResPaving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Wells	Generator Sets	4	4.00	84	0.74
Pipelines25	Plate Compactors	3	2.00	8	0.43
Pipelines25	Signal Boards	3	6.00	6	0.82
Pipelines26	Plate Compactors	3	2.00	8	0.43
Pipelines26	Signal Boards	3	6.00	6	0.82
Turnouts	Plate Compactors	3	2.00	8	0.43
Turnouts	Signal Boards	3	6.00	6	0.82
Pipelines27	Plate Compactors	3	2.00	8	0.43
Pipelines27	Signal Boards	3	6.00	6	0.82
WellheadPaving	Plate Compactors	2	6.00	8	0.43
AWPFPaving	Plate Compactors	1	6.00	8	0.43

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Wells	29	80.00	128.00	40.00	14.70	50.00	20.00	LD_Mix	HDT_Mix	HHDT
Pipelines25	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Pipelines26	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Pipelines27	40	84.00	30.00	660.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
Turnouts	40	28.00	28.00	2,000.00	40.00	40.00	40.00	LD_Mix	HDT_Mix	HHDT
AWPFSiteprep	7	40.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
AWPFGrading	6	40.00	30.00	0.00	14.70	40.00	20.00	LD_Mix	HDT_Mix	HHDT
AWPFConstruction	9	40.00	30.00	0.00	14.70	40.00	20.00	LD_Mix	HDT_Mix	HHDT
AWPFPaving	9	40.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
PumpStationsGrading	4	10.00	12.00	0.00	14.70	20.00	20.00	LD_Mix	HDT_Mix	HHDT
PumpStationsConstruct	5	10.00	0.00	0.00	40.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

WellheadDemo	4	20.00	0.00	20.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
WellheadGrading	6	20.00	0.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
WellheadConstruct	12	20.00	20.00	0.00	20.00	40.00	20.00	LD_Mix	HDT_Mix	HHDT
WellheadPaving	8	20.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT
StorageResGrading	6	24.00	0.00	600.00	20.00	6.90	50.00	LD_Mix	HDT_Mix	HHDT
StorageResConstruct	9	24.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT
StorageResPaving	8	24.00	0.00	0.00	20.00	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Wells - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					2.3675	0.0000	2.3675	1.2970	0.0000	1.2970	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.7402	7.1102	6.6556	0.0154		0.2894	0.2894		0.2691	0.2691	0.0000	1,336.434 7	1,336.434 7	0.3788	0.0000	1,345.903 5
Total	**0.7402**	**7.1102**	**6.6556**	**0.0154**	**2.3675**	**0.2894**	**2.6568**	**1.2970**	**0.2691**	**1.5661**	**0.0000**	**1,336.434 7**	**1,336.434 7**	**0.3788**	**0.0000**	**1,345.903 5**

3.2 Wells - 2025

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	8.6000e-004	2.4000e-004	0.0000	1.1000e-004	1.0000e-005	1.2000e-004	3.0000e-005	1.0000e-005	4.0000e-005	0.0000	0.3721	0.3721	2.0000e-005	6.0000e-005	0.3903
Vendor	0.0597	3.4724	0.7490	0.0199	0.7605	0.0241	0.7846	0.2191	0.0231	0.2422	0.0000	1,948.946 3	1,948.946 3	0.0748	0.2817	2,034.764 4
Worker	0.0284	0.0200	0.2954	9.2000e-004	0.1145	6.0000e-004	0.1151	0.0304	5.5000e-004	0.0310	0.0000	84.0503	84.0503	1.8900e-003	2.0000e-003	84.6949
Total	**0.0881**	**3.4933**	**1.0447**	**0.0208**	**0.8751**	**0.0247**	**0.8998**	**0.2496**	**0.0236**	**0.2732**	**0.0000**	**2,033.368 7**	**2,033.368 7**	**0.0767**	**0.2838**	**2,119.849 6**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0654	0.0000	1.0654	0.5837	0.0000	0.5837	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2506	1.8688	7.4662	0.0154		0.0557	0.0557		0.0527	0.0527	0.0000	1,336.433 1	1,336.433 1	0.3788	0.0000	1,345.901 9
Total	**0.2506**	**1.8688**	**7.4662**	**0.0154**	**1.0654**	**0.0557**	**1.1210**	**0.5837**	**0.0527**	**0.6363**	**0.0000**	**1,336.433 1**	**1,336.433 1**	**0.3788**	**0.0000**	**1,345.901 9**

3.2 Wells - 2025

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	8.6000e-004	2.4000e-004	0.0000	9.0000e-005	1.0000e-005	1.0000e-004	3.0000e-005	1.0000e-005	3.0000e-005	0.0000	0.3721	0.3721	2.0000e-005	6.0000e-005	0.3903
Vendor	0.0597	3.4724	0.7490	0.0199	0.6254	0.0241	0.6495	0.1860	0.0231	0.2091	0.0000	1,948.9463	1,948.9463	0.0748	0.2817	2,034.7644
Worker	0.0284	0.0200	0.2954	9.2000e-004	0.0897	6.0000e-004	0.0903	0.0243	5.5000e-004	0.0249	0.0000	84.0503	84.0503	1.8900e-003	2.0000e-003	84.6949
Total	**0.0881**	**3.4933**	**1.0447**	**0.0208**	**0.7152**	**0.0247**	**0.7399**	**0.2103**	**0.0236**	**0.2340**	**0.0000**	**2,033.3687**	**2,033.3687**	**0.0767**	**0.2838**	**2,119.8496**

3.2 Wells - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					2.3675	0.0000	2.3675	1.2970	0.0000	1.2970	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.7402	7.1102	6.6556	0.0154		0.2894	0.2894		0.2691	0.2691	0.0000	1,336.4347	1,336.4347	0.3788	0.0000	1,345.9035
Total	**0.7402**	**7.1102**	**6.6556**	**0.0154**	**2.3675**	**0.2894**	**2.6568**	**1.2970**	**0.2691**	**1.5661**	**0.0000**	**1,336.4347**	**1,336.4347**	**0.3788**	**0.0000**	**1,345.9035**

3.2 Wells - 2026

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	8.5000e-004	2.4000e-004	0.0000	1.1000e-004	1.0000e-005	1.2000e-004	3.0000e-005	1.0000e-005	4.0000e-005	0.0000	0.3651	0.3651	2.0000e-005	6.0000e-005	0.3830
Vendor	0.0577	3.4443	0.7385	0.0195	0.7605	0.0241	0.7846	0.2191	0.0231	0.2422	0.0000	1,912.9449	1,912.9449	0.0750	0.2768	1,997.3153
Worker	0.0268	0.0182	0.2775	8.9000e-004	0.1145	5.7000e-004	0.1151	0.0304	5.2000e-004	0.0309	0.0000	81.4738	81.4738	1.7200e-003	1.8900e-003	82.0801
Total	**0.0845**	**3.4633**	**1.0163**	**0.0204**	**0.8751**	**0.0247**	**0.8998**	**0.2496**	**0.0236**	**0.2732**	**0.0000**	**1,994.7837**	**1,994.7837**	**0.0767**	**0.2788**	**2,079.7784**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0654	0.0000	1.0654	0.5837	0.0000	0.5837	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2506	1.8688	7.4662	0.0154		0.0557	0.0557		0.0527	0.0527	0.0000	1,336.4331	1,336.4331	0.3788	0.0000	1,345.9019
Total	**0.2506**	**1.8688**	**7.4662**	**0.0154**	**1.0654**	**0.0557**	**1.1210**	**0.5837**	**0.0527**	**0.6363**	**0.0000**	**1,336.4331**	**1,336.4331**	**0.3788**	**0.0000**	**1,345.9019**

3.2 Wells - 2026

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	8.5000e-004	2.4000e-004	0.0000	9.0000e-005	1.0000e-005	1.0000e-004	3.0000e-005	1.0000e-005	3.0000e-005	0.0000	0.3651	0.3651	2.0000e-005	6.0000e-005	0.3830
Vendor	0.0577	3.4443	0.7385	0.0195	0.6254	0.0241	0.6495	0.1860	0.0231	0.2090	0.0000	1,912.9449	1,912.9449	0.0750	0.2768	1,997.3153
Worker	0.0268	0.0182	0.2775	8.9000e-004	0.0897	5.7000e-004	0.0903	0.0243	5.2000e-004	0.0249	0.0000	81.4738	81.4738	1.7200e-003	1.8900e-003	82.0801
Total	**0.0845**	**3.4633**	**1.0163**	**0.0204**	**0.7152**	**0.0247**	**0.7398**	**0.2103**	**0.0236**	**0.2339**	**0.0000**	**1,994.7837**	**1,994.7837**	**0.0767**	**0.2788**	**2,079.7784**

3.2 Wells - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					2.3675	0.0000	2.3675	1.2970	0.0000	1.2970	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.7402	7.1102	6.6556	0.0154		0.2894	0.2894		0.2691	0.2691	0.0000	1,336.4347	1,336.4347	0.3788	0.0000	1,345.9035
Total	**0.7402**	**7.1102**	**6.6556**	**0.0154**	**2.3675**	**0.2894**	**2.6568**	**1.2970**	**0.2691**	**1.5661**	**0.0000**	**1,336.4347**	**1,336.4347**	**0.3788**	**0.0000**	**1,345.9035**

3.2 Wells - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	8.4000e-004	2.4000e-004	0.0000	1.1000e-004	1.0000e-005	1.2000e-004	3.0000e-005	1.0000e-005	4.0000e-005	0.0000	0.3578	0.3578	2.0000e-005	6.0000e-005	0.3754
Vendor	0.0560	3.4140	0.7296	0.0191	0.7605	0.0240	0.7845	0.2191	0.0230	0.2421	0.0000	1,875.2229	1,875.2229	0.0749	0.2717	1,958.0722
Worker	0.0253	0.0166	0.2623	8.6000e-004	0.1145	5.3000e-004	0.1151	0.0304	4.9000e-004	0.0309	0.0000	79.1847	79.1847	1.5700e-003	1.7900e-003	79.7589
Total	**0.0813**	**3.4315**	**0.9921**	**0.0199**	**0.8751**	**0.0246**	**0.8997**	**0.2496**	**0.0235**	**0.2731**	**0.0000**	**1,954.7654**	**1,954.7654**	**0.0765**	**0.2736**	**2,038.2064**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.0654	0.0000	1.0654	0.5837	0.0000	0.5837	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2506	1.8688	7.4662	0.0154		0.0557	0.0557		0.0527	0.0527	0.0000	1,336.4331	1,336.4331	0.3788	0.0000	1,345.9019
Total	**0.2506**	**1.8688**	**7.4662**	**0.0154**	**1.0654**	**0.0557**	**1.1210**	**0.5837**	**0.0527**	**0.6363**	**0.0000**	**1,336.4331**	**1,336.4331**	**0.3788**	**0.0000**	**1,345.9019**

3.2 Wells - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	8.4000e-004	2.4000e-004	0.0000	9.0000e-005	1.0000e-005	1.0000e-004	3.0000e-005	1.0000e-005	3.0000e-005	0.0000	0.3578	0.3578	2.0000e-005	6.0000e-005	0.3754
Vendor	0.0560	3.4140	0.7296	0.0191	0.6254	0.0240	0.6494	0.1860	0.0230	0.2090	0.0000	1,875.2229	1,875.2229	0.0749	0.2717	1,958.0722
Worker	0.0253	0.0166	0.2623	8.6000e-004	0.0897	5.3000e-004	0.0903	0.0243	4.9000e-004	0.0248	0.0000	79.1847	79.1847	1.5700e-003	1.7900e-003	79.7589
Total	**0.0813**	**3.4315**	**0.9921**	**0.0199**	**0.7152**	**0.0246**	**0.7397**	**0.2103**	**0.0235**	**0.2338**	**0.0000**	**1,954.7654**	**1,954.7654**	**0.0765**	**0.2736**	**2,038.2064**

3.3 Pipelines25 - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.5988	0.0000	0.5988	0.3280	0.0000	0.3280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1586	1.4383	1.3081	2.6700e-003		0.0625	0.0625		0.0585	0.0585	0.0000	232.4422	232.4422	0.0572	0.0000	233.8721
Total	**0.1586**	**1.4383**	**1.3081**	**2.6700e-003**	**0.5988**	**0.0625**	**0.6613**	**0.3280**	**0.0585**	**0.3865**	**0.0000**	**232.4422**	**232.4422**	**0.0572**	**0.0000**	**233.8721**

3.3 Pipelines25 - 2025

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0100e-003	0.0794	0.0187	3.6000e-004	0.0114	5.7000e-004	0.0119	3.1100e-003	5.5000e-004	3.6600e-003	0.0000	36.0450	36.0450	2.3300e-003	5.7400e-003	37.8132
Vendor	1.9600e-003	0.1112	0.0248	6.3000e-004	0.0240	7.6000e-004	0.0248	6.9300e-003	7.3000e-004	7.6600e-003	0.0000	61.7846	61.7846	2.3700e-003	8.9300e-003	64.5060
Worker	0.0106	8.3700e-003	0.1275	4.4000e-004	0.0551	2.7000e-004	0.0554	0.0146	2.5000e-004	0.0149	0.0000	39.9701	39.9701	6.1000e-004	8.1000e-004	40.2272
Total	**0.0135**	**0.1991**	**0.1711**	**1.4300e-003**	**0.0905**	**1.6000e-003**	**0.0921**	**0.0247**	**1.5300e-003**	**0.0262**	**0.0000**	**137.7997**	**137.7997**	**5.3100e-003**	**0.0155**	**142.5463**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2695	0.0000	0.2695	0.1476	0.0000	0.1476	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0387	0.2440	1.4846	2.6700e-003		7.4100e-003	7.4100e-003		7.1800e-003	7.1800e-003	0.0000	232.4420	232.4420	0.0572	0.0000	233.8718
Total	**0.0387**	**0.2440**	**1.4846**	**2.6700e-003**	**0.2695**	**7.4100e-003**	**0.2769**	**0.1476**	**7.1800e-003**	**0.1548**	**0.0000**	**232.4420**	**232.4420**	**0.0572**	**0.0000**	**233.8718**

3.3 Pipelines25 - 2025

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0100e-003	0.0794	0.0187	3.6000e-004	9.2100e-003	5.7000e-004	9.7800e-003	2.5900e-003	5.5000e-004	3.1400e-003	0.0000	36.0450	36.0450	2.3300e-003	5.7400e-003	37.8132
Vendor	1.9600e-003	0.1112	0.0248	6.3000e-004	0.0198	7.6000e-004	0.0205	5.8800e-003	7.3000e-004	6.6100e-003	0.0000	61.7846	61.7846	2.3700e-003	8.9300e-003	64.5060
Worker	0.0106	8.3700e-003	0.1275	4.4000e-004	0.0432	2.7000e-004	0.0435	0.0117	2.5000e-004	0.0120	0.0000	39.9701	39.9701	6.1000e-004	8.1000e-004	40.2272
Total	**0.0135**	**0.1991**	**0.1711**	**1.4300e-003**	**0.0722**	**1.6000e-003**	**0.0738**	**0.0202**	**1.5300e-003**	**0.0217**	**0.0000**	**137.7997**	**137.7997**	**5.3100e-003**	**0.0155**	**142.5463**

3.4 Pipelines26 - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.5988	0.0000	0.5988	0.3280	0.0000	0.3280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1586	1.4383	1.3081	2.6700e-003		0.0625	0.0625		0.0585	0.0585	0.0000	232.4422	232.4422	0.0572	0.0000	233.8721
Total	**0.1586**	**1.4383**	**1.3081**	**2.6700e-003**	**0.5988**	**0.0625**	**0.6613**	**0.3280**	**0.0585**	**0.3865**	**0.0000**	**232.4422**	**232.4422**	**0.0572**	**0.0000**	**233.8721**

3.4 Pipelines26 - 2026

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-003	0.0786	0.0189	3.5000e-004	0.0114	5.7000e-004	0.0119	3.1100e-003	5.4000e-004	3.6600e-003	0.0000	35.3668	35.3668	2.3400e-003	5.6300e-003	37.1036
Vendor	1.9000e-003	0.1104	0.0245	6.2000e-004	0.0240	7.6000e-004	0.0248	6.9300e-003	7.3000e-004	7.6600e-003	0.0000	60.6432	60.6432	2.3800e-003	8.7800e-003	63.3187
Worker	0.0100	7.5600e-003	0.1195	4.2000e-004	0.0551	2.6000e-004	0.0554	0.0146	2.4000e-004	0.0149	0.0000	38.7452	38.7452	5.5000e-004	7.6000e-004	38.9863
Total	**0.0129**	**0.1965**	**0.1629**	**1.3900e-003**	**0.0905**	**1.5900e-003**	**0.0921**	**0.0247**	**1.5100e-003**	**0.0262**	**0.0000**	**134.7552**	**134.7552**	**5.2700e-003**	**0.0152**	**139.4086**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2695	0.0000	0.2695	0.1476	0.0000	0.1476	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0387	0.2440	1.4846	2.6700e-003		7.4100e-003	7.4100e-003		7.1800e-003	7.1800e-003	0.0000	232.4420	232.4420	0.0572	0.0000	233.8718
Total	**0.0387**	**0.2440**	**1.4846**	**2.6700e-003**	**0.2695**	**7.4100e-003**	**0.2769**	**0.1476**	**7.1800e-003**	**0.1548**	**0.0000**	**232.4420**	**232.4420**	**0.0572**	**0.0000**	**233.8718**

3.4 Pipelines26 - 2026

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-003	0.0786	0.0189	3.5000e-004	9.2100e-003	5.7000e-004	9.7800e-003	2.5900e-003	5.4000e-004	3.1400e-003	0.0000	35.3668	35.3668	2.3400e-003	5.6300e-003	37.1036
Vendor	1.9000e-003	0.1104	0.0245	6.2000e-004	0.0198	7.6000e-004	0.0205	5.8800e-003	7.3000e-004	6.6100e-003	0.0000	60.6432	60.6432	2.3800e-003	8.7800e-003	63.3187
Worker	0.0100	7.5600e-003	0.1195	4.2000e-004	0.0432	2.6000e-004	0.0434	0.0117	2.4000e-004	0.0119	0.0000	38.7452	38.7452	5.5000e-004	7.6000e-004	38.9863
Total	**0.0129**	**0.1965**	**0.1629**	**1.3900e-003**	**0.0722**	**1.5900e-003**	**0.0738**	**0.0202**	**1.5100e-003**	**0.0217**	**0.0000**	**134.7552**	**134.7552**	**5.2700e-003**	**0.0152**	**139.4086**

3.5 Turnouts - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.5418	0.0000	3.5418	1.9445	0.0000	1.9445	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.9406	8.5315	7.7596	0.0159		0.3707	0.3707		0.3470	0.3470	0.0000	1,378.8051	1,378.8051	0.3393	0.0000	1,387.2867
Total	**0.9406**	**8.5315**	**7.7596**	**0.0159**	**3.5418**	**0.3707**	**3.9124**	**1.9445**	**0.3470**	**2.2915**	**0.0000**	**1,378.8051**	**1,378.8051**	**0.3393**	**0.0000**	**1,387.2867**

3.5 Turnouts - 2026

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.5100e-003	0.1190	0.0287	5.3000e-004	0.0172	8.6000e-004	0.0181	4.7200e-003	8.2000e-004	5.5400e-003	0.0000	53.5860	53.5860	3.5400e-003	8.5300e-003	56.2175
Vendor	0.0105	0.6109	0.1356	3.4200e-003	0.1331	4.2200e-003	0.1373	0.0384	4.0400e-003	0.0424	0.0000	335.7430	335.7430	0.0132	0.0486	350.5553
Worker	0.0198	0.0150	0.2363	8.4000e-004	0.1090	5.2000e-004	0.1095	0.0290	4.7000e-004	0.0294	0.0000	76.6098	76.6098	1.0900e-003	1.5100e-003	77.0866
Total	**0.0318**	**0.7449**	**0.4006**	**4.7900e-003**	**0.2593**	**5.6000e-003**	**0.2649**	**0.0720**	**5.3300e-003**	**0.0774**	**0.0000**	**465.9388**	**465.9388**	**0.0178**	**0.0586**	**483.8594**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.5938	0.0000	1.5938	0.8750	0.0000	0.8750	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2295	1.4472	8.8065	0.0159		0.0440	0.0440		0.0426	0.0426	0.0000	1,378.8035	1,378.8035	0.3393	0.0000	1,387.2851
Total	**0.2295**	**1.4472**	**8.8065**	**0.0159**	**1.5938**	**0.0440**	**1.6378**	**0.8750**	**0.0426**	**0.9176**	**0.0000**	**1,378.8035**	**1,378.8035**	**0.3393**	**0.0000**	**1,387.2851**

3.5 Turnouts - 2026

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.5100e-003	0.1190	0.0287	5.3000e-004	0.0140	8.6000e-004	0.0148	3.9300e-003	8.2000e-004	4.7500e-003	0.0000	53.5860	53.5860	3.5400e-003	8.5300e-003	56.2175
Vendor	0.0105	0.6109	0.1356	3.4200e-003	0.1095	4.2200e-003	0.1137	0.0326	4.0400e-003	0.0366	0.0000	335.7430	335.7430	0.0132	0.0486	350.5553
Worker	0.0198	0.0150	0.2363	8.4000e-004	0.0854	5.2000e-004	0.0859	0.0231	4.7000e-004	0.0236	0.0000	76.6098	76.6098	1.0900e-003	1.5100e-003	77.0866
Total	**0.0318**	**0.7449**	**0.4006**	**4.7900e-003**	**0.2088**	**5.6000e-003**	**0.2144**	**0.0596**	**5.3300e-003**	**0.0650**	**0.0000**	**465.9388**	**465.9388**	**0.0178**	**0.0586**	**483.8594**

3.5 Turnouts - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.5418	0.0000	3.5418	1.9445	0.0000	1.9445	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.9406	8.5315	7.7596	0.0159		0.3707	0.3707		0.3470	0.3470	0.0000	1,378.8051	1,378.8051	0.3393	0.0000	1,387.2867
Total	**0.9406**	**8.5315**	**7.7596**	**0.0159**	**3.5418**	**0.3707**	**3.9124**	**1.9445**	**0.3470**	**2.2915**	**0.0000**	**1,378.8051**	**1,378.8051**	**0.3393**	**0.0000**	**1,387.2867**

3.5 Turnouts - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.4900e-003	0.1177	0.0290	5.2000e-004	0.0172	8.6000e-004	0.0181	4.7200e-003	8.2000e-004	5.5400e-003	0.0000	52.5139	52.5139	3.5400e-003	8.3600e-003	55.0952
Vendor	0.0102	0.6056	0.1340	3.3500e-003	0.1331	4.2100e-003	0.1373	0.0384	4.0300e-003	0.0424	0.0000	329.1233	329.1233	0.0131	0.0477	343.6685
Worker	0.0187	0.0136	0.2228	8.1000e-004	0.1090	4.8000e-004	0.1095	0.0290	4.4000e-004	0.0294	0.0000	74.4581	74.4581	9.9000e-004	1.4300e-003	74.9086
Total	**0.0304**	**0.7369**	**0.3858**	**4.6800e-003**	**0.2593**	**5.5500e-003**	**0.2649**	**0.0720**	**5.2900e-003**	**0.0773**	**0.0000**	**456.0953**	**456.0953**	**0.0177**	**0.0575**	**473.6723**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.5938	0.0000	1.5938	0.8750	0.0000	0.8750	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2295	1.4472	8.8065	0.0159		0.0440	0.0440		0.0426	0.0426	0.0000	1,378.8035	1,378.8035	0.3393	0.0000	1,387.2851
Total	**0.2295**	**1.4472**	**8.8065**	**0.0159**	**1.5938**	**0.0440**	**1.6378**	**0.8750**	**0.0426**	**0.9176**	**0.0000**	**1,378.8035**	**1,378.8035**	**0.3393**	**0.0000**	**1,387.2851**

3.5 Turnouts - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.4900e-003	0.1177	0.0290	5.2000e-004	0.0140	8.6000e-004	0.0148	3.9300e-003	8.2000e-004	4.7500e-003	0.0000	52.5139	52.5139	3.5400e-003	8.3600e-003	55.0952
Vendor	0.0102	0.6056	0.1340	3.3500e-003	0.1095	4.2100e-003	0.1137	0.0326	4.0300e-003	0.0366	0.0000	329.1233	329.1233	0.0131	0.0477	343.6685
Worker	0.0187	0.0136	0.2228	8.1000e-004	0.0854	4.8000e-004	0.0859	0.0231	4.4000e-004	0.0236	0.0000	74.4581	74.4581	9.9000e-004	1.4300e-003	74.9086
Total	**0.0304**	**0.7369**	**0.3858**	**4.6800e-003**	**0.2088**	**5.5500e-003**	**0.2144**	**0.0596**	**5.2900e-003**	**0.0649**	**0.0000**	**456.0953**	**456.0953**	**0.0177**	**0.0575**	**473.6723**

3.6 WellheadDemo - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0142	0.1335	0.0996	2.2000e-004		5.7400e-003	5.7400e-003		5.4000e-003	5.4000e-003	0.0000	19.3179	19.3179	3.9900e-003	0.0000	19.4178
Total	**0.0142**	**0.1335**	**0.0996**	**2.2000e-004**	**0.0000**	**5.7400e-003**	**5.7400e-003**	**0.0000**	**5.4000e-003**	**5.4000e-003**	**0.0000**	**19.3179**	**19.3179**	**3.9900e-003**	**0.0000**	**19.4178**

3.6 WellheadDemo - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-005	1.2700e-003	3.6000e-004	1.0000e-005	1.7000e-004	1.0000e-005	1.8000e-004	5.0000e-005	1.0000e-005	6.0000e-005	0.0000	0.5367	0.5367	4.0000e-005	9.0000e-005	0.5630
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.8000e-004	3.2000e-004	5.0200e-003	2.0000e-005	2.1900e-003	1.0000e-005	2.2000e-003	5.8000e-004	1.0000e-005	5.9000e-004	0.0000	1.5170	1.5170	3.0000e-005	3.0000e-005	1.5280
Total	**5.0000e-004**	**1.5900e-003**	**5.3800e-003**	**3.0000e-005**	**2.3600e-003**	**2.0000e-005**	**2.3800e-003**	**6.3000e-004**	**2.0000e-005**	**6.5000e-004**	**0.0000**	**2.0536**	**2.0536**	**7.0000e-005**	**1.2000e-004**	**2.0910**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-003	0.0164	0.1146	2.2000e-004		5.8000e-004	5.8000e-004		5.6000e-004	5.6000e-004	0.0000	19.3179	19.3179	3.9900e-003	0.0000	19.4178
Total	**3.0000e-003**	**0.0164**	**0.1146**	**2.2000e-004**	**0.0000**	**5.8000e-004**	**5.8000e-004**	**0.0000**	**5.6000e-004**	**5.6000e-004**	**0.0000**	**19.3179**	**19.3179**	**3.9900e-003**	**0.0000**	**19.4178**

3.6 WellheadDemo - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-005	1.2700e-003	3.6000e-004	1.0000e-005	1.4000e-004	1.0000e-005	1.5000e-004	4.0000e-005	1.0000e-005	5.0000e-005	0.0000	0.5367	0.5367	4.0000e-005	9.0000e-005	0.5630
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.8000e-004	3.2000e-004	5.0200e-003	2.0000e-005	1.7200e-003	1.0000e-005	1.7300e-003	4.7000e-004	1.0000e-005	4.8000e-004	0.0000	1.5170	1.5170	3.0000e-005	3.0000e-005	1.5280
Total	**5.0000e-004**	**1.5900e-003**	**5.3800e-003**	**3.0000e-005**	**1.8600e-003**	**2.0000e-005**	**1.8800e-003**	**5.1000e-004**	**2.0000e-005**	**5.3000e-004**	**0.0000**	**2.0536**	**2.0536**	**7.0000e-005**	**1.2000e-004**	**2.0910**

3.7 AWPFSiteprep - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0452	0.0000	0.0452	0.0248	0.0000	0.0248	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.1800e-003	0.0631	0.0448	1.0000e-004		2.7200e-003	2.7200e-003		2.5000e-003	2.5000e-003	0.0000	8.3668	8.3668	2.7100e-003	0.0000	8.4344
Total	**6.1800e-003**	**0.0631**	**0.0448**	**1.0000e-004**	**0.0452**	**2.7200e-003**	**0.0479**	**0.0248**	**2.5000e-003**	**0.0273**	**0.0000**	**8.3668**	**8.3668**	**2.7100e-003**	**0.0000**	**8.4344**

3.7 AWPFSiteprep - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.4000e-004	1.6000e-004	2.5100e-003	1.0000e-005	1.1000e-003	1.0000e-005	1.1000e-003	2.9000e-004	0.0000	3.0000e-004	0.0000	0.7585	0.7585	2.0000e-005	2.0000e-005	0.7640
Total	**2.4000e-004**	**1.6000e-004**	**2.5100e-003**	**1.0000e-005**	**1.1000e-003**	**1.0000e-005**	**1.1000e-003**	**2.9000e-004**	**0.0000**	**3.0000e-004**	**0.0000**	**0.7585**	**0.7585**	**2.0000e-005**	**2.0000e-005**	**0.7640**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0203	0.0000	0.0203	0.0112	0.0000	0.0112	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.4700e-003	8.5300e-003	0.0517	1.0000e-004		3.1000e-004	3.1000e-004		3.0000e-004	3.0000e-004	0.0000	8.3667	8.3667	2.7100e-003	0.0000	8.4344
Total	**1.4700e-003**	**8.5300e-003**	**0.0517**	**1.0000e-004**	**0.0203**	**3.1000e-004**	**0.0206**	**0.0112**	**3.0000e-004**	**0.0115**	**0.0000**	**8.3667**	**8.3667**	**2.7100e-003**	**0.0000**	**8.4344**

3.7 AWPFSiteprep - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.4000e-004	1.6000e-004	2.5100e-003	1.0000e-005	8.6000e-004	1.0000e-005	8.6000e-004	2.3000e-004	0.0000	2.4000e-004	0.0000	0.7585	0.7585	2.0000e-005	2.0000e-005	0.7640
Total	**2.4000e-004**	**1.6000e-004**	**2.5100e-003**	**1.0000e-005**	**8.6000e-004**	**1.0000e-005**	**8.6000e-004**	**2.3000e-004**	**0.0000**	**2.4000e-004**	**0.0000**	**0.7585**	**0.7585**	**2.0000e-005**	**2.0000e-005**	**0.7640**

3.8 Pipelines27 - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.5988	0.0000	0.5988	0.3280	0.0000	0.3280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1586	1.4383	1.3081	2.6700e-003		0.0625	0.0625		0.0585	0.0585	0.0000	232.4422	232.4422	0.0572	0.0000	233.8721
Total	**0.1586**	**1.4383**	**1.3081**	**2.6700e-003**	**0.5988**	**0.0625**	**0.6613**	**0.3280**	**0.0585**	**0.3865**	**0.0000**	**232.4422**	**232.4422**	**0.0572**	**0.0000**	**233.8721**

3.8 Pipelines27 - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	9.8000e-004	0.0777	0.0191	3.4000e-004	0.0114	5.7000e-004	0.0119	3.1100e-003	5.4000e-004	3.6600e-003	0.0000	34.6592	34.6592	2.3400e-003	5.5200e-003	36.3628
Vendor	1.8500e-003	0.1094	0.0242	6.0000e-004	0.0240	7.6000e-004	0.0248	6.9300e-003	7.3000e-004	7.6600e-003	0.0000	59.4476	59.4476	2.3700e-003	8.6200e-003	62.0748
Worker	9.4700e-003	6.8800e-003	0.1127	4.1000e-004	0.0551	2.4000e-004	0.0554	0.0146	2.2000e-004	0.0149	0.0000	37.6570	37.6570	5.0000e-004	7.2000e-004	37.8848
Total	**0.0123**	**0.1939**	**0.1560**	**1.3500e-003**	**0.0905**	**1.5700e-003**	**0.0921**	**0.0247**	**1.4900e-003**	**0.0262**	**0.0000**	**131.7637**	**131.7637**	**5.2100e-003**	**0.0149**	**136.3224**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2695	0.0000	0.2695	0.1476	0.0000	0.1476	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0387	0.2440	1.4846	2.6700e-003		7.4100e-003	7.4100e-003		7.1800e-003	7.1800e-003	0.0000	232.4420	232.4420	0.0572	0.0000	233.8718
Total	**0.0387**	**0.2440**	**1.4846**	**2.6700e-003**	**0.2695**	**7.4100e-003**	**0.2769**	**0.1476**	**7.1800e-003**	**0.1548**	**0.0000**	**232.4420**	**232.4420**	**0.0572**	**0.0000**	**233.8718**

3.8 Pipelines27 - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	9.8000e-004	0.0777	0.0191	3.4000e-004	9.2100e-003	5.7000e-004	9.7800e-003	2.5900e-003	5.4000e-004	3.1300e-003	0.0000	34.6592	34.6592	2.3400e-003	5.5200e-003	36.3628
Vendor	1.8500e-003	0.1094	0.0242	6.0000e-004	0.0198	7.6000e-004	0.0205	5.8800e-003	7.3000e-004	6.6100e-003	0.0000	59.4476	59.4476	2.3700e-003	8.6200e-003	62.0748
Worker	9.4700e-003	6.8800e-003	0.1127	4.1000e-004	0.0432	2.4000e-004	0.0434	0.0117	2.2000e-004	0.0119	0.0000	37.6570	37.6570	5.0000e-004	7.2000e-004	37.8848
Total	**0.0123**	**0.1939**	**0.1560**	**1.3500e-003**	**0.0722**	**1.5700e-003**	**0.0737**	**0.0202**	**1.4900e-003**	**0.0217**	**0.0000**	**131.7637**	**131.7637**	**5.2100e-003**	**0.0149**	**136.3224**

3.9 PumpStationsGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.7869	0.0000	0.7869	0.4321	0.0000	0.4321	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1553	1.6214	1.1084	2.6900e-003		0.0647	0.0647		0.0596	0.0596	0.0000	236.2777	236.2777	0.0764	0.0000	238.1881
Total	**0.1553**	**1.6214**	**1.1084**	**2.6900e-003**	**0.7869**	**0.0647**	**0.8517**	**0.4321**	**0.0596**	**0.4917**	**0.0000**	**236.2777**	**236.2777**	**0.0764**	**0.0000**	**238.1881**

3.9 PumpStationsGrading - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	2.6400e-003	0.1385	0.0355	7.3000e-004	0.0285	9.1000e-004	0.0295	8.2300e-003	8.7000e-004	9.0900e-003	0.0000	71.5543	71.5543	2.8500e-003	0.0104	74.7210
Worker	3.1600e-003	2.0800e-003	0.0328	1.1000e-004	0.0143	7.0000e-005	0.0144	3.8000e-003	6.0000e-005	3.8600e-003	0.0000	9.8981	9.8981	2.0000e-004	2.2000e-004	9.9699
Total	**5.8000e-003**	**0.1406**	**0.0683**	**8.4000e-004**	**0.0429**	**9.8000e-004**	**0.0438**	**0.0120**	**9.3000e-004**	**0.0130**	**0.0000**	**81.4523**	**81.4523**	**3.0500e-003**	**0.0106**	**84.6909**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3541	0.0000	0.3541	0.1944	0.0000	0.1944	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0385	0.2070	1.4153	2.6900e-003		7.2200e-003	7.2200e-003		6.9800e-003	6.9800e-003	0.0000	236.2774	236.2774	0.0764	0.0000	238.1878
Total	**0.0385**	**0.2070**	**1.4153**	**2.6900e-003**	**0.3541**	**7.2200e-003**	**0.3613**	**0.1944**	**6.9800e-003**	**0.2014**	**0.0000**	**236.2774**	**236.2774**	**0.0764**	**0.0000**	**238.1878**

3.9 PumpStationsGrading - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	2.6400e-003	0.1385	0.0355	7.3000e-004	0.0235	9.1000e-004	0.0244	6.9800e-003	8.7000e-004	7.8500e-003	0.0000	71.5543	71.5543	2.8500e-003	0.0104	74.7210
Worker	3.1600e-003	2.0800e-003	0.0328	1.1000e-004	0.0112	7.0000e-005	0.0113	3.0400e-003	6.0000e-005	3.1000e-003	0.0000	9.8981	9.8981	2.0000e-004	2.2000e-004	9.9699
Total	**5.8000e-003**	**0.1406**	**0.0683**	**8.4000e-004**	**0.0347**	**9.8000e-004**	**0.0357**	**0.0100**	**9.3000e-004**	**0.0110**	**0.0000**	**81.4523**	**81.4523**	**3.0500e-003**	**0.0106**	**84.6909**

3.10 PumpStationsConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0577	0.5219	0.5860	1.0500e-003		0.0214	0.0214		0.0199	0.0199	0.0000	89.8826	89.8826	0.0263	0.0000	90.5392
Total	**0.0577**	**0.5219**	**0.5860**	**1.0500e-003**		**0.0214**	**0.0214**		**0.0199**	**0.0199**	**0.0000**	**89.8826**	**89.8826**	**0.0263**	**0.0000**	**90.5392**

3.10 PumpStationsConstruct - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.6900e-003	4.8600e-003	0.0796	2.9000e-004	0.0389	1.7000e-004	0.0391	0.0103	1.6000e-004	0.0105	0.0000	26.5922	26.5922	3.5000e-004	5.1000e-004	26.7531
Total	**6.6900e-003**	**4.8600e-003**	**0.0796**	**2.9000e-004**	**0.0389**	**1.7000e-004**	**0.0391**	**0.0103**	**1.6000e-004**	**0.0105**	**0.0000**	**26.5922**	**26.5922**	**3.5000e-004**	**5.1000e-004**	**26.7531**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0152	0.1309	0.6450	1.0500e-003		2.4200e-003	2.4200e-003		2.3600e-003	2.3600e-003	0.0000	89.8825	89.8825	0.0263	0.0000	90.5391
Total	**0.0152**	**0.1309**	**0.6450**	**1.0500e-003**		**2.4200e-003**	**2.4200e-003**		**2.3600e-003**	**2.3600e-003**	**0.0000**	**89.8825**	**89.8825**	**0.0263**	**0.0000**	**90.5391**

3.10 PumpStationsConstruct - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.6900e-003	4.8600e-003	0.0796	2.9000e-004	0.0305	1.7000e-004	0.0307	8.2700e-003	1.6000e-004	8.4200e-003	0.0000	26.5922	26.5922	3.5000e-004	5.1000e-004	26.7531
Total	**6.6900e-003**	**4.8600e-003**	**0.0796**	**2.9000e-004**	**0.0305**	**1.7000e-004**	**0.0307**	**8.2700e-003**	**1.6000e-004**	**8.4200e-003**	**0.0000**	**26.5922**	**26.5922**	**3.5000e-004**	**5.1000e-004**	**26.7531**

3.11 AWPFGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0267	0.0000	0.0267	0.0135	0.0000	0.0135	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.0900e-003	0.0613	0.0582	1.2000e-004		2.4900e-003	2.4900e-003		2.2900e-003	2.2900e-003	0.0000	10.4279	10.4279	3.3700e-003	0.0000	10.5122
Total	**6.0900e-003**	**0.0613**	**0.0582**	**1.2000e-004**	**0.0267**	**2.4900e-003**	**0.0292**	**0.0135**	**2.2900e-003**	**0.0158**	**0.0000**	**10.4279**	**10.4279**	**3.3700e-003**	**0.0000**	**10.5122**

3.11 AWPFGrading - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.4000e-004	0.0199	4.4000e-003	1.1000e-004	4.3700e-003	1.4000e-004	4.5100e-003	1.2600e-003	1.3000e-004	1.3900e-003	0.0000	10.8087	10.8087	4.3000e-004	1.5700e-003	11.2863
Worker	3.9000e-004	2.5000e-004	4.0200e-003	1.0000e-005	1.7600e-003	1.0000e-005	1.7600e-003	4.7000e-004	1.0000e-005	4.7000e-004	0.0000	1.2136	1.2136	2.0000e-005	3.0000e-005	1.2224
Total	**7.3000e-004**	**0.0201**	**8.4200e-003**	**1.2000e-004**	**6.1300e-003**	**1.5000e-004**	**6.2700e-003**	**1.7300e-003**	**1.4000e-004**	**1.8600e-003**	**0.0000**	**12.0222**	**12.0222**	**4.5000e-004**	**1.6000e-003**	**12.5087**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0120	0.0000	0.0120	6.0900e-003	0.0000	6.0900e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.6800e-003	8.9200e-003	0.0705	1.2000e-004		3.1000e-004	3.1000e-004		3.0000e-004	3.0000e-004	0.0000	10.4279	10.4279	3.3700e-003	0.0000	10.5122
Total	**1.6800e-003**	**8.9200e-003**	**0.0705**	**1.2000e-004**	**0.0120**	**3.1000e-004**	**0.0123**	**6.0900e-003**	**3.0000e-004**	**6.3900e-003**	**0.0000**	**10.4279**	**10.4279**	**3.3700e-003**	**0.0000**	**10.5122**

3.11 AWPFGrading - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.4000e-004	0.0199	4.4000e-003	1.1000e-004	3.5900e-003	1.4000e-004	3.7300e-003	1.0700e-003	1.3000e-004	1.2000e-003	0.0000	10.8087	10.8087	4.3000e-004	1.5700e-003	11.2863
Worker	3.9000e-004	2.5000e-004	4.0200e-003	1.0000e-005	1.3700e-003	1.0000e-005	1.3800e-003	3.7000e-004	1.0000e-005	3.8000e-004	0.0000	1.2136	1.2136	2.0000e-005	3.0000e-005	1.2224
Total	**7.3000e-004**	**0.0201**	**8.4200e-003**	**1.2000e-004**	**4.9600e-003**	**1.5000e-004**	**5.1100e-003**	**1.4400e-003**	**1.4000e-004**	**1.5800e-003**	**0.0000**	**12.0222**	**12.0222**	**4.5000e-004**	**1.6000e-003**	**12.5087**

3.12 AWPFConstruction - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1573	1.4340	1.8497	3.1000e-003		0.0607	0.0607		0.0571	0.0571	0.0000	266.7074	266.7074	0.0627	0.0000	268.2747
Total	**0.1573**	**1.4340**	**1.8497**	**3.1000e-003**		**0.0607**	**0.0607**		**0.0571**	**0.0571**	**0.0000**	**266.7074**	**266.7074**	**0.0627**	**0.0000**	**268.2747**

3.12 AWPFConstruction - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	9.6500e-003	0.5718	0.1265	3.1600e-003	0.1257	3.9700e-003	0.1296	0.0362	3.8000e-003	0.0400	0.0000	310.7486	310.7486	0.0124	0.0450	324.4818
Worker	0.0111	7.3300e-003	0.1156	3.8000e-004	0.0505	2.3000e-004	0.0507	0.0134	2.2000e-004	0.0136	0.0000	34.8898	34.8898	6.9000e-004	7.9000e-004	35.1428
Total	**0.0208**	**0.5791**	**0.2421**	**3.5400e-003**	**0.1761**	**4.2000e-003**	**0.1803**	**0.0496**	**4.0200e-003**	**0.0536**	**0.0000**	**345.6384**	**345.6384**	**0.0131**	**0.0458**	**359.6246**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0418	0.3047	1.9993	3.1000e-003		6.7100e-003	6.7100e-003		6.5700e-003	6.5700e-003	0.0000	266.7071	266.7071	0.0627	0.0000	268.2744
Total	**0.0418**	**0.3047**	**1.9993**	**3.1000e-003**		**6.7100e-003**	**6.7100e-003**		**6.5700e-003**	**6.5700e-003**	**0.0000**	**266.7071**	**266.7071**	**0.0627**	**0.0000**	**268.2744**

3.12 AWPFConstruction - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	9.6500e-003	0.5718	0.1265	3.1600e-003	0.1034	3.9700e-003	0.1073	0.0307	3.8000e-003	0.0345	0.0000	310.7486	310.7486	0.0124	0.0450	324.4818
Worker	0.0111	7.3300e-003	0.1156	3.8000e-004	0.0395	2.3000e-004	0.0398	0.0107	2.2000e-004	0.0109	0.0000	34.8898	34.8898	6.9000e-004	7.9000e-004	35.1428
Total	**0.0208**	**0.5791**	**0.2421**	**3.5400e-003**	**0.1429**	**4.2000e-003**	**0.1471**	**0.0415**	**4.0200e-003**	**0.0455**	**0.0000**	**345.6384**	**345.6384**	**0.0131**	**0.0458**	**359.6246**

3.13 WellheadGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.1800e-003	0.0000	3.1800e-003	3.4000e-004	0.0000	3.4000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	8.6300e-003	0.0919	0.0908	1.9000e-004		3.2900e-003	3.2900e-003		3.0300e-003	3.0300e-003	0.0000	16.9329	16.9329	5.4800e-003	0.0000	17.0698
Total	**8.6300e-003**	**0.0919**	**0.0908**	**1.9000e-004**	**3.1800e-003**	**3.2900e-003**	**6.4700e-003**	**3.4000e-004**	**3.0300e-003**	**3.3700e-003**	**0.0000**	**16.9329**	**16.9329**	**5.4800e-003**	**0.0000**	**17.0698**

3.13 WellheadGrading - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.8000e-004	3.2000e-004	5.0200e-003	2.0000e-005	2.1900e-003	1.0000e-005	2.2000e-003	5.8000e-004	1.0000e-005	5.9000e-004	0.0000	1.5170	1.5170	3.0000e-005	3.0000e-005	1.5280
Total	**4.8000e-004**	**3.2000e-004**	**5.0200e-003**	**2.0000e-005**	**2.1900e-003**	**1.0000e-005**	**2.2000e-003**	**5.8000e-004**	**1.0000e-005**	**5.9000e-004**	**0.0000**	**1.5170**	**1.5170**	**3.0000e-005**	**3.0000e-005**	**1.5280**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.4300e-003	0.0000	1.4300e-003	1.5000e-004	0.0000	1.5000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.5300e-003	0.0123	0.1147	1.9000e-004		4.0000e-004	4.0000e-004		3.9000e-004	3.9000e-004	0.0000	16.9328	16.9328	5.4800e-003	0.0000	17.0697
Total	**2.5300e-003**	**0.0123**	**0.1147**	**1.9000e-004**	**1.4300e-003**	**4.0000e-004**	**1.8300e-003**	**1.5000e-004**	**3.9000e-004**	**5.4000e-004**	**0.0000**	**16.9328**	**16.9328**	**5.4800e-003**	**0.0000**	**17.0697**

3.13 WellheadGrading - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.8000e-004	3.2000e-004	5.0200e-003	2.0000e-005	1.7200e-003	1.0000e-005	1.7300e-003	4.7000e-004	1.0000e-005	4.8000e-004	0.0000	1.5170	1.5170	3.0000e-005	3.0000e-005	1.5280
Total	**4.8000e-004**	**3.2000e-004**	**5.0200e-003**	**2.0000e-005**	**1.7200e-003**	**1.0000e-005**	**1.7300e-003**	**4.7000e-004**	**1.0000e-005**	**4.8000e-004**	**0.0000**	**1.5170**	**1.5170**	**3.0000e-005**	**3.0000e-005**	**1.5280**

3.14 WellheadConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1332	1.2199	1.5514	2.6700e-003		0.0501	0.0501		0.0472	0.0472	0.0000	229.5305	229.5305	0.0536	0.0000	230.8715
Total	**0.1332**	**1.2199**	**1.5514**	**2.6700e-003**		**0.0501**	**0.0501**		**0.0472**	**0.0472**	**0.0000**	**229.5305**	**229.5305**	**0.0536**	**0.0000**	**230.8715**

3.14 WellheadConstruct - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	5.6200e-003	0.3331	0.0737	1.8400e-003	0.0732	2.3100e-003	0.0755	0.0211	2.2100e-003	0.0233	0.0000	181.0448	181.0448	7.2300e-003	0.0262	189.0459
Worker	6.0000e-003	4.1000e-003	0.0656	2.2000e-004	0.0300	1.4000e-004	0.0301	7.9700e-003	1.3000e-004	8.0900e-003	0.0000	20.6318	20.6318	3.5000e-004	4.4000e-004	20.7711
Total	**0.0116**	**0.3372**	**0.1393**	**2.0600e-003**	**0.1032**	**2.4500e-003**	**0.1057**	**0.0291**	**2.3400e-003**	**0.0314**	**0.0000**	**201.6766**	**201.6766**	**7.5800e-003**	**0.0267**	**209.8170**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0364	0.2685	1.6922	2.6700e-003		5.9800e-003	5.9800e-003		5.8500e-003	5.8500e-003	0.0000	229.5302	229.5302	0.0536	0.0000	230.8712
Total	**0.0364**	**0.2685**	**1.6922**	**2.6700e-003**		**5.9800e-003**	**5.9800e-003**		**5.8500e-003**	**5.8500e-003**	**0.0000**	**229.5302**	**229.5302**	**0.0536**	**0.0000**	**230.8712**

3.14 WellheadConstruct - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	5.6200e-003	0.3331	0.0737	1.8400e-003	0.0602	2.3100e-003	0.0625	0.0179	2.2100e-003	0.0201	0.0000	181.0448	181.0448	7.2300e-003	0.0262	189.0459
Worker	6.0000e-003	4.1000e-003	0.0656	2.2000e-004	0.0235	1.4000e-004	0.0236	6.3700e-003	1.3000e-004	6.5000e-003	0.0000	20.6318	20.6318	3.5000e-004	4.4000e-004	20.7711
Total	**0.0116**	**0.3372**	**0.1393**	**2.0600e-003**	**0.0837**	**2.4500e-003**	**0.0862**	**0.0243**	**2.3400e-003**	**0.0266**	**0.0000**	**201.6766**	**201.6766**	**7.5800e-003**	**0.0267**	**209.8170**

3.15 StorageResGrading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0322	0.0000	0.0322	0.0168	0.0000	0.0168	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	7.6100e-003	0.0766	0.0727	1.5000e-004		3.1200e-003	3.1200e-003		2.8700e-003	2.8700e-003	0.0000	13.0349	13.0349	4.2200e-003	0.0000	13.1403
Total	**7.6100e-003**	**0.0766**	**0.0727**	**1.5000e-004**	**0.0322**	**3.1200e-003**	**0.0354**	**0.0168**	**2.8700e-003**	**0.0197**	**0.0000**	**13.0349**	**13.0349**	**4.2200e-003**	**0.0000**	**13.1403**

3.15 StorageResGrading - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0400e-003	0.0869	0.0207	3.9000e-004	0.0129	6.4000e-004	0.0135	3.5400e-003	6.1000e-004	4.1500e-003	0.0000	39.2127	39.2127	2.6500e-003	6.2500e-003	41.1404
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.6000e-004	2.4000e-004	3.9200e-003	1.0000e-005	1.7900e-003	1.0000e-005	1.8000e-003	4.8000e-004	1.0000e-005	4.8000e-004	0.0000	1.2318	1.2318	2.0000e-005	3.0000e-005	1.2401
Total	**1.4000e-003**	**0.0872**	**0.0246**	**4.0000e-004**	**0.0147**	**6.5000e-004**	**0.0153**	**4.0200e-003**	**6.2000e-004**	**4.6300e-003**	**0.0000**	**40.4444**	**40.4444**	**2.6700e-003**	**6.2800e-003**	**42.3804**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0145	0.0000	0.0145	7.5500e-003	0.0000	7.5500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.1100e-003	0.0112	0.0882	1.5000e-004		3.9000e-004	3.9000e-004		3.8000e-004	3.8000e-004	0.0000	13.0349	13.0349	4.2200e-003	0.0000	13.1403
Total	**2.1100e-003**	**0.0112**	**0.0882**	**1.5000e-004**	**0.0145**	**3.9000e-004**	**0.0149**	**7.5500e-003**	**3.8000e-004**	**7.9300e-003**	**0.0000**	**13.0349**	**13.0349**	**4.2200e-003**	**0.0000**	**13.1403**

3.15 StorageResGrading - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0400e-003	0.0869	0.0207	3.9000e-004	0.0105	6.4000e-004	0.0111	2.9400e-003	6.1000e-004	3.5600e-003	0.0000	39.2127	39.2127	2.6500e-003	6.2500e-003	41.1404
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.6000e-004	2.4000e-004	3.9200e-003	1.0000e-005	1.4000e-003	1.0000e-005	1.4100e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2318	1.2318	2.0000e-005	3.0000e-005	1.2401
Total	**1.4000e-003**	**0.0872**	**0.0246**	**4.0000e-004**	**0.0119**	**6.5000e-004**	**0.0125**	**3.3200e-003**	**6.2000e-004**	**3.9500e-003**	**0.0000**	**40.4444**	**40.4444**	**2.6700e-003**	**6.2800e-003**	**42.3804**

3.16 StorageResConstruct - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0513	0.4676	0.6032	1.0100e-003		0.0198	0.0198		0.0186	0.0186	0.0000	86.9698	86.9698	0.0204	0.0000	87.4809
Total	**0.0513**	**0.4676**	**0.6032**	**1.0100e-003**		**0.0198**	**0.0198**		**0.0186**	**0.0186**	**0.0000**	**86.9698**	**86.9698**	**0.0204**	**0.0000**	**87.4809**

3.16 StorageResConstruct - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.6900e-003	1.8400e-003	0.0294	1.0000e-004	0.0134	6.0000e-005	0.0135	3.5700e-003	6.0000e-005	3.6200e-003	0.0000	9.2381	9.2381	1.6000e-004	2.0000e-004	9.3005
Total	**2.6900e-003**	**1.8400e-003**	**0.0294**	**1.0000e-004**	**0.0134**	**6.0000e-005**	**0.0135**	**3.5700e-003**	**6.0000e-005**	**3.6200e-003**	**0.0000**	**9.2381**	**9.2381**	**1.6000e-004**	**2.0000e-004**	**9.3005**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0994	0.6519	1.0100e-003		2.1900e-003	2.1900e-003		2.1400e-003	2.1400e-003	0.0000	86.9697	86.9697	0.0204	0.0000	87.4808
Total	**0.0136**	**0.0994**	**0.6519**	**1.0100e-003**		**2.1900e-003**	**2.1900e-003**		**2.1400e-003**	**2.1400e-003**	**0.0000**	**86.9697**	**86.9697**	**0.0204**	**0.0000**	**87.4808**

3.16 StorageResConstruct - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.6900e-003	1.8400e-003	0.0294	1.0000e-004	0.0105	6.0000e-005	0.0106	2.8500e-003	6.0000e-005	2.9100e-003	0.0000	9.2381	9.2381	1.6000e-004	2.0000e-004	9.3005
Total	**2.6900e-003**	**1.8400e-003**	**0.0294**	**1.0000e-004**	**0.0105**	**6.0000e-005**	**0.0106**	**2.8500e-003**	**6.0000e-005**	**2.9100e-003**	**0.0000**	**9.2381**	**9.2381**	**1.6000e-004**	**2.0000e-004**	**9.3005**

3.17 StorageResPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	4.1000e-003	0.0377	0.0609	9.0000e-005		1.7600e-003	1.7600e-003		1.6300e-003	1.6300e-003	0.0000	8.1891	8.1891	2.5700e-003	0.0000	8.2535
Paving	0.0318					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0359**	**0.0377**	**0.0609**	**9.0000e-005**		**1.7600e-003**	**1.7600e-003**		**1.6300e-003**	**1.6300e-003**	**0.0000**	**8.1891**	**8.1891**	**2.5700e-003**	**0.0000**	**8.2535**

3.17 StorageResPaving - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.6000e-004	2.4000e-004	3.9200e-003	1.0000e-005	1.7900e-003	1.0000e-005	1.8000e-003	4.8000e-004	1.0000e-005	4.8000e-004	0.0000	1.2318	1.2318	2.0000e-005	3.0000e-005	1.2401
Total	**3.6000e-004**	**2.4000e-004**	**3.9200e-003**	**1.0000e-005**	**1.7900e-003**	**1.0000e-005**	**1.8000e-003**	**4.8000e-004**	**1.0000e-005**	**4.8000e-004**	**0.0000**	**1.2318**	**1.2318**	**2.0000e-005**	**3.0000e-005**	**1.2401**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.2200e-003	6.1600e-003	0.0673	9.0000e-005		2.2000e-004	2.2000e-004		2.1000e-004	2.1000e-004	0.0000	8.1891	8.1891	2.5700e-003	0.0000	8.2534
Paving	0.0318					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0330**	**6.1600e-003**	**0.0673**	**9.0000e-005**		**2.2000e-004**	**2.2000e-004**		**2.1000e-004**	**2.1000e-004**	**0.0000**	**8.1891**	**8.1891**	**2.5700e-003**	**0.0000**	**8.2534**

3.17 StorageResPaving - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.6000e-004	2.4000e-004	3.9200e-003	1.0000e-005	1.4000e-003	1.0000e-005	1.4100e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2318	1.2318	2.0000e-005	3.0000e-005	1.2401
Total	**3.6000e-004**	**2.4000e-004**	**3.9200e-003**	**1.0000e-005**	**1.4000e-003**	**1.0000e-005**	**1.4100e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.2318**	**1.2318**	**2.0000e-005**	**3.0000e-005**	**1.2401**

3.18 WellheadPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	7.4700e-003	0.0681	0.1125	1.8000e-004		3.2900e-003	3.2900e-003		3.0300e-003	3.0300e-003	0.0000	15.4836	15.4836	4.9000e-003	0.0000	15.6063
Paving	0.0318					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0392**	**0.0681**	**0.1125**	**1.8000e-004**		**3.2900e-003**	**3.2900e-003**		**3.0300e-003**	**3.0300e-003**	**0.0000**	**15.4836**	**15.4836**	**4.9000e-003**	**0.0000**	**15.6063**

3.18 WellheadPaving - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0000e-004	4.1000e-004	6.5300e-003	2.0000e-005	2.9800e-003	1.0000e-005	3.0000e-003	7.9000e-004	1.0000e-005	8.1000e-004	0.0000	2.0529	2.0529	4.0000e-005	4.0000e-005	2.0668
Total	**6.0000e-004**	**4.1000e-004**	**6.5300e-003**	**2.0000e-005**	**2.9800e-003**	**1.0000e-005**	**3.0000e-003**	**7.9000e-004**	**1.0000e-005**	**8.1000e-004**	**0.0000**	**2.0529**	**2.0529**	**4.0000e-005**	**4.0000e-005**	**2.0668**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.3300e-003	0.0115	0.1293	1.8000e-004		4.0000e-004	4.0000e-004		3.9000e-004	3.9000e-004	0.0000	15.4836	15.4836	4.9000e-003	0.0000	15.6062
Paving	0.0318					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0341**	**0.0115**	**0.1293**	**1.8000e-004**		**4.0000e-004**	**4.0000e-004**		**3.9000e-004**	**3.9000e-004**	**0.0000**	**15.4836**	**15.4836**	**4.9000e-003**	**0.0000**	**15.6062**

3.18 WellheadPaving - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0000e-004	4.1000e-004	6.5300e-003	2.0000e-005	2.3400e-003	1.0000e-005	2.3500e-003	6.3000e-004	1.0000e-005	6.5000e-004	0.0000	2.0529	2.0529	4.0000e-005	4.0000e-005	2.0668
Total	**6.0000e-004**	**4.1000e-004**	**6.5300e-003**	**2.0000e-005**	**2.3400e-003**	**1.0000e-005**	**2.3500e-003**	**6.3000e-004**	**1.0000e-005**	**6.5000e-004**	**0.0000**	**2.0529**	**2.0529**	**4.0000e-005**	**4.0000e-005**	**2.0668**

3.19 AWPFPaving - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	7.6500e-003	0.0695	0.1110	1.7000e-004		3.2400e-003	3.2400e-003		3.0000e-003	3.0000e-003	0.0000	14.9516	14.9516	4.6500e-003	0.0000	15.0679
Paving	0.0318					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0394**	**0.0695**	**0.1110**	**1.7000e-004**		**3.2400e-003**	**3.2400e-003**		**3.0000e-003**	**3.0000e-003**	**0.0000**	**14.9516**	**14.9516**	**4.6500e-003**	**0.0000**	**15.0679**

3.19 AWPFPaving - 2027

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.7000e-004	5.7000e-004	9.0400e-003	3.0000e-005	3.9500e-003	2.0000e-005	3.9700e-003	1.0500e-003	2.0000e-005	1.0700e-003	0.0000	2.7305	2.7305	5.0000e-005	6.0000e-005	2.7503
Total	**8.7000e-004**	**5.7000e-004**	**9.0400e-003**	**3.0000e-005**	**3.9500e-003**	**2.0000e-005**	**3.9700e-003**	**1.0500e-003**	**2.0000e-005**	**1.0700e-003**	**0.0000**	**2.7305**	**2.7305**	**5.0000e-005**	**6.0000e-005**	**2.7503**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.2100e-003	0.0112	0.1213	1.7000e-004		3.9000e-004	3.9000e-004		3.8000e-004	3.8000e-004	0.0000	14.9515	14.9515	4.6500e-003	0.0000	15.0679
Paving	0.0318					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0340**	**0.0112**	**0.1213**	**1.7000e-004**		**3.9000e-004**	**3.9000e-004**		**3.8000e-004**	**3.8000e-004**	**0.0000**	**14.9515**	**14.9515**	**4.6500e-003**	**0.0000**	**15.0679**

3.19 AWPFPaving - 2027

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.7000e-004	5.7000e-004	9.0400e-003	3.0000e-005	3.0900e-003	2.0000e-005	3.1100e-003	8.4000e-004	2.0000e-005	8.6000e-004	0.0000	2.7305	2.7305	5.0000e-005	6.0000e-005	2.7503
Total	**8.7000e-004**	**5.7000e-004**	**9.0400e-003**	**3.0000e-005**	**3.0900e-003**	**2.0000e-005**	**3.1100e-003**	**8.4000e-004**	**2.0000e-005**	**8.6000e-004**	**0.0000**	**2.7305**	**2.7305**	**5.0000e-005**	**6.0000e-005**	**2.7503**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Asphalt Surfaces	0.00	0.00	0.00		
Refrigerated Warehouse-No Rail	0.00	0.00	0.00		
Unrefrigerated Warehouse-No Rail	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Asphalt Surfaces	16.60	8.40	6.90	0.00	0.00	0.00	0	0	0
Refrigerated Warehouse-No	16.60	8.40	6.90	59.00	0.00	41.00	92	5	3
Unrefrigerated Warehouse-No	16.60	8.40	6.90	59.00	0.00	41.00	92	5	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Other Asphalt Surfaces	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480
Refrigerated Warehouse-No Rail	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480

EMFAC Off-Model Adjustment Factors for Gasoline Light Duty Vehicle to Account for the SAFE Vehicle Rule Not Applied

Unrefrigerated Warehouse-No Rail	0.540005	0.063885	0.187129	0.126392	0.023842	0.006753	0.012641	0.008546	0.000821	0.000486	0.025267	0.000753	0.003480

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	5.5499	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	5.5499	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	5.5499					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**5.5499**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	5.5499					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**5.5499**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0 / 0	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0 / 0	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Refrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000
Unrefrigerated Warehouse-No Rail	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

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COMMITMENT & INTEGRITY DRIVE RESULTS

APPENDIX 10a

Chino Basin OBMP, 2020 State of the Basin Report

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Chino Basin Optimum Basin Management Program

2020 State of the Basin Report

June 2021

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2020 State of the Basin Report
June 2021

PREPARED FOR

Chino Basin Watermaster

PREPARED BY

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2020 State of the Basin Report
June 2021

Prepared for

Chino Basin Watermaster

Project No. 941-80-20-15

Project Manager: Sodavy Ou	6-22-21 Date
QA/QC Review: Veva Veamer	6-22-21 Date

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LIST OF ACRONYMS AND ABBREVIATIONS

µgl	Micrograms Per Liter
1,1,1-TCA	1,1,1-trichloroethane
1,2,3-TCP	1,2,3-trichloropropane
1,2-DCA	1,2-dichloroethane
2013 RMPU	2013 Amendment to the 2010 Recharge Master Plan Update
ABGL	Aerojet, Boeing, GE, and Lockheed Martin
af	Acre-Feet
AFFF	Film Forming Foam
afy	Acre-Feet Per Year
ASR	Aquifer Storage Recovery
AWQ	Ambient Water Quality
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
CAO	Cleanup and Abatement Order
CBDC	Chino Basin Data Collection
CCWF	Chino Creek Well Field
CCWRF	Carbon Canyon Water Reclamation Facility
CCX	Chino Creek Extensometer
CDA	Chino Basin Desalter Authority
CDFM	Cumulative Departure From Mean
CDHS	California Department of Health Services
CFC-113	Freon-113
CIM	California Institution for Men
COPC	Constituent of Potential Concern
County	County of San Bernardino Department of Airports
DDW	California State Board Division of Drinking Water
DLR	Detection Limit for Reporting
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
DYYP	Dry Year Yield Program
EDM	Electronic Distance Measurement
EPA	US Environmental Protection Agency
ET	Evapotranspiration
ET_o	Potential Evapotranspiration
ft-bgs	Feet Below Ground Surface
ft-brp	Feet Below Reference Point
FY	Fiscal Year
GE	General Electric
GLMC	Ground-Level Monitoring Committee
GMZ	Groundwater Management Zone
HCMP	Hydraulic Control Monitoring Program
IEUA	Inland Empire Utilities Agency
IMP	Interim Monitoring Program
InSAR	Interferometry Synthetic Aperture Radar
IRAP	Interim Remedial Action Plan
IRP	Integrated Resources Plan
JCSD	Jurupa Community Services District
MCL	Maximum Contaminant Level
Metropolitan	Metropolitan Water District
mgd	Million Gallons Per Day
mgl	Milligrams Per Liter
MS4	Municipal Separate
MVWD	Monte Vista Water District
MZ	Management Zone
NAWQA	National Water Quality Assessment Program
NDMA	N-nitrosodimethylamine
ngl	Nanograms Per Liter
NL	Notification Level
NPL	National Priorities List
OBMP	Optimum Basin Management Program
OEHHA	Office of Environmental Health Hazard Assessment
OEHHA	Office of Environmental Health Hazard Assessment
OIA	Ontario International Airport
PBHSP	Prado Basin Habitat Sustainability Program
PCE	Tetrachloroethene
PE	Program Element
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PHG	Public Health Goal
PPM	Parts Per Million
PRISM	Parameter-Elevation Regressions on Independent Slope Model
PX	Pomona Extensometer Facility
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
Regional Board	Santa Ana Regional Water Quality Control Board
RL	Response Level
RMPU	Recharge Master Plan Update
ROD	Record of Decision
RP	Regional Plant
SARWC	Santa Ana River Water Company
SGMA	Sustainable Groundwater Management Act
State Water Board	State Water Resources Control Board
TCE	Trichloroethene
TDS	Total Dissolved Solids
TOC	Total Organic Carbon

UCMR	Unregulated Chemicals Requiring Monitoring
UCR	University California Riverside
USGS	US Geological Survey
VOC	Volatile Organic Compound
Watermaster	Chino Basin Watermaster
White Paper	White Paper Discussion on Economic Feasibility Analysis in Consideration of a Hexavalent Chromium Maximum Contaminant Level
WQS	Water Quality Standard
WY	Water Year
XRef	Anonymous Well Reference ID

1.0 INTRODUCTION

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The Chino Basin Optimum Basin Management Program (OBMP) was developed pursuant to the Judgment (*Chino Basin Municipal Water District v. City of Chino, et al.*) and a ruling by the Court on February 19, 1998 (WEI, 1999). The OBMP maps a strategy that provides for the enhanced yield of the Chino Basin and seeks to provide reliable, high-quality water supplies for the development that is expected to occur within the Basin. The OBMP Implementation Plan is the court approved governing document for achieving the goals defined in the OBMP. The OBMP Implementation Plan includes the following Program Elements (PE):

PE 1. Develop and Implement a Comprehensive Monitoring Program

PE 2. Develop and Implement a Comprehensive Recharge Program

PE 3. Develop and Implement a Water Supply Plan for the Impaired Areas of the Basin

PE 4. Develop and Implement a Comprehensive Groundwater Management Plan for Management Zone 1

PE 5. Develop and Implement a Regional Supplemental Water Program

PE 6. Develop and Implement Cooperative Programs with the Regional Board and Other Agencies to Improve Basin Management

PE 7. Develop and Implement a Salt Management Program

PE 8. Develop and Implement a Groundwater Storage Management Program

PE 9. Develop and Implement Conjunctive Use Programs

A fundamental component in the implementation of each of the OBMP PEs is the monitoring performed in accordance with *PE 1*, which includes the monitoring of basin hydrology, pumping, recharge, groundwater levels, groundwater quality, and ground-level movement. Monitoring is performed by basin pumpers, Chino Basin Watermaster (Watermaster) staff, and other cooperating entities. Watermaster staff collects and compiles the monitoring data into relational databases to support data analysis and reporting.

As a reporting mechanism and pursuant to the OBMP Phase 1 Report, the Peace Agreement and the associated OBMP Implementation Plan, and the November 15, 2001 Court Order, Watermaster staff prepares a *State of the Basin Report* every two years. In October 2002, Watermaster completed the *Initial State of the Basin Report* (WEI, 2002). The baseline for this report was on or about July 1, 2000 – the point in time that represents the adoption of the Peace Agreement and the start of OBMP implementation. Subsequent *State of the Basin Reports* (WEI, 2005a; 2007a; 2009a; 2011c; 2013a; 2015b; 2017a, WEI 2019) were used to:

- Describe the then-current state of the Basin with respect to hydrology, production, recharge, groundwater levels, groundwater quality, and ground-level movement; and
- Demonstrate the progress made since July 1, 2000 related to activities, such as: production meter installation, desalter planning and engineering, recharge assessments, recharge master planning, hydraulic control, expansion of monitoring programs for groundwater levels and quality, and the monitoring and management of land subsidence.

This 2020 *State of the Basin Report* is an atlas-style document. It consists of detailed exhibits that characterize current Basin conditions related to hydrology, groundwater production and recharge, groundwater levels, groundwater quality, and ground-level monitoring at of the end of fiscal year (FY) 2019/2020. In many of these exhibits, data are characterized as they relate to the Management Zones (MZs) defined in the OBMP. Exhibit 1-1 is a location map of the Chino Basin OBMP MZs showing key map features. Exhibit 1-2 shows the water service area boundaries for the major municipal producers in the Chino Basin related to the OBMP MZs.

The exhibits in this report are grouped into the following sections:

Hydrologic Conditions*:* This section contains exhibits that characterize the state of the Chino Basin as it relates to land use, hydrology, and climate (e.g. precipitation, temperature, and evaporation). This information provides a context for understanding the other changes in the Chino Basin that are managed through the OBMP.

Basin Production and Recharge: This section contains exhibits that characterize groundwater production and recharge over time and space, including progress towards the expansion of the Chino Basin Desalters and the Chino Basin Groundwater Recharge Program. This information is useful in understanding historical changes in groundwater levels and quality.

Groundwater Levels*:* This section contains exhibits that characterize groundwater flow patterns and the change in groundwater elevations since 2000. It includes groundwater-elevation maps for spring 2000, spring 2016, and spring 2018, and groundwater-elevation change maps for 2000 to 2020 and 2016 to 2020. This section also includes characterizations of the time history of groundwater levels throughout the Chino Basin and correlates the change in groundwater levels to observed precipitation, recharge, and pumping patterns.

Groundwater Quality*:* This section contains exhibits that characterize the groundwater quality across the Chino Basin. The constituents characterized include total dissolved solids (TDS), nitrate, and other constituents of concern. This characterization includes maps of the spatial distribution of constituent concentrations, updated delineations of known point-source contaminant plumes across the Basin, and time-series charts that characterize TDS and nitrate concentration trends in the OBMP MZs since 1972.

Ground-Level Monitoring*:* This section contains exhibits that characterize the history of land subsidence and ground fissuring, and the current state of ground-level movement in the Chino Basin as understood through the Watermaster's ground-level monitoring program. This characterization includes an assessment of ground-level movement in each of the five Areas of Subsidence Concern.

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Chino Basin Groundwater Basin

Key Map Features

Exhibit 1-1

Boundary of Water Service Areas in the Chino Basin

Other key map features are described in the legend of Exhibit 1-1.

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2020 State of the Basin Report

Water Service Areas

Exhibit 1-2

2.0 HYDROLOGIC CONDITIONS

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This section contains seven exhibits that illustrate important hydrologic concepts to aid in understanding contemporary water management issues in the Chino Basin.

Significant hydrologic investigations have been completed in the Chino Basin that have: led to the construction of new recharge facilities increasing the amount of storm water recharge and the supplemental water recharge capacity (WEI, 2013); produced estimates of annual net recharge and Safe Yield (WEI, 2020); developed the relationship of desalter production and reoperation to Santa Ana River recharge (WEI, 2015); and built the relationship of managed storage to annual net recharge and Safe Yield (WEI, 2018). The information presented herein was mostly drawn from these investigations and some information is being published here for the first time. Apart from Exhibit 2-1, each exhibit contains text that describes and interprets the charts presented.

Exhibit 2-1 shows the location of the Chino Basin within the Upper Santa Ana River Watershed and the locations of two key stream-gaging stations in the Chino Basin. Daily discharge data measured at the USGS gaging stations on the Santa Ana River at *MWD Crossing* (USGS Station 11066460) and at the Santa Ana River at Below Prado Dam (USGS Station 11074000) can be used to characterize the discharge of the Santa Ana River as it enters and exits the Chino Basin. The relationship of groundwater management activities in the Chino Basin and the streambed infiltration of Santa Ana River discharge was incorporated into the Chino Basin OBMP. Santa Ana River discharge is composed of storm flow and base flow. Storm flow is discharge that is the direct result of runoff from precipitation. Base flow is the difference between the total measured discharge and storm flow; it consists of discharge from wastewater treatment plants and rising groundwater. Exhibit 2-1 shows the locations of the USGS gaging stations and wastewater treatment plant discharges. Base flow is a significant source of recharge to the Chino Basin.

Exhibit 2-1 also shows the annual discharge hydrographs in water year (WY) for the Santa Ana River at *MWD Crossing* and at Below Prado Dam. The annual discharge values have been divided into storm and base flows. The base flow time series tends to increase over time, following the conversion of land uses to urban and industrial, until the onset of the great recession in 2008. These land use conversions increased base flow because the improved land uses were sewered, and the resulting wastewater discharged to the River. After WY 2007/2008, the base flow decline was caused by decreased water use due to recession and drought and the Inland Empire Utilities Agency’s (IEUA) increased use of recycled water for direct and indirect uses, thereby reducing wastewater discharges to the Santa Ana River.

The Santa Ana River base flow entering the Chino Basin at the *MWD Crossing* (Riverside Narrows) reached a maximum of 71,000 af in WY 1998/1999 and has been generally decreasing since then. Starting in WY 2007/2008, the base flow at *MWD Crossing* has been less than 50,000 afy, with an average of 36,000 afy. Part of the decrease in base flow at the *MWD Crossing* after WY 2007/2008 is due to a decrease in wastewater discharge to the Santa Ana River upstream and falling groundwater levels in the groundwater basins underlying the Santa Ana River upstream, the combined effect is a decrease in rising groundwater just upstream of the Metropolitan MWD Crossing.

The base flow leaving the Chino Basin at Prado Dam is about twice the base flow entering the Chino Basin due to the combined wastewater treatment plant discharges of the Cities of Corona and Riverside, the IEUA, and the West Riverside County Wastewater Reclamation Authority. The base flow at Prado Dam reached a maximum of 188,000 af in WY 1996/1997 and has been generally decreasing since. Starting in WY 2008/2009, the base flow at Prado Dam has been less than 120,000 afy with an average of 86,500 afy. The decrease in base flow exiting the Chino Basin is due to: the decrease in base flow entering the Chino Basin at the Riverside Narrows; decreases in wastewater discharges due to water conservation and recycled water reuse; and increased streambed infiltration caused by increased groundwater production in the southern Chino Basin.

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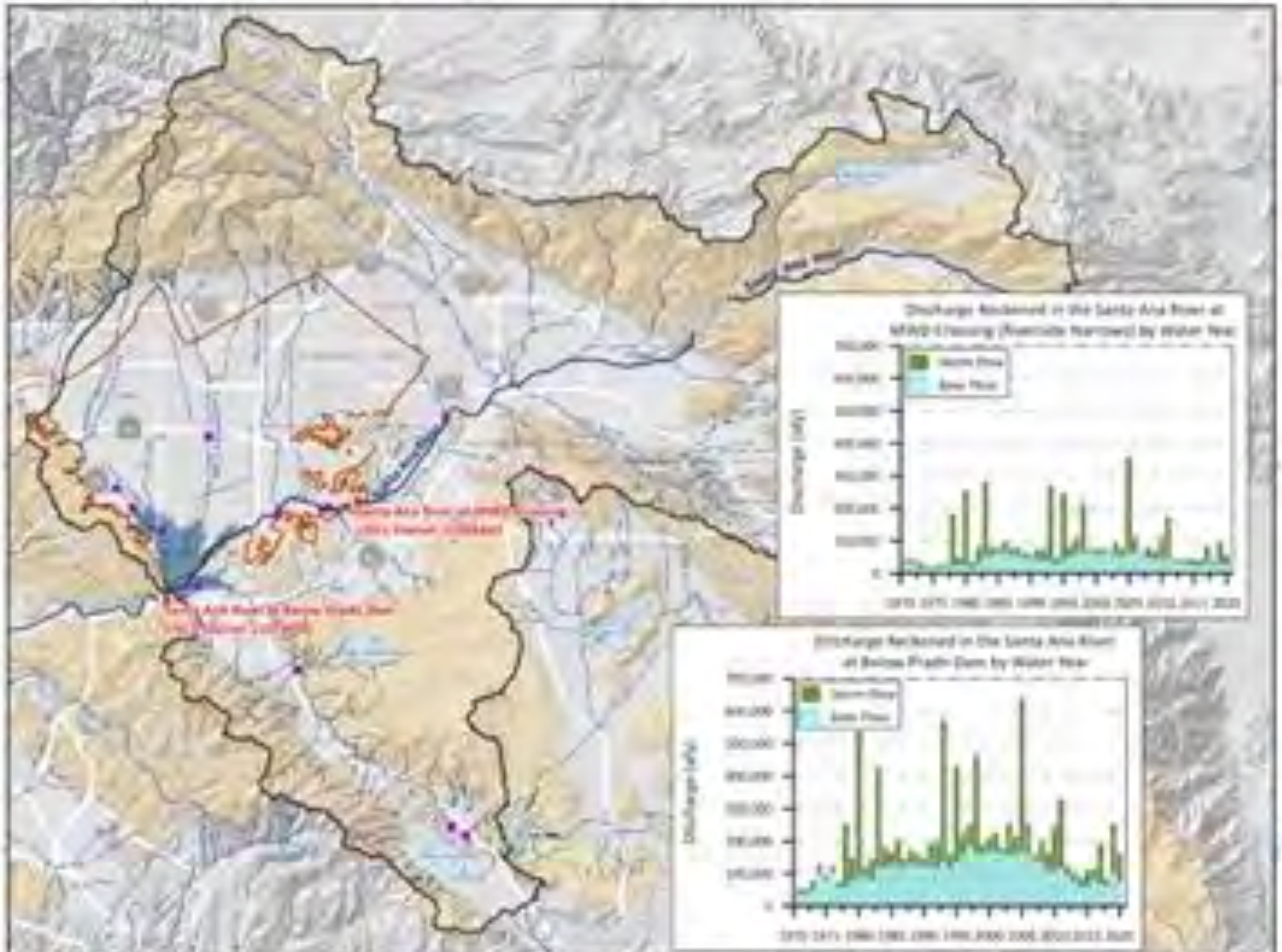

USGS Stream gaging Station

Wastewater Treatment Plant Discharge Location

Santa Ana River Watershed Tributary to Prado

Lakes and Reservoirs

Prado Flood Control Basin

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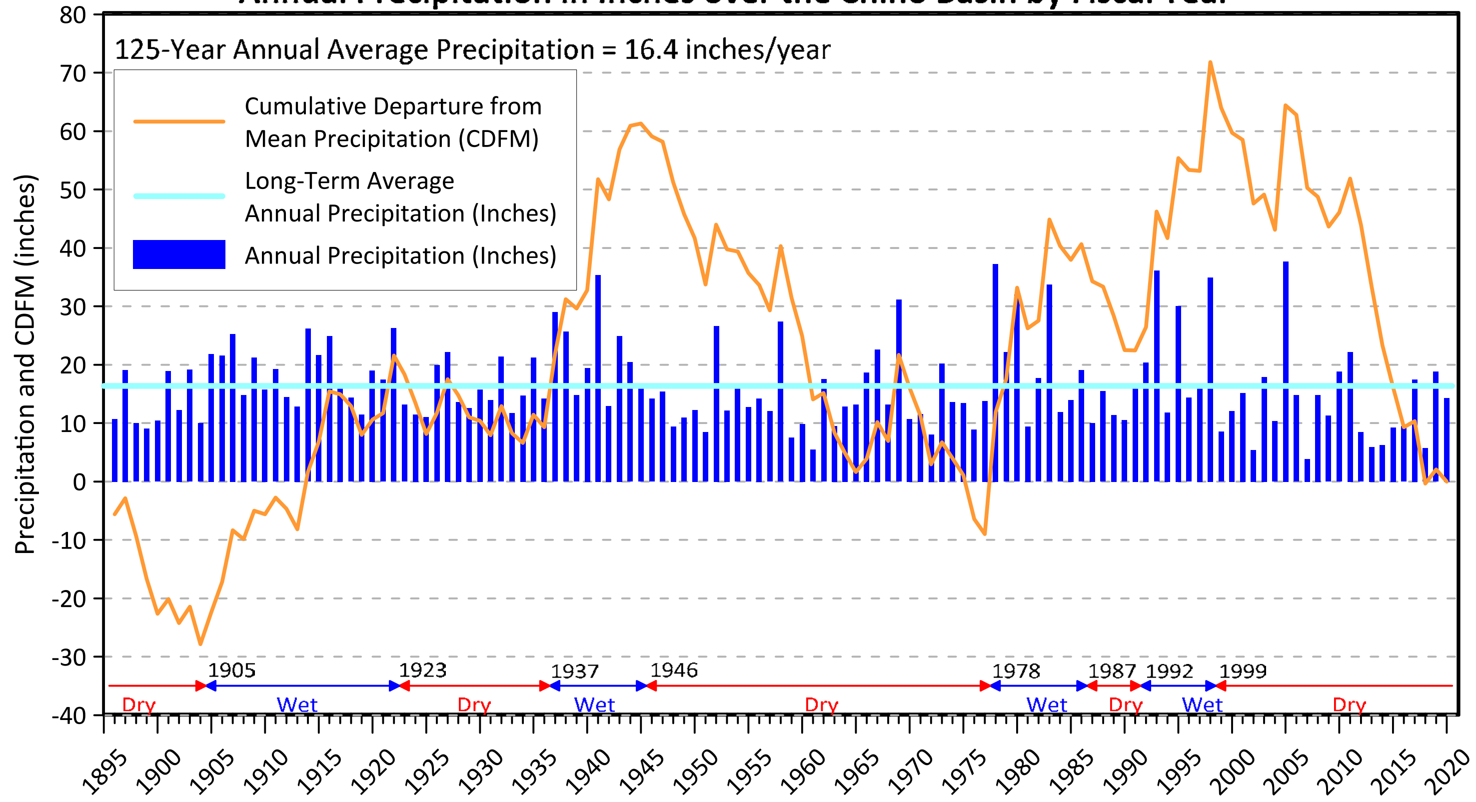
State of the Basin Report
Hydrologic Conditions

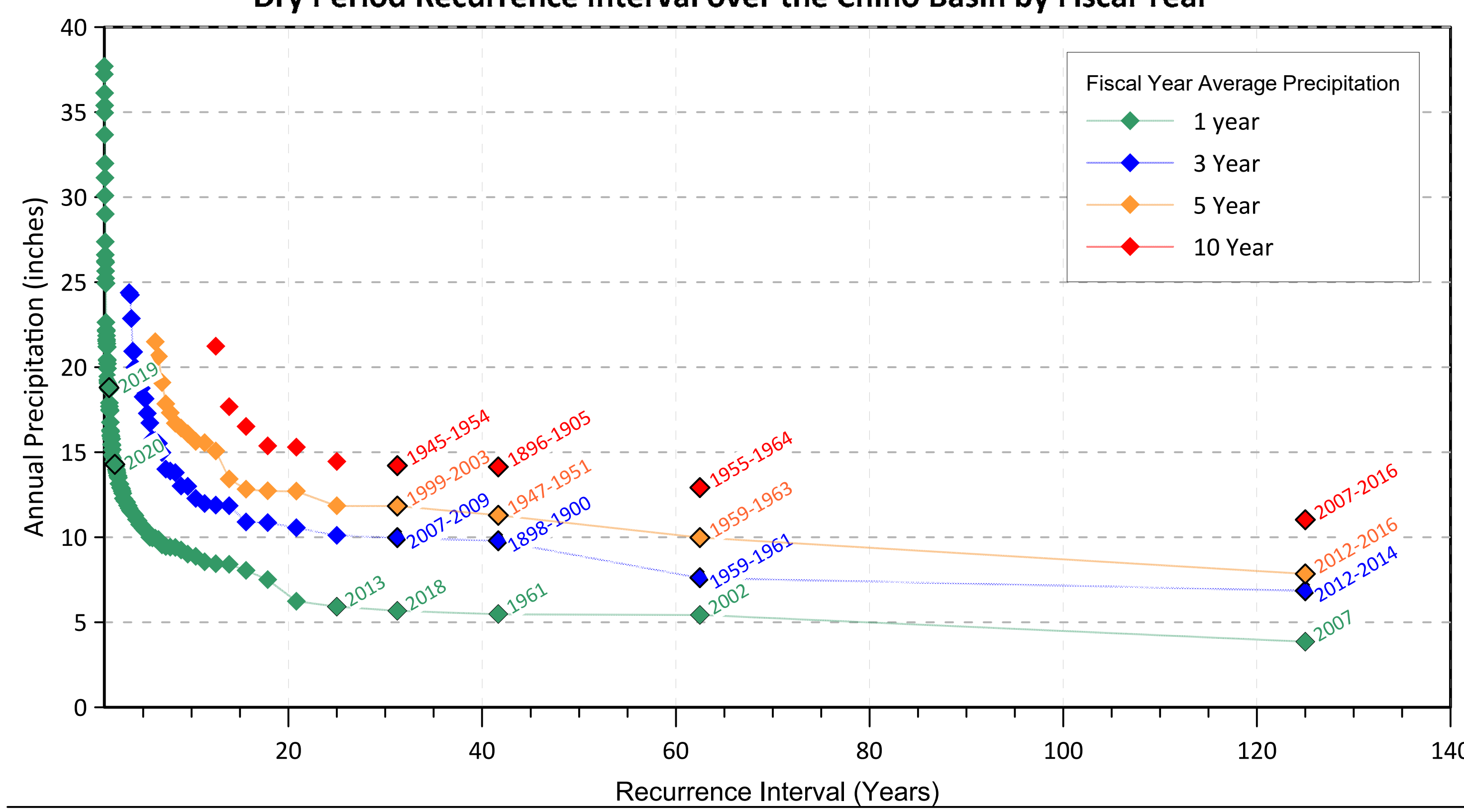
Santa Ana River Discharge in the Chino Basin

Exhibit 2-1

Annual Precipitation in Inches over the Chino Basin by Fiscal Year



Dry Period Recurrence Interval over the Chino Basin by Fiscal Year



Precipitation is a major source of groundwater recharge for the Chino Basin through the deep infiltration of precipitation and stormwater recharge in streams and recharge facilities. The chart on the upper left shows the long-term annual precipitation time series. These annual precipitation estimates are based on an areal average over the Chino Basin, created from gridded monthly precipitation estimates prepared by the PRISM Climate Group, and covers the period 1895 through 2020. The annual precipitation estimates cover the FY (July through June). The chart contains a horizontal line indicating the 125-year average annual precipitation of 16.4 inches, and the cumulative departure from mean (CDFM) precipitation. The CDFM plot is a useful way to characterize the occurrence and magnitude of wet and dry periods: positive sloping segments (trending upward from left to right) indicate wet periods, and negative sloping segments (trending downward from left to right) indicate dry periods. The wet and dry periods are labeled at the bottom of the chart. On average, the ratio of dry years to wet years is about three to two. That is, for every ten years, about six years will experience below average precipitation and four years will experience greater than average precipitation. That said, 1945 through 1976 was a 32-year dry period, punctuated by seven years of above average precipitation: a dry-to-wet year ratio of about four to one. The period 1999 through 2020 was a 22-year dry period punctuated with six wet years: a dry-to-wet year ratio of about eight to three. Dry periods tend to be long and very dry and wet periods tend to relatively short and very wet (see for example 1936 through 1944, 1977 through 1985 and 1993 through 1998).

The chart on the lower left is an annual dry-period frequency duration plot that shows the recurrence interval of dry periods of various durations for the 125-year period of 1896 through 2020. The recurrence interval (R) is calculated as, R=T/m, where T is the length of record in years and m is the rank number of the event when the events are arrayed in order of magnitude. For T=125 years, the extreme event would have a recurrence interval of 125 years, the second event - 62.5 years, the third – 41.7 years, etc. An event having recurrence interval, R, signifies that over a time period of n years, where n>> R, such an event would be expected to happen n/R times. For example, 2012 through 2014, the driest three-year period in the historical record, has a recurrence interval of 125 years, meaning that based on the historical data, a three-year period with less than or equal to 6.8 inches of average annual rainfall would be expected to happen eight times in 1,000 years. The chart shows that four of the five driest years on record occurred in the 1999 through 2020 dry period; and the driest consecutive three, five and 10-year periods have all occurred since 1999. The OBMP implementation period corresponds with this dry period.

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Author: LS
Date: 02/02/2021

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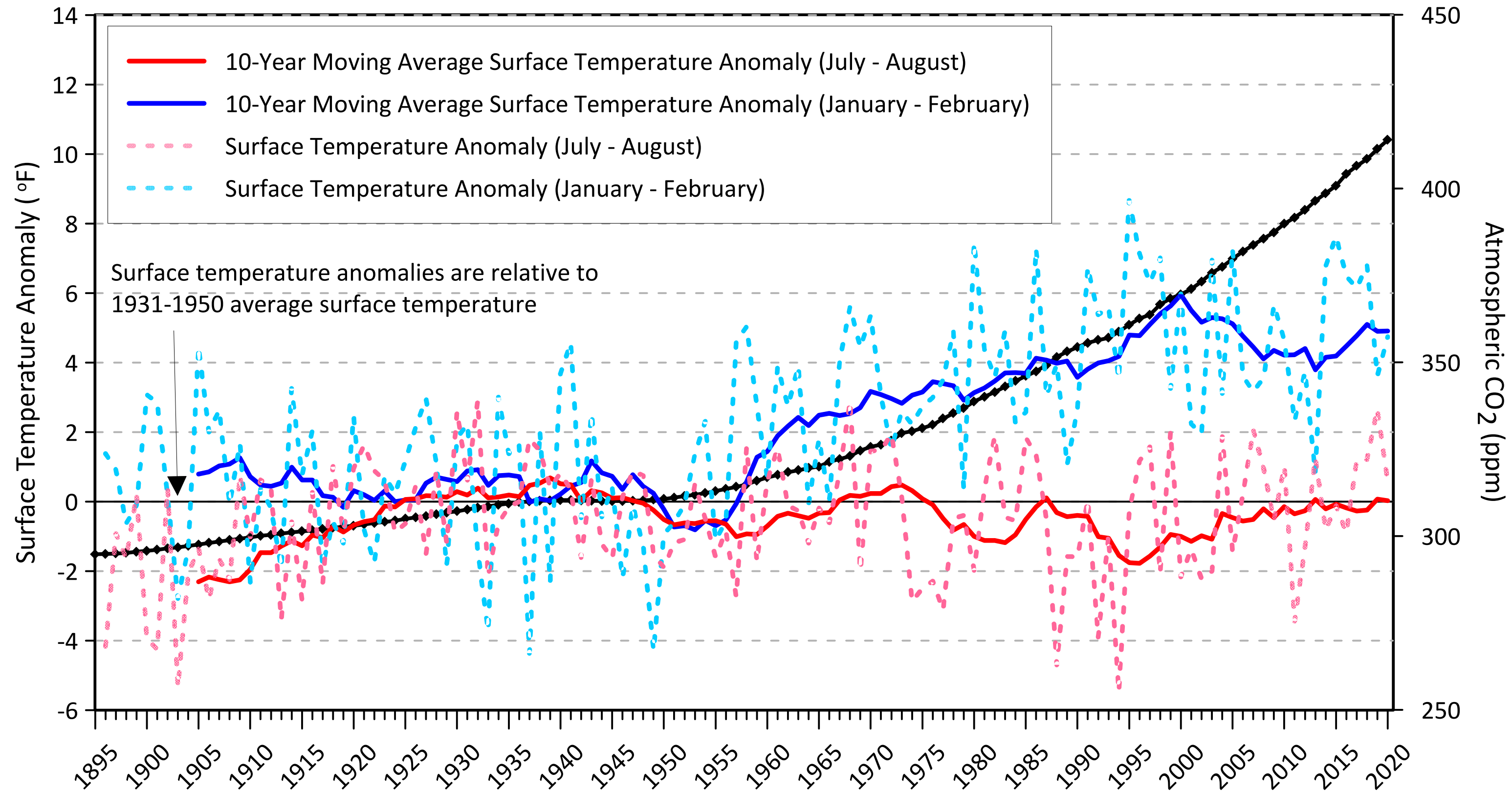
Chino Basin Watermaster
2020 State of the Basin Report
Hydrologic Conditions

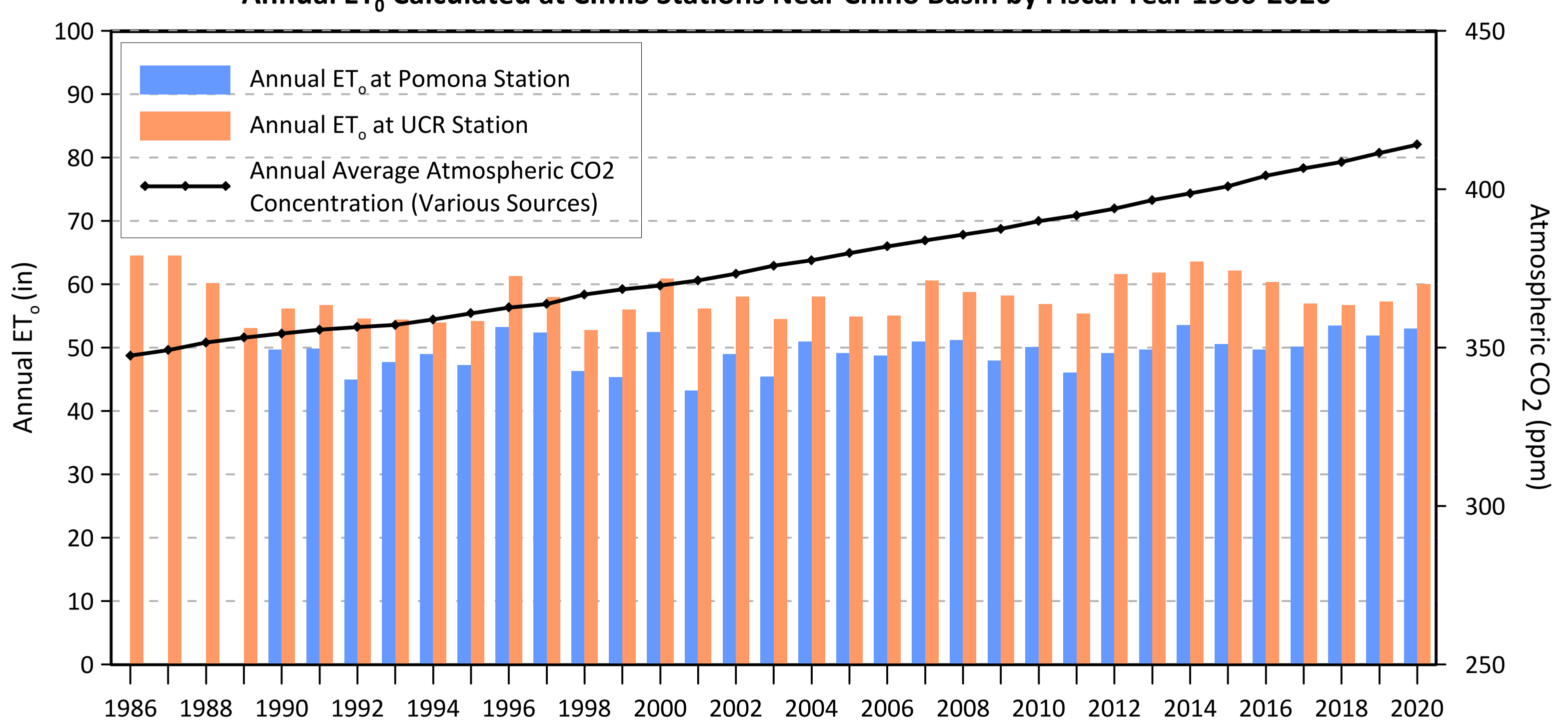
Characterization of Long-Term Annual Precipitation over the Chino Basin

Exhibit 2-2

January - February and July - August Surface Temperature Anomalies over the Chino Basin 1896-2020



Annual ET$_0$ Calculated at CIMIS Stations Near Chino Basin by Fiscal Year 1986-2020

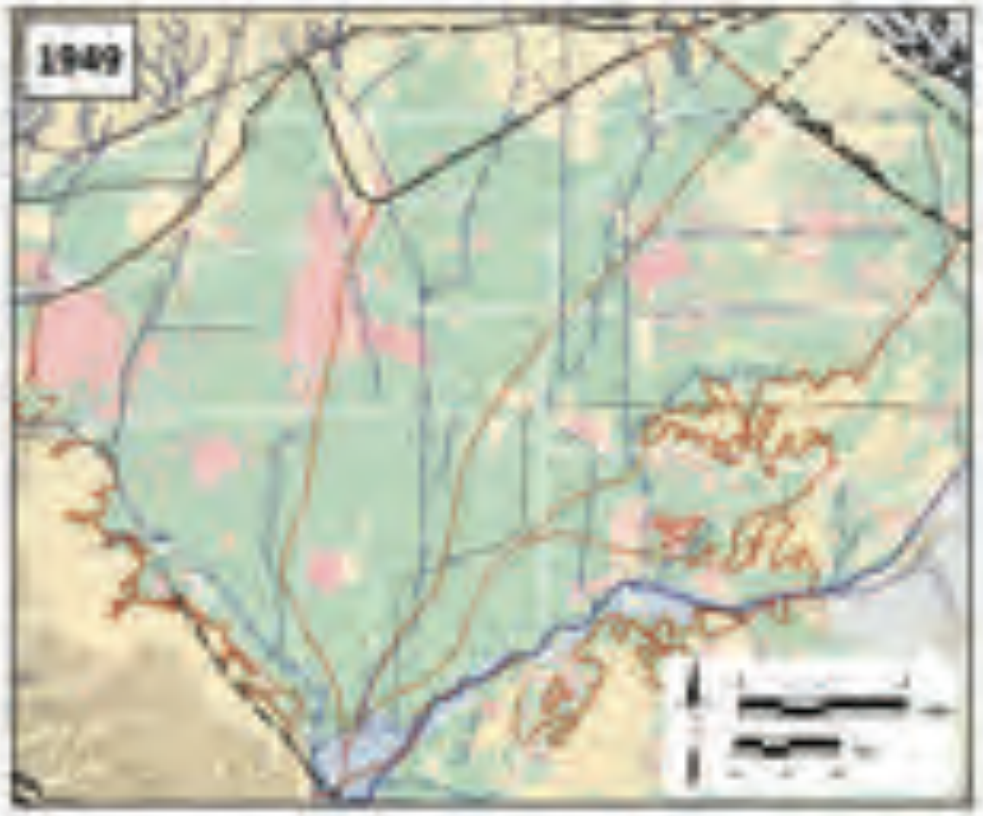


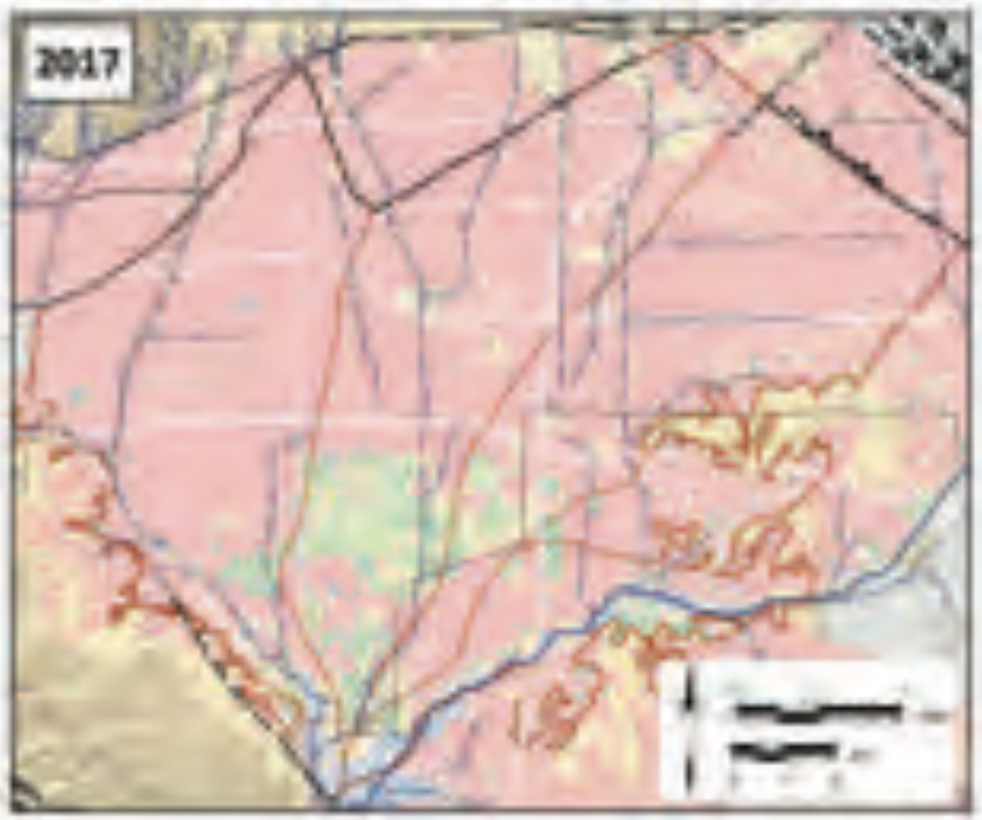
The chart on the upper left shows the time history of annual surface temperatures and 10-year average surface temperature anomalies for January-February and July-August. The January-February period represents winter and the coldest time of the year, and the July-August period represents summer and the hottest time of the year. The average 10-year surface temperature anomaly is computed as the difference between the running ten-year average surface temperature and the 20-year average surface temperature for the 1931 through 1950 period. This chart also shows the estimated atmospheric carbon dioxide concentration. The 1931 to 1950 baseline period corresponds to a period of relatively stable atmospheric carbon dioxide concentration of about 320 parts per million (ppm). After 1950, the atmospheric carbon dioxide concentration rate increases at an increasing rate through 2020. The surface temperature anomaly is a useful way to characterize surface temperature trends.

The data used to generate this chart is based on observed daily maximum and minimum temperatures converted to monthly statistics and interpolated by the PRISM Climate Group to produce gridded monthly maximum and minimum temperature estimates. The complete record of atmospheric carbon dioxide concentrations is assembled from multiple sources: prior to 1959, the annual values shown were estimated from an analysis of the Law Dome DE08 and DE08-2 ice cores in Antarctica (D.M. Etheridge, et al., 1998); values after 1959 were directly measured at the Mauna Loa Observatory in Hawaii (NOAA, 2019).

The 10-year moving average of the surface temperature anomaly for the July-August period varies between -2.0 and +0.5 degrees Fahrenheit. In contrast, the 10-year moving average of the surface temperature anomaly for the January-February period has been increasing from 1954 to 2020 at a rate of 0.08 degrees Fahrenheit per year, and resulted in a winter temperature departure of about +5 degrees Fahrenheit in 2020 compared to the 1931 to 1950 baseline period. The increase in the winter temperatures during this period appears to correlate with the increase in atmospheric carbon dioxide concentration. The significance of the increasing winter temperature to Chino Basin groundwater management is two-fold: a decrease in the occurrence of snowfall and increase in precipitation, and a slight increase in winter-time evapotranspiration (ET). The reduction in snowfall, coupled with an increase in precipitation, will increase the surface water discharge associated with individual precipitation events, cause more frequent exceedances of the recharge capacity of existing recharge facilities, and subsequently reduce the amount of stormwater recharged in the Basin relative to precipitation in the past.

The chart on the lower left shows the annual potential ET (ET$_o$) as computed at the California Irrigation Management Information System for stations in the Cities of Pomona and Riverside (University of California Riverside [UCR]). The reported ET$_o$ values are computed from measurements of solar radiation, temperature, humidity, and wind speed. It is unclear from these time series data that ET$_o$ is changing in response to increases in atmospheric carbon dioxide concentration. The trends in ET$_o$, if they become more apparent, will need to be included in future hydrologic evaluations of the Chino Basin.

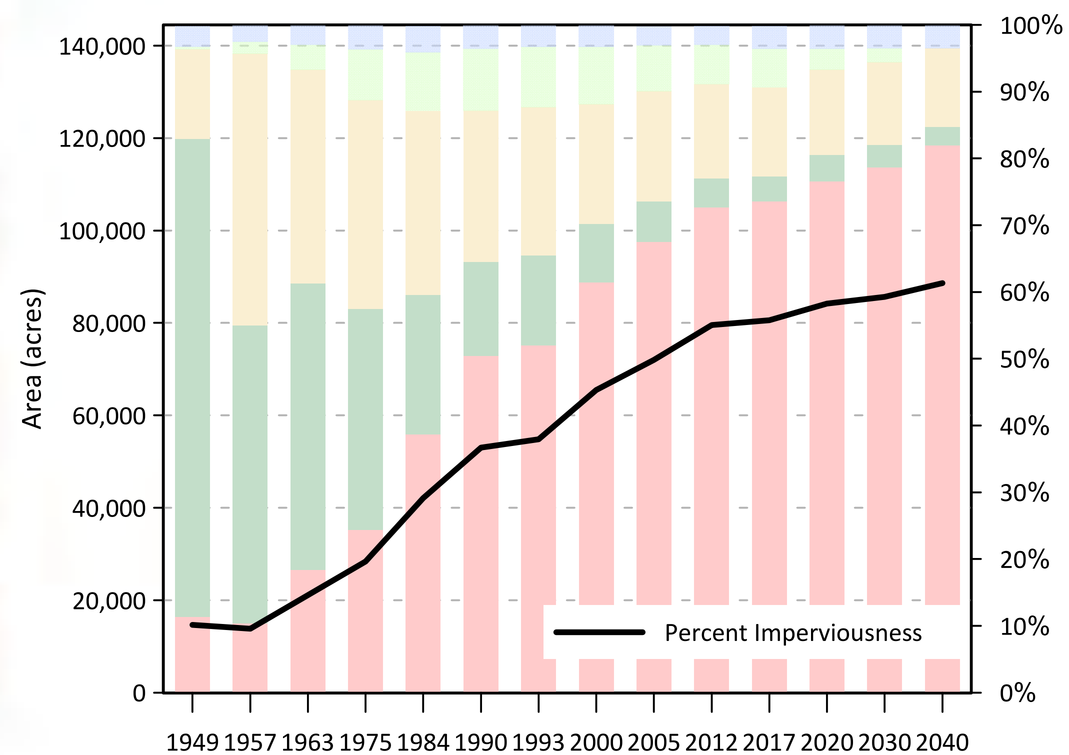




General Land Use Categories

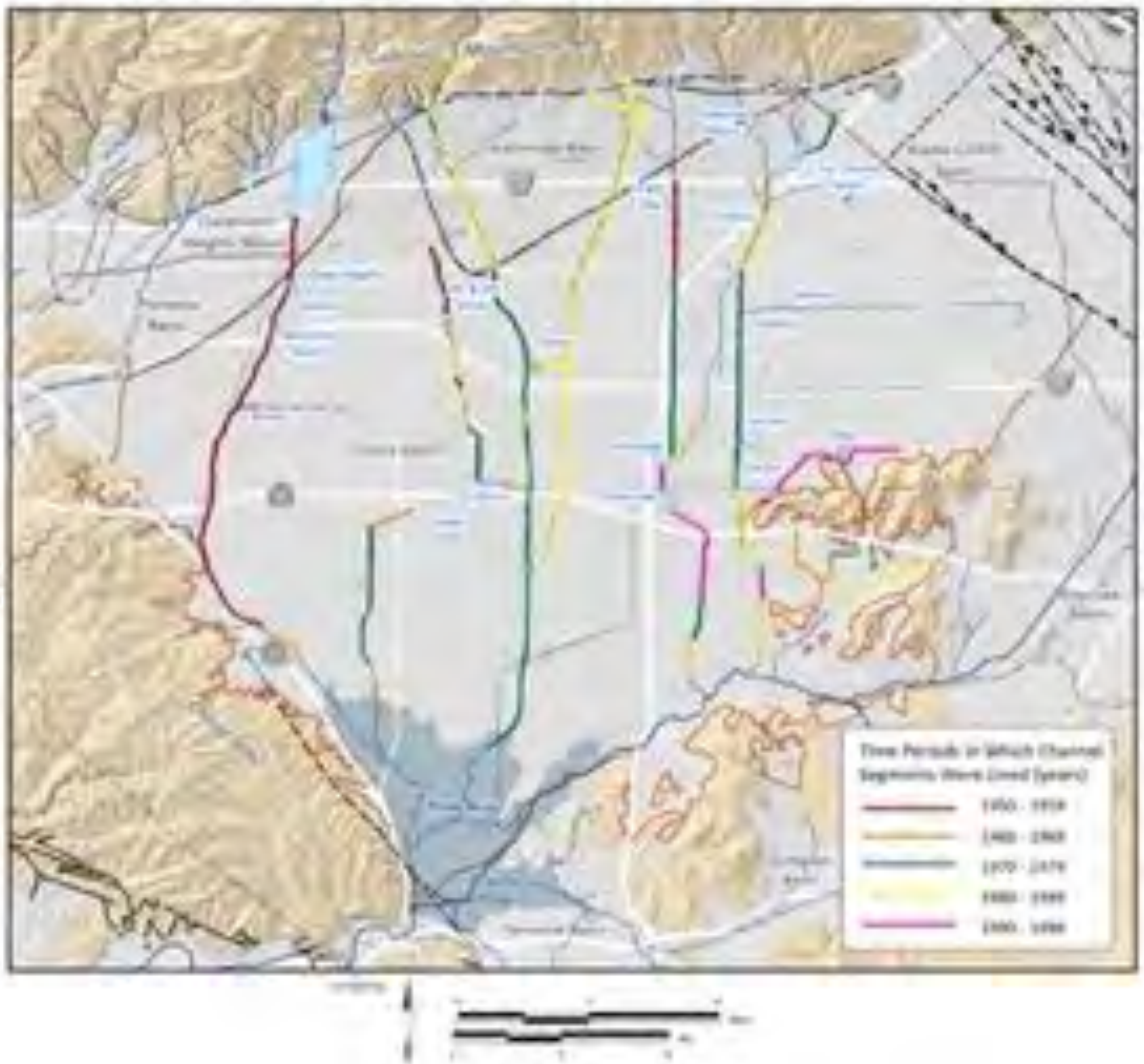
- Agriculture
- Dairy
- Urban
- Vacant
- Riparian Vegetation

Historical and Projected Distribution of Land Use in the Chino Basin

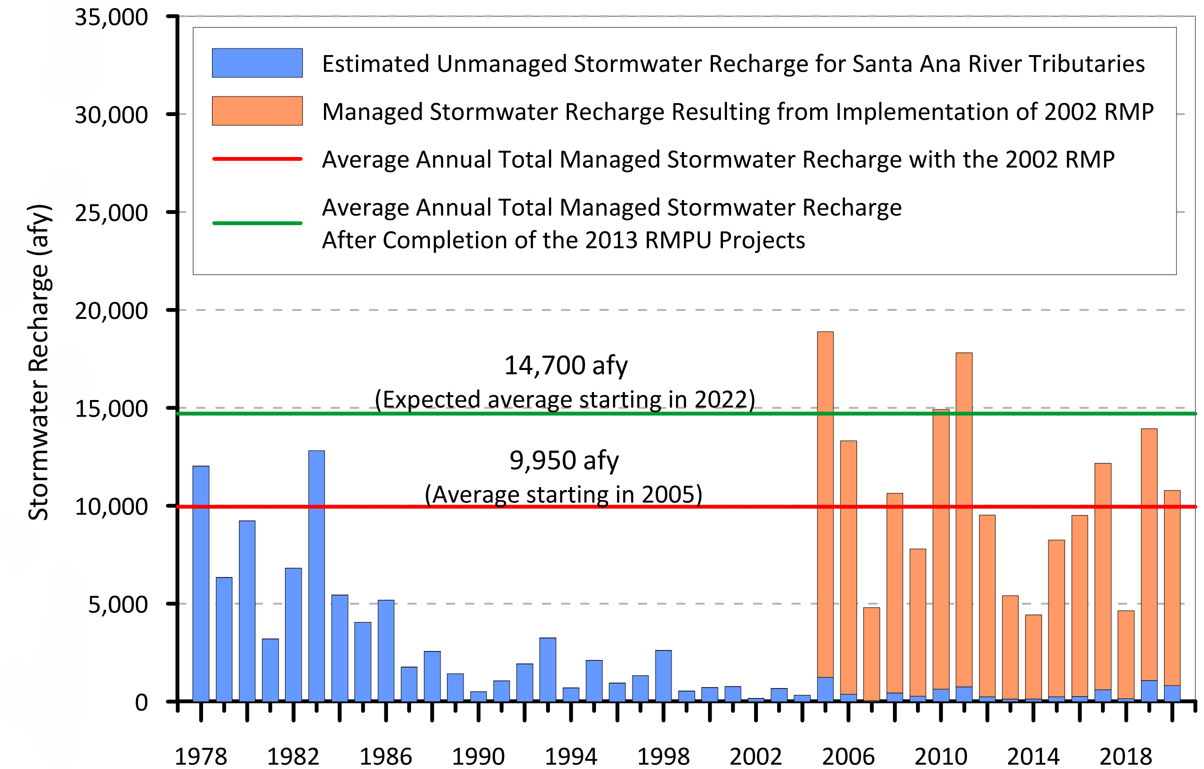


The watershed surface that is tributary to and overlies the Chino Basin and the water management practices over this surface have changed dramatically over the last 80 years. The land use, water management, and drainage conditions that are tributary to and overlie the Basin at a specific time are referred to collectively as the cultural condition of the basin. The types of land uses that overlie a groundwater basin have a profound impact on recharge. The land use transition from natural to agricultural uses and subsequently to developed urban uses changes the amount of recharge to the Basin. Furthermore, irrigation practices change over time in response to agricultural economics (e.g., demand for various agricultural products, commodity prices, production costs, etc.), regulatory requirements, technology, and the availability and cost of water. Urbanization increases the amount of imperviousness and decreases the irrigable and permeable areas that allow irrigation return flows and precipitation to infiltrate through the soil. And, urbanization increases the amount of stormwater produced on the land surface. Drainage improvements associated with the transition from natural and agricultural uses to urban uses reduce the recharge of stormwater: channels and streams in the Chino Basin were concrete-lined to move stormwater efficiently through the watershed to the Santa Ana River.

Historically, when land use has converted from natural and agricultural uses to urban uses, imperviousness has increased from near 0 to between 60 and almost 100 percent, depending on the specific land use. The maps on the left of this exhibit illustrate general land use types in the Chino Basin for 1949 and 2017. These data were obtained from the Department of Water Resources, San Bernardino County, and the Southern California Association of Governments. Also included is a chart that shows the estimated total imperviousness associated with the land uses. This latter chart is based on land use mapping for the years shown on the x-axis and projected land use from the land use control agencies. The land use was predominantly in an agricultural and undeveloped state until 1984: urban uses accounted for about 10 percent from 1933 through 1957, grew to about 25 percent in 1975, and reached about 60 percent in 2000. The total imperviousness of the Chino Basin is estimated to have increased from 18 percent in 1975 to about 56 percent in 2017 and is projected to reach about 60 percent by 2030. Based on an investigation to recalculate the Chino Basin Safe Yield, these land use changes contributed to a reduction of the deep infiltration of precipitation and applied water over the last 80 years. For example, the model-estimated deep infiltration of precipitation and applied water decreased from about 125,000 afy over the period of 1980 through 1989 to 80,000 afy over the period of 2010 through 2018 (WEI, 2020).



Estimated Unmanaged Stormwater Recharge for the Santa Ana River Tributaries in the Chino Basin and Managed Stormwater Recharge in Recharge Basins Resulting from Recharge Master Plans by Fiscal Year



Drainage improvements were incorporated into the urban landscape in the Chino Basin to convey stormwater rapidly, safely, and efficiently from the land surface through urban developments, and to discharge stormwater away from urbanized areas. Until the late 1990s, there was little or no thought as to the value of the stormwater that discharged out of the Chino Basin. The map to the left shows the stream systems that start in the San Gabriel Mountains and flow from the north to the south, crossing the Cucamonga, Chino, and Six Basins. From about 1957 to the present, the drainage areas overlying the valley floor have been almost completely converted to urban uses, and almost all the streams have been converted from unlined to concrete-lined channels.

The above chart illustrates the estimated unmanaged stormwater recharge in the Chino Basin (blue bars) for the Santa Ana River tributaries that flow south over the Chino Basin for the period of FY 1977/1978 through 2019/2020. The lining of these channels has almost eliminated unmanaged stormwater recharge in the Chino and Cucamonga Basins after 1984. The orange bars indicate the estimated managed stormwater recharged in recharge basins reported by IEUA starting in 2005 due to the construction of stormwater recharge improvements from the 2002 Recharge Master Plan (RMP) that was implemented in the OBMP. The 2002 RMP projects have replaced some of the recharge lost with channel lining. The red line indicates the average managed stormwater recharged in recharge basins (9,950 afy) from FY 2004/2005 to 2019/2020. Note that FY 2004/2005 to 2019/2020 contains the driest 10-year period (2007-2016) in the historical record (See Exhibit 2-2). The green line indicates the expected average managed stormwater recharge (9,950afy+4,750afy=14,700 afy) after the completion of the projects identified in the 2013 Amendment to the 2010 Recharge Master Plan Update (2013 RMPU), which is expected to be in 2021.

Earth's water is moved, stored, and exchanged between the atmosphere, land surface, and subsurface according to the hydrologic cycle. The hydrologic cycle begins with evaporation from the ocean. As the evaporated water rises, the water vapor cools, condenses, and ultimately returns to the Earth's surface as precipitation (rain or snow). As the precipitation falls on the land surface, some water may infiltrate into the ground to become groundwater, some water may run off and contribute to streamflow, some may evaporate, and some may be used by plants and transpired back into the atmosphere to continue the hydrologic cycle (Healy, R.W. et al., 2007).

A water budget accounts for the storage and movement of water between the four physical systems of the hydrologic cycle: the atmospheric system, the land surface system, the river and stream system, and the groundwater system. A water budget is a foundational tool used to compile water inflows (recharge) and outflows (discharge). It is an accounting of the total groundwater and surface water entering and leaving a basin or a user-defined area. The difference between inflows and outflows is the change in the amount of water stored (DWR, 2016).

Below is a tabular presentation of the Chino Basin water budget for the OBMP implementation period of FY 1999/2000 through FY 2017/2018, based on the recent modeling conducted to recalculate the Chino Basin Safe Yield (WEI, 2020). This model used historical data for the period through FY 2017/2018. The water budget below shows the recharge and discharge components and estimated change in storage on an annual time step. The recharge components include subsurface inflows from adjacent mountain blocks and groundwater basins, streambed infiltration, managed aquifer recharge, and the deep infiltration of precipitation and applied water. The discharge components include groundwater pumping, ET from riparian vegetation, groundwater discharge to streams, and subsurface outflow to adjacent groundwater basins. The change in storage is equal to the total recharge minus total discharge. The net recharge is equal to: R_{net} = Pumping + Δ Storage – R_{sw}, where: R_{ne}t is net recharge, Δ Storage is the change in storage, and R_{sw} is supplemental water recharge.

The net recharge is used with other information to estimate the Chino Basin Safe Yield. The estimated recharge and discharge components, change in storage, and net recharge shown below are slightly different than reported in past State of the Basin reports, and are based on updated information (WEI, 2020). The average net recharge for the period of FY 1999/2000 through FY 2009/2010 was about 135,000 afy, and the net recharge for the period of FY 2010/2011 through FY 2017/2018 was about 129,000 afy. For perspective, recall that the period of 2000 through 2020 contains the driest 10-year period (2007 through 2016) in the historical record (see Exhibit 2-2) and thus the estimated net recharge during this period is not representative of the long-term average net recharge.

Fiscal Year	Recharge										Discharge							Change in Storage = Recharge minus Discharge	Net Recharge
	Subsurface Boundary Inflow from:			Streambed Infiltration from:		Water Recharged in Basins from:					Pumping:								
	*Chino/Puente Hills, Six Basins, Cucamonga Basin and Rialto Basin	Bloomington Divide	Temescal Basin	*Santa Ana River Tributaries	Santa Ana River	Storm Water	Recycled Water	Imported Water	*Deep Infiltration of Precipitation and Applied Water	Subtotal Recharge	Chino Basin Desalter Authority	Overlying Non-Agricultural** and Appropriative Pools	Overlying Agricultural Pool	Evapo-transpiration of Riparian Vegetation	Groundwater Discharge to Streams	Subsurface Discharge to Temescal Basin	Subtotal Discharge		
FY 1999/2000	24,011	14,451	5,261	499	27,081	1,985	507	997	109,843	184,635	523	133,086	46,538	18,938	23,315	2,403	224,803	-40,168	138,476
FY 2000/2001	23,503	14,556	6,177	598	25,419	3,162	500	6,538	107,823	188,276	9,470	120,396	41,429	18,457	26,464	3,045	219,260	-30,985	133,272
FY 2001/2002	22,461	15,177	6,801	230	25,922	1,148	505	6,493	102,792	181,528	10,173	129,760	38,650	18,440	26,544	3,236	226,803	-45,275	126,311
FY 2002/2003	21,413	15,747	6,511	859	28,672	6,284	185	6,548	102,305	188,524	10,322	123,471	36,507	18,609	26,630	3,579	219,117	-30,593	132,974
FY 2003/2004	21,662	16,088	6,288	536	27,465	3,357	49	7,607	99,010	182,062	10,480	128,548	36,809	18,581	27,669	4,294	226,381	-44,319	123,862
FY 2004/2005	23,194	14,346	5,465	5,917	30,922	17,648	158	12,259	99,647	209,556	10,595	112,943	34,503	18,754	29,844	4,744	211,384	-1,827	143,797
FY 2005/2006	23,735	14,568	4,738	1,806	30,439	12,940	1,303	34,567	99,823	223,920	19,819	113,553	30,812	18,534	24,576	2,847	210,141	13,778	142,092
FY 2006/2007	23,168	15,150	4,023	79	29,276	4,745	2,993	32,960	96,008	208,402	28,529	123,695	29,919	18,108	21,441	2,754	224,446	-16,044	130,146
FY 2007/2008	22,439	15,044	3,580	1,530	31,703	10,205	2,340	0	93,275	180,116	30,116	127,696	26,280	18,050	20,003	2,406	224,551	-44,436	137,316
FY 2008/2009	22,413	15,271	3,217	839	33,318	7,512	2,684	0	91,489	176,741	28,456	137,345	23,386	18,127	18,475	2,521	228,310	-51,569	134,934
FY 2009/2010	21,267	15,584	3,342	1,939	35,285	14,273	7,210	5,000	88,512	192,412	28,964	108,983	22,038	18,277	18,067	2,780	199,110	-6,698	141,078
FY 2010/2011	22,132	15,960	3,561	3,358	36,213	17,052	8,065	9,465	88,763	204,568	28,941	94,413	18,042	18,356	18,765	3,004	181,522	23,047	146,913
FY 2011/2012	22,262	15,577	3,911	463	34,463	9,271	8,634	22,560	84,009	201,151	28,230	108,501	22,412	17,989	15,649	2,514	195,295	5,856	133,805
FY 2012/2013	21,703	15,144	3,791	243	33,536	5,271	10,479	0	80,130	170,298	27,380	111,748	24,074	17,634	13,871	2,275	196,982	-26,684	126,038
FY 2013/2014	21,132	15,067	3,812	241	34,301	4,299	13,593	795	78,395	171,636	29,626	118,849	22,131	17,608	13,348	2,441	204,003	-32,368	123,850
FY 2014/2015	19,582	15,230	3,759	421	34,907	8,001	10,840	0	75,817	168,555	30,022	104,317	17,552	17,763	13,585	2,542	185,780	-17,225	123,826
FY 2015/2016	17,833	15,716	3,765	476	36,134	9,236	13,222	0	73,547	169,928	28,191	101,301	16,908	17,946	14,147	2,708	181,201	-11,272	121,906
FY 2016/2017	18,839	15,967	3,843	1,920	35,805	11,575	13,934	13,150	72,874	187,907	28,284	98,960	16,191	17,931	15,261	2,314	178,941	8,966	125,317
FY 2017/2018	18,396	15,711	4,467	2,165	32,664	4,494	13,212	35,621	69,532	196,261	30,088	93,904	16,776	17,813	13,914	2,161	174,655	36,412	128,346
Statistics for the Peace Agreement Period, 2000 through 2018																			
Total	411,144	290,353	86,311	24,120	603,525	152,457	110,412	194,561	1,713,594	3,586,477	418,208	2,191,469	520,957	345,915	381,569	54,568	3,912,686	-311,402	2,514,259
Total (%)	11%	8%	2%	1%	17%	10%	3%	5%	48%	100%	11%	56%	13%	9%	10%	1%	100%	NA	NA
Average	21,639	15,282	4,543	1,269	31,764	8,024	5,811	10,240	90,189	188,762	22,011	115,340	27,419	18,206	20,083	2,872	205,931	-16,390	132,329
Maximum	24,011	16,088	6,801	5,917	36,213	17,648	13,934	35,621	109,843	223,920	30,116	137,345	46,538	18,938	29,844	4,744	228,310	36,412	146,913
Minimum	17,833	14,346	3,217	79	25,419	1,148	49	0	69,532	168,555	523	93,904	16,191	17,608	13,348	2,161	174,655	-51,569	121,906

*Recharge terms that are the results of calibrated surface water models or estimated via other analytical methods.

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WEST YOST
Water. Engineered

Author: LS
Date: 5/25/2021

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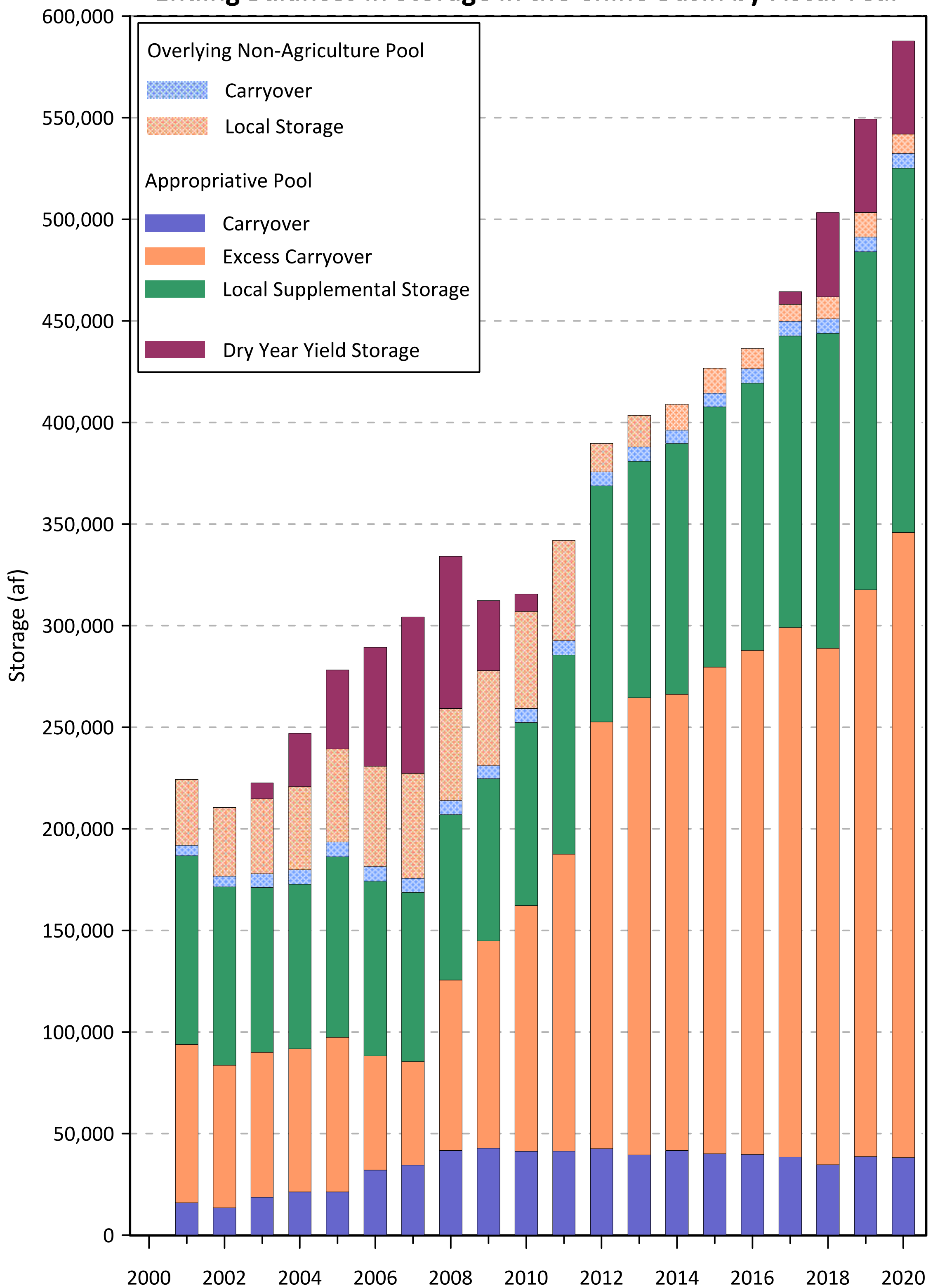
Prepared for:

Chino Basin Watermaster
2020 State of the Basin Report
Hydrologic Conditions

Water Budget for Chino Basin
Fiscal Year 2000 to 2020

Exhibit 2-6

Time History of Ending Balances in Storage in the Chino Basin by Fiscal Year



The Overlying Non-Agriculture Pool and Appropriative Pool Parties individually engage in conjunctive-use activities by storing unpumped groundwater pumping rights, and subsequently recovering their stored water as their individual needs arise. The water stored by the Overlying Non-Agricultural Parties is classified as Carryover water (unpumped rights to the Safe Yield) and local storage (stored water other than carryover water). The water stored by the Appropriative Pool Parties includes, Carryover, Excess Carryover, and local supplement water. Excess Carryover is unpumped Carryover water. Local supplemental water is imported water and recycled water stored by a Party. Managed storage collectively refers to all water stored by the Parties. The conjunctive-use activities of the Parties have caused managed storage to increase since 2000. The chart to the left and the table below show the time history of water held in managed storage at the end of each FY from July 1999 through June 2020. The Parties, in aggregate, have continued to under-pump their pumping rights, causing managed storage to increase from about 237,000 af in July 2000 to about 542,000 af in July of 2020.

Metropolitan Water District's (Metropolitan) Dry-Year Yield Program (DYYP) is the only active storage and recovery program in the Basin. In the DYYP, up to 100,000 af of imported water can be stored in the Chino Basin during surplus years and extracted during years when the availability of imported water is limited. By the end of FY 1999/2020, Metropolitan had about 46,000 af in its DYYP account.

Fiscal Year	Fiscal Year	Appropriative Pool				Overlying Non-Agricultural Pool			Total Managed Storage by Parties	Dry Year Yield Program Storage[6]	Total Managed Storage
		Carryover[2] (1)	Excess Carryover (ECO)[3] (2)	Local Supplemental Storage[4] (3)	Subtotal (4)	Carryover[2] (5)	Local Storage[5] (6)	Subtotal (7)	(8) = (7) + (4)	(9)	(10) = (9) + (8)
2000[7]	FY 1999/2000	28,911	170,342		199,253	6,541	31,031	37,572	236,825	0	236,825
2001	FY 2000/2001	15,940	77,907	92,813	186,660	5,301	32,330	37,631	224,291	0	224,291
2002	FY 2001/2002	13,521	70,103	87,801	171,425	5,285	33,727	39,012	210,437	0	210,437
2003	FY 2002/2003	18,656	71,329	81,180	171,165	6,743	36,850	43,593	214,758	7,738	222,496
2004	FY 2003/2004	21,204	70,503	80,963	172,670	7,177	40,881	48,058	220,728	26,300	247,028
2005	FY 2004/2005	21,289	76,080	88,849	186,218	7,227	45,888	53,115	239,333	38,754	278,087
2006	FY 2005/2006	32,062	56,062	86,170	174,294	7,227	49,178	56,405	230,699	58,653	289,352
2007	FY 2006/2007	34,552	50,895	83,184	168,631	7,084	51,476	58,560	227,191	77,116	304,307
2008	FY 2007/2008	41,626	83,962	81,520	207,108	6,819	45,248	52,067	259,175	74,877	334,052
2009	FY 2008/2009	42,795	101,908	79,890	224,593	6,672	46,600	53,272	277,865	34,494	312,359
2010	FY 2009/2010	41,263	120,897	90,133	252,293	6,934	47,732	54,666	306,959	8,543	315,502
2011	FY 2010/2011	41,412	146,074	98,080	285,566	6,959	49,343	56,302	341,868	0	341,868
2012	FY 2011/2012	42,614	209,981	116,138	368,733	6,914	13,993	20,907	389,640	0	389,640
2013	FY 2012/2013	39,413	225,068	116,378	380,859	7,073	15,473	22,546	403,405	0	403,405
2014	FY 2013/2014	41,708	224,496	123,484	389,688	6,478	12,812	19,290	408,978	0	408,978
2015	FY 2014/2015	40,092	239,517	127,994	407,603	6,823	12,225	19,048	426,651	0	426,651
2016	FY 2015/2016	39,733	248,013	131,522	419,267	7,195	9,949	17,144	436,411	0	436,411
2017	FY 2016/2017	38,340	260,682	143,552	442,575	7,226	8,292	15,519	458,093	6,315	464,408
2018	FY 2017/2018	34,582	254,221	155,018	443,821	7,198	10,775	17,973	461,795	41,380	503,175
2019	FY 2018/2019	38,605	279,033	166,406	484,044	7,227	12,004	19,231	503,275	45,969	549,243
2020	FY 2019/2020	38,095	307,757	179,292	525,144	7,227	9,474	16,701	541,845	45,961	587,806

1. Account balances are from Watermaster Assessment Packages and do not account for the desalter replenishment obligation or the change in Safe Yield.
2. The un-produced water in any year that may accrue to a member of the Non-Agricultural Pool or the Appropriative Pool and that is produced first each subsequent Fiscal Year or stored as Excess Carryover
3. Carryover Water which in aggregate quantities exceeds a party's share of Safe Yield in the case of the Non-Agricultural Pool, or the assigned share of Operating Safe Yield in the case of the Appropriative Pool, in any year.
4. Water imported to Chino Basin from outside the Chino Basin Watershed and recycled water.
5. Water held in a storage account pursuant to a Local Storage Agreement between a party to the Judgement and Watermaster. "Local Storage Agreement" means a Groundwater Storage Agreement for Local Storage.
6. Ending balance in the Dry Year Yield Program storage account.
7. Prior to FY2001, Excess Carryover and Local Supplemental Storage were combined into one account

Prepared by:

WEST YOST
Water. Engineered

Author: GR
Date: 20210203

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Exhibit_2-7_Chart_Managed Storage Hist.grf

Prepared for:

Chino Basin Watermaster
2020 State of the Basin Report
Hydrologic Conditions

Time History of Managed Storage in the Chino Basin

Exhibit 2-7

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3.0 BASIN PRODUCTION AND RECHARGE

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The accurate accounting of groundwater production and artificial recharge is vital to the management of the Chino Basin. Several of the Program Elements of the OBMP have been developed to address these needs, primarily *OBMP PE 1 – Develop and Implement a Comprehensive Monitoring Program* and *PE 2 – Develop and Implement Comprehensive Recharge Program.* Estimates of production and recharge are essential inputs to inform re-determinations of the Safe Yield of the Chino Basin, which are scheduled to occur every ten years. The exhibits in this section characterize the physical state of the Chino Basin with respect to groundwater production and artificial recharge.

Groundwater Production. Since its establishment in 1978, Watermaster has collected information to estimate total groundwater production from the Chino Basin. The Watermaster Rules and Regulations require groundwater producers that pump in excess of 10 afy to install and maintain meters on their well(s). Well owners that pump less than 10 afy are considered “minimal producers” and are not required to meter or report to the Watermaster. When the OBMP was adopted, many of the Agricultural Pool wells did not have properly functioning meters installed, so Watermaster initiated a meter installation program for these wells as part of *PE 1*. Meters were installed at most agricultural wells by 2003. Watermaster staff visit and record production data from the meters at these wells on a quarterly basis. For the remaining unmetered Agricultural Pool wells, including minimal producer wells, Watermaster applies a “water duty” method to estimate their production on an annual basis. Members of the Appropriative Pool and Overlying Non-Agricultural Pool, and the Chino Desalter Authority (CDA) record their own meter data and submit their report to Watermaster staff on a quarterly basis. All Chino Basin production data are checked for accuracy and stored in Watermaster’s relational database. Watermaster summarizes and reports the groundwater production data based on FY (July 1 to June 30). Watermaster uses reported production to quantify and levy assessments pursuant to the Judgment. Exhibit 3-1 shows the locations of all active production wells, symbolized by Pool, in the Chino Basin during FY 2019/2020.

Prior to the widespread metering of Agricultural Pool production wells, Agricultural Pool production estimates in Watermaster’s database are believed to have been consistently underreported. For the development of the 2013 Chino Basin Groundwater Model (WEI, 2015), agricultural production prior to FY 2001/2002 was estimated based on historical land use data and the applied water requirements for those land uses. Exhibit 3-2 shows two bar charts depicting the annual groundwater production by Pool for FY 1977/1978 through 2019/2020. Exhibit 3-2a shows the estimated production by Pool as recorded in Watermaster’s database, and Exhibit 3-2b shows the same production values as Exhibit 3-2a except Agricultural Pool production totals prior to FY 2001/2002 were replaced with the volumes estimated for the Safe Yield recalculation effort (WEI, 2015). Based on the dataset that includes model estimations (Exhibit 3-2b), total annual groundwater production in the Chino Basin has ranged from a maximum of about 191,000 af during FY 1980/1981 to a minimum of about 133,000 af during FY 2018/2019 and has averaged about 169,000 afy.

The remaining characterizations of production data in this report are based on Watermaster’s records (Exhibit 3-2a). Total annual groundwater production has ranged from a maximum of about 189,000 af during FY 2008/2009 to a minimum of about 123,000 af during FY 1982/1983 and has averaged about 153,000 afy. Since FY 1977/1978, Agricultural Pool production has decreased by 72,000 af – declining in proportion to the decline in total production – from 55 percent of total production in FY 1977/1978 to 10 percent in FY 2019/2020. During the same period, Appropriative Pool production increased by about 69,000 af—from 39 percent of total production in FY 1977/1978 to 88 percent as of FY 2019/2020—inclusive of production at the CDA wells. Production in the Overlying Non-Agricultural Pool declined from about six percent of total production in FY 1977/1978 to two percent as of FY 2019/2020.

The spatial distribution of production has also shifted since 1978. Exhibit 3-3 is a series of maps that illustrate the location and magnitude of groundwater production of wells in the Chino Basin for FYs 1977/1978 (Establishment of Watermaster), 1999/2000 (commencement of the OBMP), and 2019/2020 (current conditions).

The decline in agricultural production in the southern half of the Chino Basin has gradually been replaced by production at the CDA wells since FY 2000/2001. The CDA wells and treatment facilities were developed as part of *OBMP PE 3 – Develop and Implement Water Supply Plan for the Impaired Areas of the Basin* and *PE 5 – Develop and Implement Regional Supplemental Water Program*. The desalters are meant to enhance water supply reliability and improve groundwater quality in the Chino Basin. Exhibit 3-4 is a map that displays the locations of the desalter wells and treatment facilities. This exhibit also summarizes the history of desalter production in the southern portion of the Chino Basin and its nexus to the OBMP goals.

Artificial Recharge. Watermaster also improves water supply reliability and water quality in the Chino Basin through the execution of *OBMP PE 2.* The comprehensive recharge program has been developed through a recharge master planning process that began in 1998 to increase the recharge of local and supplemental waters in the Chino Basin. Since the *Recharge Master Plan Phase II* report was developed in 2001 (WEI, 2001), Watermaster has partnered with the Inland Empire Utilities Agency, San Bernardino County Flood Control District, and Chino Basin Water Conservation District to construct and/or improve recharge facilities in the Chino Basin, in accordance with the Recharge Master Plan and the Four-Party Agreement (2003). The Peace Agreement requires the preparation of a recharge master plan update (RMPU) no more than every five years; the most recent approved recharge master plan update is the 2018 RMPU (WEI, 2018). A primary goal of the recharge master plan is to increase the capacity for and recharge of stormwater, imported water, and recycled water in the Chino Basin. Exhibit 3-5 shows the network of recharge facilities in the Chino Basin, a time history of the magnitude and types of groundwater recharge since FY 2004/2005 (when the Chino Basin Recycled Water Groundwater Recharge Program was initiated), and a summary of the groundwater recharge programs and recharge master planning. Exhibit 3-6 characterizes the seasonal recharge of stormwater, recycled water, and imported water. Exhibit 3-7 shows annual recharge by water type and recharge facility for FY 2000/2001 through FY 2019/2020.

Exhibit 3-8 shows the recycled water infrastructure, areas of recycled water reuse, and annual reuse from FY 1999/2000 through FY 2019/2020. Recycled water ruse has significantly increased since the OBMP implementation began in FY 1999/2000.

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During FY 2019/2020, 376 production wells were active in the Chino Basin. Total production was about 149,000 af and was divided as follows:

Agricultural Pool:
15,700 af, 10 percent of total production

Overlying Non-Agricultural Pool:
2,300 af, two percent of total production

Appropriative Pool:
95,400 af, 64 percent of total production

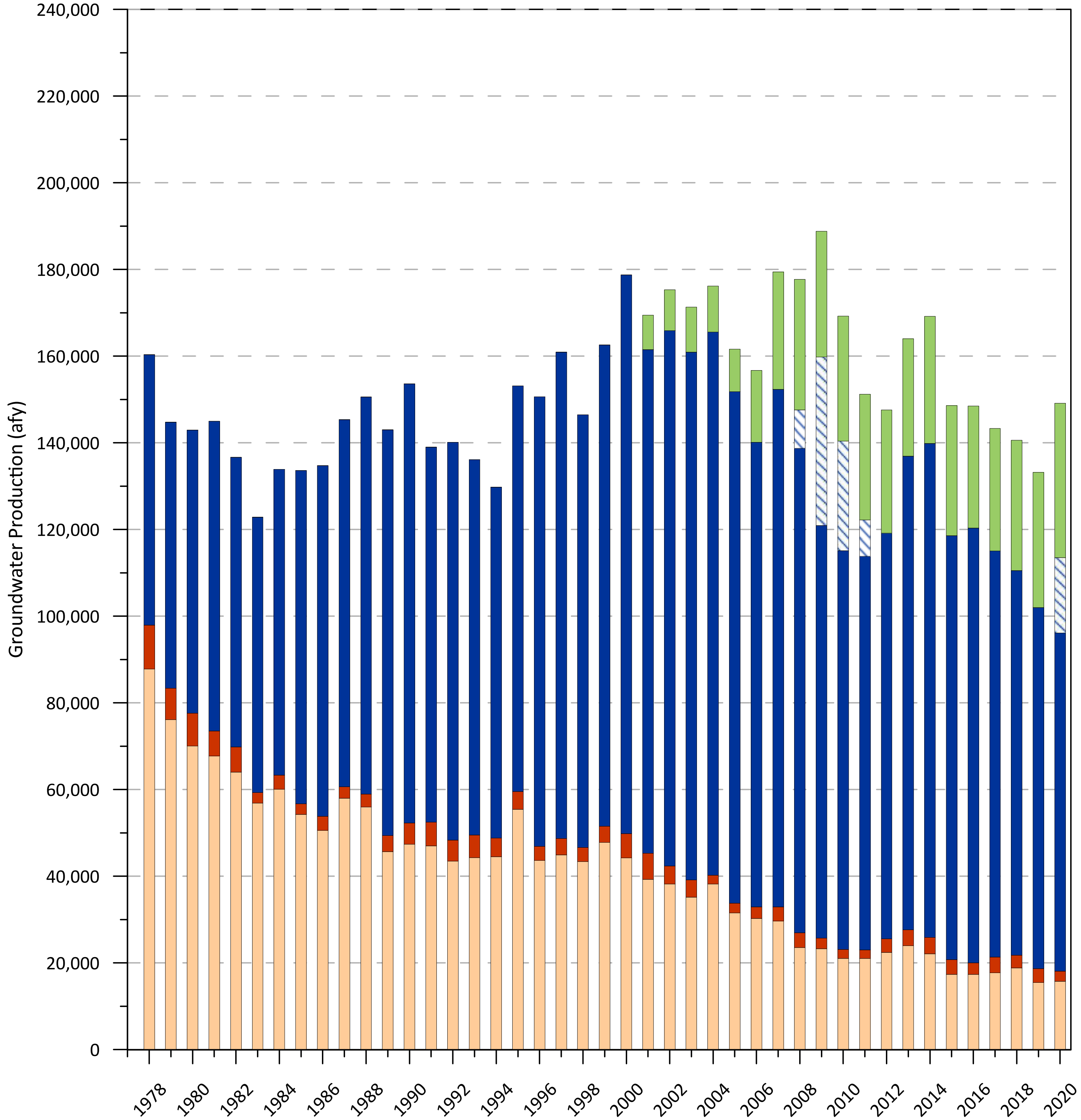
Chino Basin Desalters:
35,600 af, 24 percent of total production

Exhibits 3-2 and 3-3 characterize how production has changed over time across the Chino Basin.

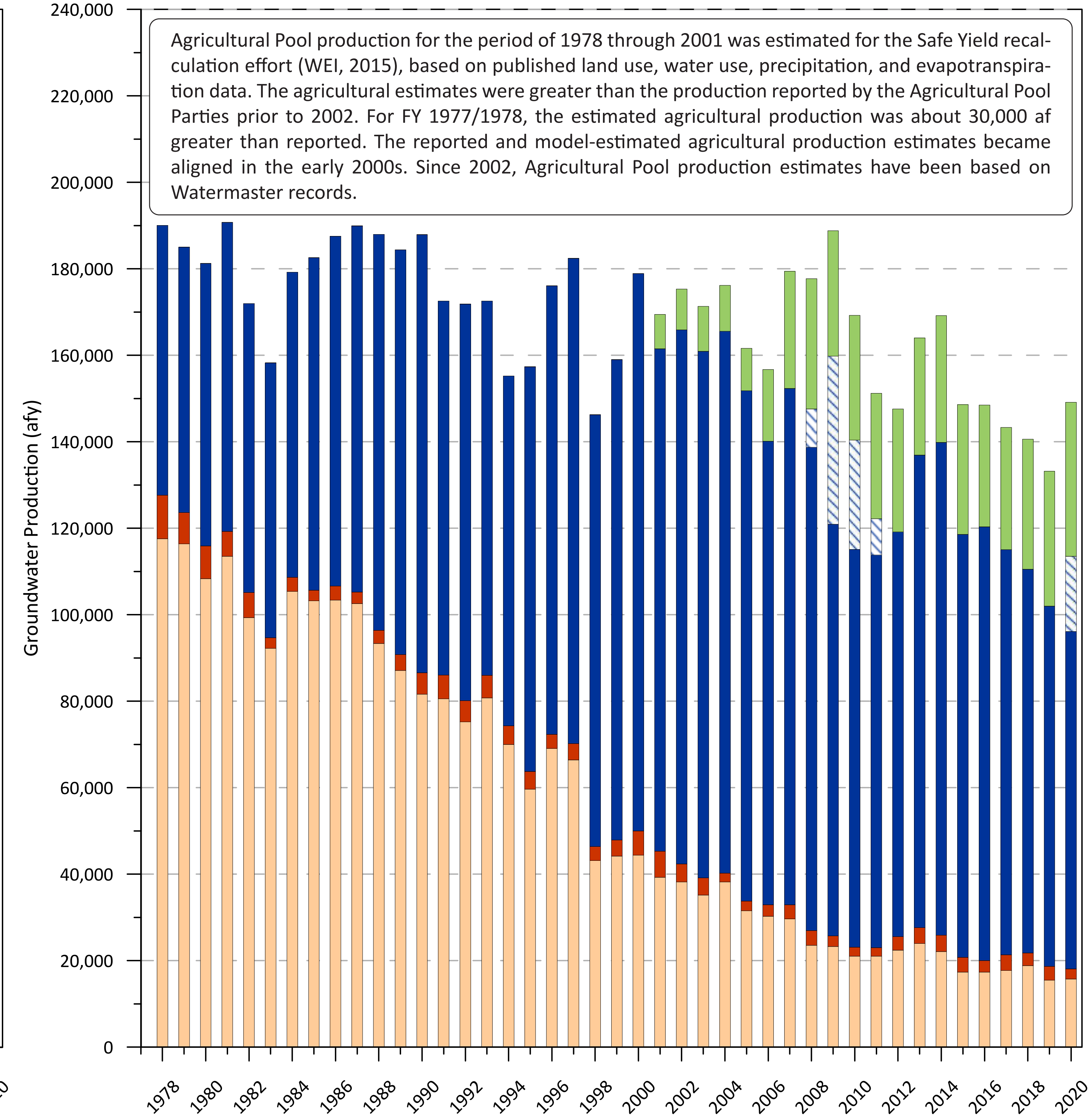
Active Production Wells in the Chino Basin
Fiscal Year 2019/2020

Exhibit 3-1

3-2a
Groundwater Production by Pool in the Chino Basin with Agricultural Pool Production Amounts from Watermaster Database by Fiscal Year



3-2b
Groundwater Production by Pool in the Chino Basin with Agricultural Pool Production Amounts from the Chino Basin Model Prior to 2002 by Fiscal Year



Agricultural Pool

Overlying Non-Agricultural Pool

Appropriative Pool

Appropriative Pool - Metropolitan Dry Year Yield Program

Chino Basin Desalter Authority

Prepared by:

WEST YOST
Water. Engineered

Author: SO
Date: 3/24/2021

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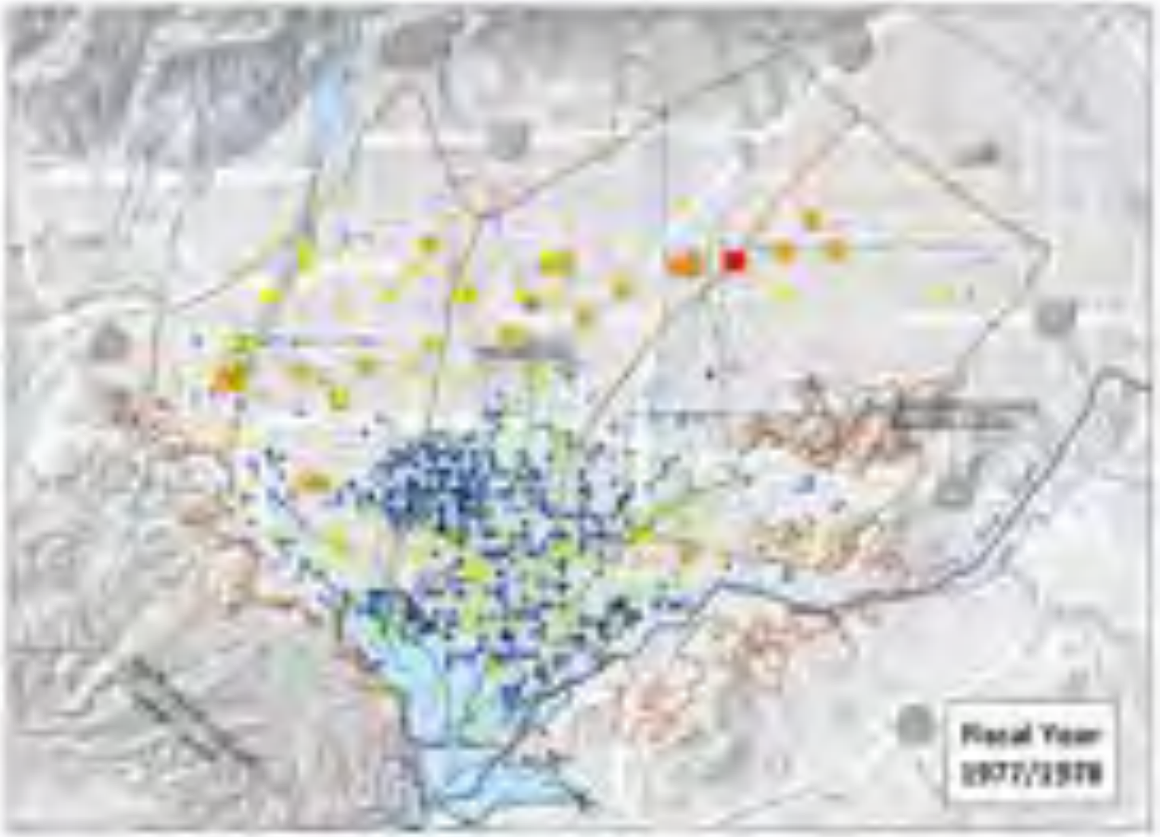
Prepared for:

Chino Basin Watermaster
2020 State of the Basin Report
Basin Production and Recharge

Distribution of Groundwater Production
Fiscal Year 1977/1978 to 2019/2020

Exhibit 3-2



In FY 1977/1978, production located south of Highway 60 in the Chino Basin was about 93,500 af and production located north of Highway 60 was about 65,300 af, accounting for 59 and 41 percent of total production, respectively. The agricultural production estimate for FY 1977/1978 from the Safe Yield recalculation effort in 2015 was greater than the reported production and primarily occurred south of Highway 60.

Between FY 1977/1978 and FY 1999/2000, groundwater production shifted north, with groundwater production south of Highway 60 declining from 59 to 31 percent of total production. North of Highway 60, production increased from 41 to 69 percent of total production. This shift in production was a result of land use transitions: south of Highway 60, irrigated agricultural land had been largely replaced by dairies, which have lower water use requirements; and north of Highway 60, Appropriative Pool production increased concurrent with urbanization. In FY 1999/2000, after the CDA wells were constructed and came online south of Highway 60 (see Exhibit 3-4), the spatial distribution of pumping began to shift again, south of Highway 60.

The number of wells producing greater than 1,000 afy began to increase from FY 1977/1978 through the present period. This was due to the increase in urbanization, which tends to concentrate production over fewer wells, compared to agricultural production. The construction and operation of the Chino Desalter wells, most of which produce more than 1,000 afy, also contributed to this increase. Despite this increase, the total groundwater production has been declining since 2007 due to the drought conditions, state-mandated water conservation measures, a trend towards greater water conservation, and the economic downturn that occurred in 2008.

Pool	FY 1977/1978 Production		FY 1999/2000 Production		FY 2019/2020 Production	
	af	percentage	af	percentage	af	percentage
Agricultural	87,800	55	44,200	25	15,700	11
Overlying Non-Agricultural	10,100	6	5,600	3	2,300	2
Appropriative	62,400	39	128,900	72	95,400	64
CDA	0	0	0	0	35,600	24
Total	**160,300**	**100**	**178,700**	**100**	**149,000**	**100**

WEST YOST

Groundwater Production by Well

Fiscal Year 1977/1978, 1999/2000, and 2019/2020

The CDA is a Joint Powers Authority that operates and manages the Chino Desalters. CDA member agencies include the IEUA, the Jurupa Community Services District (JCSD), the Santa Ana River Water Company, the Western Municipal Water District, and the Cities of Chino, Chino Hills, Norco, and Ontario. Currently, the Chino Desalters consist of 29 wells that pump brackish groundwater from the southern portion of the Chino Basin, two facilities that treat the groundwater with reverse osmosis and ion exchange, a conveyance system to deliver treated water to its member agencies, and brine disposal. One well was constructed in late 2020 and is estimated to begin operation in mid-2021.

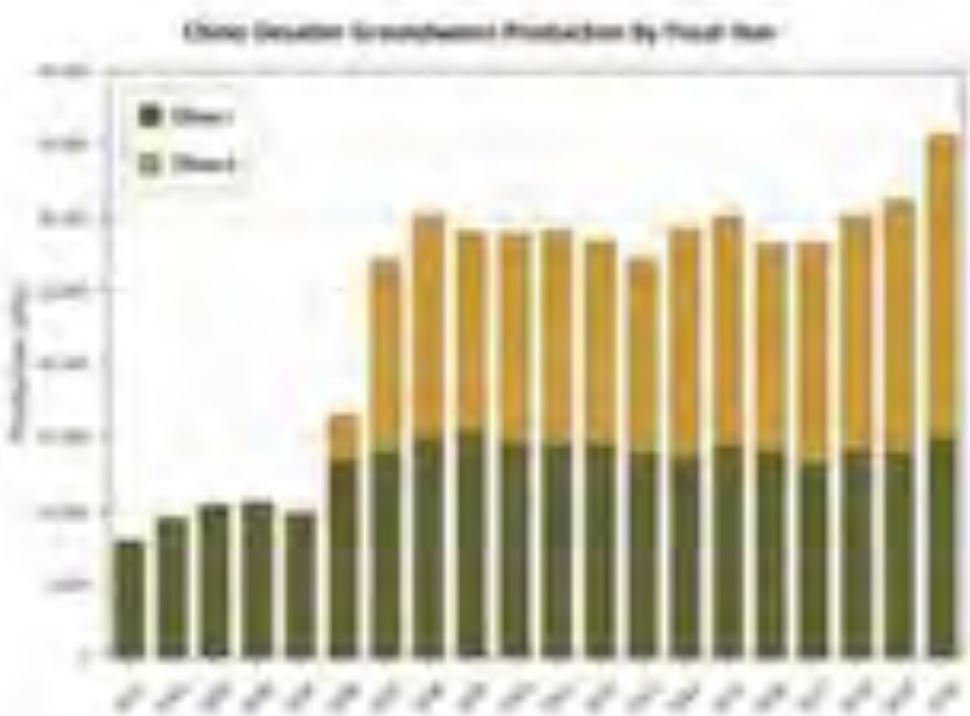
The need for the Chino Desalters was described in the OBMP Phase 1 Report. Throughout the 20th century, land uses in the southern portion of the Chino Basin were primarily agricultural. Over time, groundwater quality degraded in this area, and it is not suitable for municipal use unless it is treated to reduce TDS, nitrate, and other contaminant concentrations. The OBMP recognized that urban land uses would ultimately replace agriculture and that if municipal pumping did not replace agricultural pumping, groundwater levels would rise and discharge to the Santa Ana River. The potential consequences would be the loss of Safe Yield in the Chino Basin and the degradation of the quality of the Santa Ana River—the latter of which could impair downstream beneficial uses in Orange County. Mitigating the lost yield and the subsequent degradation of water quality would come with high costs to the Chino Basin parties.

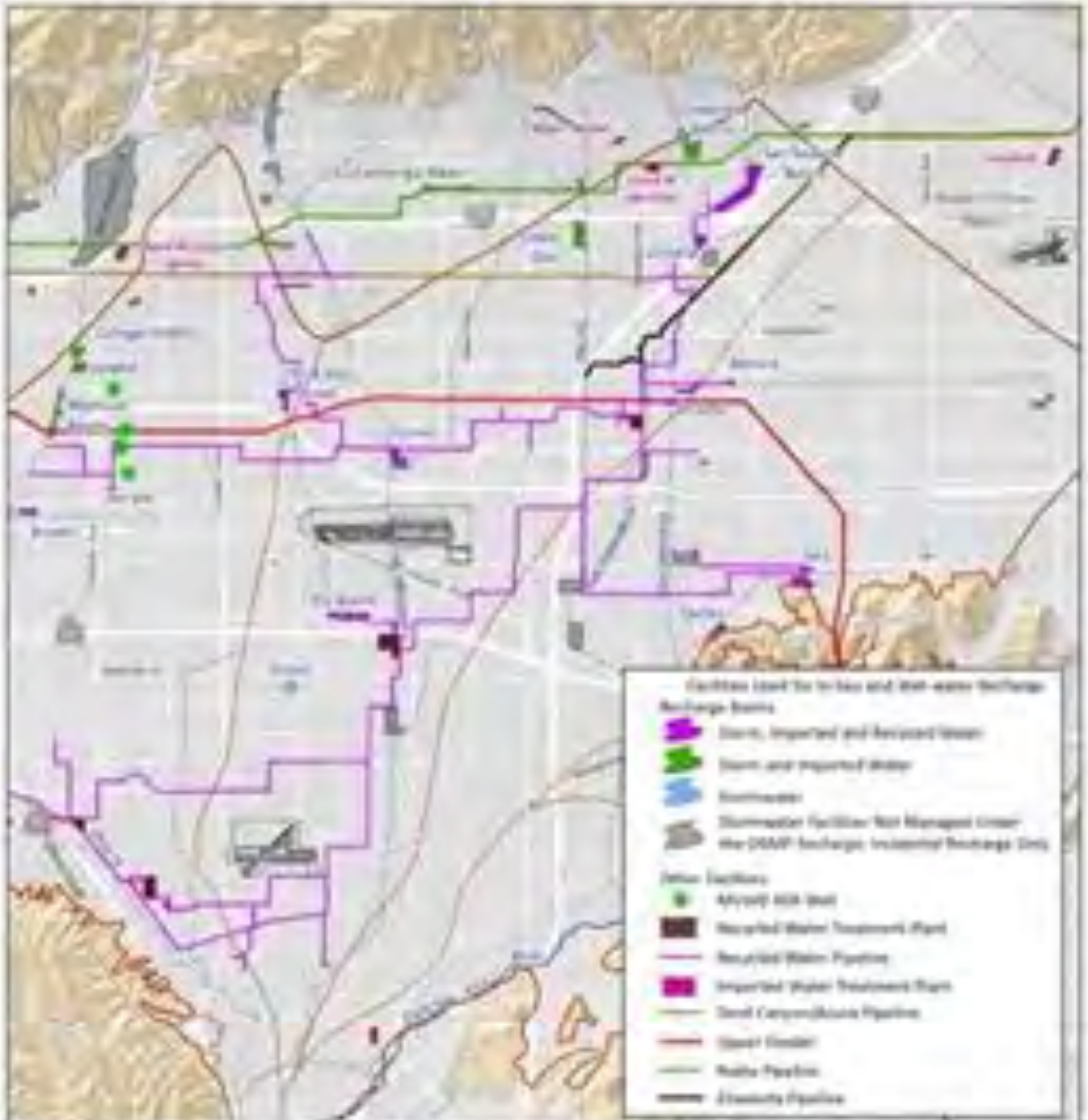
The Chino Desalters were designed to replace the expected decrease in agricultural production and accomplish the following objectives: meet emerging municipal demands in the Chino Basin, maintain or enhance Safe Yield, remove groundwater contaminants, and protect the beneficial uses of the Santa Ana River. Pursuant to the OBMP and the Peace Agreement, Watermaster's goal for desalter production was set at 40,000 afy.

The Chino Desalters also became a fundamental component of the salt and nutrient management plan for the Chino Basin, which was written into the 2004 Water Quality Control Plan for the Santa Ana River Basin ([Basin Plan], Regional Board, 2004)). The Basin Plan adopted maximum-benefit based water quality objectives in the Chino Basin, enabling the implementation of large-scale recycled-water reuse projects in the Chino Basin for direct reuse an indirect potable reuse. Watermaster and the IEUA made nine "maximum-benefit commitments," ensuring that beneficial uses in the Chino Basin will not be impaired by TDS and nitrate, and groundwater management in the Chino Basin will not contribute to the impairment of beneficial uses of the Santa Ana River. The operation of the Chino Desalters is necessary to attain "Hydraulic Control" in the southern portion of Chino Basin. Hydraulic Control is achieved when groundwater discharge from the Chino-North Management Zone to the Santa Ana River is eliminated or reduced to de minimis levels by pumping at the Chino Desalter wells. Hydraulic Control is necessary to maximize the Safe Yield and to prevent degraded groundwater from discharging from the Chino Basin to the Santa Ana River. Four of the nine maximum-benefit commitments are related to the Chino Desalters and Hydraulic Control.

The Chino-I Desalter began operating in 2000 with a design capacity of 8 million gallons per day (mgd) (about 9,000 afy). In 2005, the Chino-I Desalter was expanded to 14 mgd (about 16,000 afy). The Chino-II Desalter began operating in June 2006 at a capacity of 15 mgd (about 17,000 afy). In 2012, the CDA completed construction of the Chino Creek Well Field (CCWF). Production at some of the CCWF wells began in mid-2014, and production at the other CCWF wells began in early 2016, reaching the level of production required to achieve Hydraulic Control. In 2015, the CDA completed the construction of two more wells (I-10 and I-11), and production at these wells started in mid-2018. In 2020, the CDA completed the construction of the last planned well (II-12) and pumping at this well is expected to begin in late 2021. I n FY 2019/2020, the Chino Desalters pumped about 35,000 afy of groundwater. In June 2020, the Chino Desalters reached the pumping capacity of 40,000 afy, thus, achieving the OBMP production goal. The chart below shows annual groundwater production by the Chino Desalters.

Pursuant to the Peace II Agreement, Watermaster initiated additional controlled overdraft, referred to as "Re-operation." Re-operation is the controlled overdraft of 400,000 af through 2030, allocated specifically to meet the replenishment obligation of the Chino Desalters (WEI, 2009b). An investigation conducted to evaluate the Peace II Agreement and desalter expansion concluded that Re-operation was required to ensure the attainment of Hydraulic Control (WEI, 2007).





Increasing groundwater recharge is an integral part of the OBMP's goals to enhance water supplies and improve water quality, and it is essential for compliance with the maximum-commitments in the Basin Plan. The IEUA, Watermaster, the Chino Basin Water Conservation District, and the San Bernardino County Flood Control District are partners in the planning and implementation of groundwater recharge projects in the Chino Basin. Existing and planned recharge facilities are shown in the map to the left and include recharge basins and Aquifer Storage and Recovery (ASR) wells, not shown on the map are the municipal separate storm sewer system (MS4) facilities.

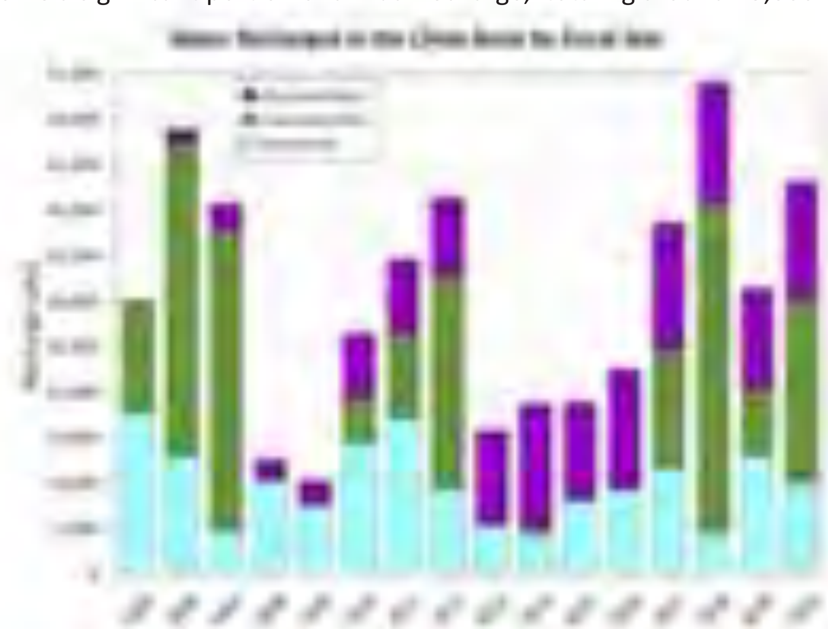
Recharge basins. Imported water, stormwater, dry-weather flow, and recycled water are recharged at 17 recharge basins. Watermaster has permits from the State Water Resources Control Board (State Water Board) to divert stormwater and dry-weather flow to the basins for recharge and storage, and subsequently recover it for beneficial use. Since about 2004, water-level sensors have been installed at most of the recharge basins. These sensors are used to estimate recharge and measure infiltration rates. The estimated recharge is then used in Sustainable Groundwater Management Act (SGMA) reporting, in determining compliance with maximum benefit commitments and recharge permits, in Safe Yield calculations, and for scheduling maintenance.

ASR wells. ASR wells are used to inject treated imported water into the Basin and to pump groundwater. The Monte Vista Water District (MVWD) owns and operates four ASR wells in the Chino Basin.

In-lie u recharge. In-lieu recharge can occur when a Chino Basin Party with pumping rights in the Chino Basin elects to use supplemental water directly in lieu of pumping some or all its rights in the Chino Basin for the specific purpose of recharging supplemental water.

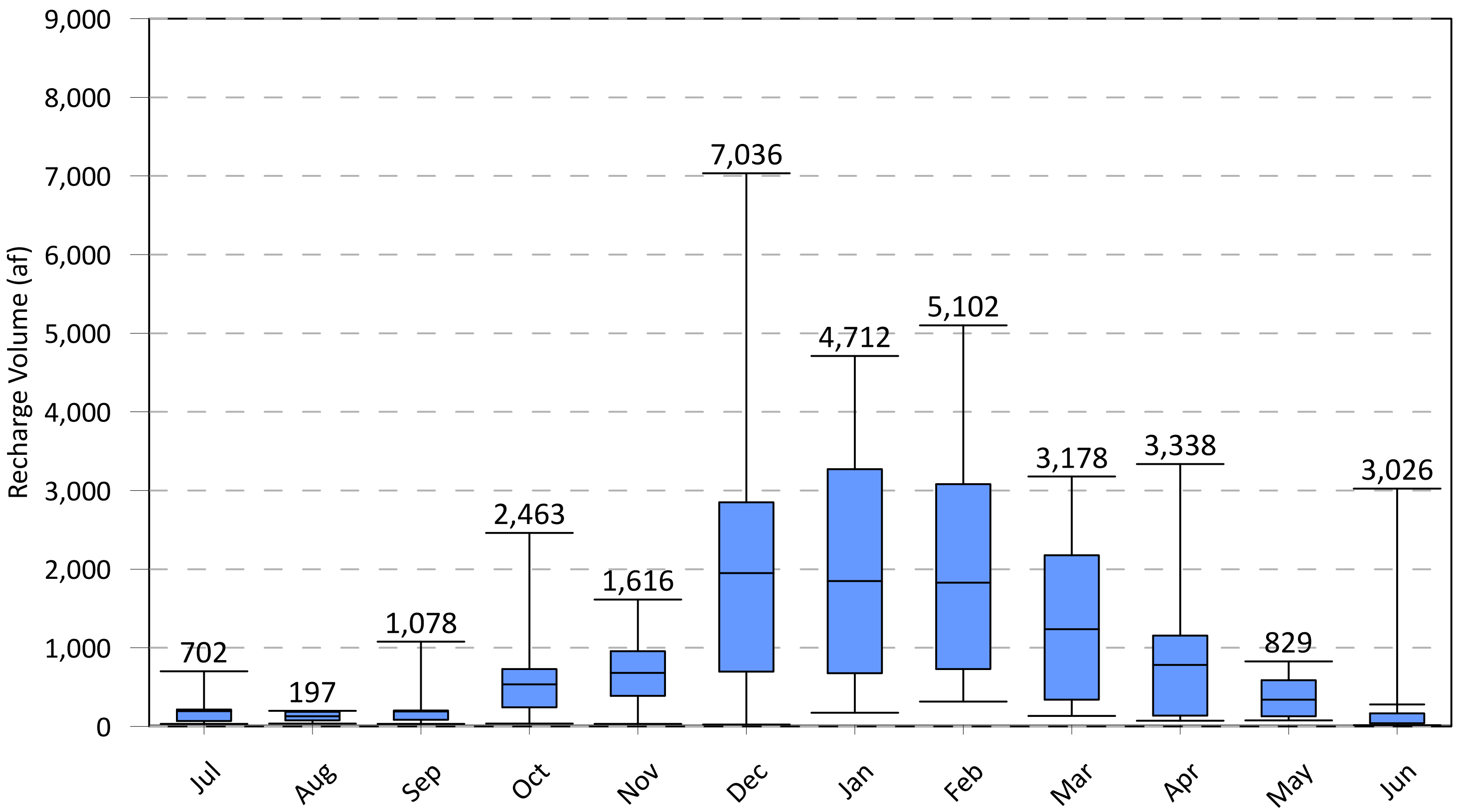
MS4 facilities. The 2013 RMPU implementation included a process to create and update a database of all known runoff management projects implemented through the MS4 permits in the Chino Basin. This was done to create the data necessary to evaluate the significance of new stormwater recharge created by MS4 projects. As of FY 2016/2017, a total of 114 MS4 projects were identified as complying with the MS4 permit through infiltration features. These 114 projects have an aggregate drainage area of 1,733 acres.

Watermaster maintains a database of monthly recharge volumes by water type and recharge location. The chart below shows annual wet-water recharge at recharge basins and ASR wells by water type since the initiation of the recharge program in FY 2004/2005 (dry-weather flow is included with stormwater). With OBMP implementation, recycled water has become a significant portion of annual recharge, totaling around 13,000 af in FY 2019/2020 and averaging about 12,900 afy over the past five years. Recycled water recharge reduces the need for and dependence on imported water for replenishment.

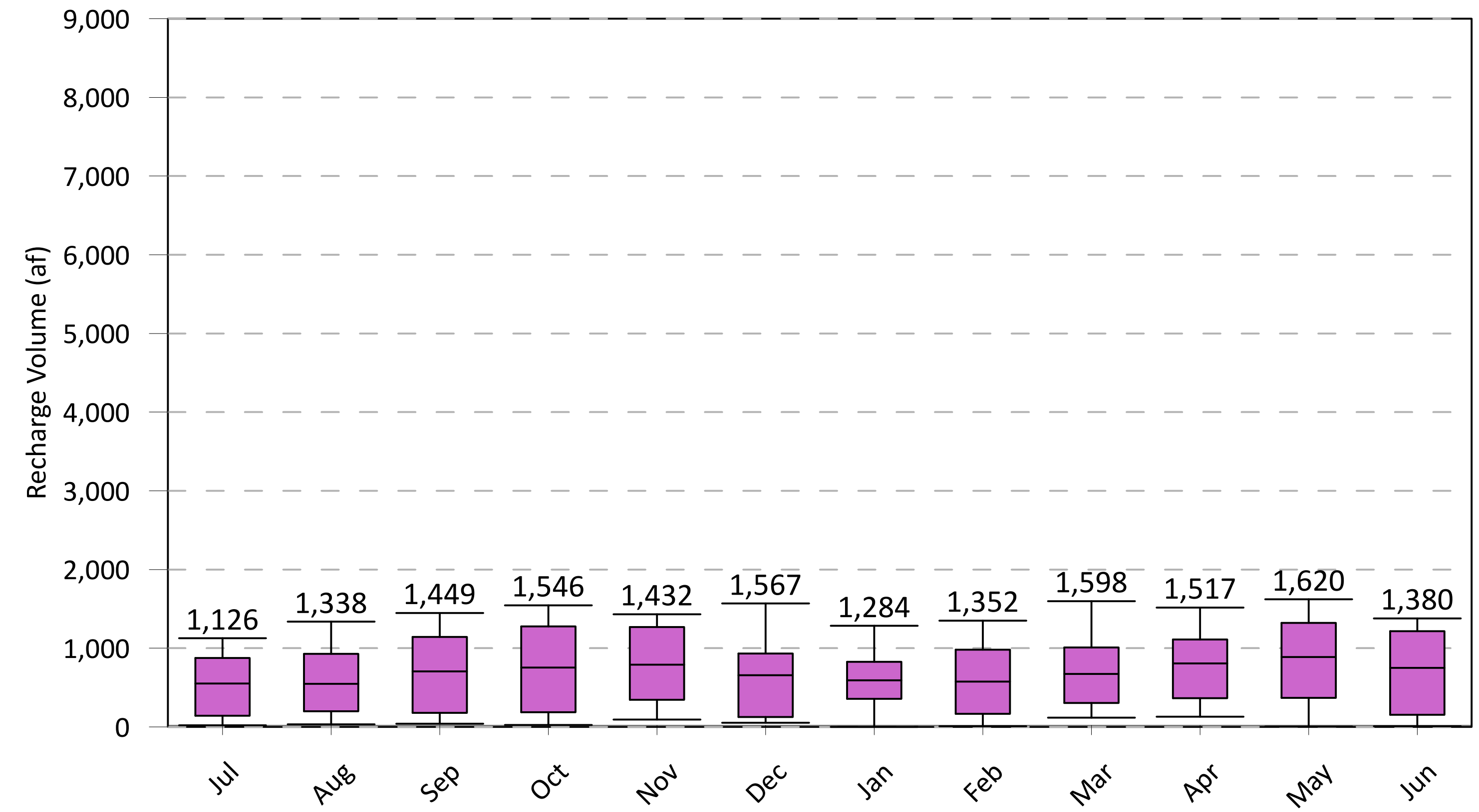


The annual magnitude of imported water recharge at recharge basins fluctuates based on the need for replenishment water, conjunctive-use operations, imported water availability, and other factors. In years where imported water has been recharged in basins for conjunctive-use operations, it has ranged from about 2,400 to 35,000 afy. And in the other non-conjunctive-use influenced years, imported water recharge has varied from 0 to about 35,000 afy.

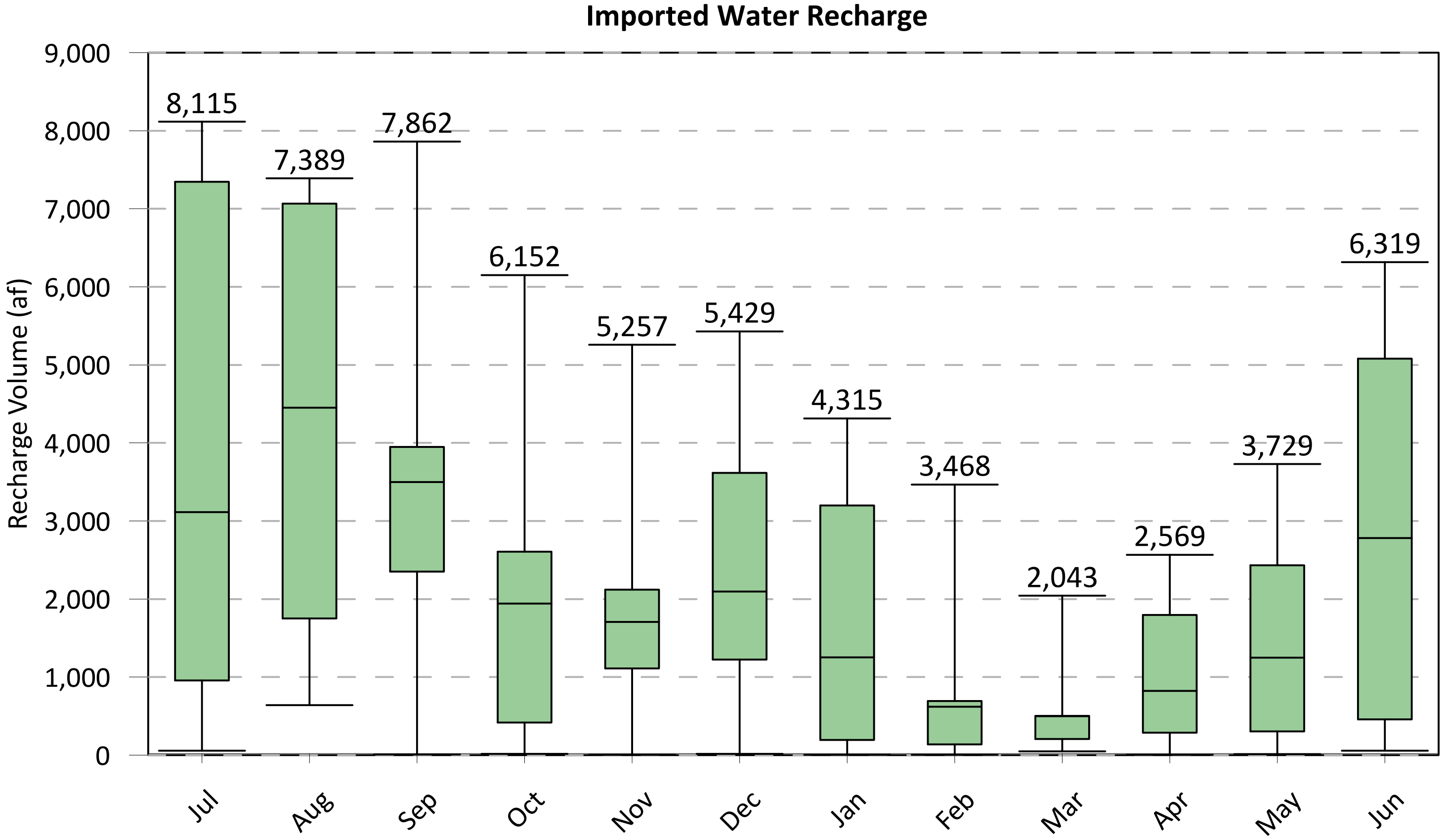
Stormwater Recharge

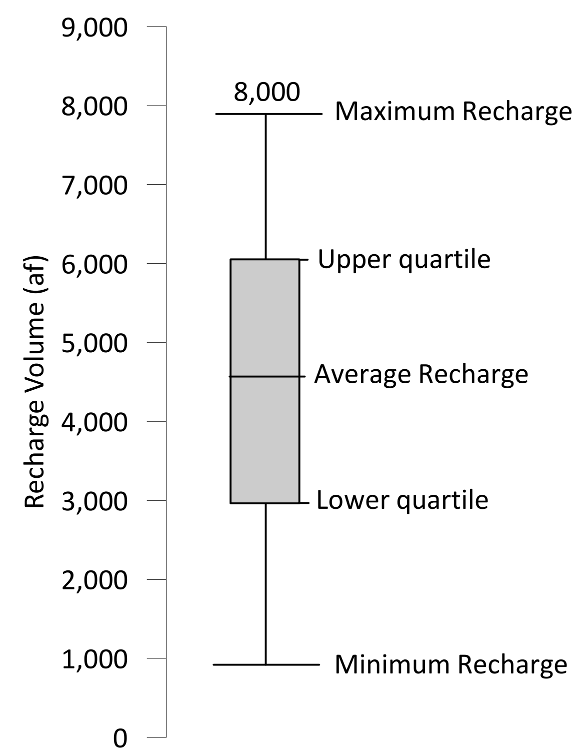


Recycled Water Recharge



Imported Water Recharge





Recharge in the Chino Basin varies based on recharge water source and the seasonal changes in the availability of the water source. The monthly stormwater, recycled water, and imported water recharge to the Chino Basin from FY 2004/2005 through FY 2019/2020 are plotted in the Box and Whisker Plots which characterize the distribution of numerical data. The Box and Whisker Plot shows the minimum, lower quartile (the lower quartile represents the 25^{th} percentile: 25 percent of the observed values are less than the upper quartile), average, upper quartile (the upper quartile represents the 75^{th} percentile: 25 percent of the observed values are greater than the upper quartile), and maximum recharge volumes for each source.

The plots demonstrate that: stormwater recharge varies based on seasonal climate and precipitation with significant recharge occurring from December through March where the average recharge volume is around 1,200 to 2,000 af; imported water recharge varies based on the need to supplement stormwater recharge with significant recharge occurring from June to September where the average recharge volume is around 2,800 to 4,400 af; recycled water remains consistent from month to month where the average recharge volume is around 500 af.

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WEST YOST Water. Engineered

Author: SO
Date: 3/24/2021

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2020 State of the Basin Report
Basin Production and Recharge

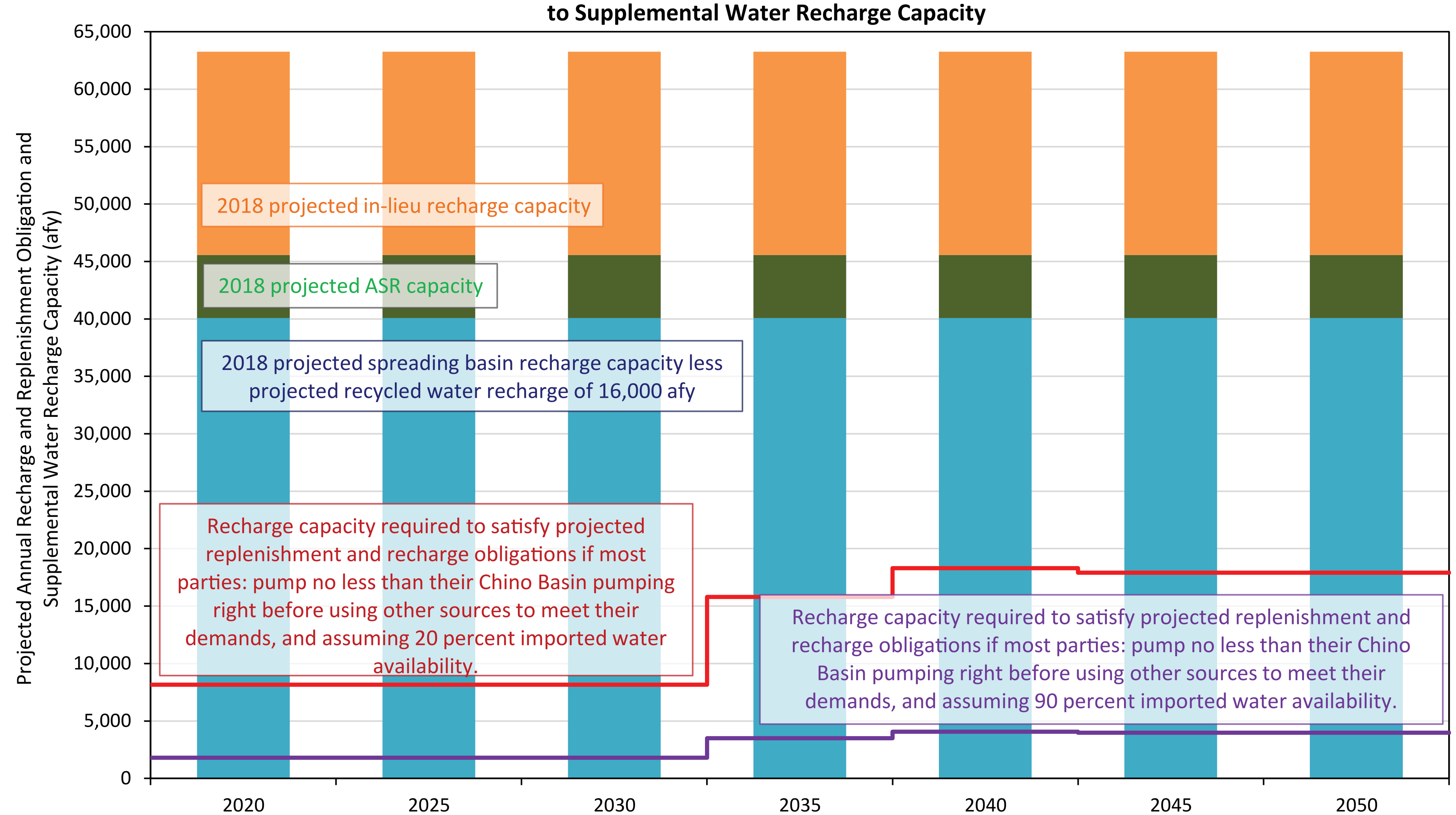
Box Whisker Diagram of Groundwater Recharge
Stormwater and Supplemental Water
Fiscal Year 2004/2005 to Fiscal Year 2019/2020

Exhibit 3-6

Estimated Recharge Capacities in the Chino Basin (af)

Water Type	Recharge Type	2020 Conditions	2020 Conditions Plus Pending Recommended 2013 RMPU Projects
Stormwater	Average Stormwater Recharge in Spreading Basins	9,950	14,700
	Average Expected Recharge of MS4 Projects	380	380
	Subtotal	10,330	15,080
Supplemental Water	Spreading Capacity for Supplemental Water	56,600	56,600
	ASR Injection Capacity	5,480	5,480
	In-Lieu Recharge Capacity	17,700	17,700
	Subtotal	79,780	79,780
	Total	90,110	94,860

Comparison of Projected Annual Recharge and Replenishment Obligation to Supplemental Water Recharge Capacity

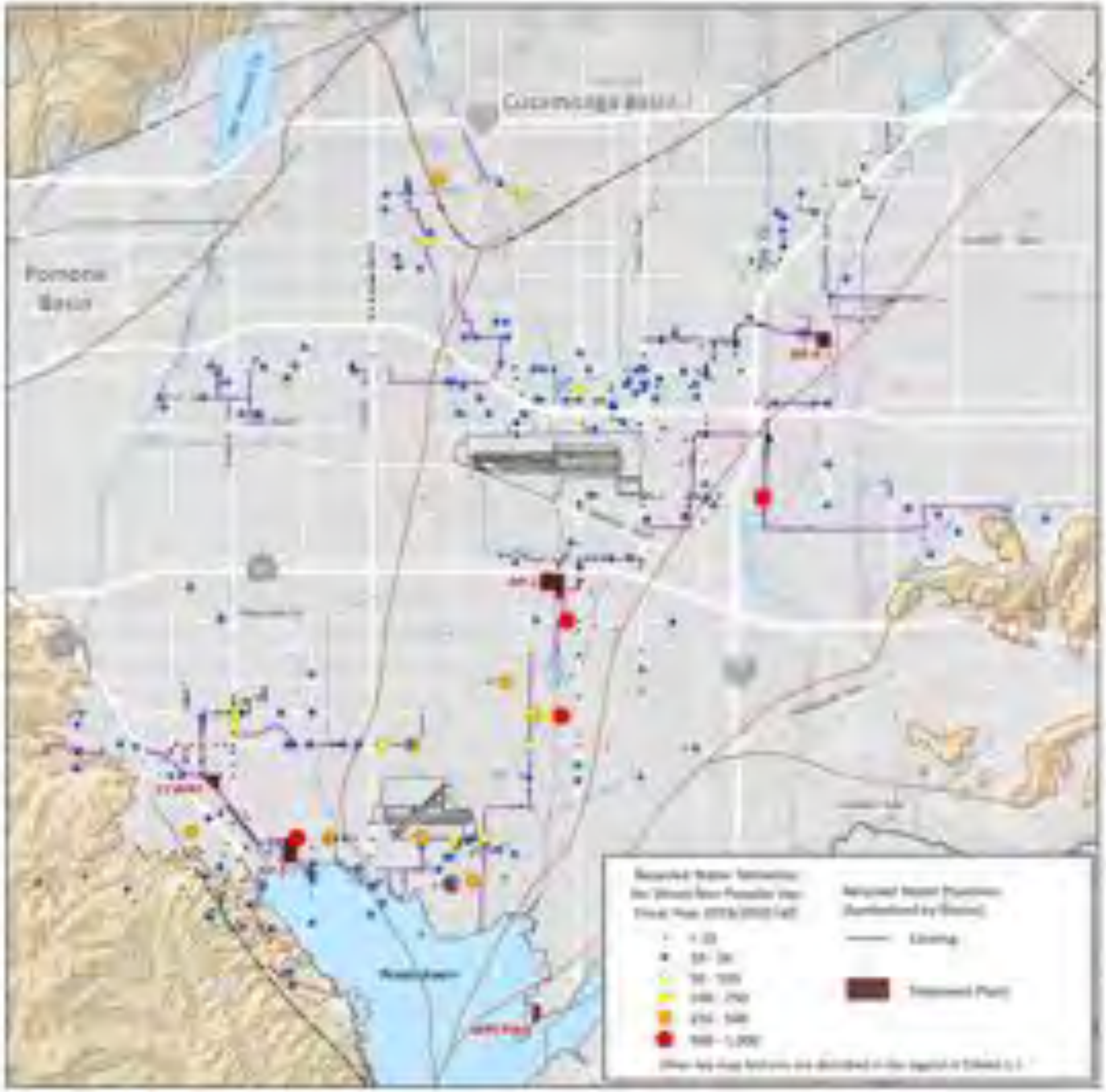


The table above summarizes the existing recharge capacity and the recharge capacity expected when the planned 2013 RMPU projects are online in 2022. Stormwater recharge varies by year, based on hydrologic conditions, and averaged about 9,950 afy during the period FY 2004/2005 through FY 2019/2020 (period of available historical data). The net new stormwater recharge from MS4 projects is estimated to average about 380 afy (WEI, 2018). Supplemental water recharge in recharge basins occurs during non-storm periods. The recharge capacity available for supplemental water recharge varies from year to year based on the hydrologic conditions and is projected to average about 56,600 afy (WEI, 2018). The ASR and in-lieu recharge capacities are estimated to be about 5,480 afy and 17,700 afy, respectively (WEI, 2018).

The initial OBMP recharge master plan was developed in 2002; its current version is the 2018 Recharge Master Plan Update (2018 RMPU) (WEI, 2018). No capital projects were selected as part of the 2018 RMPU process. However, the projects selected for implementation in the 2013 RMPU are currently being implemented and involve improvements to existing recharge facilities and the construction of new facilities that, in aggregate, will increase the recharge of stormwater and dry-weather flow by 4,900 afy and increase recycled water recharge capacity by 7,100 afy. These projects are expected to be fully constructed and operational by 2022. Pursuant to the Peace II Agreement, Watermaster and the IEUA update their recharge master plan on a five-year frequency with the next plan scheduled to be completed in October 2023.

Future supplemental water recharge capacity requirements are estimated by assessing future supplemental water recharge projections in the context of the availability of supplemental water for recharge. Recycled water is assumed 100-percent reliable, and therefore the recharge capacity requirement to recharge recycled water is assumed equal to its projected supply. The imported water supply from Metropolitan is assumed to be 20 percent reliable (available one out of five years) without full implementation of its 2015 Integrated Resources Plan (IRP) and 90 percent reliable (available nine out ten years) with it (Metropolitan, 2016). Therefore, the recharge capacity required to meet recharge and replenishment obligations with imported water supplied by Metropolitan is five times the projected recharge and replenishment requirement without full implementation of the 2015 IRP, and about 1.1 times the projected recharge and replenishment requirement with its full implementation. The chart above shows: the projected recharge capacity available at recharge basins less that used for recycled water recharge, in-lieu recharge capacity, and ASR recharge capacity as a stacked bar chart—the total supplemental capacity being the sum of these recharge capacities. The chart also shows the time history of the supplemental water recharge capacity required to recharge imported water from Metropolitan without and with full implementation of Metropolitan's 2015 IRP.

As the chart above shows, whether or not Metropolitan fully implements its 2015 IRP, Watermaster and the IEUA are projected to have enough recharge capacity available to meet all of their recharge and replenishment obligations through 2050.



Increasing recycled water reuse is an integral part of the OBMP's goal to enhance water supplies. The direct use of recycled water increases the availability of native and imported waters for higher-priority beneficial uses. The 2004 Basin Plan incorporated the maximum-benefit based salt and nutrient management program for the Chino Basin, as an innovative regulatory construct that enabled an aggressive expansion of recycled-water reuse in the Chino Basin. The IEUA owns and operates four treatment facilities: Regional Plant No. 1 (RP-1), Regional Plant No. 4 (RP-4), Regional Plant No. 5 (RP-5), and the Carbon Canyon Water Reclamation Facility (CCWRF). And, the IEUA has progressively built infrastructure to deliver recycled water to all of its member agencies throughout much of the Chino Basin. The map to the left shows the existing recycled water pipelines and areas of recycled water reuse by volumes during FY 2019/2020.

This graph below characterizes the direct use of recycled water in the Chino Basin from FY 1999/2000 through FY 2019/2020. Recycled water from the IEUA's facilities is reused directly for: irrigation of crops, animal pastures, freeway landscape, parks, schools, golf courses, commercial laundry, car washes outdoor cleaning, construction, toilet plumbing, and industrial processes. Prior to 1997, there was minimal reuse of recycled water. Recycled water reuse started in 1997 after the completion of the conveyance facilities from the CCWRF to the Cities of Chino and Chino Hills. The direct use of recycled water has increased significantly since OBMP implementation began from about 3,500 af in FY 1999/2000 to about 24,600 af in FY 2013/2014, declining to 17,100 af in FY 2019/2020. The decline in direct reuse of recycled water over the past six years is a result of the reduced water use during the recent drought and state-mandated water conservation programs, reducing the amount of recycled water reused and wastewater generated from households that can be treated for recycled water reuse.

Chino Basin Watermaster

Recycled Deliveries for Direct Use

Exhibit 3-8

4.0 GROUNDWATER LEVELS

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The exhibits in this section show the physical state of the Chino Basin for groundwater levels during the implementation of the Judgment and the OBMP. The groundwater-level data used to generate these exhibits were collected and compiled as part of Watermaster's groundwater-level monitoring program.

Prior to OBMP implementation, there was no formal groundwater-level monitoring program in the Chino Basin. Problems with historical groundwater-level monitoring included an inadequate areal distribution of wells that were monitored, short time histories, questionable data quality, and insufficient resources to develop and conduct a comprehensive program. The OBMP defined a new, comprehensive, basin-wide groundwater-level monitoring program pursuant to *OBMP Program Element 1 – Develop and Implement a Comprehensive Monitoring Program* to support the activities in other Program Elements, such as *PE 4 – Develop and Implement a Comprehensive Groundwater Management Plan for Management Zone 1.* The monitoring program has been refined over time to increase efficiency and to satisfy the evolving needs of the Watermaster and the IEUA, such as new regulatory requirements.

Currently, the groundwater-level monitoring program supports many Watermaster functions, such as the periodic reassessment of Safe Yield, the monitoring and management of land subsidence, and the assessment of Hydraulic Control. The data are also used to update and re-calibrate Watermaster's groundwater-flow model, to understand directions of groundwater flow, to estimate storage changes, to interpret groundwater-quality data, to identify areas of the basin where recharge and discharge are not in balance, and to monitor changes in groundwater levels in the Prado Basin where riparian vegetation is consumptively using shallow groundwater.

Exhibit 4-1 shows the locations and measurement frequencies of all wells currently in Watermaster's groundwater-level monitoring program. The groundwater-level data collected at these wells were used to create groundwater-elevation contour maps for the shallow aquifer system in the Chino Basin for spring 2000 (Exhibit 4-2), spring 2018 (Exhibit 4-3), and spring 2020 (Exhibit 4-4). These contour maps indicate the direction of groundwater flow, which is perpendicular to the contours from high elevations to low elevations. Rasters of groundwater elevation were subtracted from each other to show how groundwater levels have changed during OBMP implementation. Exhibit 4-5 shows the change from spring 2000 to spring 2020—the total 20-year period of OBMP implementation. Exhibit 4-6 shows the change from spring 2018 to spring 2020—the two-year period since the last State of the Basin analysis. The changes in groundwater levels are illustrative of changes in groundwater storage.

Exhibits 4-7 and 4-8 address the state of Hydraulic Control in the southern portion of Chino Basin in 2000 and 2020, respectively. Achieving "Hydraulic Control" is an important objective of Watermaster, the IEUA, and the Regional Board. Hydraulic Control is achieved when groundwater discharge from the Chino-North groundwater management zone (GMZ) to Prado Basin is eliminated or reduced to *de minimis* levels. *De minimis* discharge is defined as less than 1,000 afy. The Regional Board made achieving Hydraulic Control a commitment for the Watermaster and the IEUA in the Basin Plan (Regional Board, 2004) in exchange for relaxed groundwater-quality objectives in Chino-North GMZ. These objectives, called "maximum-benefit" objectives, allow for the implementation of recycled-water reuse in the Chino Basin for both direct use and recharge while simultaneously assuring the protection of the beneficial uses of the Chino Basin and the Santa Ana River. Achieving Hydraulic Control also maintains the yield of the Chino Basin by controlling groundwater levels in its southern portion, which controls outflow as rising groundwater and streambed recharge in the Santa Ana River. These exhibits include a brief interpretation of the state of Hydraulic Control. For an in-depth discussion of Hydraulic Control, see *Chino Basin Maximum Benefit Monitoring Program 2019 Annual Report* (WEI, 2020).

Exhibit 4-9 shows the location of selected wells across the Chino Basin that have long time-histories of water level measurements. The time-histories describe long-term trends in groundwater levels in the GMZs. The wells were selected based on geographic location within the GMZ, well-screen interval, and the length, density, and quality of the water-level records. Exhibits 4-10 through 4-14 are water-level time-series charts for these wells grouped by GMZ for the period of 1978 to 2020. These exhibits compare the behavior of groundwater levels to trends in precipitation, groundwater production, and recharge, which reveal cause-and-effect relationships.

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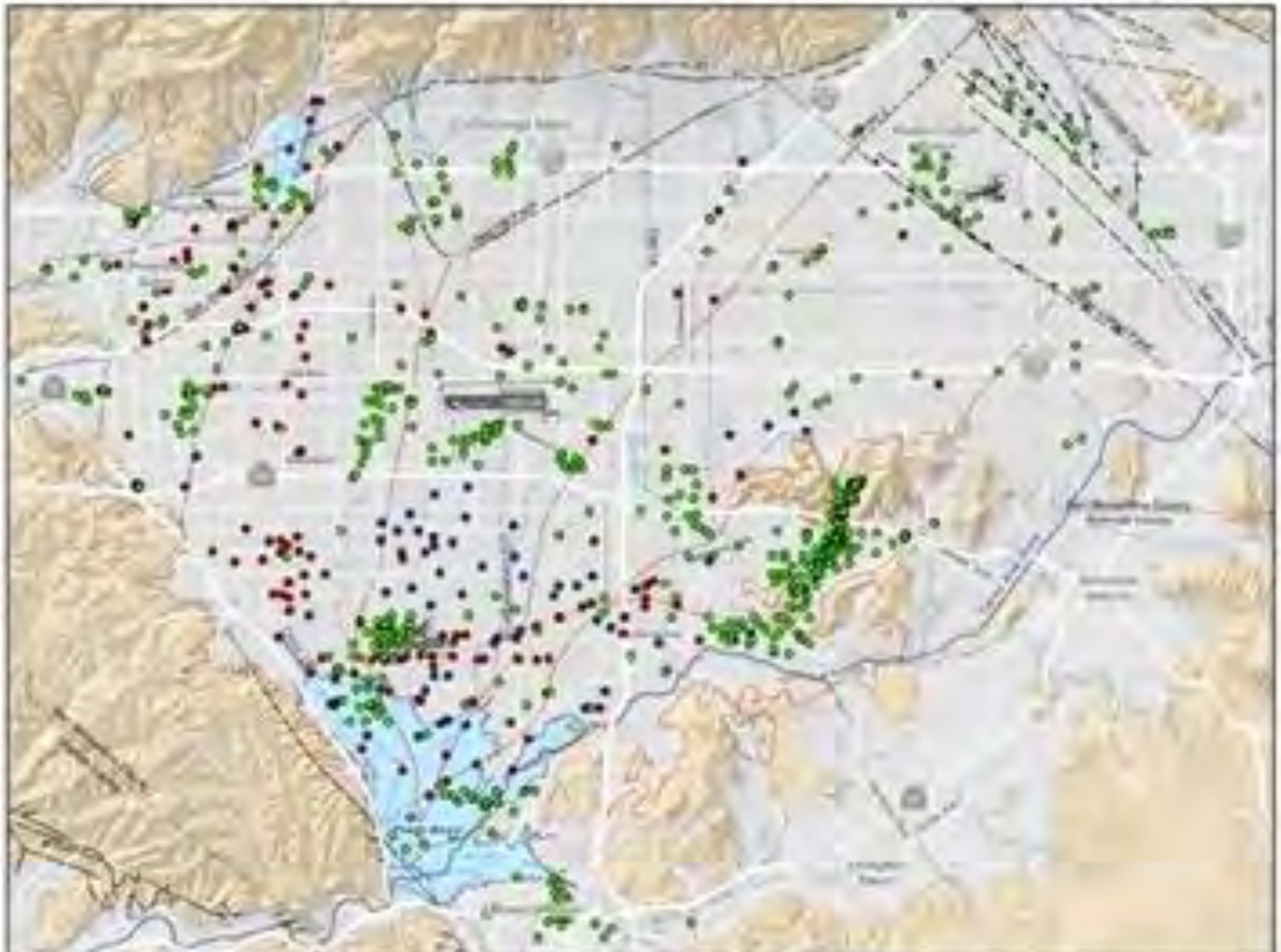

Basin-Wide Groundwater-Level Monitoring Program
Wells symbolized by Measurement Frequency

- Monthly Measurement by Watermaster Staff (81 wells)
- Measurement by Transducer - Every 15 Minutes (185 wells)
- Measurement by Owner at Various Frequencies (1,175 wells)

Other base map features are described in the legend of Exhibit 1-1.

To support OBMP implementation, Watermaster conducts a comprehensive groundwater-level monitoring program. In FY 2019/2020, about 1,400 wells comprised Watermaster's groundwater-level monitoring program. At about 1,200 of these wells, well owners measure water levels and provide the data to Watermaster. These well owners include municipal water agencies, private water companies, the California Department of Toxic Substance Control (DTSC), the County of San Bernardino, and various private consulting firms. The remaining 200 wells are private or dedicated monitoring wells that are mostly located in the southern portion of the Basin. Watermaster staff measures water levels at these wells once a month or with pressure transducers that record water levels once every 15 minutes. These wells were preferentially selected to support Watermaster's monitoring programs for Hydraulic Control, Prado Basin habitat sustainability, land subsidence, and others. All groundwater-level data are collected, compiled, and checked by Watermaster staff, and uploaded to a centralized relational database that can be accessed online through HydroDaMS™.

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Chino Basin Watermaster
2020 State of the Basin Report
Groundwater Levels

Groundwater-Level Monitoring Network
Well Location and Measurement Frequency
During Fiscal Year 2019/2020

Exhibit 4-1

Groundwater Elevation Contours
(feet above mean sea level)

Boundary of Contoured Area

This map displays contours of equal groundwater elevation across the Chino Basin during the spring of 2000—just prior to OBMP implementation. Two distinct aquifer systems exist in Chino Basin: a shallow unconfined to semi-confined aquifer system and a deeper confined aquifer system. The groundwater elevations shown on this map (and Exhibits 4-3, 4-4, 4-7, and 4-8) were drawn based on measured groundwater levels within the shallow aquifer system.

Groundwater flows from higher to lower elevations, with flow direction perpendicular to the contours. The groundwater-elevation contours on this map indicate that in 2000 groundwater was flowing in a south-southwest direction from the primary areas of recharge in the northern parts of the Basin toward the Prado Basin in the south. There were notable pumping depressions in the groundwater-level surface that interrupted the general flow patterns in the northern portion of MZ1 (Montclair and Pomona areas) and directly west of the Jurupa Mountains (near the JCSD's main well field). Pumping at the desalter wells had not yet begun in the spring of 2000.

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Groundwater Levels

Groundwater-Elevation Contours for Spring 2000

Shallow Aquifer System

Exhibit 4-2

Groundwater Elevation Contours (feet above mean sea level)

Boundary of Contoured Area (contours are not shown outside of this boundary due to lack of groundwater-level data)

Well With a Groundwater-Level Time History Plotted on Exhibits 4-10 through 4-14

Chino Desalter Wells

Other key map features are described in the legend of Exhibit 2-1.

This map displays contours of equal groundwater elevation across the Chino Basin during the spring of 2018, showing the effects of about 18 years of OBMP implementation. There was a large increase in the data available for this contouring effort – nearly twice as many wells were monitored in 2018 as were monitored in 2000. As with Exhibit 4-2, the groundwater elevation contours indicate that groundwater was flowing in a south-southwest direction from the primary areas of recharge in the northern parts of the Basin toward the Prado Basin in the south. There is a discernible depression in groundwater levels around the eastern portion of the Chino Basin Desalter well field, which demonstrates that Hydraulic Control is achieved in the area. The depression has merged with the pumping depression around the JCSD well field to the east and has increased the hydraulic gradient from the Santa Ana River toward the desalter well field. As was the case in 2000, there continued to be a notable pumping depression in the groundwater-level surface in the northern portion of MZ1 (Montclair and Pomona areas).

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2020 State of the Basin Report
Groundwater Levels

Groundwater-Elevation Contours for Spring 2018
Shallow Aquifer System

Exhibit 4-5

Groundwater Elevation Contours (feet above mean sea level)

Boundary of Contoured Area (contours are not shown outside of this boundary due to lack of groundwater level data)

Well With a Groundwater-level Time History Plotted on Exhibits 4-10 through 4-14

Chino Desalter Wells

Other base map features are described in the legend of Exhibit 3-1.

This map displays contours of equal groundwater elevation across the Chino Basin during the spring of 2020, showing the effects of about 20 years of OBMP implementation. The contours are generally consistent with the groundwater-elevation contours for spring 2018, indicating regional groundwater flow in a south-southwest direction from the primary areas of recharge in the northern parts of the Basin toward the Prado Basin in the south. There continued to be a discernible depression in groundwater levels around the eastern portion of the Chino Basin Desalter well field, which demonstrates the achievement of Hydraulic Control in this area. This depression merged with the pumping depression around the JCSD well field to the east and increased the hydraulic gradient from the Santa Ana River toward the desalter well field. As was the case in 2000 and 2018, there continues to be a notable pumping depression in the groundwater-level surface in the northern portion of MZ1 (Montclair and Pomona areas).

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2020 State of the Basin Report
Groundwater Levels

Groundwater-Elevation Contours for Spring 2020
Shallow Aquifer System

Exhibit 4-4

Contour of Groundwater-Level Change (feet) Spring 2000 to Spring 2020

Groundwater-Level Change (feet) Spring 2000 to Spring 2020

Increase

Decrease

Area Not Included in the Change Calculation Due to Lack of Groundwater-Level Data

Well with a Groundwater-Level Time History Plotted on Exhibits 4-10 through 4-24

Chino Desalter Well

Other key map features are described in the legend of Exhibit 1-1.

This map shows the change in groundwater elevation during the 20-year period of OBMP implementation: spring 2000 to spring 2020. This map was created by subtracting a rasterized grid created from the groundwater elevations for spring 2000 (Exhibit 4-2) from a rasterized grid created from the groundwater elevations for spring 2020 (Exhibit 4-4).

Groundwater levels have increased in the western portion of the Basin. Groundwater levels have decreased in the central and eastern portions of the Basin and around the eastern portion of the Chino Desalter well field in the south. The changes in groundwater elevation shown here are consistent with projections from Watermaster's groundwater modeling efforts (WEI, 2003a; 2007c; 2015d; 2020) that simulated changes in the groundwater levels and flow patterns from the production and recharge strategies described in the Judgment, OBMP, Peace Agreement, and Peace II Agreement. These strategies include: desalter production in the southern portion of the Basin; controlled overdraft through Basin Re-operation to achieve Hydraulic Control; subsidence management in MZ1; mandatory recharge of Supplemental Water in MZ1 to improve the balance of recharge and discharge; and facilities improvements to enhance the recharge of storm, recycled, and imported waters.

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Chino Basin Watermaster
2020 State of the Basin Report
Groundwater Levels

Groundwater-Level Change from Spring 2000 to Spring 2020

Shallow Aquifer System

Exhibit 4-5

This map shows the change in groundwater elevation for the two-year period since the last State of the Basin Report: spring 2018 to spring 2020. It was created by subtracting a rasterized grid created from the groundwater elevations for spring 2018 (Exhibit 4-3) from a rasterized grid created from the groundwater elevations for spring 2020 (Exhibit 4-4). Groundwater levels have changed by less than 10 feet across most of the Basin during this two-year period. Groundwater levels have increased in the northeastern corner of the Basin along the Bloomington Divide, which could indicate increased groundwater inflow from the Bloomington Divide. Groundwater levels have increased in western portion of the Basin and decreased in parts of the eastern portion of the Basin—consistent with local changes in pumping from 2018 to 2020.

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Chino Basin Watermaster
2020 State of the Basin Report
Groundwater Levels

Groundwater-Level Change from Spring 2018 to Spring 2020
Shallow Aquifer System

Exhibit 4-6

Groundwater Elevation Contours (feet above mean sea level)

Water Level Qualification Symbol Code (Showing Groundwater Elevation)

- Static
- Recovering
- Estimated Static
- Dynamic

Aquifer Layer Where Well Casing is Perforated

- Layer 1
- Layer 2
- Layer 3
- Layers 1 & 2
- Layers 1 & 2 & 3
- Unknown Well Construction
- Future Location of Chino Desalter Well

Numbers next to well indicate groundwater elevation

Other key map features are described in the legend of Exhibit 1-1.

Hydraulic Control is a commitment of the Watermaster and IEUA to the Regional Board that allows for the reuse and recharge of recycled water in the Chino Basin. Hydraulic Control is defined as eliminating groundwater discharge from the Chino North GMZ to the Prado Basin GMZ or controlling the discharge to de minimis levels of less than 1,000 afy. Hydraulic Control is to be achieved and maintained by controlling groundwater levels via pumping at the Chino Desalter wells.

This map illustrates groundwater elevation and flow directions in the southern Chino Basin prior to the commencement of pumping at the Chino Desalter wells (Spring 2000). The groundwater-elevation contours depict regional groundwater flow from the northeast to the southwest under a hydraulic gradient that steepens slightly south of the current location of the Chino-I Desalter well field. This map is consistent with the conceptual model of the Chino Basin, wherein groundwater flows from areas of recharge in the north/northeast toward areas of discharge in the south near the Prado Basin and the Santa Ana River. Pumping at the Chino-I Desalter well field began in late spring to early summer 2000, so its effects on groundwater levels are not apparent in this map.

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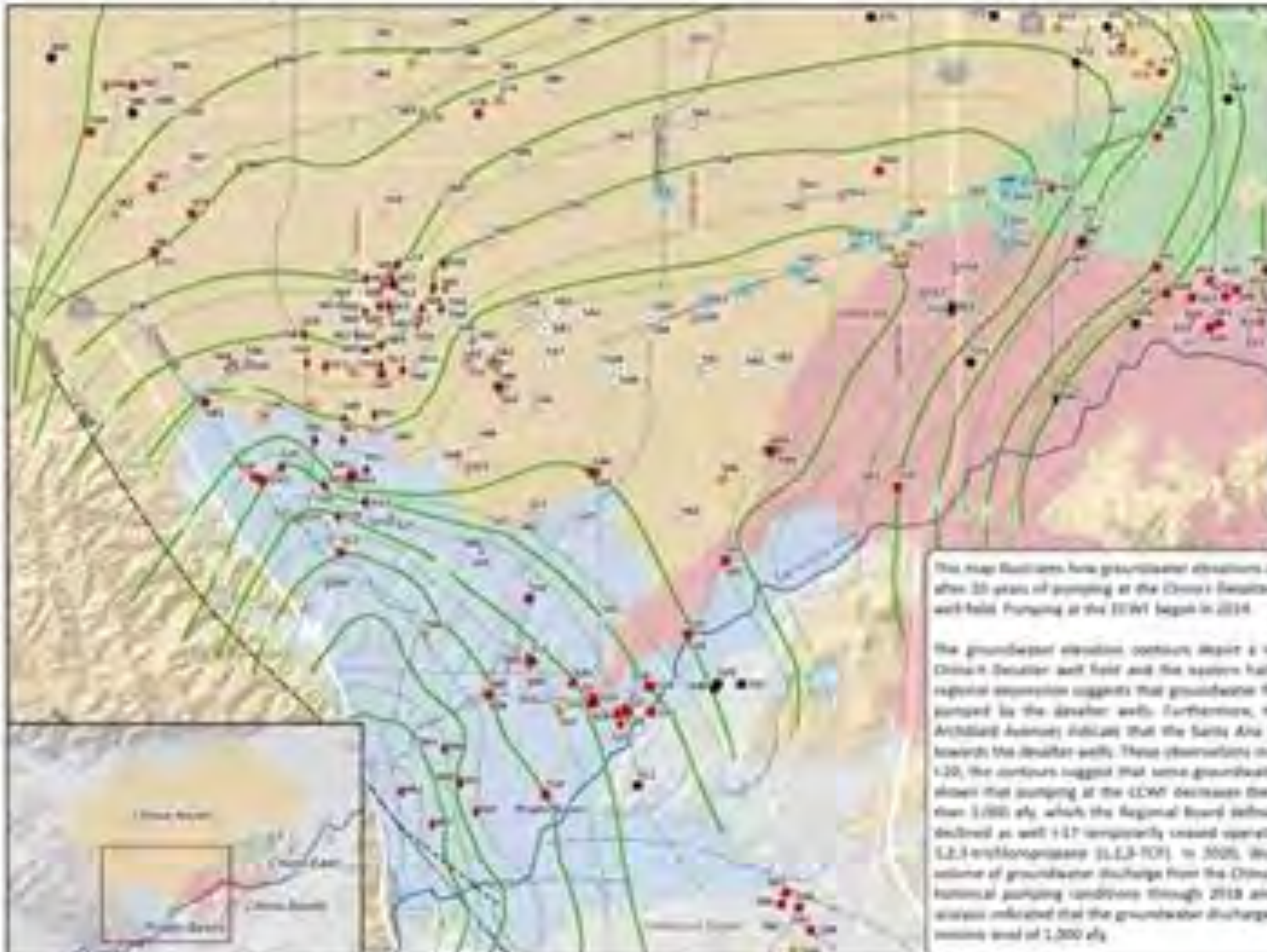
Chino Basin Watermaster
2020 State of the Basin Report
Groundwater Levels

State of Hydraulic Control in Spring 2000
Shallow Aquifer System

Exhibit 4-7



This map illustrates how groundwater elevations and flow directions have changed in the southern Chino Basin after 20 years of pumping at the Chino-I Desalter well field and 14 years of pumping at the Chino-II Desalter well field. Pumping at the CCWF began in 2014.

The groundwater elevation contours depict a regional depression in groundwater levels surrounding the Chino-II Desalter well field and the eastern half of the Chino-I Desalter well field (east of well I-20). This regional depression suggests that groundwater flowing south in the Chino-North GMZ is being captured and pumped by the desalter wells. Furthermore, the contours southeast of the desalter well field (east of Archibald Avenue) indicate that the Santa Ana River is recharging the Chino Basin and flowing northwest towards the desalter wells. These observations indicate that Hydraulic Control is achieved east of I-20. West of I-20, the contours suggest that some groundwater flows past the desalter wells. Groundwater modeling has shown that pumping at the CCWF decreases the volume of groundwater flow past the desalter wells to less than 1,000 afy, which the Regional Board defines as *de minimis* discharge. In 2017, pumping at the CCWF declined as well I-17 temporarily ceased operation due to the new maximum contaminant level (MCL) for 1,2,3-trichloropropane (1,2,3-TCP). In 2020, Watermaster used its groundwater model to determine the volume of groundwater discharge from the Chino-North GMZ to the Prado Basin GMZ past the CCWF for both historical pumping conditions through 2018 and projected pumping conditions through 2050. The model analysis indicated that the groundwater discharge past the CCWF into Prado Basin was always less than the *de minimis* level of 1,000 afy.

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State of Hydraulic Control in Spring 2020
Shallow Aquifer System

Exhibit 4-8

Wells With a Groundwater Level Time History Plotted on Exhibit 4-10 through Exhibit 4-14

Surface Water Sites With Discharge Time History Plotted on Exhibit 4-14

Wastewater Discharge Location

USGS Gaging Station

Other key map features are described in the legend of Exhibit 1-1.

The wells shown on this map have long groundwater-level time histories that are representative of the groundwater-level trends in their respective GMZs. Subsequent exhibits display time-series charts of groundwater-level data from these wells by GMZ with respect to precipitation, production, and artificial recharge, which are stresses that cause changes in groundwater levels. Precipitation trends on the charts are displayed as a CDFM precipitation curve using PRISM data from 1896 to 2020. An upward slope on the CDFM curve indicates wet years or periods. A downward slope indicates dry years or periods. See Section 2 of the report for more information on precipitation trends.

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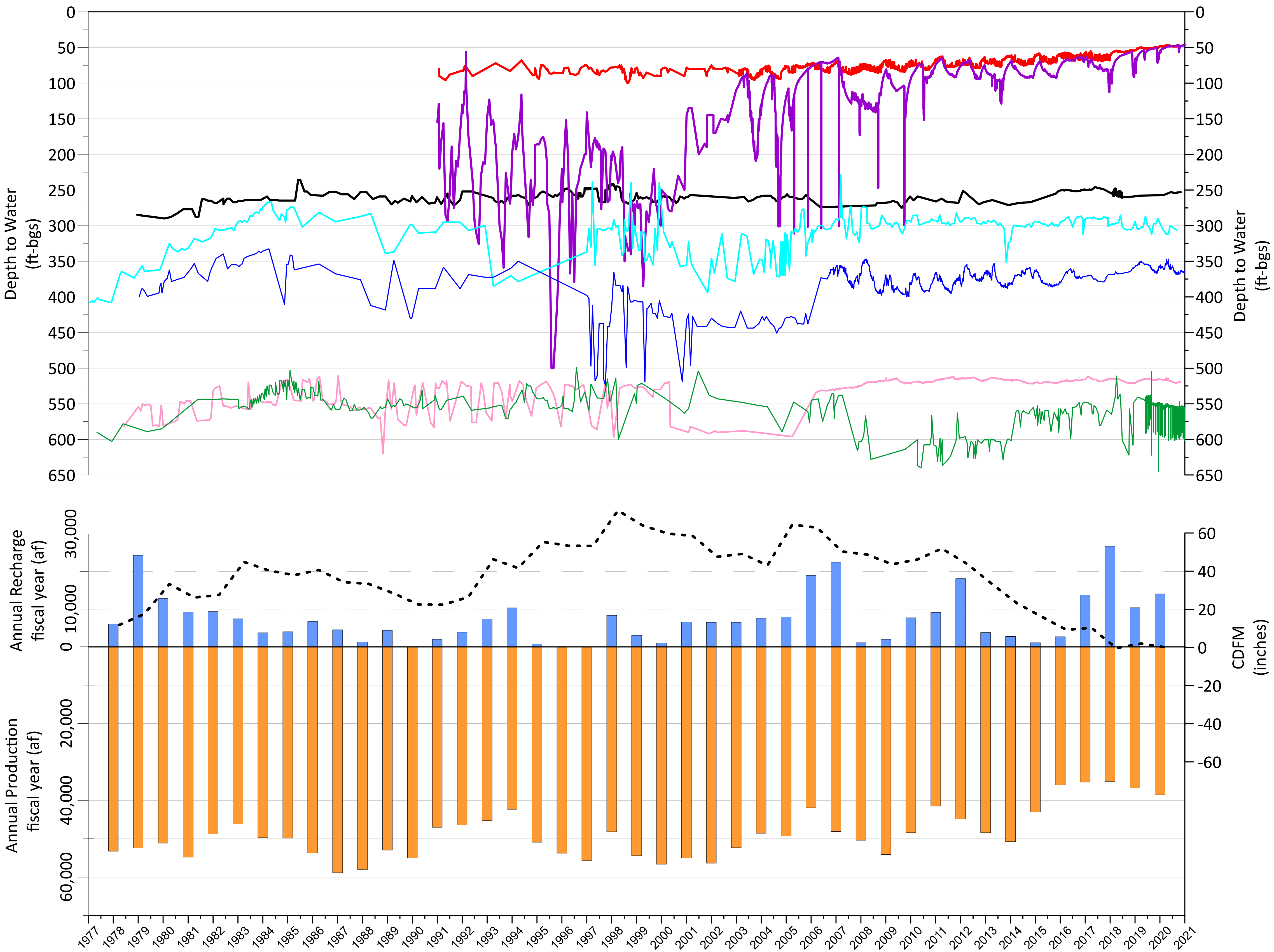
Wells Used to Characterize Long-Term Trends in Groundwater Levels Versus Precipitation, Production, and Recharge

Exhibit 4-9



Author: EM; Date: 5/4/2021; K\Clients\941 CBWM\CBWM proj\SOB\Grapher\GRF\4_GWL\Ex_4-10_MZ1

Water levels at MVWD-4 and Upland-9 are representative of groundwater-level trends in the northern portion of MZ1. In this area, water levels appear to be controlled by local pumping and recharge stresses. Water levels at wells P-06, P-30 and C-5 are representative of groundwater-level trends in the central portion of MZ1. During the implementation of the OBMP from 2000 to 2016, groundwater levels at P-6 and P-30 increased by 35 and 65 feet respectively, although this was a relatively dry period. The changes in groundwater levels in this area are due to a general decline in groundwater production, the “put and take” cycles associated with Metropolitan’s Dry-Year Yield storage program in Chino Basin, the mandatory recharge of Supplemental Water in MZ1 to improve the balance of recharge and discharge, and facilities improvements to enhance the recharge of storm, recycled, and imported waters. From 2016 to 2020, groundwater levels at both wells remained relatively stable, with levels at P-30 fluctuating by about 15 feet seasonally. At well C-5, groundwater levels remained relatively stable from 2000 to 2020, fluctuating by about +/- 10 feet.

Water levels at well CH-1B are representative of groundwater-level trends in the deep, confined aquifer system in the southern portion of MZ1. Water levels at this well are influenced by pumping from nearby wells that are also screened within the deep aquifer system. During the 1990s, water levels at this well declined by up to 200 feet due to increased pumping from the deep aquifer system in this area. From 2000 to 2007, water levels at this well increased primarily due to decreased pumping from the deep aquifer system associated with poor groundwater quality and the management of land subsidence (WEI, 2007b). From 2007 to 2018, water levels at this well remained relatively stable, fluctuating annually by about +/- 30 feet due to seasonal production patterns from the deep aquifer system. From 2018 to 2020, water levels at this well increased by about 20 feet, primary due to decreased pumping in this area.

Water levels at well CH-15A are representative of groundwater-level trends in the shallow, unconfined aquifer system in the southern portion of MZ1. Historically, water levels in CH-15A were stable, fluctuating between 80 to 90 ft-bgs in response to nearby pumping. Since 2000, water levels have risen by about 30 feet, which is partly due to the increasing availability of recycled water for direct uses, resulting in decreased local pumping.

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Groundwater Levels at Wells (Perforated Interval Depth)

- C-5 (430-1,078 ft-bgs)
- P-6 (536-1,050 ft-bgs)
- P-30 (565-875 ft-bgs)
- MVWD-4 (484-864 ft-bgs)
- CH-1B (440-1,180 ft-bgs)
- CH-15A (190-310 ft-bgs)
- Upland-9 (445-874 ft-bgs)

- Recharge of Imported Water and Recycled Water at Basins in MZ1
- Groundwater Production from Wells in MZ1
- CDFM Precipitation Plot using PRISM 4-km grid for 1896-2020 (Spatial Average for the Chino Basin)

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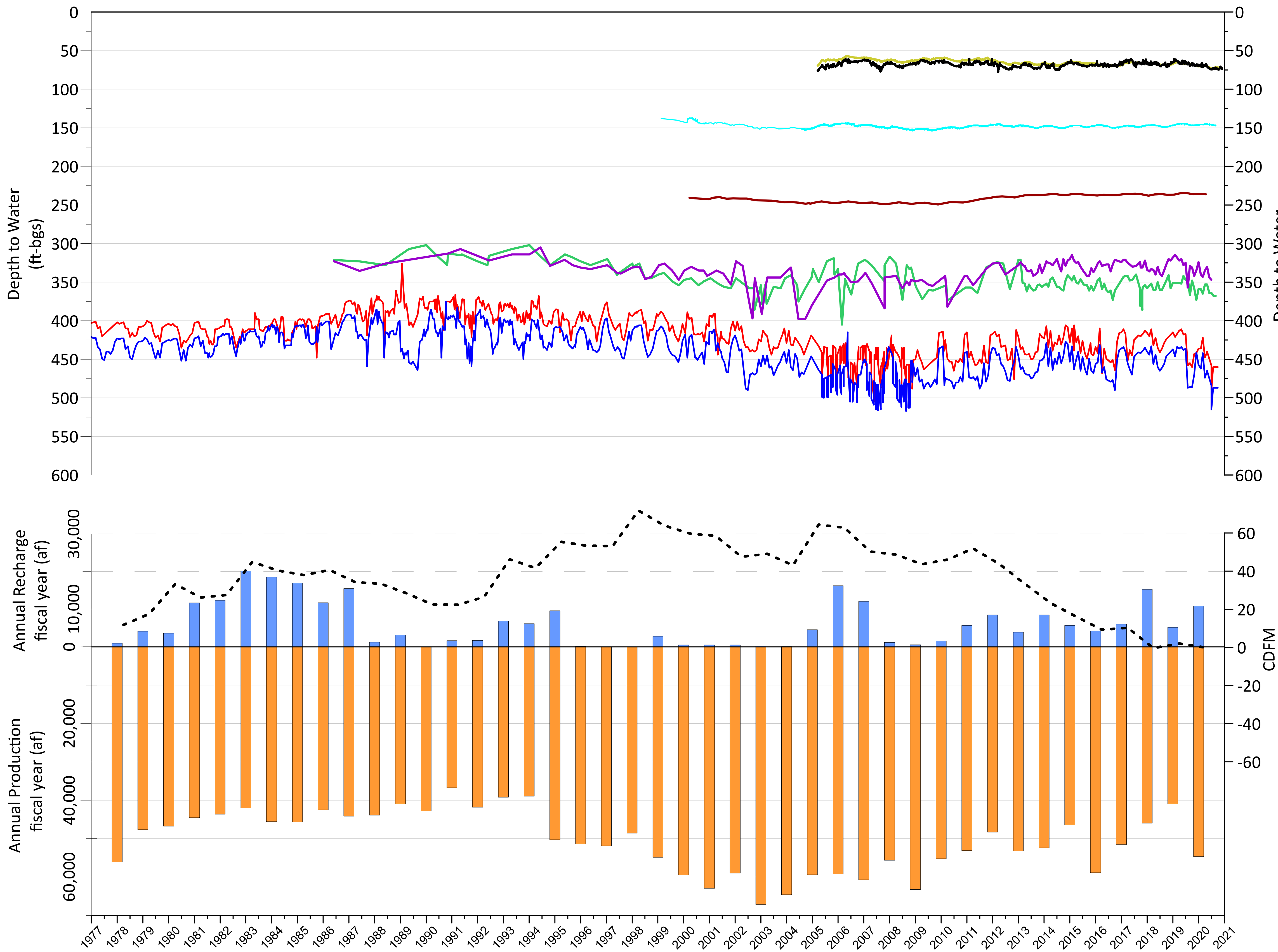
Time-Series Chart of Groundwater Levels Versus Precipitation, Production, and Recharge
MZ1 - 1978 to 2020

Exhibit 4-10



Author: EM; Date: 5/4/2021; K:\Clients\941 CBWM\CBWM proj\SOB\Grapher\GRF\4_GWL\Ex_4-11_MZ2

Water levels at wells CVWD-3, CVWD-5, O-29 and O-24 are representative of groundwater-level trends in the north-central portion of MZ2. Water levels increased from 1978 to about 1990, likely due to a combination of the 1978 to 1983 wet period, decreased production following the execution of the Judgment, and the initiation of the artificial recharge of imported water in the San Sevaine and Etiwanda Basins. From 1990 to 2010, water levels progressively declined by about 75 feet due to increased production in the region. From 2010 to 2014, water levels increased by about 30 feet, likely due to decreased production and increased artificial recharge. From 2014 to 2019 water levels remained relatively stable, indicating a general balance of recharge and discharge during this period. Water levels decreased in 2020 primarily due to increased pumping in the area.

Water level data at wells OW-11 and XRef 404 are representative of trends in the central portion of MZ2. Well OW-11 is located adjacent to the Ely Basins, and well XRef 404 is located in the region south of all recharge basins in MZ2 and north of the Chino Basin Desalter wells. From 2000 to 2004, water levels at both wells decreased by about 10 feet, likely due to a combination of a dry period, increases in production in MZ2, and very little artificial recharge. From 2005 to 2020, water levels increased by up to 15 feet, likely due to decreased production and increased artificial recharge.

Water levels at wells HCMP-2/1 (shallow aquifer) and HCMP-2/2 (deep aquifer) are representative of groundwater-level trends in the southern portion of MZ2, just south of the Chino-I Desalter wells. One of the objectives of the desalter well field is to cause the lowering of groundwater levels to achieve Hydraulic Control of the Chino Basin (see Exhibits 4-7 and 4-8 for further explanation of Hydraulic Control). The Chino-I Desalter well field began pumping in late 2000. Since 2005, when these wells were constructed, groundwater levels in this area have declined by about ten feet.

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Groundwater Levels at Wells (Perforated Interval Depth)

- CVWD-5 (538-1,238 ft-bgs)
- CVWD-3 (341-810 ft-bgs)
- O-29 (400-1,095 ft-bgs)
- O-24 (484-952 ft-bgs)
- OW-11 (323-333 ft-bgs)
- XRef 404 (274-354 ft-bgs)
- HCMP-2/2 (296-316 ft-bgs)
- HCMP-2/1 (124-164 ft-bgs)

- Recharge of Imported Water and Recycled Water at Basins in MZ2
- Groundwater Production from Wells in MZ2
- CDFM Precipitation Plot using PRISM 4-km grid for 1896-2020 (Spatial Average for the Chino Basin)

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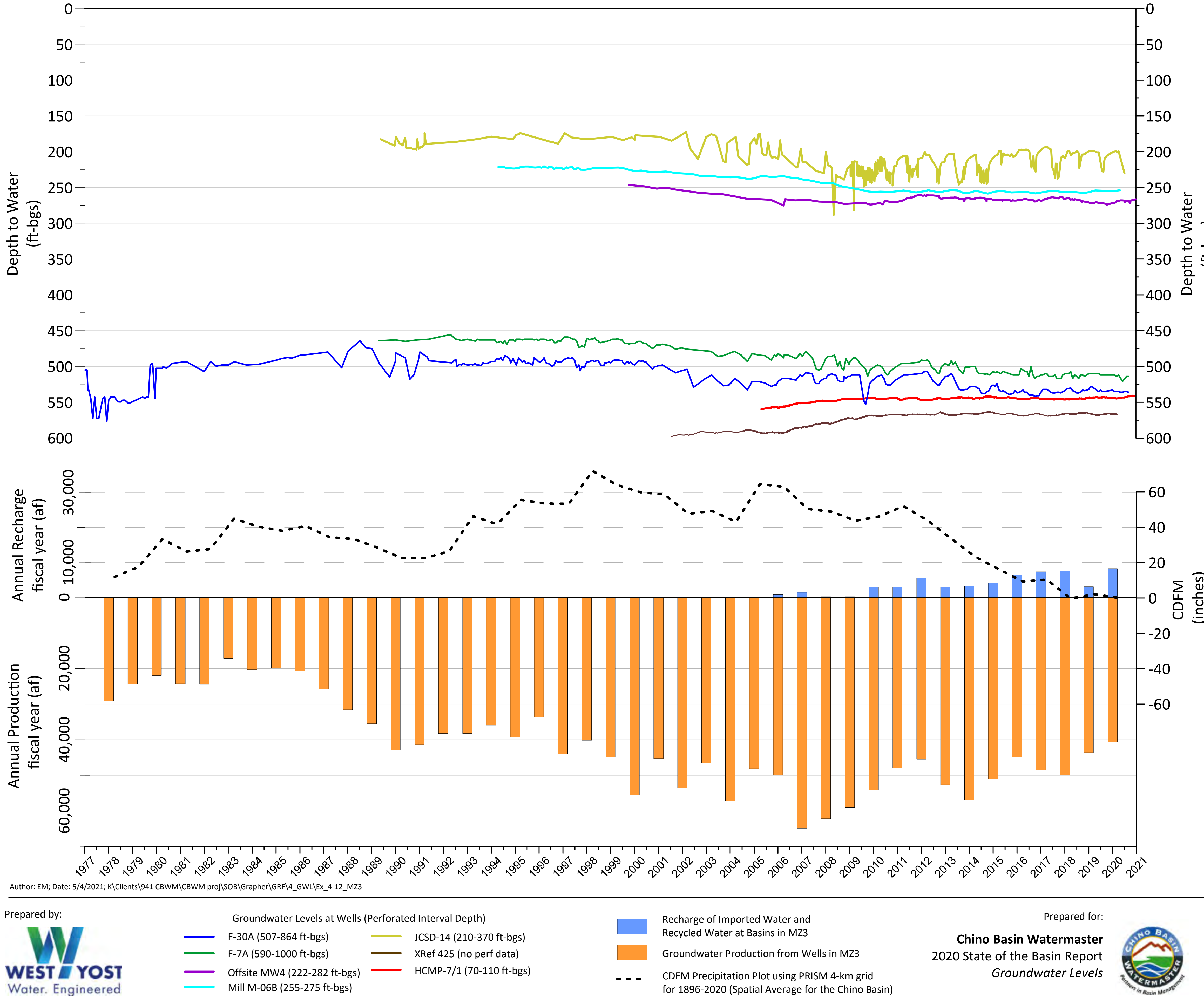
Time-Series Chart of Groundwater Levels Versus Precipitation, Production, and Recharge
MZ2 - 1978 to 2020

Exhibit 4-11



Water levels at wells F-30A and F-7A are representative of groundwater-level trends in the northeastern portions of MZ3. From 2000 to 2020, water levels declined in this area by approximately 35-50 feet due to a dry climatic period and increased pumping in MZ3.

Water levels at wells Offsite MW4, Mill M-6B, JCSD-14, and XRef 425 are representative of groundwater-level trends in the central portion of MZ3. From 2000 to 2010, groundwater levels in this area progressively declined by about 30 feet due to a dry period and increased pumping in MZ3. From 2010 to 2020, groundwater levels stabilized or increased by up to 10 feet, likely due to reduced production and increases in artificial recharge.

Water levels at well HCMP-7/1 are representative of groundwater-level trends in the southernmost portion of MZ3—just south of the Chino-II Desalter well field and just north of the Santa Ana River. From 2005 to 2010, water levels at this well declined by about 15 feet, mainly due to the onset of pumping at the Chino-II Desalter well field. From 2011 to 2020, water levels remained relatively stable in this area.

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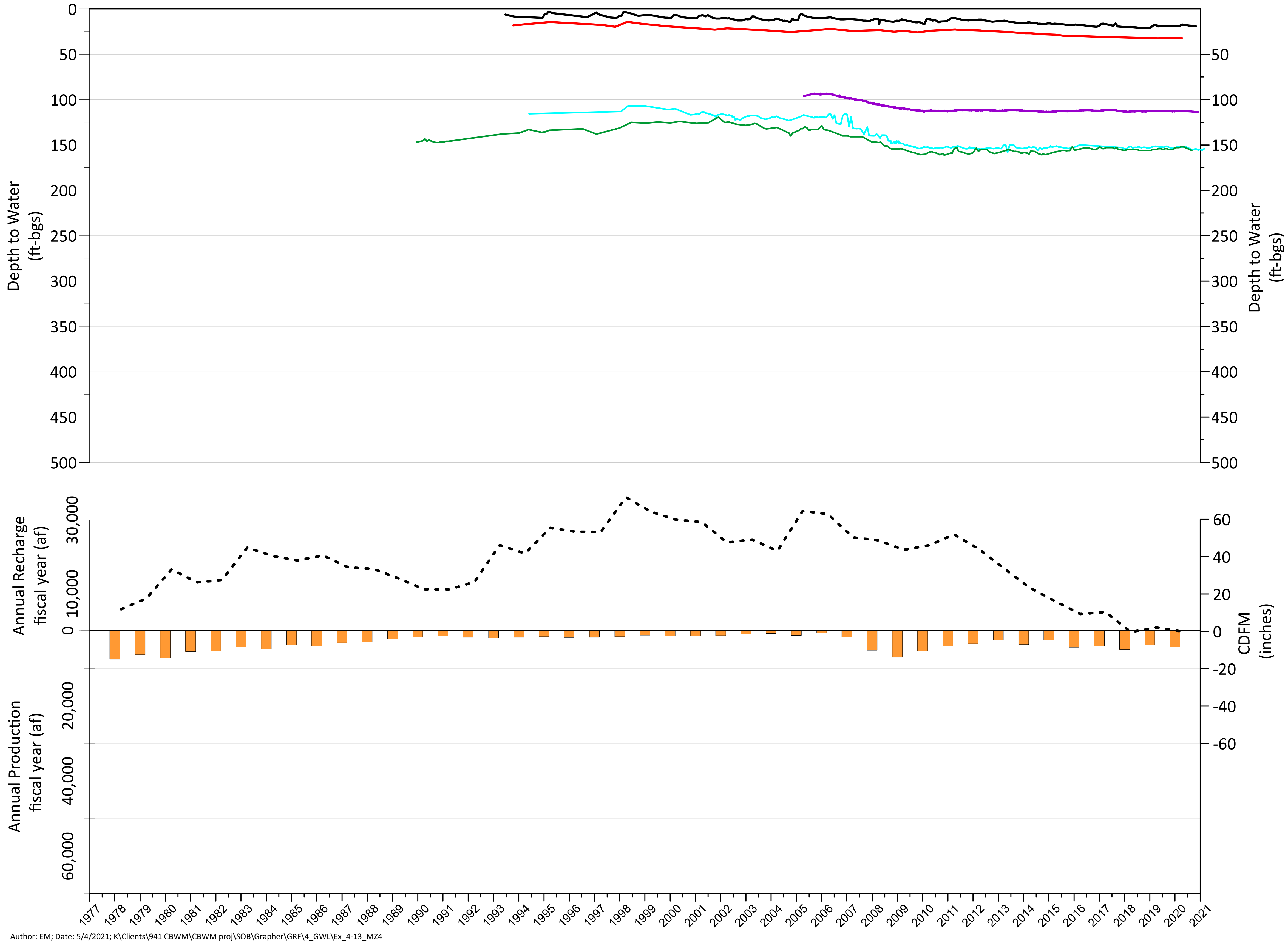
Time-Series Chart of Groundwater Levels Versus Precipitation, Production, and Recharge
MZ3 - 1978 to 2020

Exhibit 4-12



Water levels at wells JCSD-10, XRef 4513, and HCMP-9/1 are representative of groundwater-level trends in the western portion of MZ4 in the vicinity of the JCSD and Chino-II Desalter well fields. Water levels at JCSD-10 and XRef 4513 began to decrease around 2000 and notably accelerated in decline around 2006 when pumping at Chino-II Desalter wells in commenced in MZ3 and MZ4. From 2000 to 2010, water levels declined by about 35 feet at these wells. Water levels at HCMP-9/1 show a similar decrease during this time, declining by about 20 feet from the well's construction in 2005 to 2010. The decline of groundwater levels in this portion of the basin was necessary to achieve Hydraulic Control of the Chino Basin (see Exhibits 4-7 and 4-8 for further explanation of Hydraulic Control); however groundwater level decline in this area is a concern of the JCSD with regard to production sustainability at its wells. Hydraulic Control was achieved in this area by 2010, and from 2010 to 2020 groundwater levels stabilized.

Water levels at wells FC-720A2 and FC-932A2 are representative of groundwater-level trends in the eastern portion of MZ4. From 2000 to 2018, the water levels at these wells declined by about 10 feet, likely in response to the dry period. From 2018 to 2020 water levels at these wells were relatively stable.

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Groundwater Levels at Wells (Perforated Interval Depth)

- JCSD-10 (no perf data)
- XRef 4513 (no perf data)
- HCMP-9/1 (110-150 ft-bgs)
- FC-752A2 (no perf data)
- FC-932A2 (no perf data)

- Recharge of Imported Water and Recycled Water at Basins in MZ4
- Groundwater Production from Wells in MZ4
- CDFM Precipitation Plot using PRISM 4-km grid for 1896-2020 (Spatial Average for the Chino Basin)

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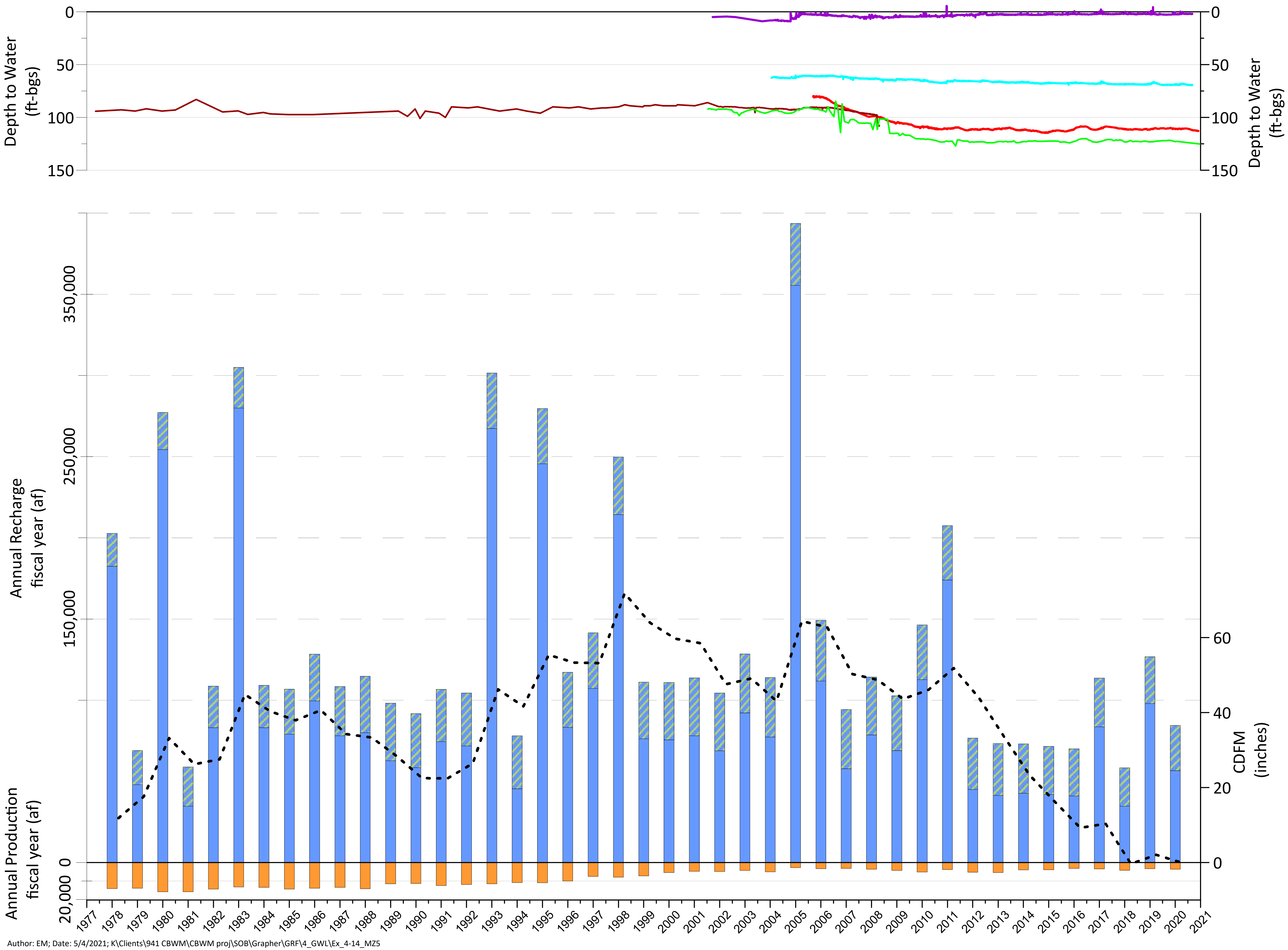
Time-Series Chart of Groundwater Levels Versus Precipitation, Production, and Recharge
MZ4 - 1978 to 2020

Exhibit 4-13



MZ5 is a groundwater flow system that parallels the Santa Ana River. The discharge of the Santa Ana River shown on this chart is the total flow measured at USGS gage SAR at MWD Crossing and the total effluent discharged to the Santa Ana River from the City of Riverside's wastewater treatment plant. A portion of this Santa Ana River discharge can recharge the Chino Basin in MZ5.

Water levels at wells XRef 4802, SARWC-7, SARWC-11, and HCMP-8/2 are representative of groundwater levels in the eastern portion of MZ5, where the Santa Ana River is recharging the Chino Basin. From 2005 to 2020, water levels at these wells progressively declined by about 8 to 35 feet. This decline of groundwater-levels coincided with increased pumping at the Chino Desalter well field nearby in MZ3 and MZ4, which has helped to achieve Hydraulic Control in this portion of the Chino Basin. This decline of groundwater-levels also suggests that Santa Ana River recharge to the Chino Basin in this area has increased.

Water levels at the Archibald-1 ell are representative of groundwater-levels in the southwestern portion of MZ5, where groundwater is very near the ground surface and could rise to become flow in the Santa Ana River. Water levels at this near-river well have remained relatively stable since monitoring began in 2000.

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Groundwater Levels at Wells (Perforated Interval Depth)

- XRef 4802 (no perf data)
- SARWC-07 (100-172 ft-bgs)
- HCMP-8/2 (145-165 ft-bgs)
- SARWC-11 (75-230 ft-bgs)
- Archibald 1 (75-85 ft-bgs)

- Flow of the Santa Ana River at MWD Crossing
- Discharge from the City of Riverside WWTP
- Groundwater Production from Wells in MZ5
- CDFM Precipitation Plot using PRISM 4-km grid for 1896-2020 (Spatial Average for the Chino Basin)

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Time-Series Chart of Groundwater Levels Versus Precipitation, Production, and Recharge
MZ5 - 1978 to 2020

Exhibit 4-14

5.0 GROUNDWATER QUALITY

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The exhibits in this section show the physical state of the Chino Basin with respect to groundwater quality, using data from the Chino Basin groundwater-quality monitoring programs.

Prior to OBMP implementation, historical groundwater-quality data were obtained from the California Department of Water Resources (DWR) and supplemented with data from some producers in the Appropriative Pool and from the State of California Department of Public Health (now the California State Water Resources Control Board Division of Drinking Water [DDW]). As part of the implementation of OBMP *PE 1 – Develop and Implement a Comprehensive Monitoring Program*, Watermaster began conducting a more robust water-quality monitoring program to support the activities in other Program Elements, such as *PE 6 – Develop and Implement Cooperative Programs with the Regional Board and Other Agencies to Improve Basin Management* and *PE 7 – Develop and Implement Salt Management Program*.

In 1999, Watermaster initiated a comprehensive monitoring program to perform systematic sampling of private wells south of Highway 60 in the Chino Basin. By 2001, Watermaster had sampled all known wells at least once to develop a robust baseline dataset. Since that time, Watermaster has continued its sampling and data collection efforts and is constantly evaluating and revising the monitoring programs as wells are abandoned or destroyed wells due to urban development. The details of the groundwater monitoring program as of FY 2019/2020 are described below.

Chino Basin Data Collection (CBDC). Watermaster routinely and proactively collects groundwater quality data from well owners that perform sampling at their own wells, such as municipal producers and government agencies. Groundwater-quality data are also obtained from special studies and monitoring that takes place under the orders of the Regional Board, the DTSC, the USGS, and others. These data are collected from well owners and monitoring entities twice per year. In 2020, data from over 890 wells were compiled as part of the CBDC program.

Watermaster Field Groundwater Quality Monitoring Programs. Watermaster continues to sample privately owned wells and its own monitoring wells on a routine basis.

Private Wells. Watermaster collects groundwater quality samples at about 85 private wells, located predominantly in the southern portion of the Basin. The wells are sampled at various frequencies based on their proximity to known point-source contamination plumes. Seventy-seven wells are sampled on a triennial basis, and eight wells near contaminant plumes are sampled on an annual basis.

Watermaster Monitoring Wells. Watermaster collects groundwater quality samples at 22 multi-nested monitoring sites located throughout the southern Chino Basin. There is a total of 53 well casings at these sites. These include nine Hydraulic Control Monitoring Program (HCMP) monitoring well sites constructed to support the demonstration of Hydraulic Control, nine monitoring well sites constructed to support the Prado Basin Habitat Sustainability Program (PBHSP), and four sites that fill spatial data gaps near contamination plumes in Management Zone 3 (MZ3). Each nested well site contains up to three wells in the borehole. The HCMP and MZ3 wells are sampled annually. The PBHSP wells are sampled quarterly to semiannually.

Other wells. Watermaster collects samples from four near-river wells quarterly. The data are used to characterize the interaction of the Santa Ana River and groundwater in this area. These shallow monitoring wells along the Santa Ana River consist of two former USGS National Water Quality Assessment Program (NAWQA) wells (Archibald 1 and Archibald 2) and two Santa Ana River Water Company (SARWC) wells (Well 9 and Well 11).

All groundwater-quality data are checked for quality assurance and quality control (QA/QC) by Watermaster staff and uploaded to a centralized database management system that can be accessed online through HydroDaVE^{SM}. The data are used (1) to comply with two of Watermaster and IEUA's maximum benefit salinity management commitments: the triennial ambient water quality re-computation and the analysis of hydraulic control; (2) to prepare Watermaster's biennial State of the Basin report (this report); (3) to support ground-water modeling; (4) to characterize non-point source contamination and plumes associated with point-source discharges; (5) to characterize long-term trends in water quality; and (6) to periodically perform special studies.

Groundwater-quality data representing the five-year period from July 2015 to June 2020 were analyzed synoptically and temporally to characterize current water quality conditions in the Chino Basin. This analysis does not represent a programmatic investigation of potential sources of chemical constituents in the Chino Basin. Exhibit 5-1 shows the wells with data over this five-year period.

Groundwater quality is characterized with respect to constituents where groundwater exceeds primary or secondary California MCLs or notification levels (NLs). Wells with constituent concentrations greater than a primary MCL represent areas of concern, and the spatial distribution of these wells indicates areas in the Basin where groundwater may be impaired from a beneficial use standpoint. Exhibit 5-2 characterizes the number of wells in the Basin that exceed primary or secondary MCLs or NLs. Exhibits 5-3 through 5-16 show the areal distribution of concentrations for the constituents of potential concern (COPC) described in Exhibit 5-2.

Several of the constituents in Exhibits 5-3 through 5-16 are associated with known point-source contaminant discharges to groundwater. Understanding point-sources of concern is critical to the overall management of groundwater quality to ensure that Chino Basin groundwater remains a sustainable resource. Watermaster closely monitors information, decisions, cleanup activities, and monitoring data pertaining to point-source contamination within the Chino Basin. The following is a list of the regulatory and voluntary groundwater quality contamination monitoring efforts in the Chino Basin that are tracked by Watermaster, the locations of which are shown in Exhibit 5-17.

- Alumax Aluminum Recycling Facility

  Constituents of Concern: TDS, chloride, sulfate, nitrate
  Order: Regional Board Cleanup and Abatement Order 99-38
- Alger Manufacturing Co.

  Constituents of Concern: volatile organic chemicals (VOCs)
  Order: Voluntary Cleanup and Monitoring
- Chino Airport

  Constituents of Concern: VOCs and 1,2,3-TCP
  Order: Regional Board Cleanup and Abatement Orders 90-134, R8-2008-0064, and R8-2017-0011
- California Institution for Men (CIM) (No Further Action status, as of 2/17/2009)

  Constituents of Concern: VOCs
  Order: Voluntary Cleanup and Monitoring
- General Electric (GE) Flatiron Facility

  Constituents of Concern: VOCs and hexavalent chromium
  Order: Voluntary Cleanup and Monitoring
- GE Test Cell Facility

  Constituents of Concern: VOCs
  Order: Voluntary Cleanup and Monitoring
- Former Kaiser Steel Mill

  Constituents of Concern: TDS, total organic carbon (TOC), and VOCs
  Order: Regional Board Cleanup and Abatement Order 91-40 Closed. Kaiser granted capacity in the Chino II Desalter to remediate.
- Former Kaiser Steel Mill – CCG Property

  Constituents of Concern: chromium, hexavalent chromium, other metals, VOCs
  Order: DTSC Consent Order 00/01-001
- Milliken Sanitary Landfill

  Constituents of Concern: VOCs
  Order: Regional Board Cleanup and Abatement Order 81-003
- Upland Sanitary Landfill

  Constituents of Concern: VOCs
  Order Regional Board Cleanup and Abatement Order 98-99-07
- South Archibald Plume

  Constituents of Concern: VOCs
  Order: Stipulated Settlement and Regional Board Cleanup and Abatement Order R8-2016-0016 to a group of eight responsible parties

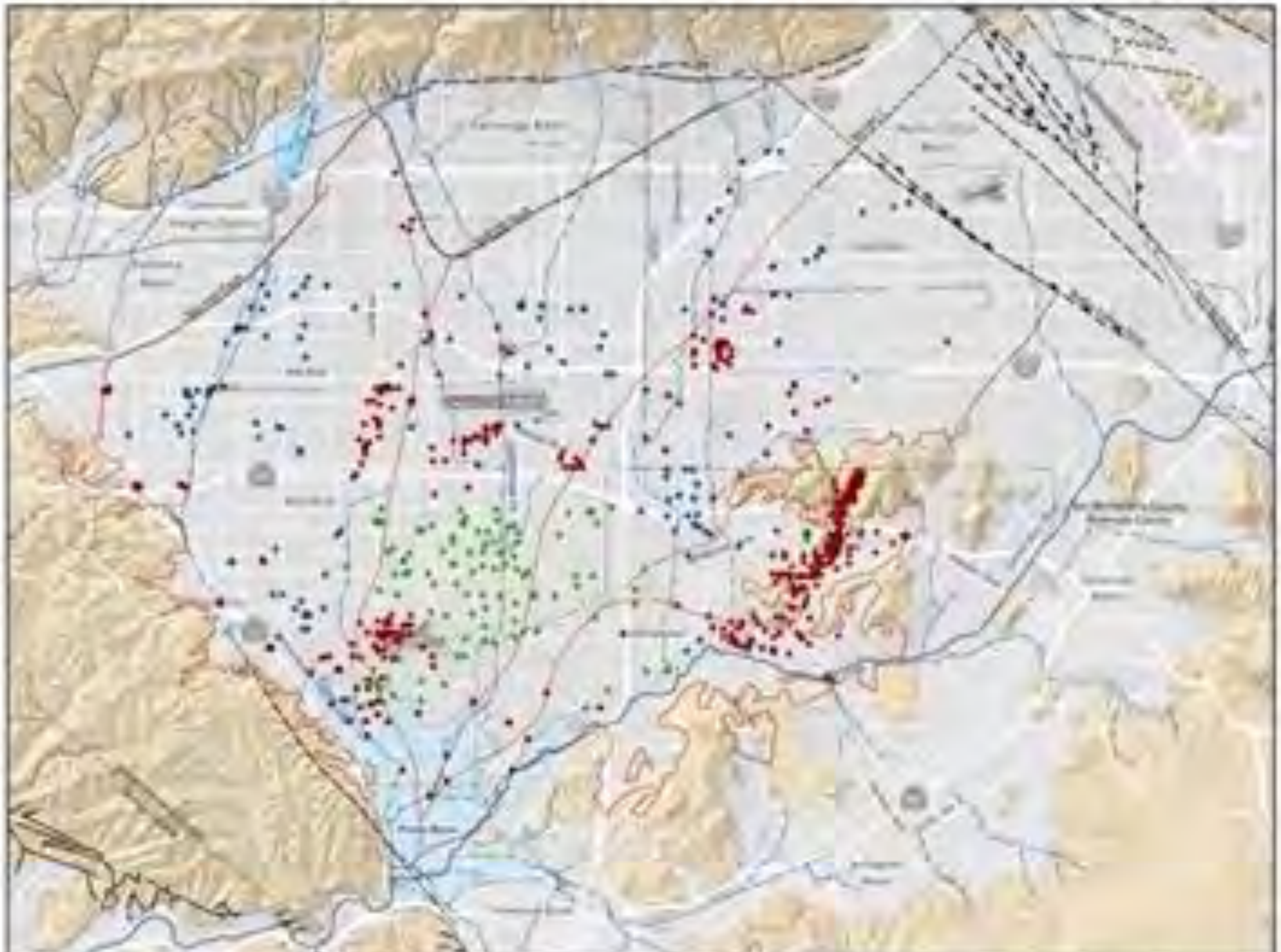
- Stringfellow National Priorities List (NPL) Site

  Constituents of Concern: VOCs, perchlorate, N-nitrosodimethylamine (NDMA), trace metals
  Order: The Stringfellow Site is the subject of US Environmental Protection Agency (EPA) Records of Decision (RODs): EPA/ROD/R09-84/007, EPA/ROD/R09-83/005, EPA/ROD/R09-87/016, and EPA/ROD/R09-90/048.

Every two years, Watermaster uses the data collected as part of its monitoring programs and other information to delineate the extent of contaminant plumes comprised of VOCs. Exhibits 5-17 and 5-18 show the current delineation and chemical differentiation of the VOC plumes. Exhibits 5-19 through 5-22 show more detailed information about the Chino Airport, South Archibald, GE Flatiron, and GE Test Cell plumes, the monitoring and remediation activities for which are tracked and reported on by Watermaster on a semiannual or annual basis.

Exhibit 5-23 shows all known point sources of potential contamination in the Chino Basin as of 2020, based on the State Water Resources Control Board's (State Water Board's) GeoTracker and EnviroStor websites. GeoTracker is the State Water Board's online data-management system for the compliance data collected from point-source discharge sites with confirmed or potential impacts to groundwater. This includes locations where there have been unauthorized discharges of waste to land or unauthorized releases of hazardous substances from underground storage tanks. EnviroStor is the DTSC's online data-management system for permitted hazardous waste facilities. In 2014, Watermaster performed a comprehensive review of the GeoTracker and EnviroStor databases to identify sites in the Chino Basin that may have an impact on groundwater quality, but have not been previously tracked by Watermaster. Watermaster reviews the GeoTracker and EnviroStor databases annually to track the status of previously identified sites, identify new sites with potential or confirmed impacts to groundwater, and add new data to Watermaster's database.

The remaining exhibits in this section characterize long-term trends in groundwater quality in the Basin with respect to TDS and nitrate concentrations. The management of TDS and nitrate concentrations is essential to Watermaster's maximum benefit salt and nutrient management plan. In 2002, Watermaster proposed that the Regional Board adopt alternative maximum benefit water quality objectives for the Chino-North GMZ that were higher than the antidegradation water quality objectives for MZ1, MZ2, and MZ3. The proposed objectives were approved by the Regional Board and incorporated into the Basin Plan in 2004 (Regional Board, 2004). The maximum benefit objectives enabled Watermaster and the IEUA to implement recycled water recharge and reuse throughout the Chino Basin. The application of the maximum benefit objectives is contingent upon the implementation of specific projects and programs known as the "Chino Basin maximum benefit commitments." The commitments include requirements for basin-wide monitoring of groundwater quality, and the triennial re-computation of ambient TDS and nitrate. The commitments also require the development of plans and schedules for water quality improvement programs when current ambient TDS exceeds the maximum benefit objective or when recycled water used for recharge and irrigation exceeds the discharge limitations listed in the IEUA's recycled water discharge and reuse permits. Exhibits 5-24 and 5-25 show trends in the ambient water quality determinations for TDS and nitrate. Exhibits 5-26 through 5-33 show TDS and nitrate concentration time histories from 1973 to 2020 for selected wells. These time histories illustrate groundwater-quality variations and trends within each management zone and the trends in groundwater quality compared to the MZ TDS and nitrate objectives.



Wells with Groundwater Quality Monitoring Data
Between July 2015 and June 2020

Other key map features are described in the legend of Exhibit 5-1

Watermaster's current water quality monitoring program relies on municipal producers, government agencies, and others to supply groundwater quality data on a cooperative basis. Watermaster supplements these data through its own sampling and analysis of private wells and monitoring wells in the area generally south of Highway 60. All groundwater quality data are collected and checked for QA/QC by Watermaster staff and uploaded to a centralized data management system that can be accessed online through HydroDaVE™. For the July 2015 to June 2020 period, water quality data were available for a total of 1,199 wells within the Chino Basin. Of those, 890 wells were sampled in FY 2019/2020.

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2020 State of the Basin Report
Groundwater Quality

Wells with Groundwater Quality Data
July 2015 - June 2020

Exhibit 5-1

All Chino Basin groundwater-quality data for the five-year period of July 2015 through June 2020 were analyzed for exceedances of primary or secondary MCLs and NLs. Primary MCLs are enforceable drinking water standards set by the California DDW to protect the public from potential negative health effects associated with constituents of concern. Secondary MCLs are drinking water standards set by the DDW based on undesirable aesthetic, cosmetic, or technical effects caused by a respective constituent. NLs are set by the DDW as a health advisory level for unregulated contaminants with the potential for negative health impacts. Contaminants with an NL may eventually become regulated with an MCL, pending formal regulatory review. HydroDaVE^{SM} was used to create an exceedance report for wells in the Chino Basin. The tables shown here list the number of wells in the Chino Basin with sample results that exceeded California primary/secondary MCLs or NLs during the reporting period.

Contaminant with a Primary MCL		
Contaminant	**California MCL**	**Number of Wells with Exceedance**
1,1,2,2-Tetrachloroethane	1 µgl	4
1,1,2-Trichloroethane	5 µgl	2
1,1-Dichloroethane	5 µgl	3
1,1-Dichloroethene (1,1-DCE)	5 µgl	21
1,2,3-Trichloropropane	0.5 µgl	133
1,2,4-Trichlorobenzene	5 µgl	33
1,2-Dibromo-3-chloropropane	0.2 µgl	4
1,2-Dichlorobenzene	600 µgl	39
1,2-Dichloroethane	0.005 µgl	57
1,2-Dichloropropane	5 µgl	4
1,4-Dichlorobenzene	5 µgl	110
Aluminum*	1 mgl	77
Antimony	6 µgl	8
Arsenic	0.01 mgl	72
Barium	1 mgl	12
Benzene	1 µgl	85
Benzo(a)pyrene	0.2 µgl	12
Beryllium	0.004 mgl	13
Cadmium	0.005 mgl	53
Carbon Tetrachloride	0.5 µgl	22
Chlordane	0.1 µgl	12
Chlorine	4 mgl	36
Chlorobenzene	70 µgl	63
Chromium	50 µgl	183
Chromium (VI)	10 µgl	107
cis-1,2-Dichloroethene (cis-1,2-DCE)	6 µgl	58
Copper*	1.3 mgl	33
Di(2-ethylhexyl)phthalate	4 µgl	40
Dichloromethane (Freon 30)	5 µgl	97
Ethylbenzene	300 µgl	37
Ethylene Dibromide	0.05 µgl	29

Contaminant with a Primary MCL (continued)		
Contaminant	**California MCL**	**Number of Wells with Exceedance**
Fluoride	2 mgl	37
Gross Alpha	15 pCi/L	14
Heptachlor	0.01 µgl	10
Heptachlor Epoxide	0.01 µgl	8
Hexachlorobenzene	1 µgl	12
Hexachlorocyclopentadiene	50 µgl	12
Lead	0.015 mgl	35
Mercury	0.002 mgl	4
Methyl Tert-Butyl Ether (MTBE)*	13 µgl	29
Nickel	0.1 mgl	64
Nitrate-Nitrogen	10 mgl	423
Nitrite-Nitrogen	1 mgl	14
Pentachlorophenol	1 µgl	16
Perchlorate	6 µgl	391
Selenium	0.05 mgl	5
Tetrachloroethene (PCE)	5 µgl	110
Thallium	2 µgl	11
Toluene	150 µgl	34
Total Xylene	1750 µgl	23
Toxaphene	3 µgl	2
trans-1,2-Dichloroethene (trans-1,2-DCE)	10 µgl	1
Trichloroethylene (TCE)	5 µgl	307
Trihalomethanes	80 µgl	4
Uranium	20 pCi/L	2
Vinyl Chloride	0.5 µgl	5

Contaminant with a California NL		
Contaminant	**California NL**	**Number of Wells with Exceedance**
1,2,4-Trimethylbenzene	330 µgl	21
1,3,5-Trimethylbenzene	330 µgl	15
1,4-Dioxane	1 µgl	70
Chlorate	800 µgl	1
Manganese	500 µgl	61
Methyl Isobutyl Ketone	120 µgl	11
n-Butylbenzene	260 µgl	2
N-Nitrosodimethylamine (NDMA)	0.01 µgl	52
N-Nitrosodipropylamine (NDPA)	0.01 µgl	12
n-Propylbenzene	260 µgl	9
Naphthalene	17 µgl	33
PFOA (Perfluorooctanoic acid)	5.1 ngl	39
PFOS (Perfluorooctanesulfonic acid)	6.5 ngl	33
Tert-Butyl Alcohol	120 µgl	53
Vanadium	50 µgl	56

Contaminant with a Secondary MCL		
Contaminant	**California MCL**	**Number of Wells with Exceedance**
Aluminum*	0.2 mgl	98
Chloride	500 mgl	7
Color	15 color units	13
Copper*	1 mgl	34
Iron	0.3 mgl	124
Manganese	0.05 mgl	112
Methyl Tert-Butyl Ether (MTBE)*	5 µgl	42
Odor	3 TON	3
Specific Conductance	1600 µS/cm	98
Sulfate	250 mgl	90
TDS	1000 mgl	144
Turbidity	5 NTU	52
Zinc	5 mgl	44

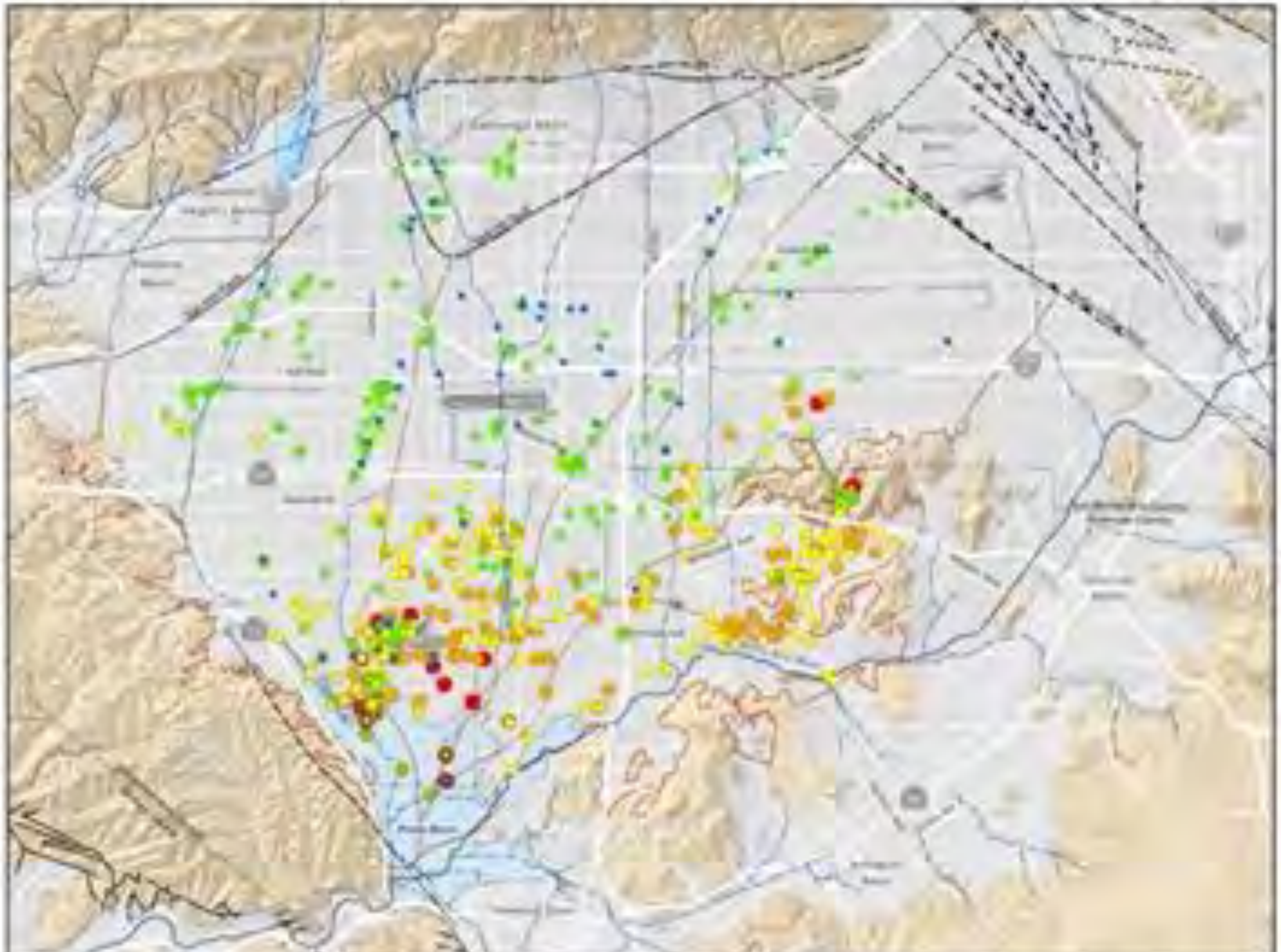
mgl = milligrams per liter
µgl = micrograms per liter
ngl = nanograms per liter
*Contaminant has both a primary and secondary MCL

Exhibits 5-3 through 5-16 are maps of the Chino and Cucamonga basins depicting the spatial distribution of wells with exceedances for contaminants of potential concern. The contaminants of potential concern are defined as follows:

- Contaminants associated with salt and nutrient management planning (i.e. TDS and nitrate).
- Contaminants where a primary MCL was exceeded in 50 or more wells from July 2015 to June 2020 and are not associated with a single point-source contamination plume (i.e. the Stringfellow NPL Site, Milliken Landfill, etc.). These constituents 1,2,3-TCP, 1,2-dichloroethane (1,2-DCA), arsenic, benzene, total chromium, hexavalent chromium, perchlorate, tetrachloroethene (PCE), and trichloroethylene (TCE).
- Contaminants which the California DDW considers a candidate for the development of an MCL or is in the process of developing an MCL. These include PFOA, PFOS, and 1,4-dioxane.

In each exhibit, the water-quality standard is defined in the legend, and each well is symbolized by the maximum concentration value measured during the reporting period. The following class interval convention is applied to each exhibit based on the subject water quality standard (WQS):

Symbol	Class Interval
○	Not Detected above the reporting limit (ND)
● (blue)	< 0.5x WQS
● (green)	0.5x WQS to WQS
● (yellow)	> WQS to 2x WQS
● (orange)	> 2x WQS to 4x WQS
● (red)	> 4x WQS



TDS (mg/L)

- < 125
- 125 - 250
- 250 - 500
- 500 - 1,000
- 1,000 - 2,000
- > 2,000

California Secondary MCL = 500 mg/L

Other base map features are described in the legend of Exhibit 5-1.

TDS is a measure of all dissolved substances in water (salinity), which includes organic matter and ions such as chloride, sodium, nitrate, calcium, potassium, magnesium, bicarbonate, and sulfate. Common sources of salinity in groundwater can include agricultural, municipal and industrial wastewaters, applied water for irrigation (urban and agricultural), or natural sources. TDS has a secondary California recommended MCL of 500 mg/L. From 2015 to 2020, TDS was measured at 581 wells in the Chino Basin. Of these, 314 (54 percent) have five-year maximum values that exceed the MCL. The highest five-year maximum TDS concentrations are located near the Jurupa Mountains, within the Stringfellow NPL site, and range from 8,600 to 11,300 mg/L. Exclusive of these concentrations, the five-year maximum concentrations across the basin range from 130 to 4,000 mg/L, with average and median values of 685 and 544 mg/L, respectively. The wells with the highest TDS concentrations in this range are predominantly located south of Highway 60 in the area of historic and current agricultural land uses, including irrigated agriculture and dairies. Agricultural land uses impact TDS concentrations through the disposal of dairy waste via land application and discharge to ponds, the use of fertilizer on crops, and the concentrating effects of the consumptive use of applied water for irrigation.

Data shown on this map is for raw groundwater and is not representative of the drinking water supplies served in the Chino Basin.

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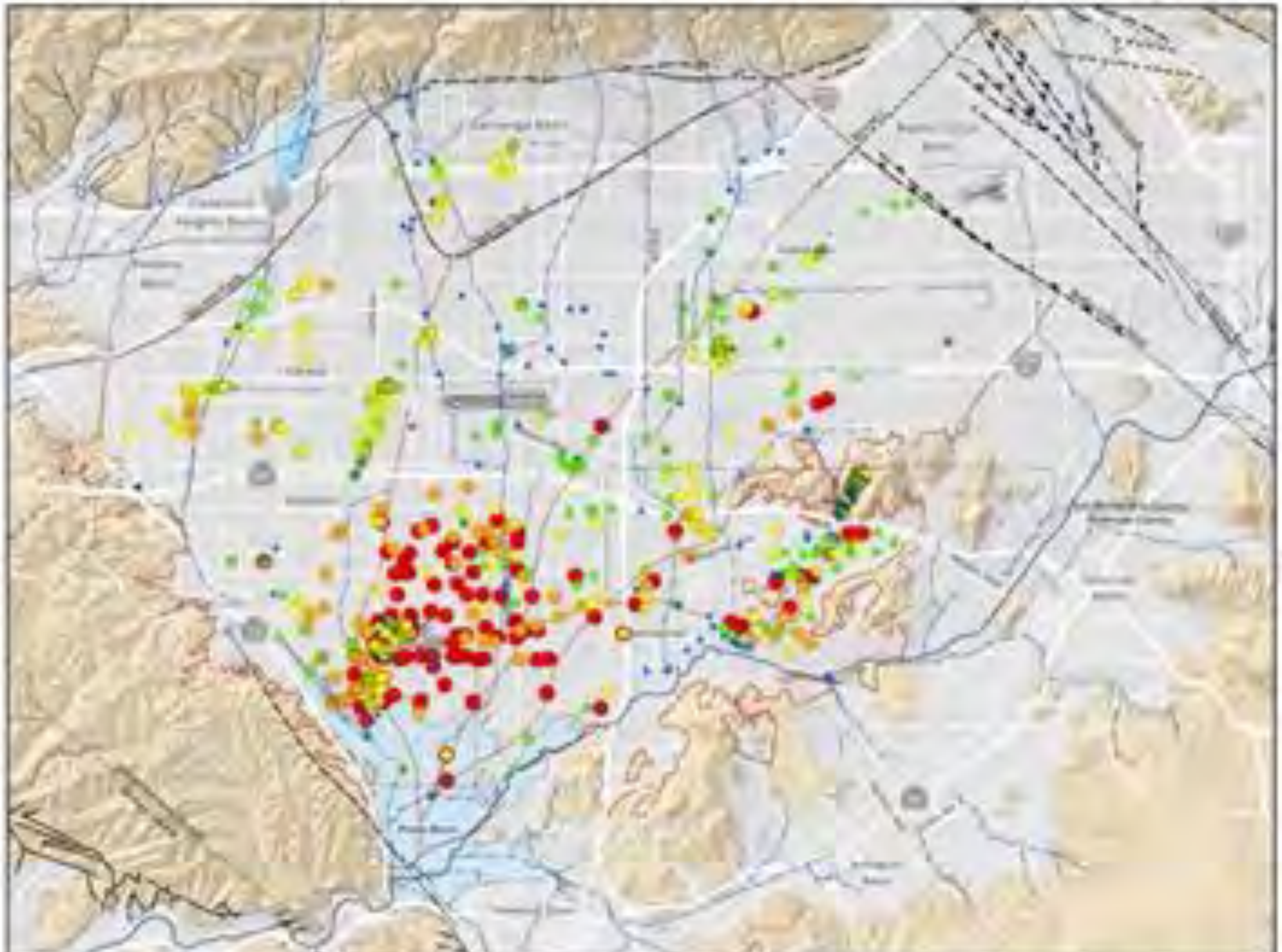
2020 State of the Basin Report
Groundwater Quality

Total Dissolved Solids (TDS) in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-3



Nitrate-N (mg/L)

ND

< 5

5 – 10

10 – 20

20 – 40

> 40

California Primary MCL = 10 mg/L

Other map base features are described in the legend of Exhibit 1-1.

Nitrate is a common contaminant in groundwater. It forms both naturally through a process known as nitrification, as well as being synthesized in the industrial manufacturing of fertilizers (USGS, 2017). The California primary MCL for nitrate (expressed as nitrogen) in drinking water is 10 mg/L. From 2015 to 2020, nitrate was measured at 699 wells in the Chino Basin with 685 (98 percent) of the wells having detectable concentrations ranging from 0.03 to 280 mg/L, with average and median concentrations of 23 and 15 mg/L, respectively. 422 wells (60 percent) have a five-year maximum concentration value that exceeds the MCL. The wells with the highest nitrate concentrations are predominantly located south of Highway 60, where historical agricultural land uses progressively converted from irrigated agricultural to dairies. In this area, sample results frequently exceed the MCL and often exceed 40 mg/L (four times the MCL).

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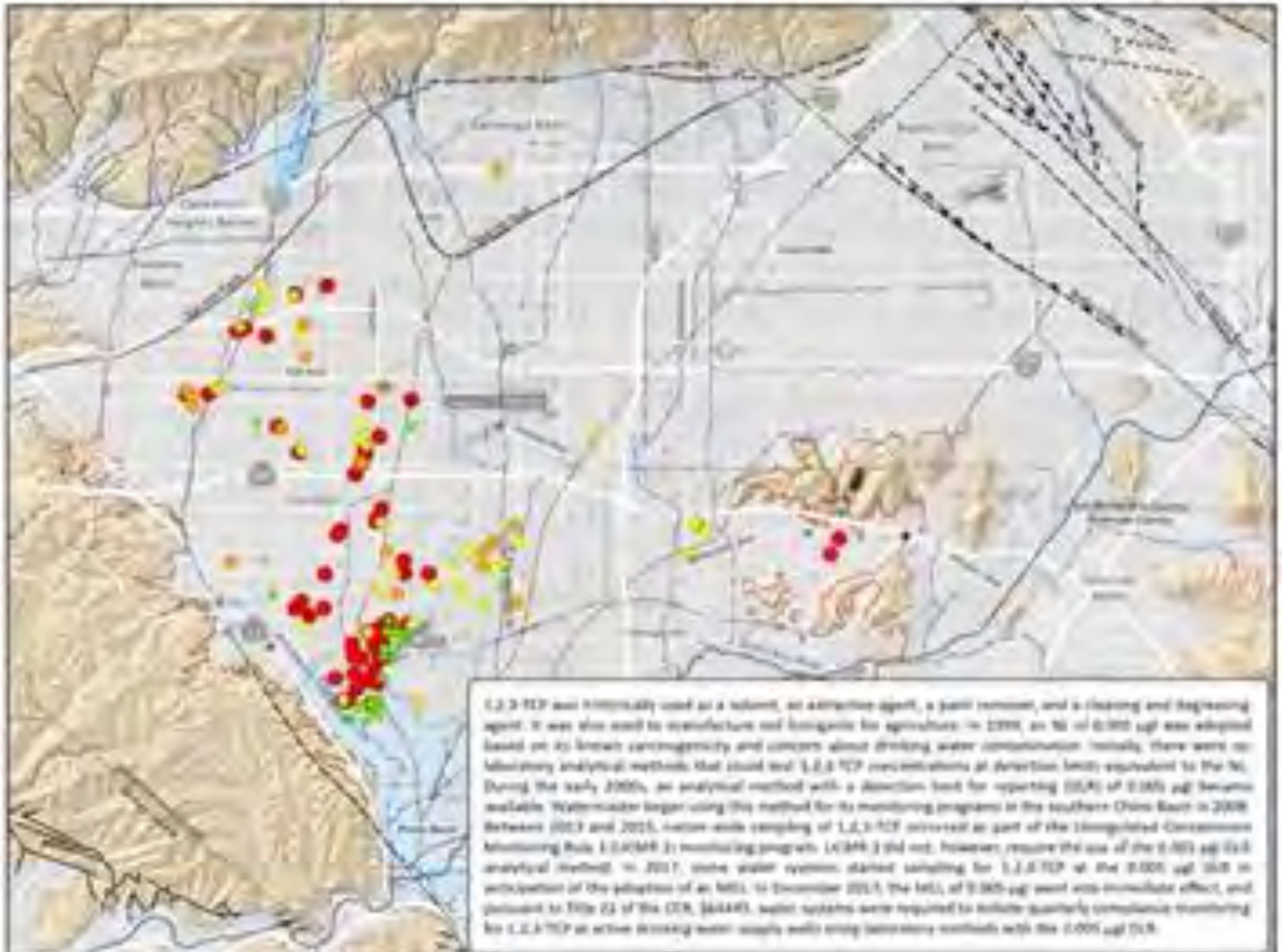
Nitrate (as Nitrogen) in Groundwater
Maximum Concentration (July 2015 to June 2020)

Exhibit 5-4



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1,2,3-Trichloropropane (1,2,3-TCP) in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-5

1,2-DCA (µg/l)

California Primary MCL = 0.5 µg/l

1,2-DCA is a regulated drinking water contaminant in California with a Primary MCL of 0.5 µg/l. 1,2-DCA is used in the manufacturing of plastics, rubber and synthetic textile fibers (typically as an intermediate chemical for the production of vinyl chloride) and is a common component of certain soil fumigants used for agriculture. From 2015 to 2020, 1,2-DCA was measured at 1,050 wells in the Chino Basin with 110 (11 percent) of the wells having detectable concentrations ranging from 0.14 to 52 µg/l, with average and median concentrations of 1.26 and 0.53 µg/l, respectively; 56 wells (4 percent) have a five-year maximum concentration value that exceeds the MCL. Wells with detectable levels of 1,2-DCA occur predominantly in monitoring well clusters associated with known VOC point-source contamination sites, such as the GE Test Cell Facility, Chino Airport, and Stringfellow NPL site. The Stringfellow NPL site is the only area that has concentrations of 10 µg/l or higher. All the concentrations in the other plumes are less than 10 µg/l.

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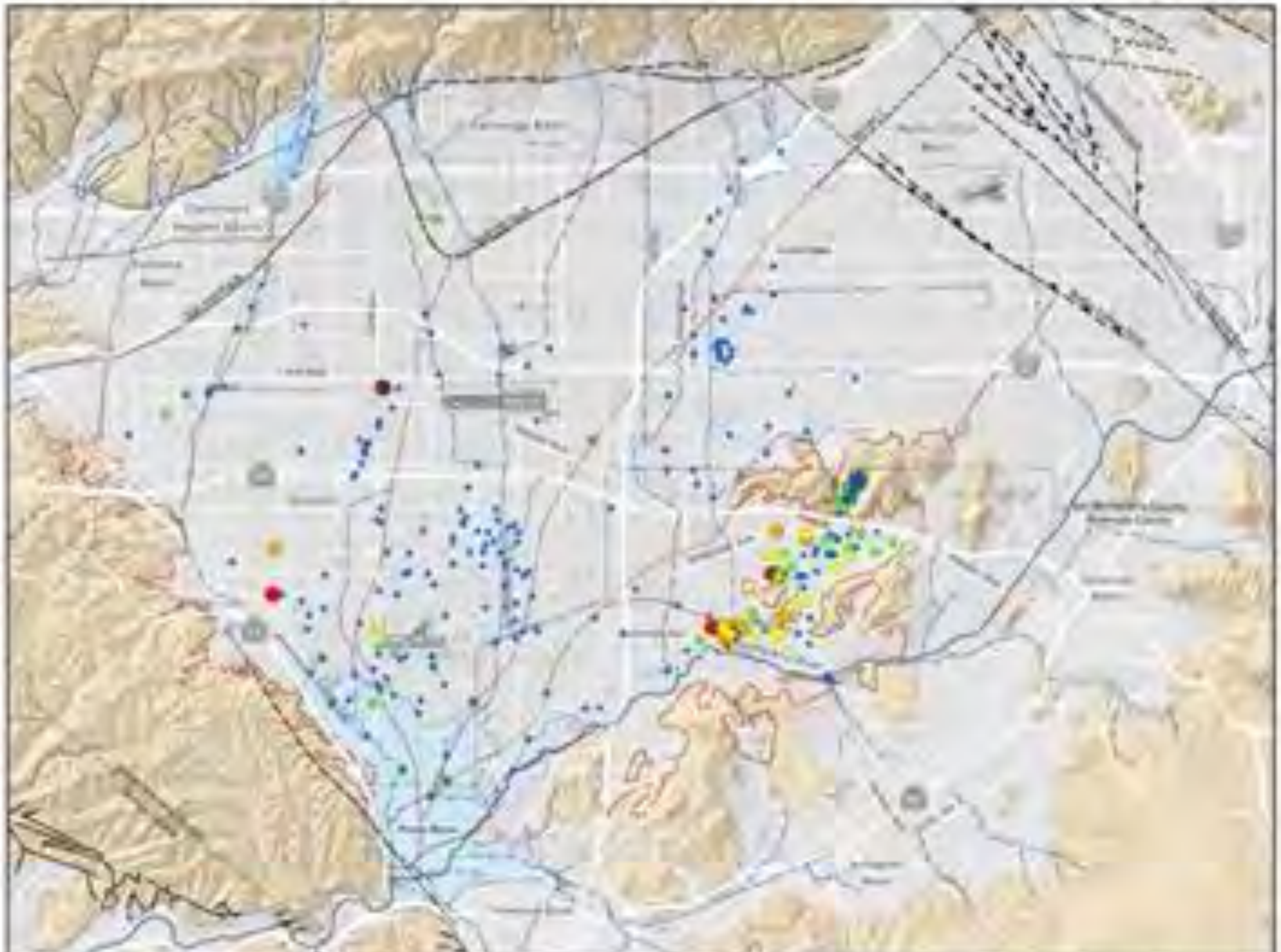
1,2-Dichloroethane (1,2-DCA) in Groundwater
Maximum Concentration (July 2015 to June 2020)

Exhibit 5-6



Arsenic (mg/l)

- ND
- < 0.001
- 0.001 – 0.01
- 0.01 – 0.02
- 0.02 – 0.04
- > 0.04

California Primary MCL = 0.01 mg/l

Other base map features are described in the legend of Exhibit [illegible].

Arsenic is a regulated drinking water contaminant in California with a primary MCL of 0.01 mg/l. Arsenic in groundwater is made up of both natural and anthropogenic sources. Most anthropogenic arsenic contamination derives from manufacturing processes, with significant sources from ore mining operations. Arsenic can naturally derive from bedrock weathering of arsenic-containing rock. Ingestion of arsenic at or near the MCL can pose a risk of cancer. From 2015 to 2020, arsenic was measured at 563 wells in the Chino Basin with 388 (69 percent) of the wells having detectable concentrations ranging from 0.0001 to 20,000 mg/l, with average and median concentrations of 57.81 and 0.0025 mg/l, respectively. 71 wells (13 percent) have a five-year maximum concentration value that exceeds the MCL. Most of the exceedances occur within the general area of point source contamination sites. The monitoring wells associated with the Stringfellow NPL site are the only wells where there are concentrations of arsenic greater than or equal to 1 mg/l. Excluding these wells, the average detectable concentration of arsenic in wells in the Chino Basin is 0.02 mg/l. Higher arsenic concentrations in the City of Chino/Chino Hills area in the southwestern area of the basin occur in the deeper aquifer at depths greater than about 350 ft below ground surface (ft-bgs); these higher arsenic concentrations are thought to be of natural geologic origin.

Data shown on this map is for raw groundwater and is not representative of the drinking water supplies served in the Chino Basin.

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Groundwater Quality

Arsenic in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-7

Benzene (µg/l)

ND

< 0.5

0.5 - 1

[illegible]

[illegible]

> 4

California Primary MCL = 1 µg/l

Other land uses features are described in the legend of Exhibit 1-1.

Benzene is a regulated drinking water contaminant in California with a primary MCL of 1 µg/l. It is a colorless, highly flammable liquid that evaporates quickly into air and dissolves slightly in water. It is found in crude oil and gasoline, but also occurs naturally in volcanic gasses and smoke resulting from forest fires. Benzene in unleaded gasoline is typically only around 1 percent of the total volume, and was originally used as a replacement for lead as a gasoline additive. It is most likely to be released to groundwater from leaking underground fuel storage tanks, fuel spills, and leaks at refineries. Benzene is a known carcinogen. From 2015 to 2020, 1,871 wells in the Chino Basin were sampled for benzene with 236 (13 percent) having detectable concentrations; 84 wells (8 percent) have a five-year maximum concentration exceeding the MCL. The five-year maximum detected concentrations range from 0.15 to 20,000 µg/l, with average and median concentrations of 327.053 µg/l and 2.25 µg/l respectively. Wells with detectable levels of benzene in the Chino Basin occur predominantly in monitoring wells at point source contaminant sites with leaky underground fuel storage tanks.

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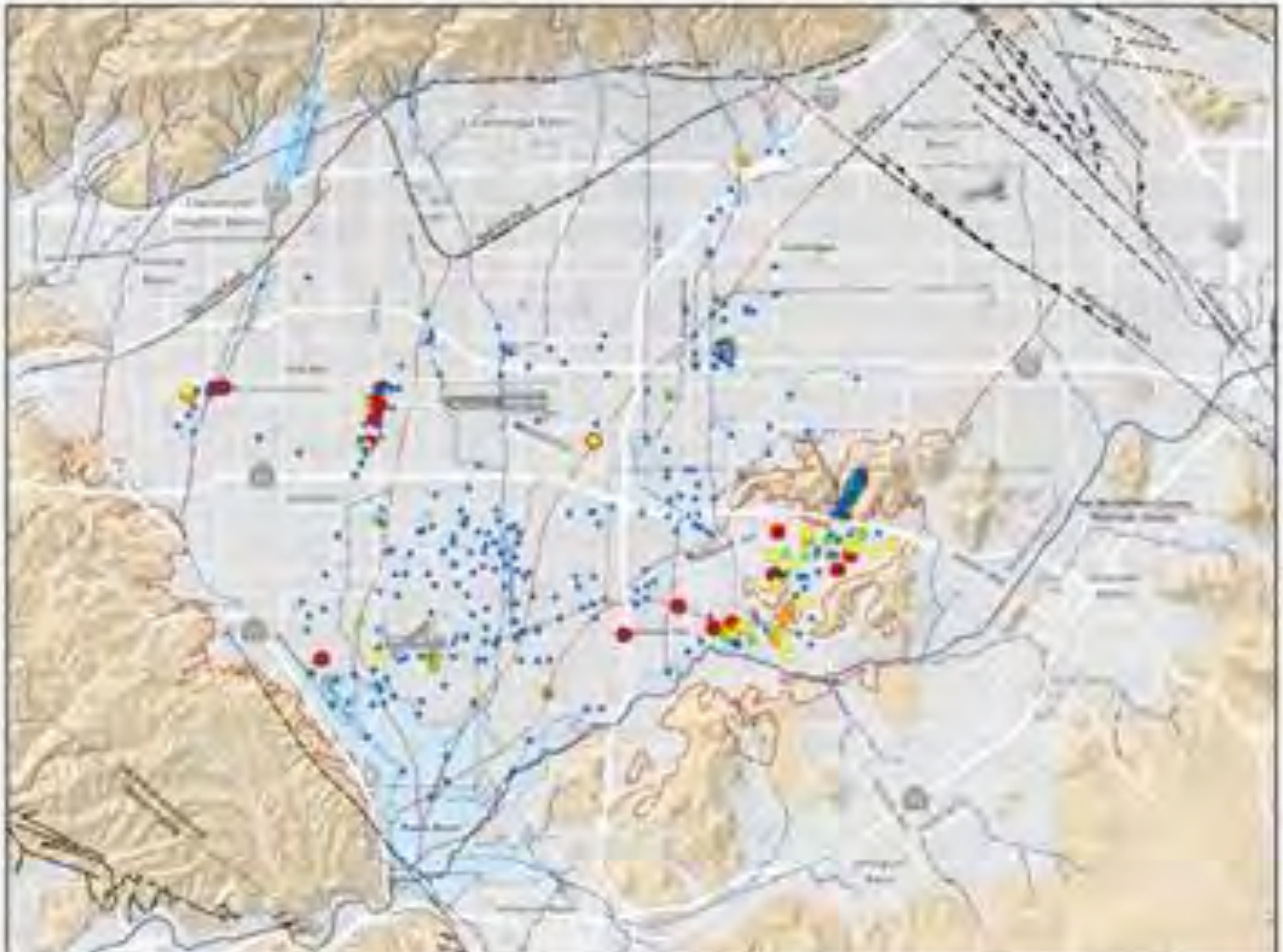
Groundwater Quality

Benzene in Groundwater
Maximum Concentration (July 2015 to June 2020)

Exhibit 5-8



Total Chromium (ug/l)

Other base map features are described in the legend of Exhibit 5-1.

Total Chromium is a regulated drinking water contaminant in California with a primary MCL of 50 ug/l. Total chromium in groundwater consists of trivalent and hexavalent chromium, deriving from both natural and anthropogenic sources. Examples of anthropogenic sources include [illegible], paint pigments, and chrome plating liquid wastes. Most chromium in the environment exists as the trivalent ion; however, under oxidizing conditions, the hexavalent ion may form and dissolve in water (DDW, 2016). While trace amounts of trivalent chromium are required for maintaining human health, hexavalent chromium is a known carcinogen. From 2015 to 2020, total chromium was measured at 745 wells in the Chino Basin with 588 (80 percent) of the wells having detectable concentrations ranging from 0.11 to 3,200,000 ug/l, with average and median concentrations of 11,986.40 and 13 ug/l, respectively. 180 wells (24 percent) have a five-year maximum concentration value that exceeds the MCL. Wells with higher concentrations of total chromium occur predominantly in monitoring wells associated with known point-source contamination sites, for the former Kaiser Steel Mill CCG property, GE Flatiron, and Stringfellow NPL site. Monitoring wells at the Stringfellow NPL site is the only area where there are concentrations of total chromium greater than 8,000 ug/l.

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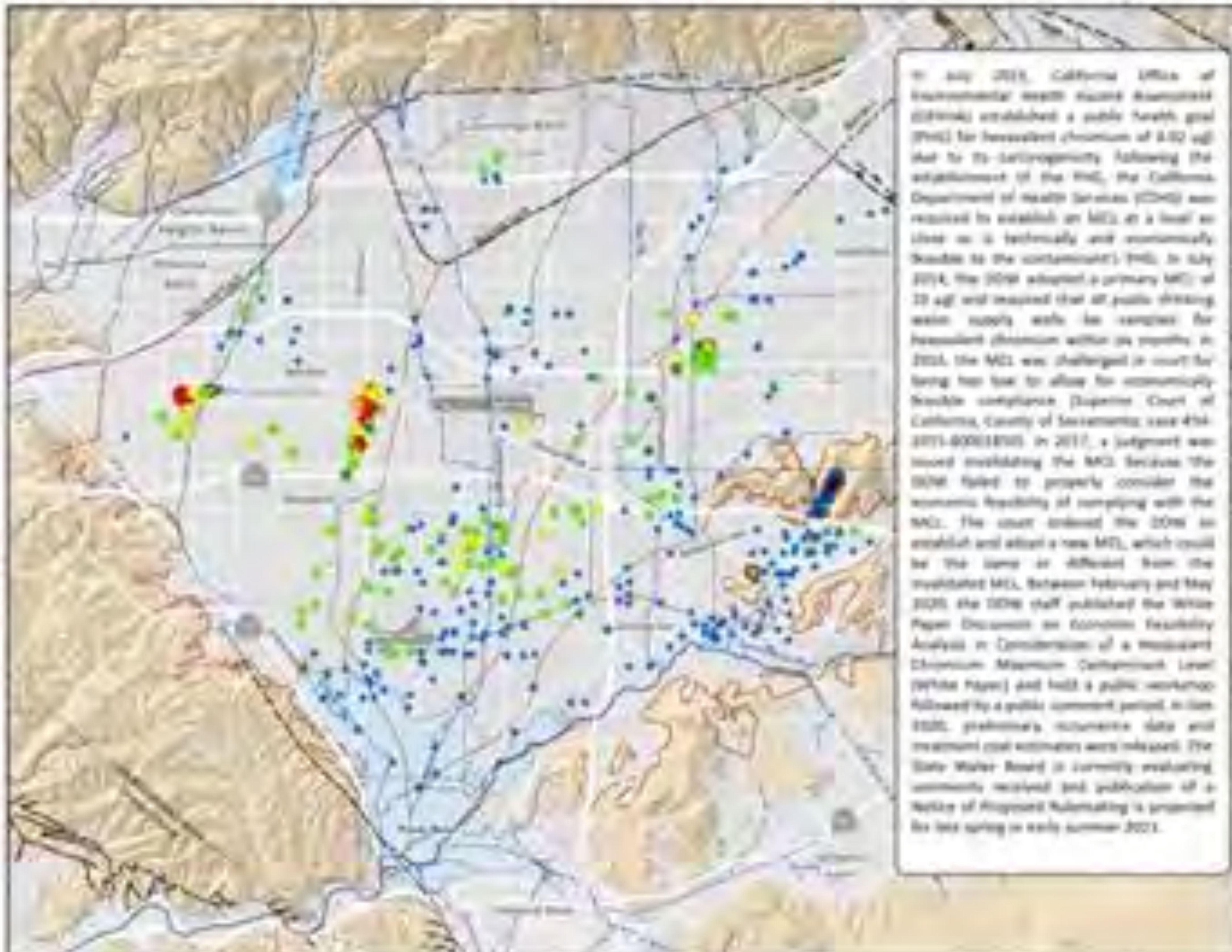
Total Chromium in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-9



In July 2011, California Office of Environmental Health Hazard Assessment (OEHHA) established a public health goal (PHG) for hexavalent chromium of 0.02 ug/l due to its carcinogenicity. Following the establishment of the PHG, the California Department of Health Services (CDHS) was required to establish an MCL at a level as close as is technically and economically feasible to the contaminant's PHG. In July 2014, the DDW adopted a primary MCL of 10 ug/l and required that all public drinking water supply wells be sampled for hexavalent chromium within six months. In 2015, the MCL was challenged in court for being too low to allow for economically feasible compliance (Superior Court of California, County of Sacramento, case #34-2015-80001850). In 2017, a judgment was issued invalidating the MCL because the DDW failed to properly consider the economic feasibility of complying with the MCL. The court ordered the DDW to establish and adopt a new MCL, which could be the same or different from the invalidated MCL. Between February and May 2020, the DDW staff published the White Paper Discussion on Economic Feasibility Analysis in Consideration of a Hexavalent Chromium Maximum Contaminant Level (White Paper) and held a public workshop followed by a public comment period. In late 2020, preliminary occurrence data and treatment cost estimates were released. The State Water Board is currently evaluating comments received and publication of a Notice of Proposed Rulemaking is projected for late spring or early summer 2021.

Hexavalent Chromium (ug/l)

- ND
- < 1
- 1 - 10
- 10 - 20
- 20 - 40
- > 40

2014 California Primary MCL (rescinded in 2017) = 10 ug/l

Other land cover features are described in the legend of Exhibit 1-1.

From 2015 to 2020, hexavalent chromium was measured at 729 wells in the Chino Basin with 617 (85 percent) of the wells having detectable concentrations ranging from 0.02 to 14,000 ug/l with average and median concentrations of 81.39 and 3.30 ug/l, respectively. 107 wells (15 percent) have a five-year maximum concentration value that exceeds the MCL. Wells with higher concentrations of hexavalent chromium occur predominantly in monitoring wells associated with known point-source contamination sites for the former Kaiser Steel Mill (CCX) property, GE Flatiron, and Stringfellow NPL site. Monitoring wells at the Stringfellow NPL site is the only area where there are concentrations of hexavalent chromium greater than 1,200 ug/l.

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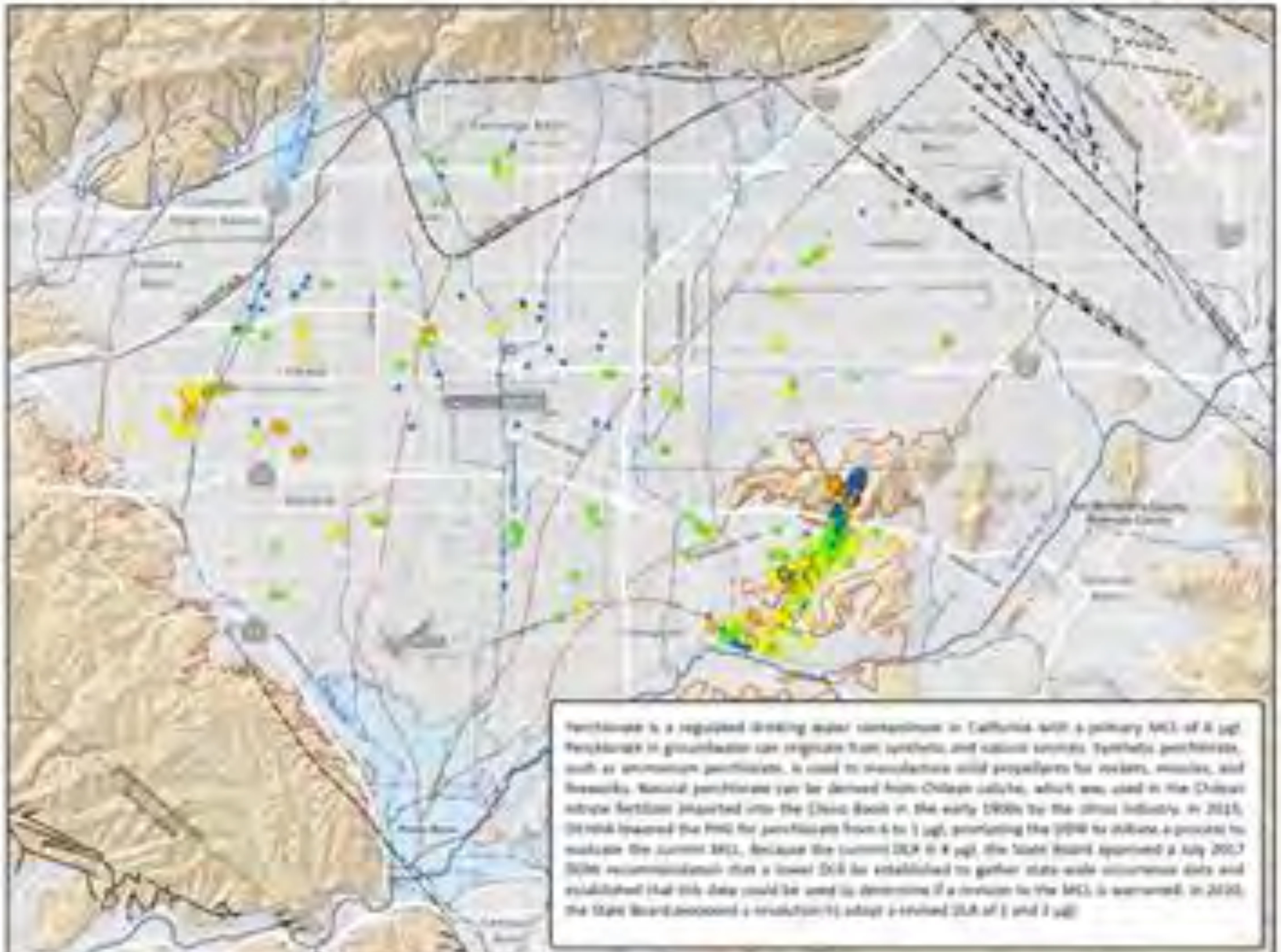
Groundwater Quality

Hexavalent Chromium in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-10



Perchlorate is a regulated drinking water contaminant in California with a primary MCL of 6 µg/L. Perchlorate in groundwater can originate from synthetic and natural sources. Synthetic perchlorate, such as ammonium perchlorate, is used to manufacture solid propellants for rockets, missiles, and fireworks. Natural perchlorate can be derived from Chilean caliche, which was used in the Chilean nitrate fertilizer imported into the Chino Basin in the early 1900s by the citrus industry. In 2015, OEHHA lowered the PHG for perchlorate from 6 to 1 µg/L, prompting the DDW to initiate a process to evaluate the current MCL. Because the current DLR is 4 µg/L, the State Board approved a July 2017 DDW recommendation that a lower DLR be established to gather state-wide occurrence data and established that this data could be used to determine if a revision to the MCL is warranted. In 2020, the State Board proposed a resolution to adopt a revised DLR of 1 and 2 µg/L.

Perchlorate (µg/L)

- ND
- < 3
- 3 - 6
- 6 - 12
- 12 - 24
- > 24

California Primary MCL = 6 µg/L

Other map features are described in the legend of Exhibit 5-1.

From 2015 to 2020, perchlorate was measured at 797 wells in the Chino Basin with 574 (72 percent) of the wells having detectable concentrations ranging from 0.01 to 1,300 µg/L with average and median concentrations of 70.84 and 10.00 µg/L, respectively. 391 (49 percent) have a five-year maximum concentration value that exceeds the MCL. All of the wells with concentrations of perchlorate over 24 µg/L are monitoring wells associated with the Stringfellow NPL site, where a perchlorate plume of synthetic nature extends from the Jurupa Mountains downgradient to Limonite Avenue. A perchlorate isotope investigation performed by Watermaster in 2006 confirmed that most of the perchlorate in the west and central portions of the Chino Basin was derived from Chilean nitrate fertilizer.

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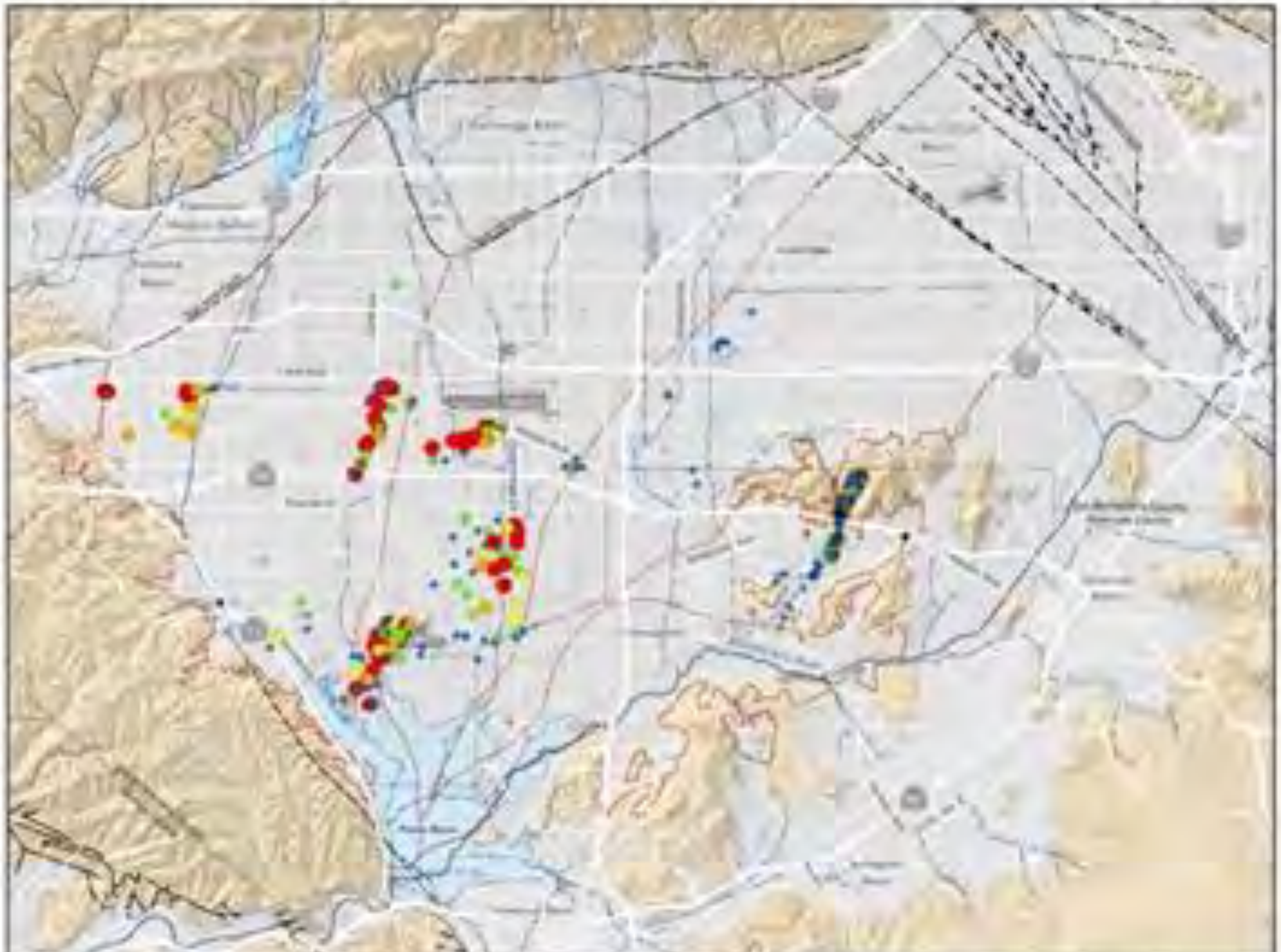
Groundwater Quality

Perchlorate in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-11



TCE (µg/l)

- ND
- < 0.5
- 0.5 – 5
- 5 – 10
- 10 – 20
- > 20

California Primary MCL = 5 µg/l

Other base map features are described in the legend of Exhibit 5-1.

TCE is a regulated drinking water contaminant in California with a Primary MCL of 5 µg/l. TCE, along with PCE, is an industrial solvent that has been widely used as a metal degreaser in the aviation, automotive, and other metal working industries for almost a century. The largest sources of TCE in groundwater are releases from chemical waste sites, improper disposal practices, and leaking storage tanks and pipelines. From 2015 to 2020, 1,029 wells in the Chino Basin were sampled for TCE, with 468 (46 percent) having detectable concentrations ranging from 0.0005 to 330,000 µg/l, with average and median concentrations of 1,730 µg/l and 14 µg/l, respectively. 299 wells (29 percent) have a five-year maximum concentration exceeding the MCL. Wells with concentrations of TCE above the MCL occur predominantly at monitoring wells associated with the following VOC point-source contamination sites: Milliken Landfill, GE Flatiron, GE Test Cell, South Archibald plume, Chino Airport, Pomona, and Stringfellow NPL site. Monitoring wells at the Stringfellow NPL site is the only area where there are concentrations of TCE greater than 15,000 µg/l.

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Groundwater Quality

Trichloroethene (TCE) in Groundwater
Maximum Concentration (July 2015 to June 2020)

Exhibit 5-12

PCE (µg/L)

- ND
- < 2.5
- 2.5 - 5
- 5 - 10
- 10 - 20
- > 20

California Primary MCL = 5 µg/L

Other map features are described in the legend of Exhibit 5-1.

PCE is a regulated drinking water contaminant in California with a Primary MCL of 5 µg/L. Like TCE, PCE is an industrial solvent that has been widely used as a metal degreaser in the aviation, automotive, and other metal working industries. PCE is also commonly used in the dry-cleaning industry and in the production of CFC-113 (Freon-113) and other fluorocarbons. Due to poor handling and disposal practices, PCE has entered the environment through evaporation, leaks, and improper disposal. From 2015 to 2020, 1,919 wells in Chino Basin were sampled for PCE, with 239 (13 percent) having detectable concentrations ranging from 0.1 to 14,000 µg/L with average and median concentrations of 215 µg/L and 3.6 µg/L, respectively. 196 wells (10 percent) have concentrations exceeding the MCL. Wells with concentrations of PCE above the MCL occur predominantly in monitoring wells associated with the following VOC contaminant plumes: Milliken Landfill, Upland Landfill, GE Flatiron, GE Test Cell, Alger Manufacturing Facility, Chino Airport, CIM, Pomona, and Stringfellow NPL site. Monitoring wells at the Stringfellow NPL site is the only area where there are concentrations of PCE greater than 5,000 µg/L.

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Tetrachloroethene (PCE) in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-13

PFOA is an unregulated drinking water contaminant in California with a NL of 5.1 nanograms per liter (ng/l). PFOA is a manmade fluorinated chemical that is part of a larger group of emerging contaminants of concern referred to as per- and polyfluoroalkyl substances (PFAS). PFAS are used to make materials resistant to stains, non-stick, and waterproof, and can be found in products such as non-stick cookware, food packaging, furniture, carpets, and clothing; and also used in aqueous film forming foam (AFFF). PFAS have been found to be persistent in both the environment and human body and are considered toxic, causing developmental and other adverse effects in humans. In 2012, PFOA was included on the EPA's UCMR 3 for sampling nation-wide at select locations using an analytical laboratory method with a DLR of 20 ng/l. Following the UCMR 3 monitoring efforts, the US EPA established a Lifetime Health Advisory Level of 70 ng/l for PFOA and PFOS combined. Soon after, the California DDW adopted this combined 70 ng/l level as the response level (RL), recommending that a public water supply system remove that water source from service or implement treatment. In July 2018, the DDW adopted an NL for PFOA of 14 ng/l, and in August 2019, lowered the NL to 5.1 ng/l.

California NL = 5.1 ng/l

In 2019, the State Water Board began issuing orders for the monitoring of PFAS compounds including PFOA at selected monitoring and public supply wells throughout the state. The sample results collected during or after 2019 provide a more accurate characterization of the occurrence of PFOA, because laboratory analytical methods with a lower DLR below the NL were developed and utilized. From 2015 to 2020, PFOA was measured at 131 wells in the Chino Basin with 51 (39 percent) of the wells having detectable concentrations ranging from 1.7 to 48 ng/l, with average and median concentrations of 12.3 and 7.5 ng/l, respectively. 39 (30 percent) have a five-year maximum concentration value that exceeds the NL. Wells with detectable levels of PFOA are widely distributed across the Chino Basin.

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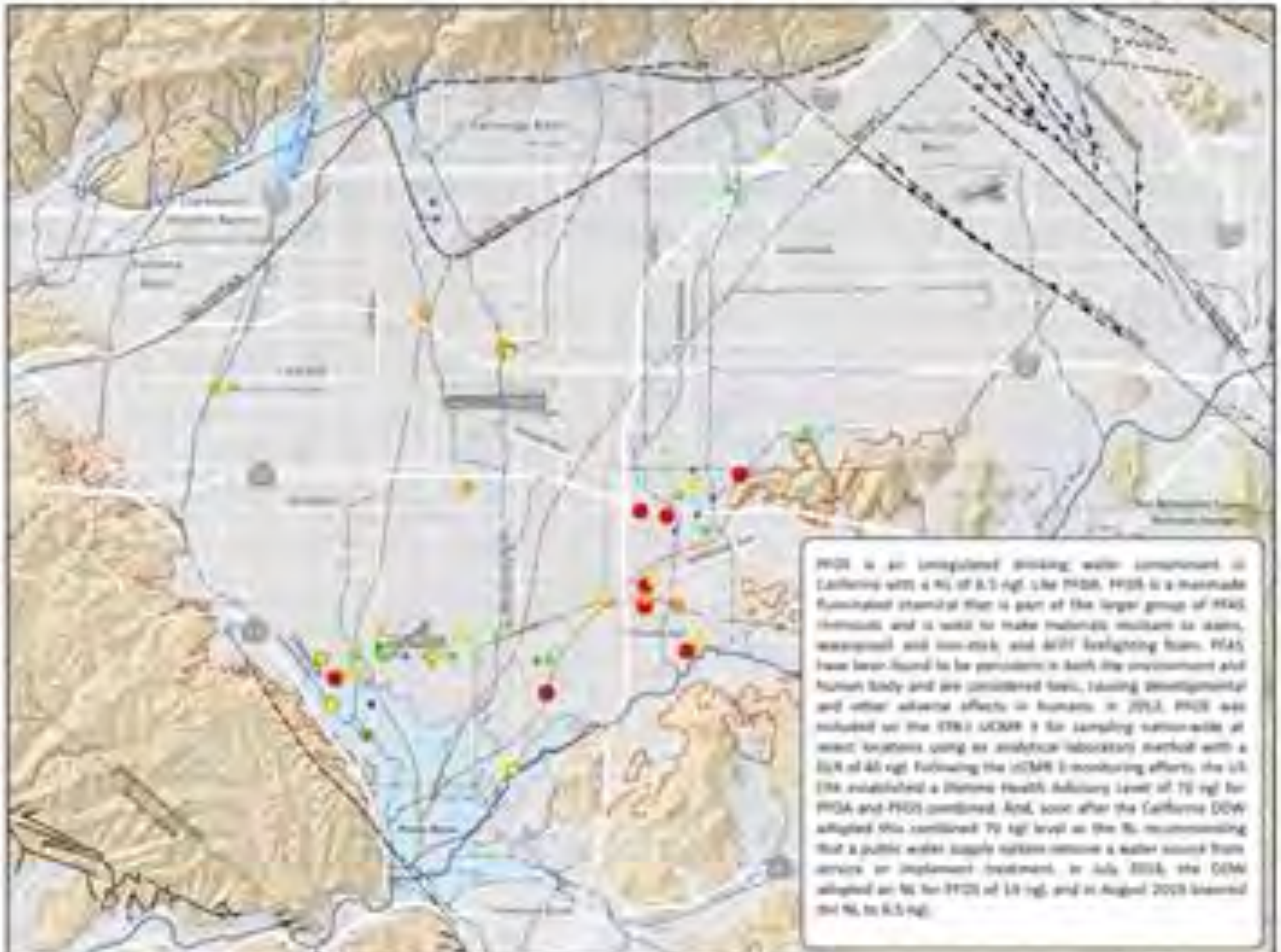
Prepared for: Chino Basin Watermaster, 2020 State of the Basin Report, Groundwater Quality

Perfluorooctanoic Acid (PFOA) in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-24



PFOS (ng/l)

- ND
- < 3.25
- 3.25 - 6.5
- 6.5 - 13
- 13 - 26
- > 26

California NL = 6.5 ng/l

PFOS is an unregulated drinking water contaminant in California with a NL of 6.5 ng/l. Like PFOA, PFOS is a manmade fluorinated chemical that is part of the larger group of PFAS chemicals and is used to make materials resistant to stains, waterproof, and non-stick, and AFFF firefighting foam. PFAS have been found to be persistent in both the environment and human body and are considered toxic, causing developmental and other adverse effects in humans. In 2013, PFOS was included on the EPA's UCMR 3 for sampling nation-wide at select locations using an analytical laboratory method with a DLR of 40 ng/l. Following the UCMR 3 monitoring efforts, the US EPA established a Lifetime Health Advisory Level of 70 ng/l for PFOA and PFOS combined. And, soon after the California DDW adopted this combined 70 ng/l level as the RL recommending that a public water supply system remove a water source from service or implement treatment. In July 2018, the DDW adopted an NL for PFOS of 13 ng/l, and in August 2019 lowered the NL to 6.5 ng/l.

In 2019, the State Water Board began issuing orders for the monitoring of PFAS compounds, including PFOS at selected monitoring and public supply wells throughout the state. The sample results collected during or after 2019 provide a more accurate characterization of the occurrence of PFOS, because laboratory analytical methods were developed and utilized with a lower DLR below the NL. From 2015 to 2020, PFOS was measured at 131 wells in the Chino Basin with 55 wells (42 percent) of the wells having detectable concentrations ranging from 1.7 to 250 ng/l, with average and median concentrations of 15.6 and 8.5 ng/l, respectively. 33 (25 percent) have a five-year maximum concentration value that exceeds the NL. Wells with detectable levels of PFOS are widely distributed across the Basin.

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Groundwater Quality

Perfluorooctane Sulfonic Acid (PFOS) in Groundwater
Maximum Concentration (July 2015 to June 2020)

Exhibit 5-25

1,4-dioxane is an unregulated drinking water contaminant in California with a NL of 1 µg/L. 1,4-dioxane is a manmade industrial solvent commonly used as a stabilizer for other solvents, specifically 1,1,1-trichloroethane (1,1,1-TCA). 1,4-dioxane does not require routine monitoring but is considered an emerging drinking water contaminant and is a known carcinogen. In 1998, a California NL of 3 µg/L was set for 1,4-dioxane. In 2010, the California NL was lowered to 1 µg/L. In January 2019, the DDW requested that OEHHA establish a PHG for 1,4-dioxane as the first step for developing a MCL in California.

1,4-Dioxane (µg/L)

- ND
- < 0.5
- 0.5 - 1
- 1 - 2
- 2 - 4
- > 4

California NL = 1 µg/L

DLR greater than the CA NL of 1 µg/L

Other key map features are described in the legend of Exhibit 5.1.

The recommended DLR for laboratory analytical methods is 1 µg/L which is equivalent to the NL. However, there are some methods that can test for low levels. 1,4-dioxane is not commonly monitored for in the Chino Basin and when monitoring is performed, it is not always done using laboratory methods with the DLR of 1 µg/L or lower. From 2015-2020, 323 wells were sampled for 1,4-dioxane. This is about 27 percent of all the wells in the Chino Basin that are sampled for water quality analyses. Of the 323 wells sampled for 1,4-dioxane, 140 wells (43 percent) had detected concentrations. The five-year maximum concentrations range from 0.1 to 290 µg/L with an average and median concentrations of 17.1 µg/L and 0.8 µg/L. 68 wells (21 percent) have a five-year maximum concentration that exceeds the NL. Most of the wells sampled for 1,4-dioxane during the last five years in the Chino Basin are monitoring wells associated with the Stringfellow NPL site. About 75 percent of the actively sampled wells have not been analyzed for 1,4-dioxane in the last five years or analyzed using laboratory methods with DLRs equivalent to or below the NL of 1 µg/L. Thus, there is paucity in the characterization of 1,4-dioxane in the Chino Basin and its occurrence is not well known as the DDW moves towards developing an MCL.

Data shown on this map is for raw groundwater and is not representative of the drinking water supplied served in the Chino Basin.

Prepared by:

WEST YOST
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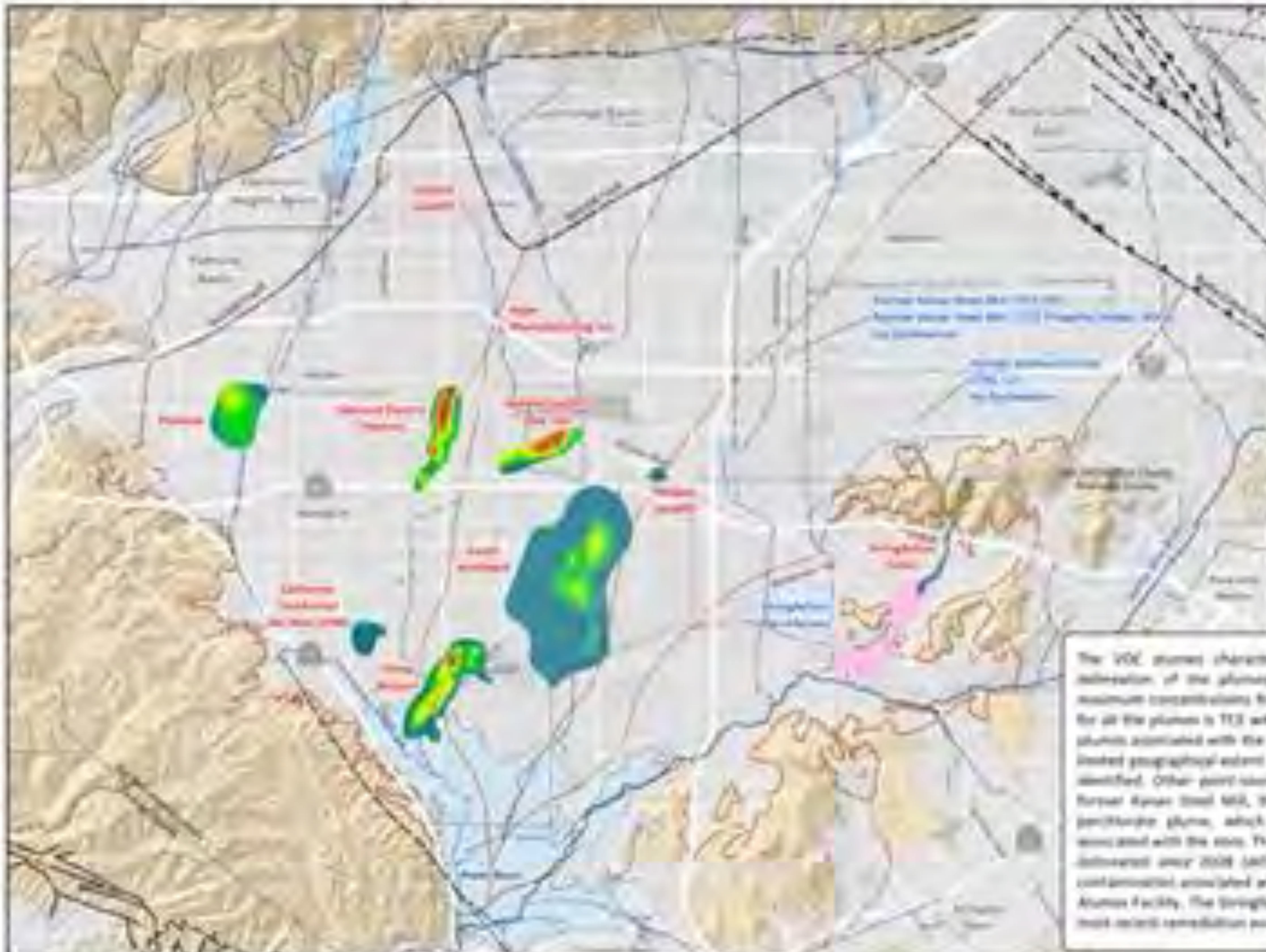
Prepared for:

Chino Basin Watermaster
2020 State of the Basin Report
Groundwater Quality

1,4-Dioxane in Groundwater

Maximum Concentration (July 2015 to June 2020)

Exhibit 5-16



Other key map features are described in the legend of Exhibit 1-1.

The VOC plumes shown on this map are generalized illustrations of the estimated spatial extent of TCE or PCE, based on the maximum concentration measured at wells from July 2015 to June 2020. The estimated spatial distribution of VOC concentrations were generated by an ordinary kriging method performed using PyKrige, a kriging toolkit for Python. The experimental semivariograms were approximated using a spherical semivariogram whose parameters (range, sill and nugget) and anisotropy (ratio and angle) were chosen through trial and error, taking into account local groundwater flow directions predicted by the Chino Basin groundwater flow model. The plume extents were determined based on measured concentrations and local groundwater flow patterns.

The VOC plumes characterized by color ramp are Watermaster's most recent delineation of the plumes for the primary contaminant based on the five-year maximum concentrations from July 2015 to June 2020. The primary VOC contaminant for all the plumes is TCE with the exception of the CIM plume, which is PCE. The VOC plumes associated with the Upland Landfill and the Alger Manufacturing Facility are of limited geographical extent at the scale of this map, so only their general locations are identified. Other point-source contamination plumes in the Chino Basin include the former Kaiser Steel Mill, the former Alumax Facility, and the Stringfellow NPL Site perchlorate plume, which are labeled by name and the primary contaminants associated with the sites. The former Kaiser Steel Mill TDS and TOC plume has not been delineated since 2008 (WEI, 2008b), and there are no plume delineations for the contamination associated with the former Kaiser Steel Mill CCG Property or the former Alumax Facility. The Stringfellow perchlorate plume shown here was delineated in the most recent remediation evaluation report for the site (Kleinfelder, 2019).

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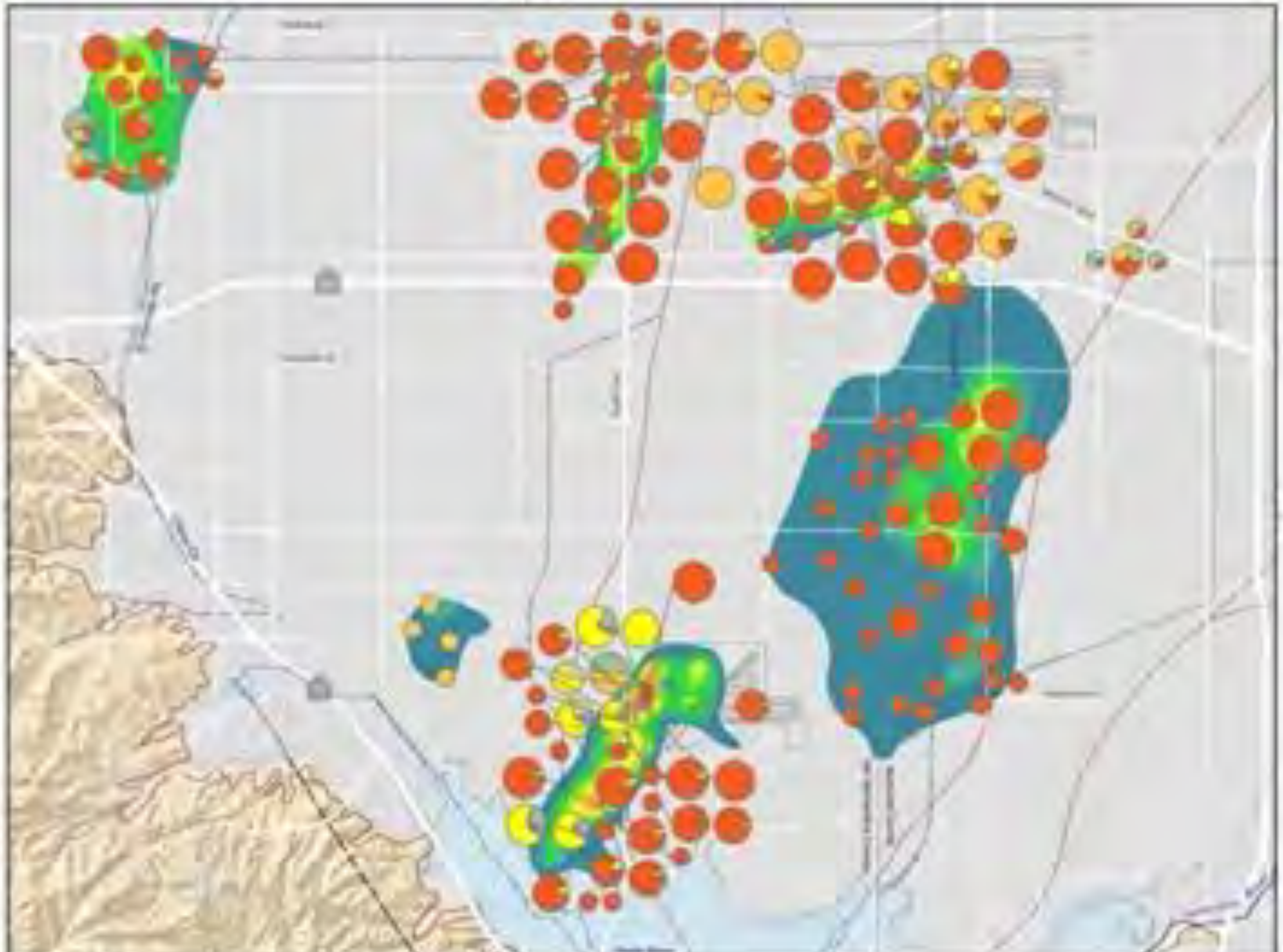
Delineation of Groundwater Contamination
Plumes and Point Sources of Concern

Exhibit 5-17



Percent of Detectable TCE, PCE, and their Degradation By-Products During the Last Sample Event

- 1,1,1-Trichloroethane
- 1,1-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloroethane
- cis-1,2-Dichloroethene
- Tetrachloroethene (PCE)
- trans-1,2-Dichloroethene
- Trichloroethene (TCE)
- Vinyl Chloride

Sample Size
(Based on the Sum of TCE, PCE, and their Degradation By-Products)
(µg/L)

- 0.05 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- > 50

Well with Non-Detect Results for VOCs During Last Sample Event

Other key map features are described in the legend of Exhibit 1-1.

These composition pie charts show the relative percentages of VOCs measured at wells within each of the VOC plumes shown in Exhibit 5-17. The data used to create the charts are based on the results from the most recent sampling event over the five-year period of July 2015 to June 2020. The chemical differentiation of these plumes can be understood by comparing the proportions of TCE, PCE, and their breakdown by-products. For example, the Milliken Landfill plume and the GE Test Cell plume directly south of the Ontario Airport have significant concentrations of both TCE and PCE, as well as the presence of breakdown products, whereas the South Archibald plume is predominantly comprised of TCE. This demonstrates that there is no intermingling of these plumes.

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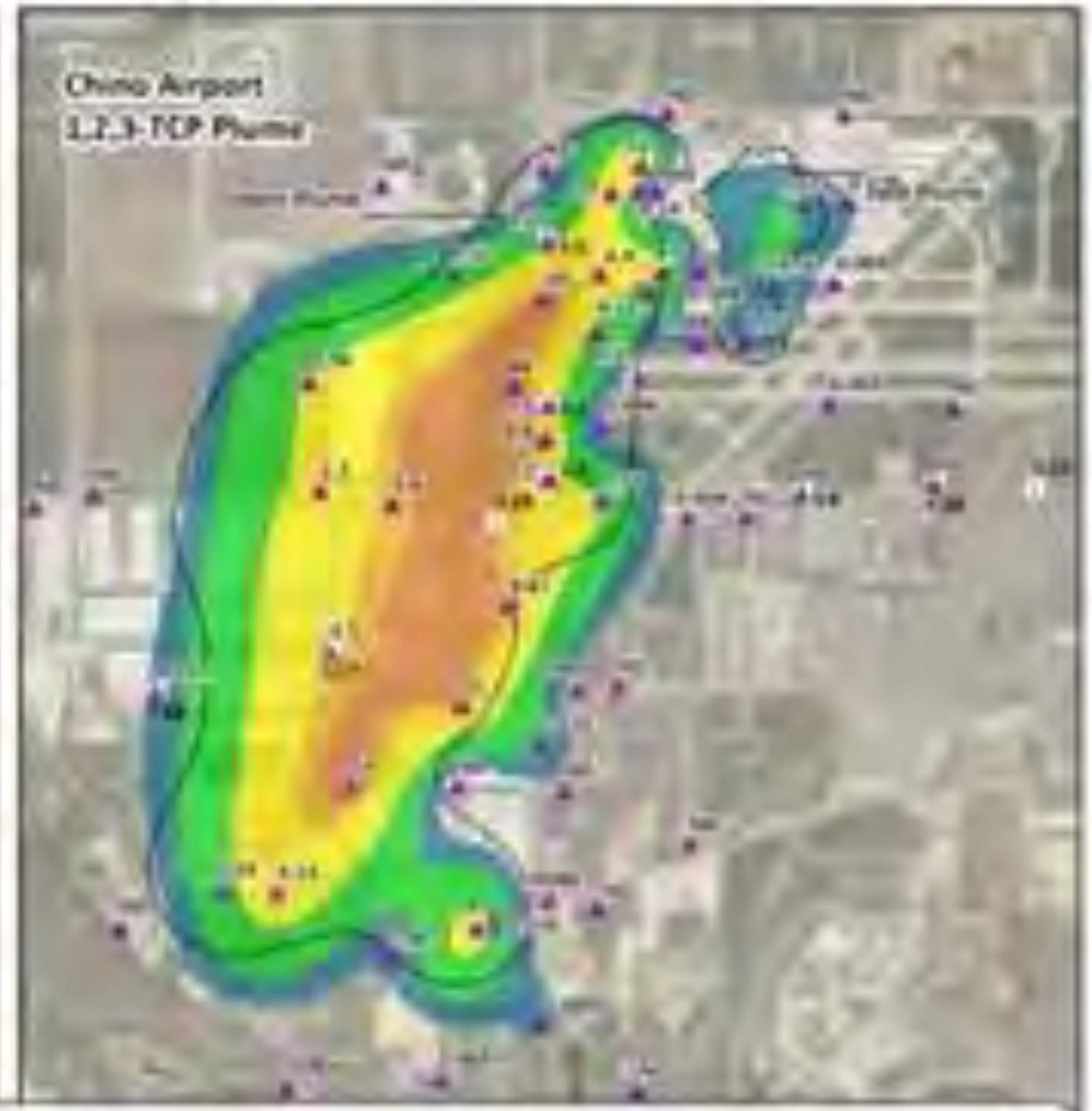
VOC Composition Charts
Wells Within and Adjacent to VOC Plumes

Exhibit 5-18



TCE Concentration (µg/l)

- > 0 to ≤ 5
- > 5 to ≤ 10
- > 10 to ≤ 25
- > 25 to ≤ 50
- > 50 to ≤ 100
- > 100 to ≤ 200
- > 200 to ≤ 500
- > 500

TCE MCL = 5 µg/l

1,2,3-TCP Concentration (µg/l)

- > 0.005 to ≤ 0.05
- > 0.05 to ≤ 1
- > 1 to ≤ 5
- > 5 to ≤ 10
- > 10 to ≤ 100

1,2,3-TCP MCL = 0.005 µg/l

The VOC plumes shown in this exhibit are generalized illustrations of the estimated spatial extent of TCE and 1,2,3-TCP based on the maximum concentration over the five-year period from July 2015 to June 2020. The estimated spatial distribution of the plume concentrations were generated using the same method as the plumes for Exhibit 5-27, using an ordinary kriging method performed using Pykrige, a kriging toolkit for Python.

Wells Labeled by Maximum TCE or 1,2,3-TCP Concentration (µg/l) for July 2015 to June 2020

Chino Airport Well

Approximate Extent of TCE (5 µg/l) or 1,2,3-TCP (0.005 µg/l) Plumes as Delineated by the County of San Bernardino Using Data in 2020

TCE and 1,2,3-TCP are the primary contaminants associated with the Chino Airport plume. Since 2015, the County of San Bernardino Department of Airports (County) has characterized West and East Plumes, originating from two different source areas at the Chino Airport. The extent of the West Plume is greater than the East Plume, and the TCE and 1,2,3-TCP concentrations are higher. The West and East TCE plumes are comingled, whereas the West and East 1,2,3-TCP plumes are delineated as two distinct plumes. The County prepared its most recent characterization of the TCE and 1,2,3-TCP plumes in 2020 (Tetra Tech, 2020b), which are shown here compared to Watermaster's delineation of the plumes.

The Chino Airport TCE and 1,2,3-TCP plumes are located in the southwestern portion of the Chino Basin within the City of Chino. The County is identified as the responsible party for the Chino Airport plumes. Since the discovery of the plume, the Regional Board has issued cleanup and abatement orders 90-134, R8-2008-0064, and R8-2017-0011, ordering the County to characterize the extent of the plume on and offsite, and prepare a feasibility study and remedial action plan. Since 2003, the County has constructed a total of 88 monitoring wells and conducted extensive investigations to characterize the soil and groundwater contamination on and offsite. The County submitted a final feasibility study for the Chino Airport in May 2017 and a final interim remedial action plan (IRAP) in May 2020, which was approved by the Regional Board in November 2020 (Tetra Tech, 2017; 2020a). The remedial action includes institutional controls, monitored natural attenuation, and a groundwater pump-and-treat system, which will consist of two extraction well sites constructed by the County and the existing CDA wells I-16, I-17, I-18, and potentially I-20 and I-21. The extracted groundwater will be treated using carbon adsorption at the County's VOC treatment system at CDA Desalter Plant No. 1.

Watermaster collects groundwater-quality samples from private wells in the plume area and at its HCMP-4 monitoring well. Additionally, the CDA collects groundwater-quality samples from its production wells. Watermaster uses data from the County, CDA, and its own sampling to perform an independent characterization of the areal extent and concentration of the TCE and 1,2,3-TCP plumes every two years for the State of the Basin Report. Watermaster's 2020 plume characterizations are based on the maximum concentrations measured at wells from July 2015 to June 2020.

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Groundwater Quality

Chino Airport TCE and 1,2,3-TCP Plumes

Exhibit 5-19

The South Archibald TCE plume is located in the southern Chino Basin within the City of Ontario. In the mid-1980s, when Metropolitan sampled wells south of the Ontario International Airport (OIA) as part of the Chino Basin Storage Program, they found TCE in several private wells (Metropolitan et al., 1987). The Regional Board confirmed the presence of TCE with subsequent rounds of sampling and identified activities at OIA as likely sources of TCE. In 2005, the Regional Board issued Draft Cleanup and Abatement Orders (CAOs) to six different parties who were tenants on the OIA property. On a voluntary basis, four of the six parties (Aerojet, Boeing, GE, and Lockheed Martin; collectively the ABGL parties) worked together along with the U.S. Department of Defense, to investigate the source of contamination. The investigation included collecting water-quality samples from private wells and taps at residences, as well as constructing and sampling four triple-nested monitoring wells. Alternative water supplies were provided at private residences in the area where groundwater was contaminated.

In 2008, Regional Board staff identified discharges of wastewater to both the RP-1 treatment plant and the associated disposal areas as potential sources of TCE. The Regional Board identified several industries, including some previously identified tenants of the OIA property, that likely used TCE solvents in the past and discharged wastes to the Cities of Ontario and Upland sewage systems tributary to the RP-1 treatment plant and disposal areas. In 2012, the RWQCB issued an additional Draft CAO to the City of Ontario, City of Upland, and IEUA as the previous and current operators of the RP-1 treatment plant and disposal area (collectively the RP-1 parties). Under the Regional Board's oversight from 2007 to 2014, the ABGL parties and the RP-1 parties conducted sampling at private residential wells and taps approximately every two years.

In November 2015, the RP-1 Parties completed a draft feasibility study and remedial action plan. The preferred groundwater remediation alternative identified in the remedial action plan was a pump-and-treat system using air-stripping to remove TCE and other VOCs. The system will rely on the use of existing CDA production wells and treatment facilities, as well as three newly constructed CDA production wells and a dedicated pipeline to convey water to the Desalter 1 treatment facility. The preferred domestic water supply alternative identified in the remedial action plan includes the installation of [illegible] systems, where water is delivered from the City of Ontario potable supply, and the installation of a pipeline to connect some residences to the City of Ontario potable water system.

In September 2016, the Regional Board issued the Final Stipulated Settlement and CAO R8-2016-0016 (Stipulated CAO) collectively to the RP-1 parties and the ABGL parties (including Northrop Grumman). The Stipulated CAO was adopted by all parties in November 2016, thus approving the preferred plume remediation and domestic water supply alternatives identified in the remedial action plan. The parties also reached a settlement agreement that aligned with the Final CAO and authorized funding to initiate implementation of the plume remediation alternative. Pumping began at two of the new CDA wells (II-10 and II-11) in 2018, and construction was completed of the third well (II-12) in 2020. The equipping of Well II-12 and construction of the dedicated raw water pipeline is underway and is estimated for completion by the end of June 2021.

TCE Concentration (µg/L)

- > 0 to ≤ 5
- > 5 to ≤ 10
- > 10 to ≤ 20
- > 20 to ≤ 50
- > 50 to ≤ 100
- > 100 to ≤ 200
- > 200 to ≤ 500
- > 500

TCE MCL = 5 µg/L

The VOC plume shown in this exhibit is a generalized illustration of the estimated spatial extent of TCE based on the maximum concentrations over the five-year period from July 2015 to June 2020. The estimated spatial distribution of the plume concentrations was generated using the same method as the plumes for Exhibit 5-17, using an ordinary kriging method performed using PyKrige, a kriging toolkit for Python.

Wells Labeled by Maximum TCE Concentration (µg/L) From July 2015 to June 2020

[illegible]

Chino Desalter Well

No data exist in the southern portion of the plume for the analysis period, and the approximate location of the spatial extent and TCE concentrations in the southern portion of the plume is unknown.

The Cities of Ontario and Upland are responsible for conducting ongoing monitoring and submitting an annual monitoring report to the Regional Board pursuant to the CAO. The CDA and IEUA will begin implementing a monitoring plan in 2021 pursuant to the Proposition 1 Grant Agreement for the CDA expansion for groundwater cleanup. This monitoring plan includes the construction of two new monitoring wells in the plume. Additionally, Watermaster routinely collects and analyzes samples from active private wells in and around the plume and uses the available data to delineate the TCE plume every two years. This 2020 plume characterization is based on the maximum TCE concentrations measured at wells from July 2015 to June 2020. Watermaster works closely with the Regional Board, the responsible parties, and other stakeholders in providing the available information to assist in the investigation and provides semi-annual updates to the Watermaster Board on the status of the investigation and remediation.

Prepared by: WEST YOST Water Engineers

Prepared for: Chino Basin Watermaster, 2020 State of the Basin Report, Groundwater Quality

South Archibald TCE Plume

Exhibit 5-20

The GE Flatiron TCE plume is in the central Chino Basin within the City of Ontario. GE manufactured clothes irons at the Flatiron facility from the early 1900s to 1982. In 1987, TCE and chromium were detected above drinking water standards at a municipal supply well downgradient from the site. A Phase I investigation performed by GE confirmed that the former facility was the source of contamination. The Regional Board issued Investigation Order No. 87-[illegible] which required GE to further characterize on-site conditions and groundwater flow patterns. Following the onsite characterization, Phases II-[illegible] of the investigation required extensive sampling to define the extent of contaminants in groundwater both on and offsite. In the end, these investigations revealed a contaminant plume beneath and downgradient of the former Flatiron facility. An interim remedial measure was proposed in 1991, which prescribed a pump-and-treat program using an ion exchange resin and liquid-phase granular activated carbon to remove TCE, chromium, and other VOCs in groundwater. In 1996, GE began operation of the first extraction well (EW-01) at the leading edge of the plume. In 2011, GE began operation of an additional extraction well (EW-02), located in the center of the plume. Groundwater from the extraction wells was treated at GE Flatiron's groundwater treatment system and discharged to the Ely Basins. In 2005, the Ely Basins became fully dedicated to the recharge of storm water, recycled water, and imported water for Watermaster and IEUA's long-term recharge plan, and the treated effluent could no longer be discharged into the Ely Basins. As an alternative, three injection wells (IW-01, IW-02, and IW-03) and conveyance pipelines were installed in July 2013.

In 2016 and 2017, under the Regional Board's direction, GE constructed two new monitoring well clusters downgradient of the known plume extent. Monitoring of these new wells indicated that the plume extended another 0.5 miles downgradient from EW-01. Additionally, in 2016 and 2017, GE constructed four new monitoring well clusters in the upgradient end of the plume. High concentrations of TCE, PCE, total chromium, and hexavalent chromium have been detected at several of the wells, and the highest concentration of TCE ever measured in the GE Flatiron plume (12,000 µg/l) was at one of these wells in 2020.

Currently, GE performs quarterly monitoring of groundwater levels and groundwater quality at 11 monitoring wells onsite, and monthly monitoring of groundwater quality at the two extraction wells. Watermaster routinely compiles the data from the GE monitoring wells and uses them to independently delineate the spatial extent of the TCE plume every two years. This 2020 plume characterization is based on the maximum TCE concentrations measured at wells from July 2015 to June 2020. Watermaster provides annual updates to the Watermaster Board on the status of the investigation and remediation of these wells.

TCE Concentration (µg/l)

- > 0 to ≤ 5
- > 5 to ≤ 10
- > 10 to ≤ 20
- > 20 to ≤ 50
- > 50 to ≤ 100
- > 100 to ≤ 200
- > 200 to ≤ 500
- > 500

TCE MCL = 5 µg/l

The VOC plume shown in this exhibit is a generalized illustration of the estimated spatial extent of TCE based on the maximum concentration over the five-year period from July 2015 to June 2020. The estimated spatial distribution of the plume concentrations was generated using the same method as the plumes for Exhibit 5-17, using an ordinary kriging method performed using PyKrige, a kriging toolkit for Python.

Wells Labeled by Maximum TCE Concentration (µg/l) from July 2015 to June 2020

ND = TCE was Not Detected in samples from July 2015 to June 2020

GE Extraction Well

Prepared by:

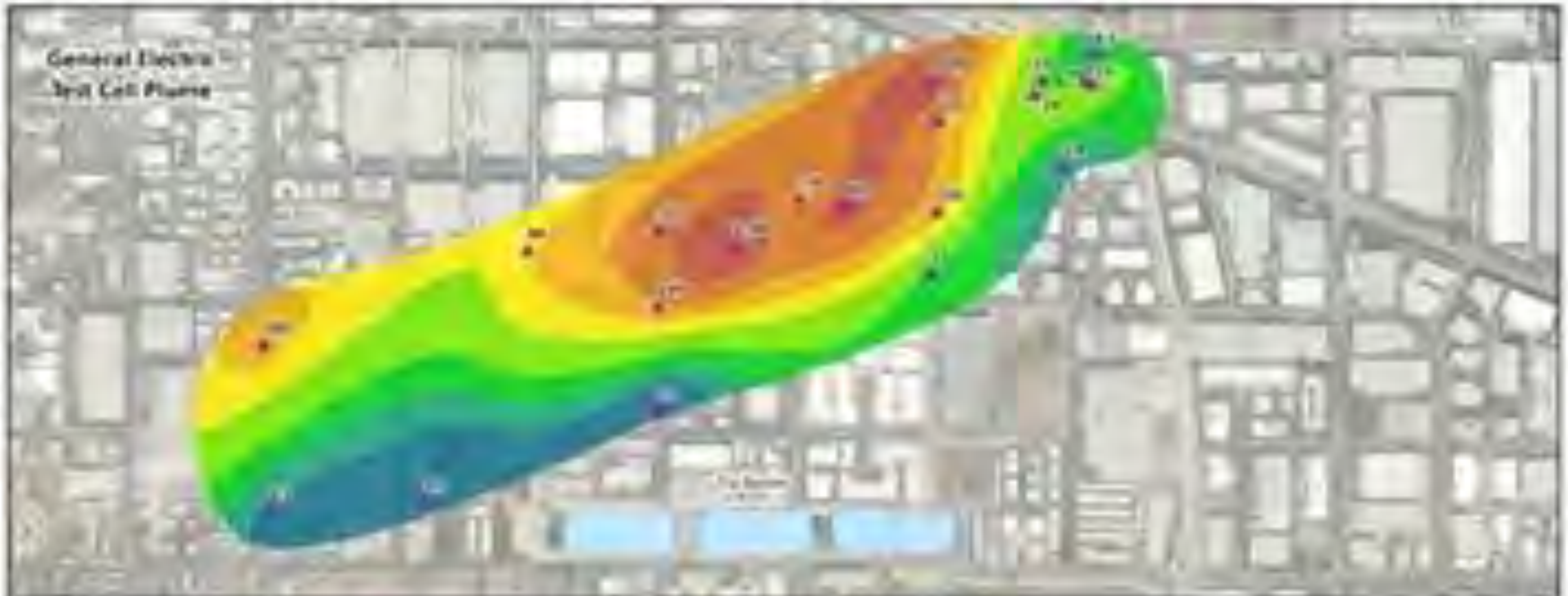
WEST YOST
Water Engineers

Prepared for:

Chino Basin Watermaster
2020 State of the Basin Report
Groundwater Quality

General Electric Flatiron TCE Plume

Exhibit 5-21



TCE Concentration (µg/l)

- > 0 to ≤ 5
- > 5 to ≤ 10
- > 10 to ≤ 20
- > 20 to ≤ 50
- > 50 to ≤ 100
- > 100 to ≤ 200
- > 200 to ≤ 500
- > 500

TCE MCL = 5 µg/l

The VOC plume shown in this exhibit is a generalized illustration of the estimated spatial extent of TCE based on the maximum concentration over the five-year period from July 2015 to June 2020. The estimated spatial distribution of the plume concentrations was generated using the same method as the plumes for Exhibit 5-17, using an ordinary kriging method performed using PyKrige, a kriging toolkit for Python.

Wells Labeled by Maximum TCE Concentration (µg/l) from July 2015 to June 2020
ND = TCE was Non-Detect in Samples from July 2015 to June 2020

The GE Test Cell plume is located in the central Chino Basin within the City of Ontario, south of the OIA. From 1956 to 2011 the GE Test Cell facility was predominately used to test and maintain commercial and military aircraft engines. Solvents used at the facility included TCE, PCE, 1,1,1-TCA, methyl ethyl ketone, and isopropyl alcohol. From 1956 to 1974, wastewater with residual solvents was diverted to below ground separators where it was recycled. Beginning in 1974, wastewater was disposed of directly to the separators via onsite dry wells. In 2006, GE stopped discharging wastewater underground, instead storing it in above-ground storage tanks to transport offsite for treatment and disposal. The Test Cell facility ceased operation in 2011, and the site is currently vacant.

In 1984, following the discovery of VOCs in the soil near the disposal sites, GE and the DTSC signed Consent Order 88/89-009 to initiate the investigation of soil, surface water, and groundwater contamination. From 1991 to 1995, 21 monitoring wells were constructed both on and offsite. These wells showed that the VOC plume extended about 4,000 feet offsite. Between 1996 and the early 2000s, GE constructed eight multi-depth well clusters on and offsite. Data collected from these wells provided information on the vertical distribution of VOCs, indicating that TCE concentrations were highest in the intermediate and deep interval zones.

In 2001, GE submitted a groundwater feasibility study to the Regional Board and in 2006 they submitted a draft remedial action plan (RAP). The RAP identified two groundwater remediation alternatives: (1) extraction and treatment of groundwater for areas that have VOC concentrations approximately ten times the MCL and (2) monitored natural attenuation of groundwater for areas that have VOC concentrations less than ten times the MCL. It was determined that both alternatives would likely decrease TCE concentrations to equal to or less than the MCL within 50 years. In 2010, GE replaced the RAP with a new RAP for monitored natural attenuation only. The new RAP was approved with the condition that GE would install additional monitoring wells. As of 2020, monitored natural attenuation is still the only remedial action that has been implemented. In May 2015 the DTSC transferred regulatory oversight to the Regional Board. Following this, the Regional Board requested GE prepare a Conceptual Site Model to aid in determining the appropriate remedial action. The findings in the 2019 Conceptual Site Model showed: TCE concentrations have decreased one to two orders of magnitude near the source area and have remained below the MCL in the most downgradient wells; the groundwater plume is predicted to remain stable in the future; the plume has shifted slightly to the north, likely due to recharge at the Ely Basins; and that increases in TCE concentrations found at monitoring wells in the central portion of the plume indicate that TCE contamination is likely due to an offsite source.

Currently, GE performs quarterly monitoring of groundwater levels and groundwater quality at 11 single casing monitoring wells, 17 multi-nested monitoring wells, and seven piezometers. Watermaster routinely compiles the data from the GE monitoring wells and uses them to independently delineate the spatial extent of the TCE plume every two years. Watermaster's 2020 plume characterization is based on the maximum TCE concentrations measured at wells from July 2015 to June 2020. Watermaster also provides annual updates to the Watermaster Board on the status of the investigation and remediation of the wells.

GeoTracker and EnviroStor Sites

Site Status (Symbol)

- Open Case
- Closed Case

Contaminated Media (Color)

- Groundwater (potential or confirmed)
- No Media Established, but Potential Impacts to Groundwater Quality Identified

VOC Plumes Delineated in 2020
- Labeled in Purple by Name

Other Plumes*
- Labeled in Blue by Name and Dominant Contaminant

* Plumes that are too small to be shown on this map, or are not delineated, are labeled with a line indicating the general location of the point source site.

Other base map features are described in the legend of Exhibit 5-1.

Watermaster performs a review of the GeoTracker and EnviroStor databases to identify all sites in the Chino Basin that have the potential to impact groundwater quality. As of 2020, a total of 880 sites with contaminated media were identified in the Chino Basin. The sites are categorized by site status (open or closed case) and the contaminated media (groundwater, soil, air, or not identified). Of the 880 sites, 290 were identified as having the potential to impact groundwater quality. Since 2018, three new sites have been identified with the potential to impact groundwater quality. Fifty-four of the 290 sites with the potential to impact groundwater quality are open cases, and 237 are closed cases. Watermaster downloads all newly-available monitoring data for the open sites on average twice per year. For more information about GeoTracker, see:

www.geotracker.waterboards.ca.gov

www.envirostor.dtsc.ca.gov

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WEST YOST Water. Engineered.

Prepared for:

Chino Basin Watermaster

2020 State of the Basin Report

Groundwater Quality

GeoTracker and EnviroStor Sites in the Chino Basin

With the Potential to Impact Groundwater Quality

Exhibit 5-23

The ambient water quality (AWQ) of GMZs in the Santa Ana Watershed are computed on a triennial basis and compared with the groundwater-quality objectives defined in the Basin Plan to determine assimilative capacity for TDS and nitrate, and to assess if waste discharge requirements are protective of groundwater quality. AWQ represents the volume-weighted average concentration for a GMZ, and is derived from water quality statistics computed at wells based on a 20-year time-history of sample results.

In the Chino Basin, the Chino-North GMZ maximum-benefit objective is used as the measure of compliance to permit recycled water discharge and reuse. The Chino-North GMZ is the combined extent of MZ1, MZ2, and MZ3 upgradient of the Prado Basin. The Chino-North maximum-benefit objective is numerically higher than the individual anti-degradation objectives set for MZ1, MZ2, and MZ3. If Watermaster and the IEUA do not implement the specific projects and programs described in the Chino Basin maximum-benefit commitments in the Basin Plan (Table 5-8), the anti-degradation objectives will apply, and Watermaster and the IEUA will be required to mitigate TDS and nitrate loading from recycled water discharge and reuse above the anti-degradation objectives.

AWQ determinations have been made for eight 20-year periods: 1954-1973, 1978-1997, 1984-2003, 1987-2006, 1990-2009, 1993-2012 (WEI, 2000; 2005b; 2008a; 2011b; and 2014), 1996-2015 (DBS&A, 2017), and 1999-2018 (WSC, 2020). From 1973 to 2018, the ambient TDS concentration for Chino-North increased from 260 to 350 mg/L but remains below the maximum-benefit objective of 420 mg/L and 70 mg/L of assimilative capacity remains. When the current ambient TDS exceeds the maximum-benefit objective, there will be a mitigation requirement for the recharge and direct use of recycled water.

In the Chino-East and Chino-South GMZs, the current ambient TDS concentrations are greater than the objectives. Because the TDS concentration of the recycled water reused by the Chino Basin parties in these GMZs is less than the antidegradation objectives of 730 and 680 mg/L, there are no regulatory compliance challenges.

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Groundwater Quality

Trends in Ambient Water Quality Determinations for Total Dissolved Solids By Groundwater Management Zone

Exhibit 5-24

From 1973 to 2018, the ambient nitrate in Chino-North increased from 3.7 to 10.1 mg/L and is currently above the maximum benefit objective of 5.0 mg/L. To ensure recycled water recharge in the Chino-North GMZ is in compliance with the maximum benefit objective, Watermaster and the IEUA must recharge low-nitrate imported water and storm waters such that the 12-month, volume-weighted concentration of the all recharge sources (storm water, recycled water, and imported water) is less than or equal to the maximum benefit objective of 5.0 mg/l.

In the Chino-East GMZ, the current ambient nitrate concentration is about two to three times greater than the antidegradation objective of 10 mg/L and has been increasing since 1973.

In the Chino-South GMZ, the current ambient nitrate concentration is about six times greater than the antidegradation objective of 4.2 mg/L and has also been increasing since 1973.

For all GMZs, the increase in ambient concentrations is likely related to an increase in the data available to perform the calculations since the implementation of the OBMP monitoring programs, opposed to actual the degradation of water quality.

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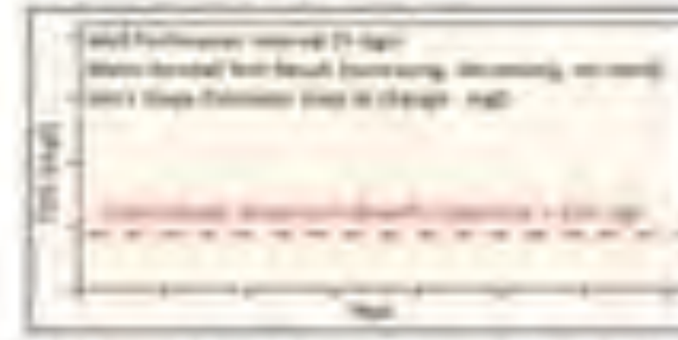
Trends in Ambient Water Quality Determinations for Nitrate as Nitrogen By Groundwater Management Zone

Exhibit 5-25



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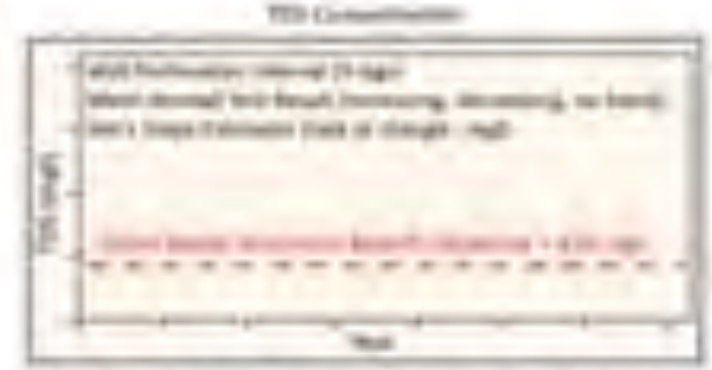
Chino Basin Management Zone 1
Trends in TDS Concentrations

Exhibit 5-26



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China Basin Management Zone 2
Trends in TDS Concentrations

Exhibit 5-27

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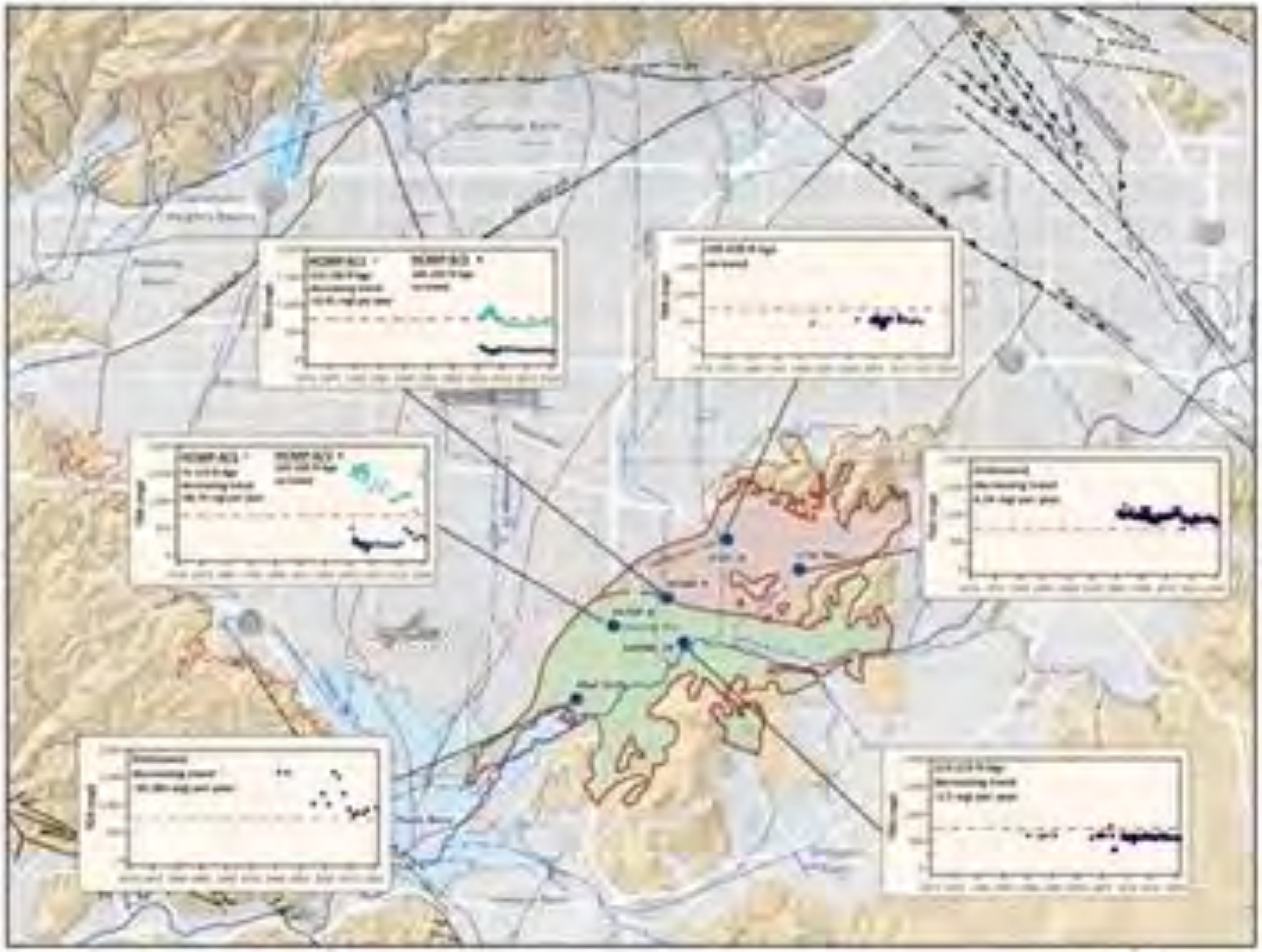
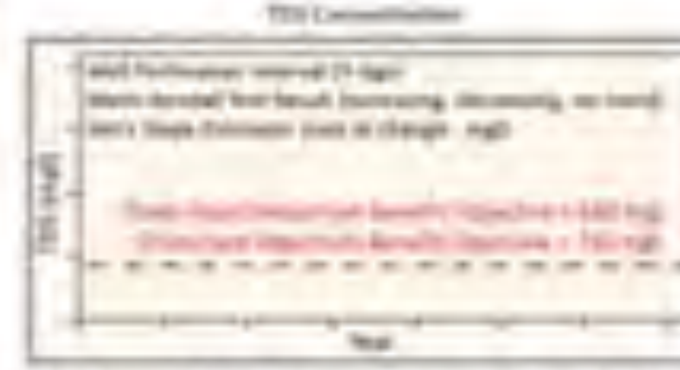
Chino Basin Management Zone 3
Trends in TDS Concentrations

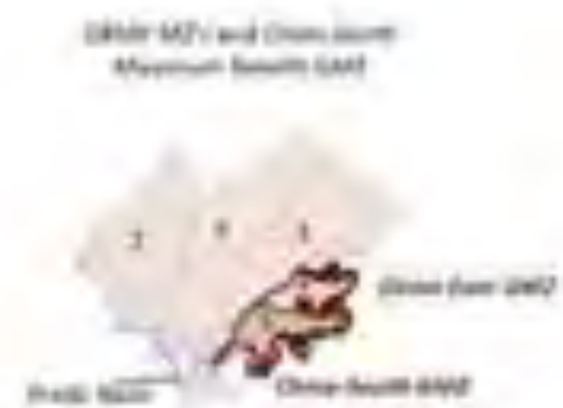
Exhibit 5-28





Two statistical trend tests were computed on the TDS concentration data. The Mann-Kendall test indicates whether data is increasing, decreasing, or does not have a statistically quantifiable trend (no trend). The Sen's Slope estimator is a non-parametric determination of the rate of change in concentration over time. All calculations were computed using Python. Both statistics were interpreted using a confidence level of 95%.

Other map base features are described in the legend of Exhibit 5-1.



Note: Prado Basin Management Zone has a surface water objective only.

Prepared by:

WEST YOST Water. Engineered.

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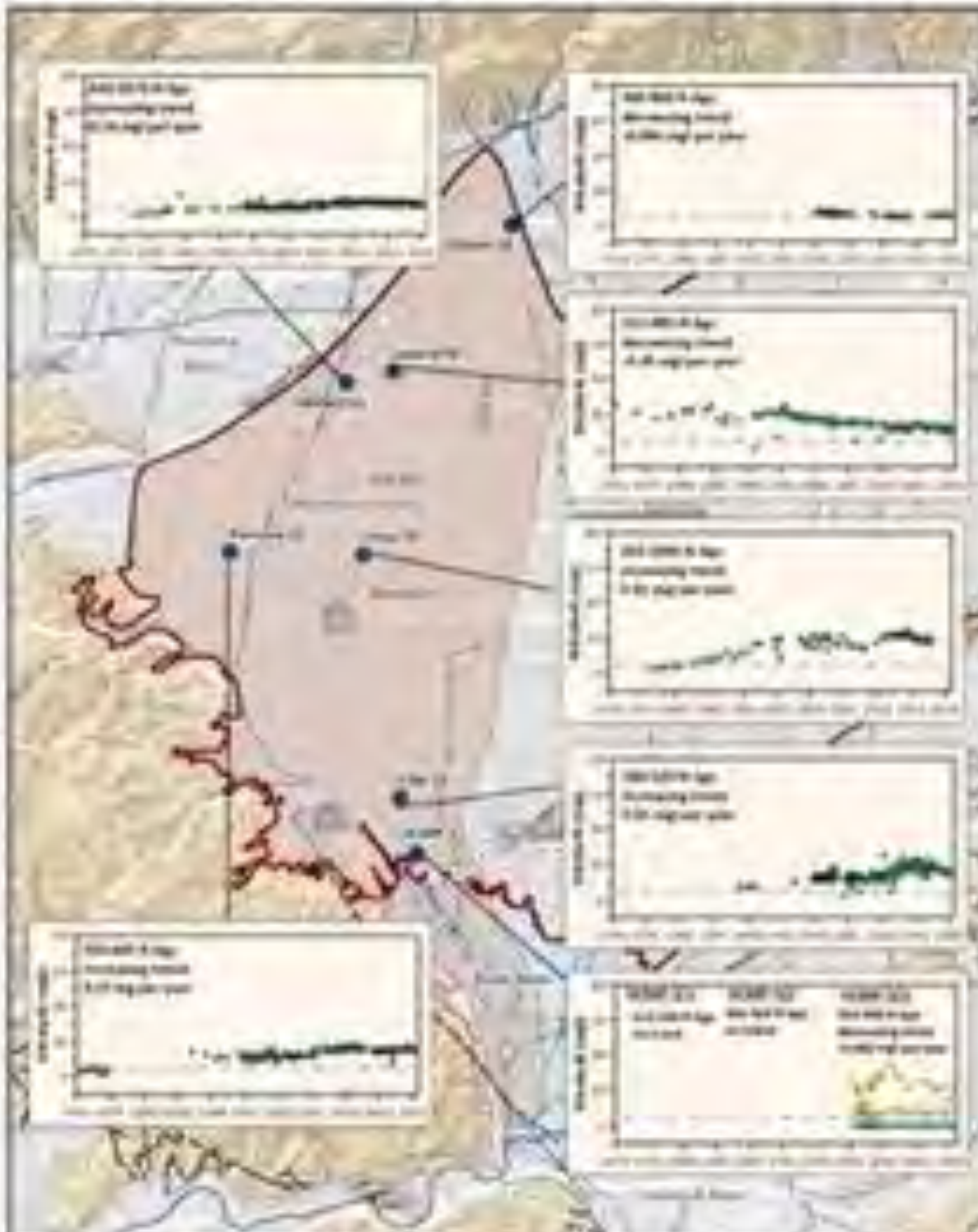
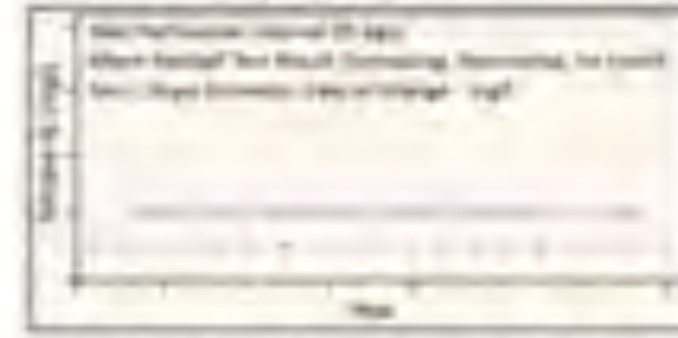
Chino Basin Management Zone 4 and Zone 5 Trends in TDS Concentrations

Exhibit 5-29





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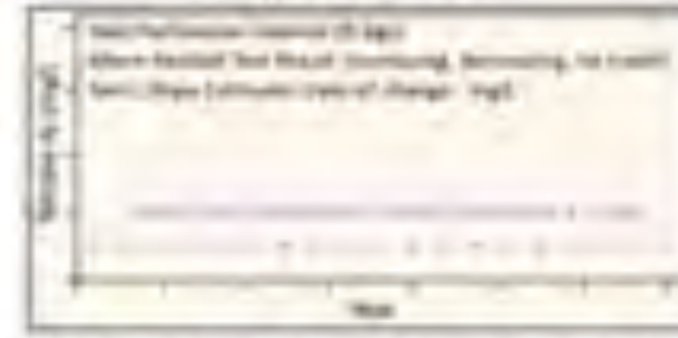
Chino Basin Management Zone 1
Trends in Nitrate Concentrations

Exhibit 5-30



Two statistical trend tests were computed on the TDS concentration data. The Mann-Kendall test indicates whether data is increasing, decreasing, or does not have a statistically quantifiable trend (no trend). The Sen's Slope estimator is a non-parametric determination of the rate of change in concentration over time. All calculations were computed using Python. Both statistics were interpreted using a confidence level of 95%.

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Chino Basin Management Zone 2
Trends in Nitrate Concentrations

Exhibit 5-31

Two statistical trend tests were computed on the TDS concentration data. The Mann-Kendall test indicates whether data is increasing, decreasing, or does not have a statistically quantifiable trend (no trend). The Sen's Slope estimator is a non-parametric determination of the rate of change in concentration over time. All calculations were computed using Python. Both statistics were interpreted using a confidence level of 95%.

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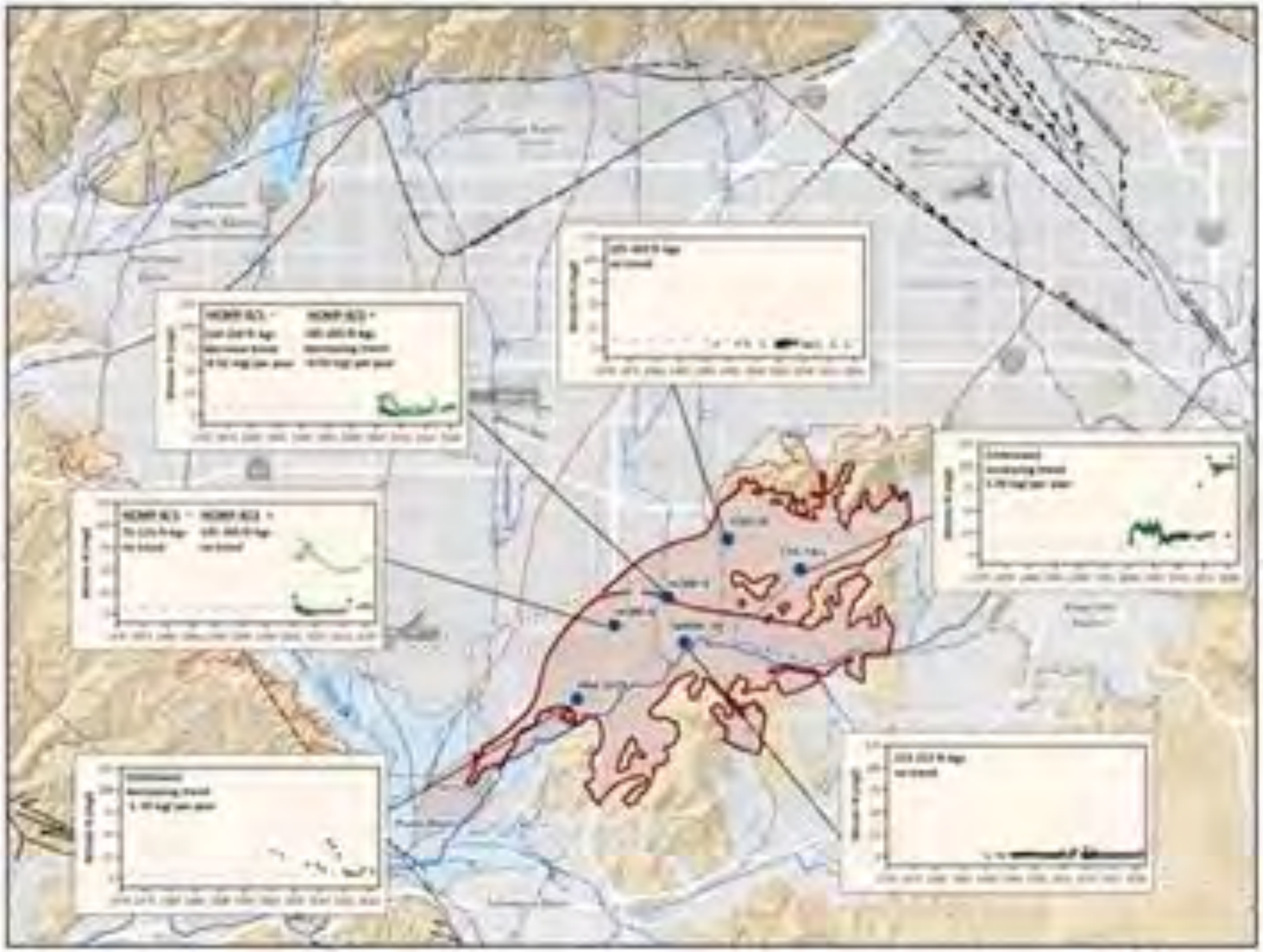
Chino Basin Management Zone 3
Trends in Nitrate Concentrations

Exhibit 5-32



Chino Basin Management
Zone 4 and Zone 5
Trends in Nitrate Concentrations

Exhibit 5-33

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6.0 GROUND-LEVEL MONITORING

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This section characterizes the history of land subsidence and ground fissuring, and the current state of ground-motion in the Chino Basin as understood through Watermaster's ground-level monitoring program. One of the earliest indications of land subsidence in the Chino Basin was the appearance of ground fissures in the City of Chino. These fissures appeared as early as 1973, but an accelerated occurrence of ground fissuring ensued after 1991, and resulted in damaged infrastructure. In 1999, the OBMP Phase I Report (WEI, 1999) identified in MZ1 a pumping-induced decline of piezometric levels and subsequent aquifer-system compaction as the most likely cause of land subsidence and ground fissuring. PE 1 – *Develop and Implement a Comprehensive Monitoring Program* called for basin-wide analysis of ground-motion via ground-level surveys and Interferometry Synthetic Aperture Radar (InSAR) and ongoing monitoring based on the analysis of the ground-motion data. PE *4 – Develop and Implement a Comprehensive Groundwater Management Plan for Management Zone 1* called for the development and implementation of an interim management plan for MZ1 that would:

- Minimize subsidence and fissuring in the short-term.
- Collect the information necessary to understand the extent, rate, and mechanisms of subsidence and fissuring.
- Formulate a management plan to monitor and manage ground-level movement to abate future subsidence and fissuring, or reduce it to tolerable levels.

In 2000, the Implementation Plan for the Peace Agreement called for an aquifer-system and land-subsidence investigation in the southwestern portion of MZ1 to support the development of a management plan (second and third bullets above). This investigation was titled the MZ1 Interim Monitoring Program (IMP). From 2001 to 2005, Watermaster developed, coordinated, and conducted the IMP under the guidance of the MZ1 Technical Committee, which was composed of representatives from all major producers in MZ1 and their technical consultants. The investigation methods, results, and conclusions are described in detail in the *MZ1 Summary Report* (WEI, 2006). The investigation provided enough information for Watermaster to develop Guidance Criteria for MZ1 that, if followed, would minimize the potential for subsidence and fissuring in the investigation area.

The Guidance Criteria also formed the basis for the *MZ1 Subsidence Management Plan* (MZ1 Plan; WEI, 2007b). The MZ1 Plan was developed by the MZ1 Technical Committee and approved by Watermaster in October 2007. In November 2007, the California Superior Court for the County of San Bernardino, which retains continuing jurisdiction over the Chino Basin adjudication, approved the MZ1 Plan and ordered its implementation. The MZ1 Plan called for the continued scope and frequency of monitoring implemented within the MZ1 Managed Area during the IMP, and expanded monitoring of the aquifer system and ground-motion in other areas of the Chino Basin where the IMP indicated concern for future subsidence and ground fissuring. The so-called "Areas of Subsidence Concern" include the Central MZ1, Northwest MZ1, and the Northeast and Southeast Areas. The Watermaster's ground-level monitoring program includes:

- *Piezometric Levels*. Piezometric levels are an important part of the ground-level monitoring program because piezometric changes are the mechanism for aquifer-system deformation and land subsidence. Watermaster conducts high-frequency, piezometric level monitoring at about 64 wells as part of its ground-level monitoring program. A pressure transducer data-logger is installed at each of these wells and records one water-level measurement every 15 minutes. Data loggers also record depth-specific piezometric levels at the piezometers located at the Watermaster's Ayala Park, Chino Creek, and Pomona Extensometer Facilities (PX) once every 15 minutes.
- *Aquifer-System Deformation*. The vertical deformation of the aquifer-system is measured and recorded with borehole extensometers. In 2003, the Watermaster installed the Ayala Park extensometer in the Managed Area to support the IMP. At this facility, two extensometers are completed to depths of 550 ft-bgs and 1,400 ft-bgs. In 2012, the Watermaster installed the Chino Creek Extensometer Facility (CCX) in the Southeast Area to understand the effects of pumping at the newly constructed CCWF. The CCX also consists of two extensometers: one completed to a depth of 140 ft-bgs and the other to 610 ft-bgs. In 2019, the Watermaster installed the PX in Northwest MZ1 to support the development of the *Subsidence Management Plan* for Northwest MZ1. At this facility, two dual-nested extensometers were completed to 520 ft-bgs (PX1-1), 750 ft-bgs (PX1-2), 1,025 ft-bgs (PX2-3), and 1290 ft-bgs (PX2-4). All three extensometer facilities record the vertical component of aquifer system compression and expansion once every 15 minutes, synchronized with the piezometric measurements to understand the relationship between piezometric changes and aquifer system deformation.
- *Vertical Ground-Motion*. The Watermaster monitors vertical ground-motion via traditional elevation surveys at benchmark monuments and via InSAR techniques established during the IMP. Elevation surveys are typically conducted in the MZ1 Managed Area, Northwest MZ1, Northeast Area, and Southeast Area once a year to every two to three years. Vertical ground-motion data, based on InSAR, are collected about every two months and analyzed once per year.
- *Horizontal Ground-Surface Deformation*. The Watermaster monitors horizontal ground-surface deformation across areas that are experiencing differential land subsidence to understand the potential threats and locations of ground fissuring. These data are obtained by electronic distance measurements (EDMs) between benchmark monuments in two areas: across the historical zone of ground fissuring in the MZ1 Managed Area and across the San Jose Fault Zone in Northwest MZ1.

Exhibits 6-1 through 6-3 illustrate the historical occurrence of vertical ground-motion in the Chino Basin as interpreted from InSAR and elevation surveys. These maps demonstrate that land subsidence concerns are primarily confined to the west side of the Chino Basin.

The land subsidence that has occurred in the Chino Basin was mainly controlled by changes in piezometric levels, which, in turn, were mainly controlled by pumping and recharge. Exhibits 6-4b through 6-8b show the relationships between groundwater pumping, recharge, recycled water reuse, piezometric levels, and vertical ground-motion in the MZ1 Managed Area and the other Areas of Subsidence Concern. These graphics can reveal cause-and-effect relationships and the current state and nature of vertical ground-motion. For reference, Exhibits 6-4a through 6-8a illustrate vertical ground-motion for each area of subsidence concern as estimated by InSAR for the period March 2011 to March 2020, and display the locations of wells with long-term time series of depth to groundwater, key benchmark locations with time series of cumulative ground-surface-elevation displacement, and InSAR with time series of cumulative vertical ground-motion.

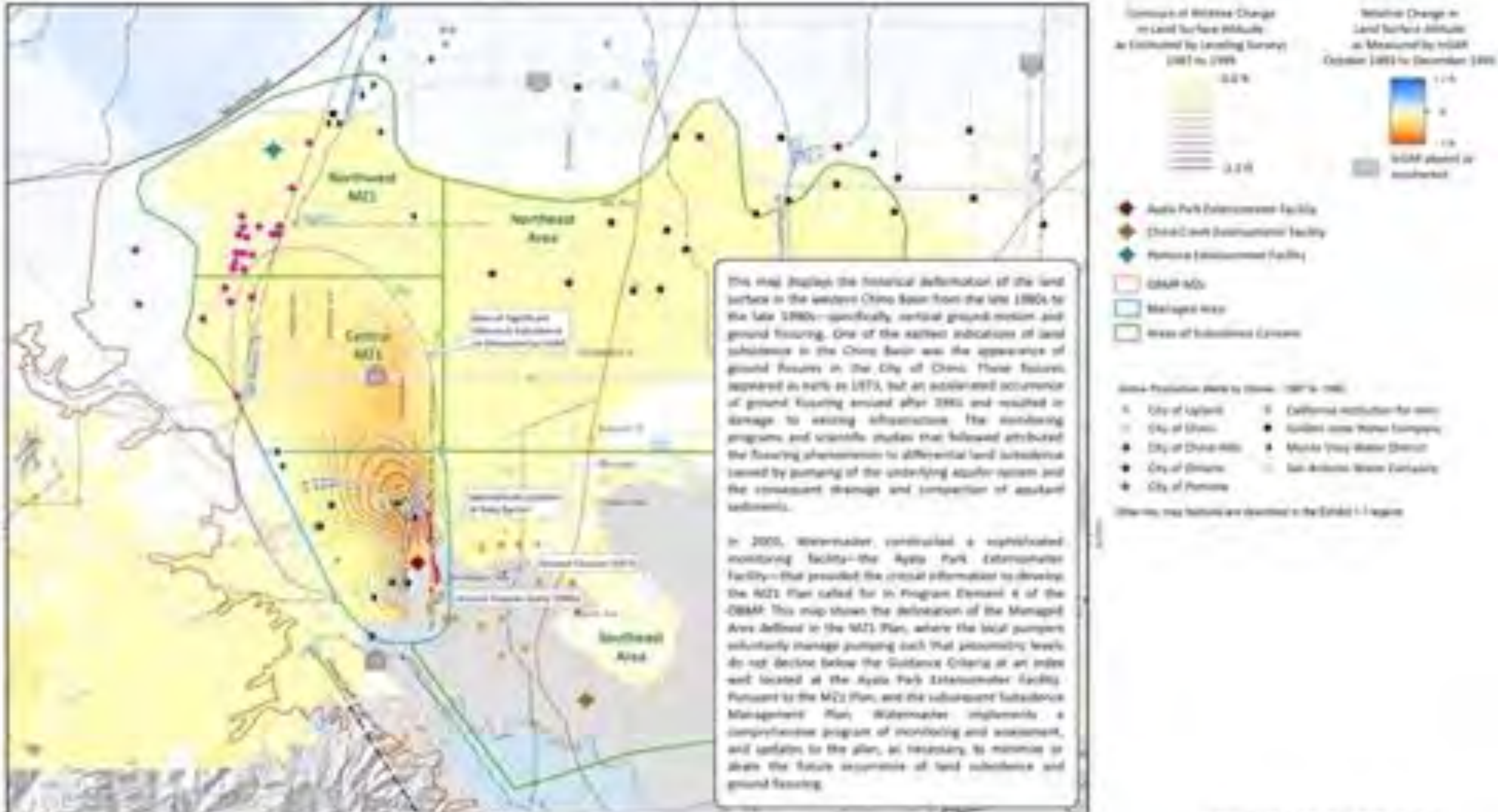
The Watermaster convenes a Ground-Level Monitoring Committee (GLMC) annually to review and interpret data from the ground-level monitoring program. The GLMC prepares annual reports that include recommendations for changes to the monitoring program and/or the MZ1 Plan, if such changes are demonstrated to be necessary to achieve the objectives of the monitoring program.

Based on the data collected and analyzed for the ground-level monitoring program, the GLMC became increasingly concerned with the occurrence of persistent differential subsidence in Northwest MZ1. In 2014, the GLMC recommended that the MZ1 Plan be updated to include a subsidence management plan for Northwest MZ1 with the long-term objective of minimizing or abating the occurrence of the differential land subsidence. In 2015, Watermaster updated the MZ1 Plan to reflect the Watermaster's current and future efforts more accurately to monitor and manage land subsidence, including the effort to develop a subsidence management plan for Northwest MZ1. The MZ1 Plan was renamed the *Chino Basin Subsidence Management Plan* (WEI, 2015c).

This new effort in Northwest MZ1 is an example of adaptive management of land subsidence, based on monitoring data, and includes the following activities:

- To better understand the extent, rate, and causes of the ongoing subsidence in Northwest MZ1, the GLMC and the Watermaster have increased monitoring efforts to include the installation of benchmark monuments across Northwest MZ1, performing annual elevation surveys at the benchmarks, performing EDMs between benchmarks across the San Jose Fault and expanding the high-frequency measurement of piezometric levels at wells.

- Aquifer-system compaction may be occurring (or may have occurred historically) at specific depths within Northwest MZ1, caused by depth-specific piezometric changes. Depth-specific data, obtained from piezometers and extensometers, are critical to understanding how groundwater production and recharge affect piezometric levels and the deformation of the aquifer-system. This understanding is needed to develop a subsidence management plan for Northwest MZ1. Between 2018 and 2020, the Watermaster constructed the PX facility at Montvue Park, Pomona CA. The PX facility consists of two dual-nested piezometers/extensometers designed to collect depth-specific piezometric and aquifer-system deformation data in an area of greatest observed land subsidence in Northwest MZ1. Depth-specific piezometric and aquifer-system deformation data is currently being collected and analyzed on a monthly basis in conjunction with pumping data from nearby production wells independently operated by Monte Vista Water District and the City of Pomona. The subsidence management plan for Northwest MZ1 is expected to be completed by the end of FY 2023/24.



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Historical Land Surface Deformation
in Management Zone 1
Leveling Surveys (1987-1999)
and InSAR (1993-1995)

Exhibit 6-1

Relative Change in Land Surface Altitude as Measured by InSAR June 2005 to September 2010

InSAR absent or incoherent

Ayala Park Extensometer Facility

Chino Creek Extensometer Facility (CCX)

Pomona Extensometer Facility (PX)

Managed Area

Areas of Subsidence Concern

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Ground-Level Monitoring

Vertical Ground-Motion as Measured by InSAR

2005 to 2010

Exhibit 6-2

This map displays the most recent measurements of vertical ground motion measured by InSAR for the western half of the Chino Basin, from March 2011 to March 2020. The InSAR indicates minor land subsidence occurred across most of the Managed Area and Areas of Subsidence Concern. Approximately 0.06 ft of subsidence was measured by InSAR in the Managed Area, indicating subsidence management continues to be successful. The greatest subsidence continued to occur in Northeast MZ1, where up to 0.29 ft of subsidence was measured by InSAR. InSAR continues to show a steep gradient of subsidence across the San Jose Fault, indicating the potential for the accumulation of horizontal strain in the shallow sediments and a threat of ground fissuring.

The exhibits that follow describe the history of land subsidence in each area, the current state of land subsidence, and the possible cause-and-effect relationships between pumping and recharge, piezometric levels, and vertical ground-motion.

Relative Change in Land Surface Altitude as Measured by InSAR March 2011 to March 2020

0

InSAR absent or incoherent

Wells with Piezometric Level Time Histories Plotted on Exhibits 6-4b to 6-8b

InSAR Time-History Point Plotted on Exhibits 6-4b to 6-8b

Ground-Level Survey Benchmark Time-History Point Plotted on Exhibits 6-4b to 6-8b

Ayala Park Extensometer Facility

Chino Creek Extensometer Facility (CCX)

Pomona Extensometer Facility (PX)

Chino I/Chino II Desalter Well

Chino Creek Desalter Well

OBMP MZs

Managed Area

Areas of Subsidence Concern

Ground Fissure

Approximate Location of the Riley Barrier

Other key map features are described in the Exhibit 1-1 legend

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Ground-Level Monitoring

Vertical Ground-Motion as Measured by InSAR
2011 to 2020

Exhibit 6-3

Other key map features are described in the Exhibit 1-1 and 6-1 legend.

This map displays vertical ground-motion as estimated by InSAR across the Managed Area for the period from March 2011 to March 2020. Where coherent, InSAR indicates the occurrence of zero to -0.08 ft of vertical ground-motion across the Managed Area over this time period. The greatest area of downward ground-motion occurred in the northern and central portions of the Managed Area. The main areas of InSAR incoherence in the Managed Area are located south of Schaefer Avenue. The InSAR estimates of vertical ground-motion are consistent with the Deep Extensometer record at Ayala Park from March 2011 to March 2020. Over this time period, the Deep Extensometer recorded about -0.03 ft of aquifer-system deformation compared to about -0.04 ft of vertical ground-motion estimated by InSAR at the Ayala Park Deep Extensometer Facility location.

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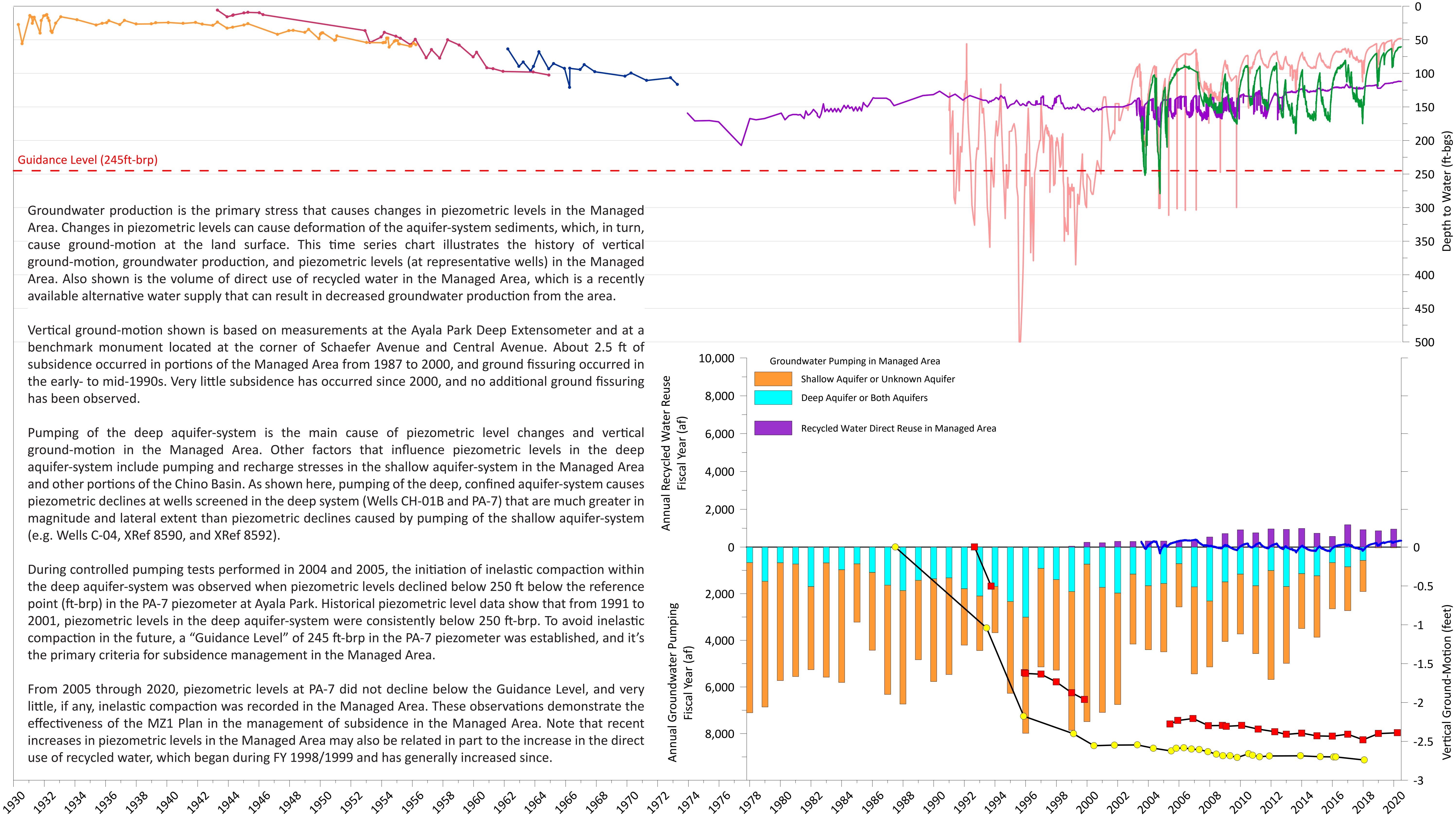
Vertical Ground-Motion across the Manged Area
2011 to 2020

Exhibit 6-4a



Groundwater production is the primary stress that causes changes in piezometric levels in the Managed Area. Changes in piezometric levels can cause deformation of the aquifer-system sediments, which, in turn, cause ground-motion at the land surface. This time series chart illustrates the history of vertical ground-motion, groundwater production, and piezometric levels (at representative wells) in the Managed Area. Also shown is the volume of direct use of recycled water in the Managed Area, which is a recently available alternative water supply that can result in decreased groundwater production from the area.

Vertical ground-motion shown is based on measurements at the Ayala Park Deep Extensometer and at a benchmark monument located at the corner of Schaefer Avenue and Central Avenue. About 2.5 ft of subsidence occurred in portions of the Managed Area from 1987 to 2000, and ground fissuring occurred in the early- to mid-1990s. Very little subsidence has occurred since 2000, and no additional ground fissuring has been observed.

Pumping of the deep aquifer-system is the main cause of piezometric level changes and vertical ground-motion in the Managed Area. Other factors that influence piezometric levels in the deep aquifer-system include pumping and recharge stresses in the shallow aquifer-system in the Managed Area and other portions of the Chino Basin. As shown here, pumping of the deep, confined aquifer-system causes piezometric declines at wells screened in the deep system (Wells CH-01B and PA-7) that are much greater in magnitude and lateral extent than piezometric declines caused by pumping of the shallow aquifer-system (e.g. Wells C-04, XRef 8590, and XRef 8592).

During controlled pumping tests performed in 2004 and 2005, the initiation of inelastic compaction within the deep aquifer-system was observed when piezometric levels declined below 250 ft below the reference point (ft-brp) in the PA-7 piezometer at Ayala Park. Historical piezometric level data show that from 1991 to 2001, piezometric levels in the deep aquifer-system were consistently below 250 ft-brp. To avoid inelastic compaction in the future, a “Guidance Level” of 245 ft-brp in the PA-7 piezometer was established, and it’s the primary criteria for subsidence management in the Managed Area.

From 2005 through 2020, piezometric levels at PA-7 did not decline below the Guidance Level, and very little, if any, inelastic compaction was recorded in the Managed Area. These observations demonstrate the effectiveness of the MZ1 Plan in the management of subsidence in the Managed Area. Note that recent increases in piezometric levels in the Managed Area may also be related in part to the increase in the direct use of recycled water, which began during FY 1998/1999 and has generally increased since.

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Shallow Aquifer-System
- C-04 (160-275 ft-bgs)
- XRef 8590 (80-225 ft-bgs)
- XRef 8591 (unknown)
- XRef 8592 (90-230 ft-bgs)

Deep Aquifer-Sytem
- CH-01B (440-1,180 ft-bgs)
- PA-7 (438-448 ft-bgs)

Vertical Ground-Motion
(Cumulative Displacement)
- InSAR Point A
- BM 137/53 (Last Surveyed: January 2018)
- Ayala Park Deep Extensometer
Measures between: 30 and 1,440 ft-bgs

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The History of Land Subsidence in the Managed Area

Exhibit 6-4b

Relative Change in Land Surface Altitude
as Measured by InSAR
March 2011 to March 2020

InSAR absent or incoherent

Wells with Piezometric Level Time Histories Plotted on Exhibit 6-5b

InSAR Time-History Point Plotted on Exhibit 6-5b

Benchmark Time-History Point Plotted on Exhibit 6-5b

Other key map features are described in the Exhibit 1-1 and 6-3 legend.

This map displays vertical ground-motion as estimated by InSAR across Central MZ1 for the period March 2011 to March 2020. The InSAR indicates areas in Central MZ1 that experienced the greatest magnitude of subsidence from 2011 to 2020 are located along the western portion of Central MZ1 – where up to -0.18 ft of vertical ground-motion had occurred.

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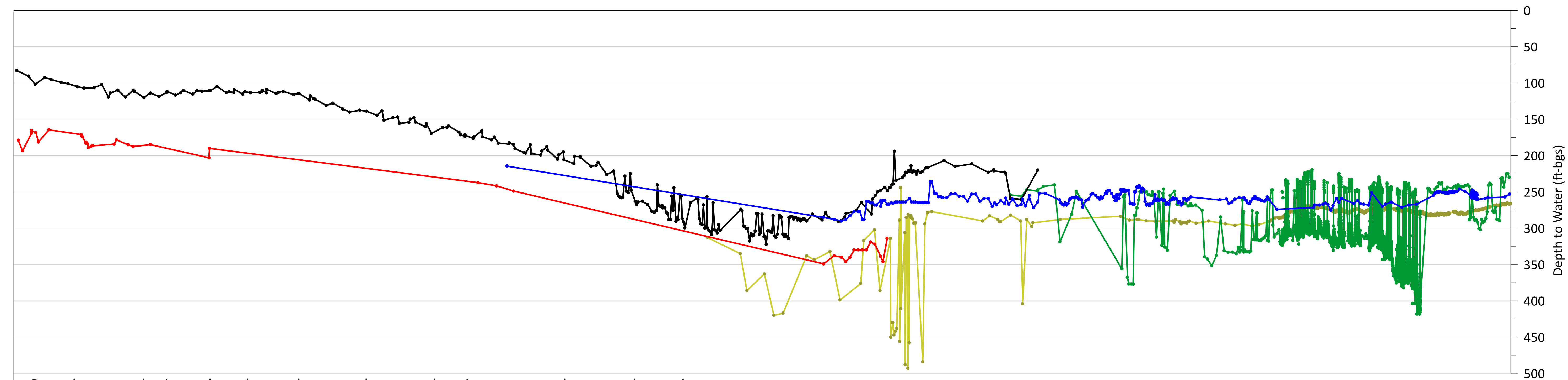
**Vertical Ground-Motion across
Central MZ1**
2011 to 2020

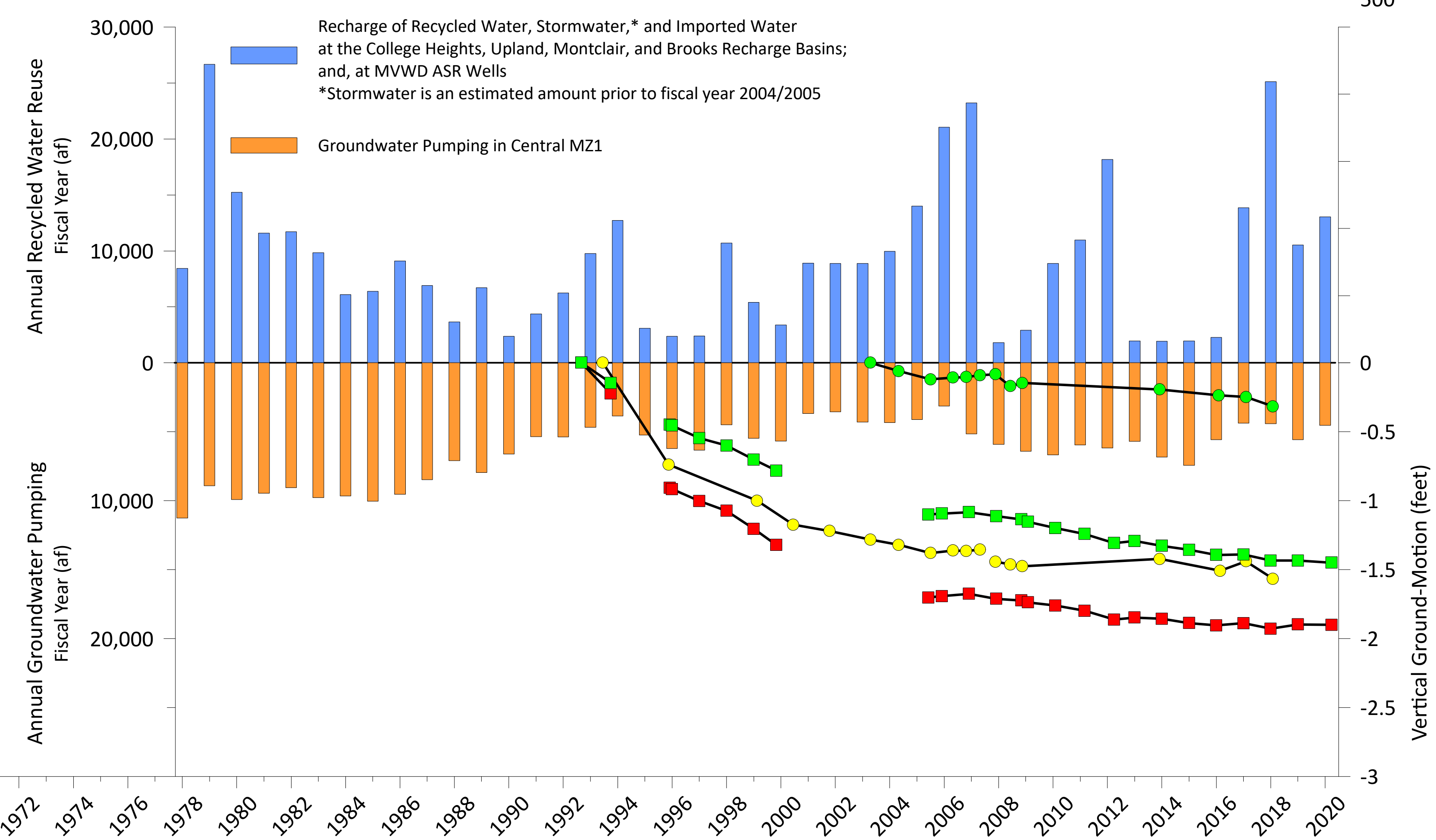
Exhibit 6-5a



Groundwater production and supplemental-water recharge are the primary stresses that cause changes in piezometric levels in Central MZ1. Changes in piezometric levels can cause deformation of the aquifer-system sediments, which, in turn, cause ground-motion at the land surface. This time series chart illustrates the history of vertical ground-motion, groundwater production, managed recharge and piezometric levels at representative wells in Central MZ1.

Vertical ground-motion shown here is based on InSAR and ground-level surveys at benchmark monuments within Central MZ1. Single and multi-year gaps in the InSAR record in 1994 and between 2000 and 2005, respectively, are due to incongruent datasets collected from different radar satellites. Vertical ground-motion during these gaps in the InSAR record was estimated based on the rate of vertical ground-motion measured at nearby benchmarks or the rate of vertical ground-motion measured by InSAR before and after the gap.

The time history of vertical ground-motion in Central MZ1 is similar to that of the Managed Area. Over two feet of subsidence occurred at the corner of Philadelphia Street and Monte Vista Avenue from 1993 to 2000, but only about 0.4 ft of subsidence has occurred since 2000. The similarity to the vertical ground-motion that occurred in the Managed Area suggests a relationship to the causes of land subsidence in the Managed Area (e.g. piezometric drawdowns due to pumping of the deep aquifer-system can cause inelastic [permanent] compaction of the aquifer-system sediments) however, there are not enough historical piezometric level data in this area to confirm this relationship. The most recent data between 2014 and 2020 indicate that piezometric levels have either stabilized or increased, with very little to no subsidence occurring in Central MZ1.



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Piezometric Levels at Wells
(Top-Bottom Screen Interval)

- C-3 (230-245 ft-bgs)
- C-5 (430-1,100 ft-bgs)
- P-24 old (Uknown)
- P-26 (300-775 ft-bgs)
- MVWD 02 (397-962 ft-bgs)

Vertical Ground-Motion
(Cumulative Displacement)

- InSAR Point B
- BM 125/49*
- BM 121/49*
- InSAR Point E

*Benchmarks Last Surveyed: January 2018

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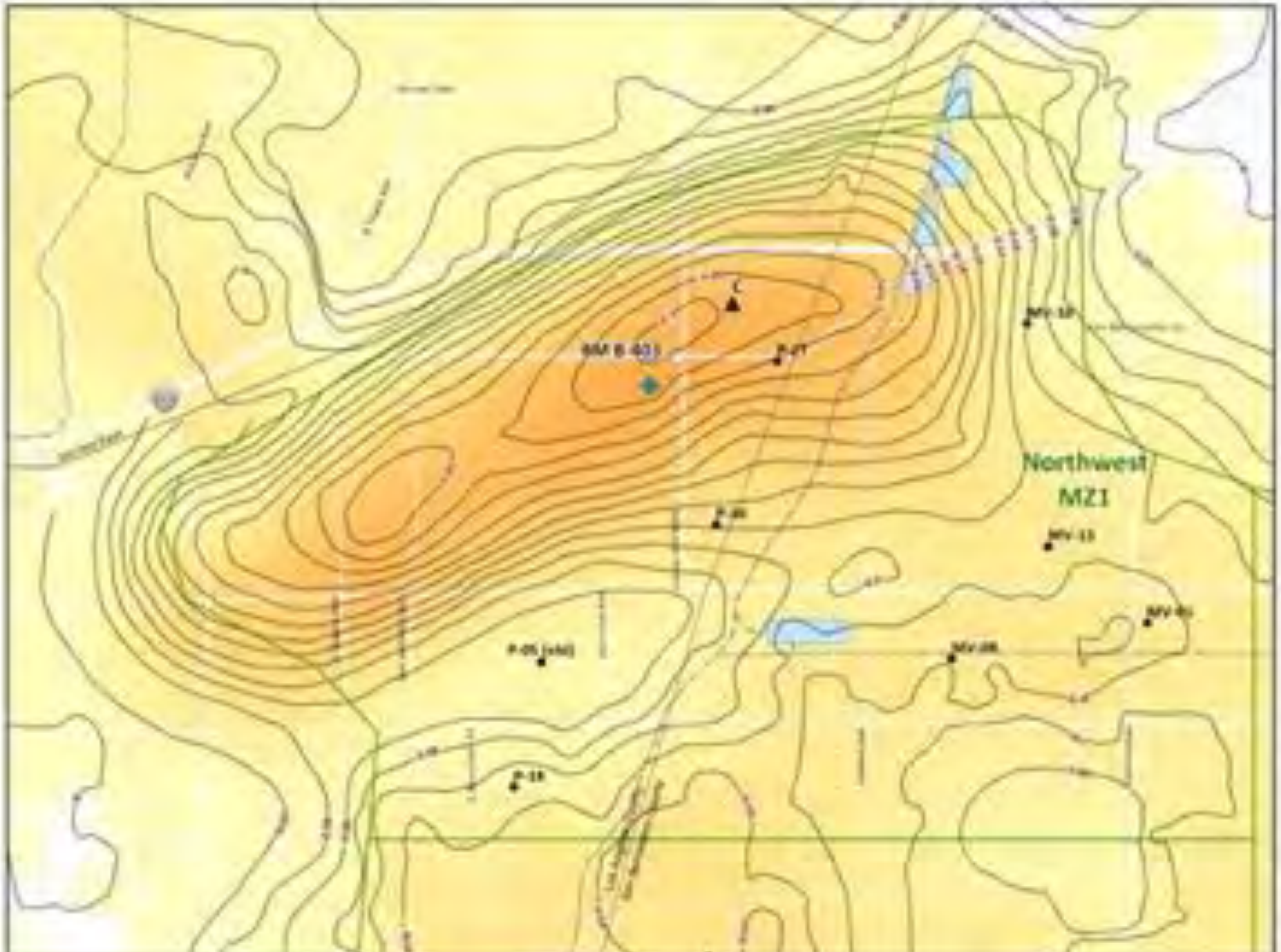
The History of Land Subsidence in Central MZ1

Exhibit 6-5b



Relative Change in Land Surface Altitude
as Measured by InSAR
March 2011 to March 2020

InSAR absent or incoherent

Pomona Extensometer Facility (PX)

Wells with Piezometric Level Time Histories
Plotted on Exhibit 6-6b

InSAR Time-History Point Plotted on Exhibit 6-6b

Benchmark Time-History Point Plotted on Exhibit 6-6b

Other key map features are described in the Exhibit 1-1 and 6-3 legend.

This map displays vertical ground-motion as estimated by InSAR across Northwest MZ1 Area for the period March 2011 to March 2020. The InSAR indicates a maximum of about -0.29 ft of vertical ground-motion occurred near the intersection of Indian Hill Boulevard and San Bernardino Avenue in Northwest MZ1.

Also shown on this map, is the location of the PX. The PX houses two dual-nested piezometers each equipped with pressure transducer data-loggers and cable extensometers. The fully-functional PX collects depth-specific piezometric and aquifer-system deformation data at 15-minute intervals. These data are critical to understanding how groundwater production and recharge affect piezometric levels and the deformation of the aquifer system in Northwest MZ1.

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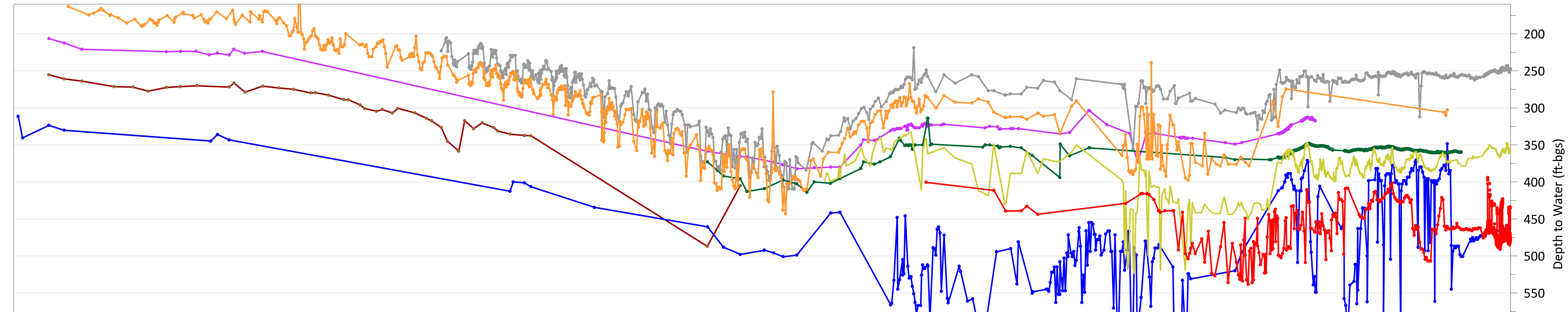
Vertical Ground-Motion across Northwest MZ1
2011 to 2020

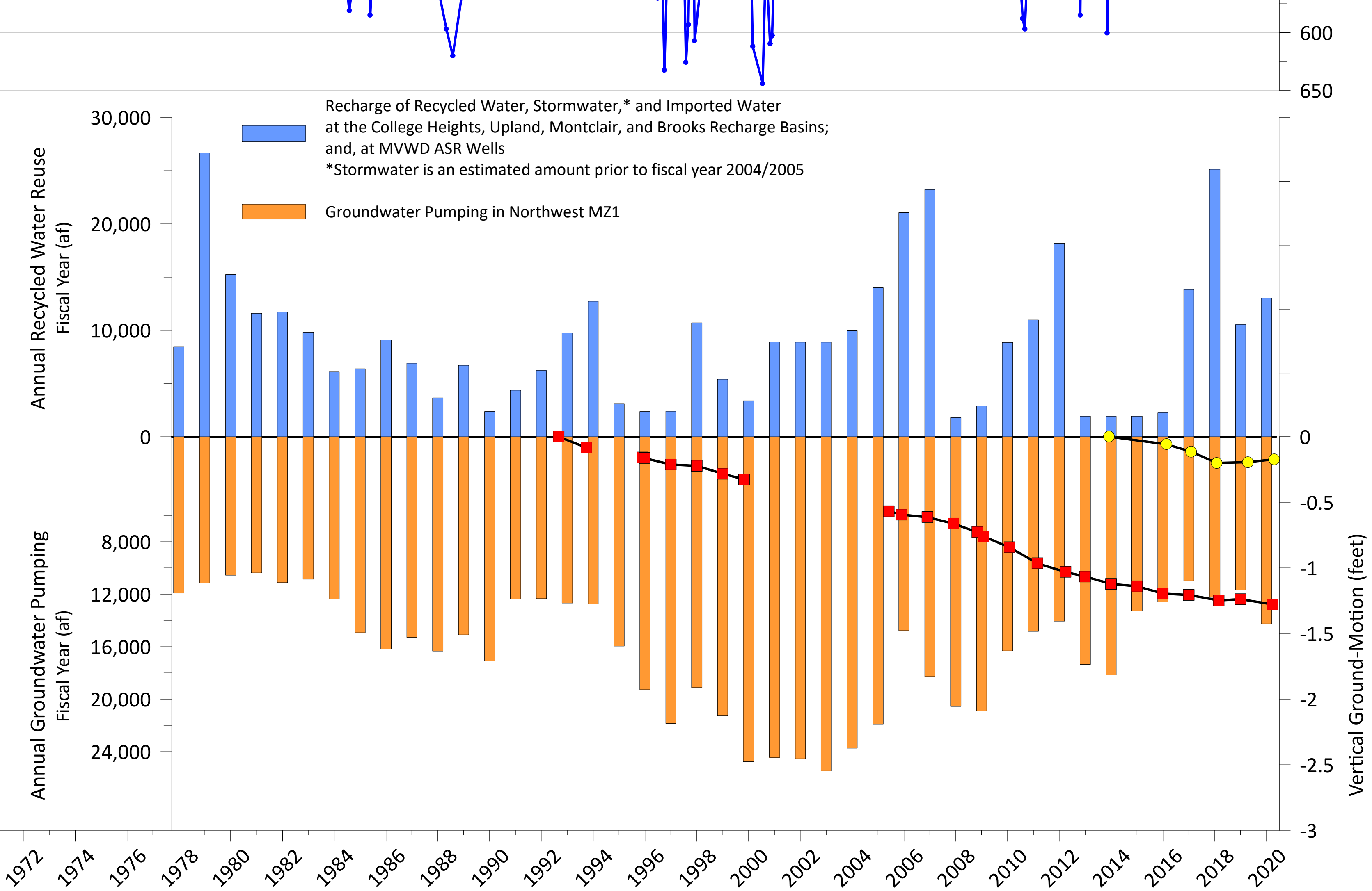
Exhibit 6-6a



Groundwater production and supplemental water recharge are the primary stresses that cause changes in piezometric levels in Northwest MZ1. Changes in piezometric levels can cause deformation of the aquifer-system sediments, which, in turn, cause ground-motion at the land surface. This time series chart illustrates the history of vertical ground-motion, groundwater production, managed recharge, and piezometric levels at representative wells in Northwest MZ1.

Vertical ground-motion shown here is based on InSAR and, more recently, by ground-level surveys at newly installed benchmark monuments within Northwest MZ1 and across the San Jose Fault Zone. About 1.27 ft of subsidence has occurred in this area from 1992 through 2020. Of concern, is that subsidence has occurred differentially across the San Jose Fault Zone—the same pattern of differential subsidence that occurred in the Managed Area. Single and multi-year gaps in the InSAR record in 1994 and between 2000 and 2005, respectively, are due to incongruent datasets collected from different radar satellites. Vertical ground-motion during the gaps in the InSAR record was estimated based on the rate of vertical ground-motion measured by InSAR before and after the gap.

From about 1930 to 1978, piezometric levels in Northwest MZ1 continuously declined by about 175 ft. Piezometric levels increased by about 50 to 100 ft during the 1980s, but declined again by about 25 to 50 ft from about 1990 to 2004. From 2004 to 2008, piezometric levels increased by about 50 to over 100 ft. From 2008 to 2020, piezometric levels at P-27 and MV-10 have fluctuated by about 100 to 200 ft, respectively, due to groundwater production and supplemental-water recharge in Northwest MZ1. Piezometric levels at P-18, P-30, and MV-01 have remained generally stable since 2008, but still below the levels of 1930. The observed continuous land subsidence that occurred from 1992 to 2020 cannot be explained entirely by the concurrent changes in piezometric levels. A plausible explanation for the subsidence is that thick, slowly-draining aquitards are compacting in response to the historical decline of piezometric levels that occurred from 1930 to 1978; it is logical to assume that subsidence began when piezometric levels began to decline in 1930. If subsidence has been occurring at a constant rate of 0.05 ft/yr (the average rate of subsidence between 1992 and 2020) since 1930, then Northwest MZ1 has experienced about 4.5 ft of permanent subsidence since the onset of declining piezometric levels in this area.



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Piezometric Levels at Wells (Top-Bottom Screen Interal)

- MV-01 (245-472 ft-bgs)
- MV 08 (225-447 ft-bgs)
- MV-10 (250-1,084 ft-bgs)
- MV-13 (203-475 ft-bgs)
- P-18 (307-660 ft-bgs)
- P-27 (472-849 ft-bgs)
- P-30 (565-875 ft-bgs)
- P-05 (old) (141-488 ft-bgs)

Vertical Ground-Motion (Cumulative Displacement)

- InSAR Point C
- BM B-403

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The History of Land Subsidence in Northwest MZ1

Exhibit 6-6b

Relative Change in Land Surface Altitude as Measured by InSAR March 2011 to March 2020

InSAR absent or incoherent

Wells with Piezometric Level Time Histories Plotted on Exhibit 6-7b

InSAR Time-History Point Plotted on Exhibit 6-7b

Other key map features are described in the Exhibit 1-1 and 6-3 legend.

This map displays vertical ground-motion as estimated by InSAR across the Northeast Area for the period March 2011 to March 2020. The InSAR indicates a maximum of about -0.11 ft of vertical ground-motion occurred in the area between Vineyard Avenue and Archibald Avenue, south of the Ontario International Airport.

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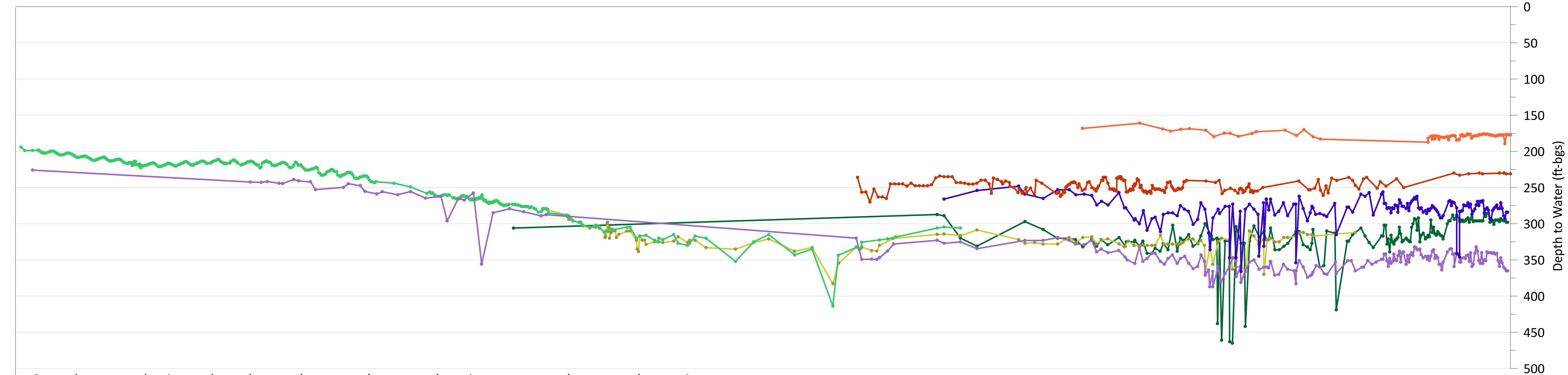
Vertical Ground-Motion across the Northeast Area
2011 to 2020

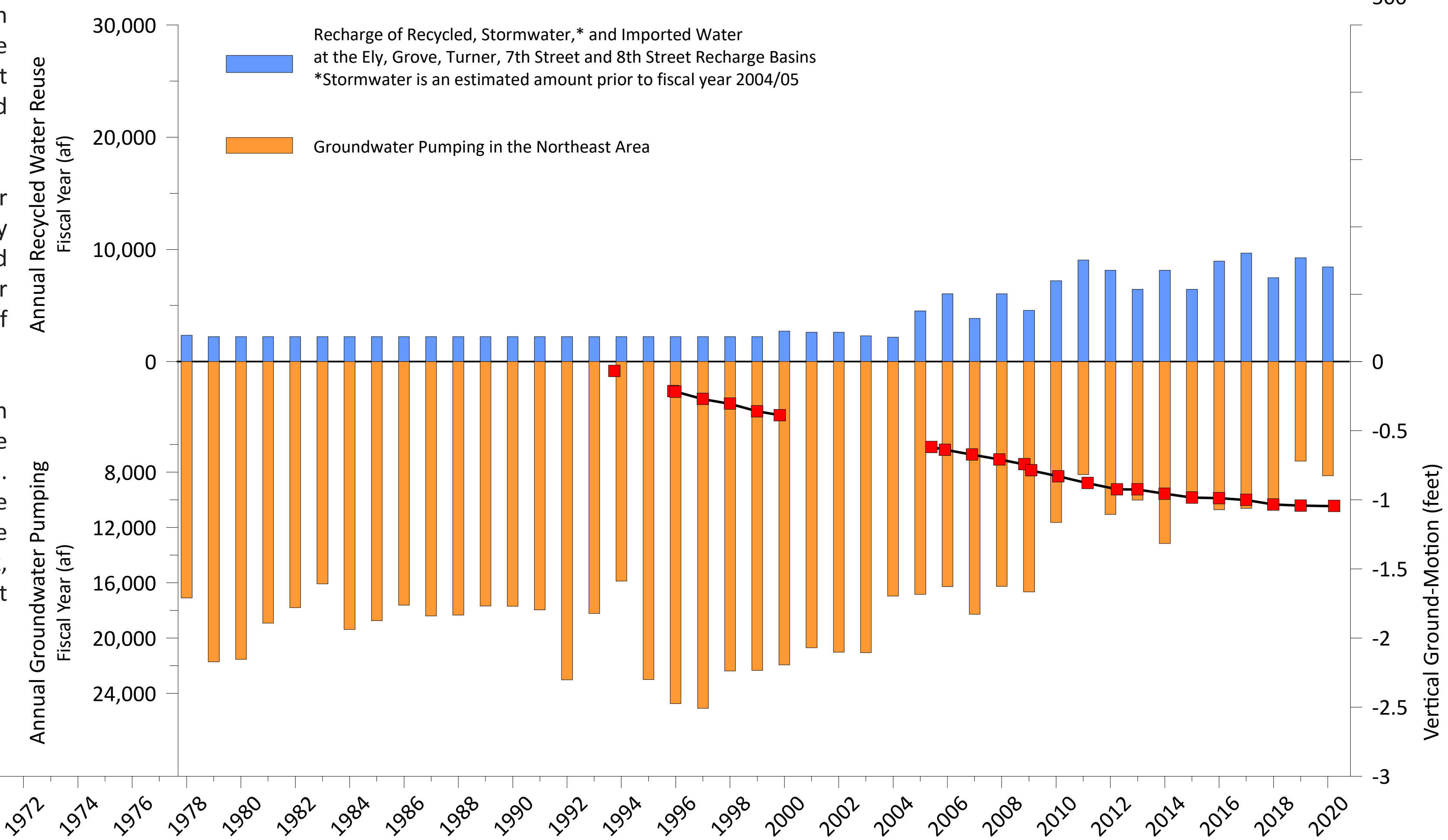
Exhibit 6-7a



Groundwater production and supplemental-water recharge are the primary stresses that cause changes in piezometric levels in the Northeast Area. Changes in piezometric levels can cause deformation of the aquifer-system sediments, which, in turn, cause ground-motion at the land surface. This time series chart illustrates the history of vertical ground-motion, groundwater production, managed recharge and piezometric levels at representative wells in the Northeast Area.

Vertical ground-motion shown here is based on InSAR measurements within the Northeast Area. Over one-foot of subsidence has occurred in this area from 1992 through 2020. This subsidence has generally occurred gradually and over a broad area. Single and multi-year gaps in the InSAR record in 1994 and between 2000 and 2005, respectively, are due to incongruent datasets collected from different radar satellites. Vertical ground-motion during the gaps in the InSAR record was estimated based on the rate of vertical ground-motion measured by InSAR before and after the gap.

From about 1930 to 1978, piezometric levels in the Northeast Area continuously declined by about 125 ft. In the early 1980s, the pattern of continuous piezometric decline ceased, and piezometric levels have fluctuated between 25 and 175 ft in response to groundwater production and supplemental-water recharge. Since 2012, piezometric levels have remained relatively stable, but still below the levels of 1930. The observed, continuous land subsidence that occurred from 1992 to 2020 cannot be explained entirely by the concurrent changes in piezometric levels. A plausible explanation for the subsidence is that thick, slowly-draining aquitards are compacting in response to the historical decline of piezometric levels that occurred from 1930 to 1978.



Author: AP, Date: 5/30/2021, K\Clients\941 CBWM\CBWM proj\SOB\Grapher\GRF\6_GLM\Fig_6-7

Piezometric Levels at Wells (Top-Bottom Screen Interval)

- O-05 (360-470 ft-bgs)
- O-15 (474-966 ft-bgs)
- O-25 (370-903 ft-bgs)
- O-34 (522-1,092 ft-bgs)
- O-36 (530-1,000 ft-bgs)
- C-11 (390-910 ft-bgs)
- XRef 18 (Unknown)

Vertical Ground-Motion (Cumulative Displacement)

- InSAR Point D

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Chino Basin Watermaster
2020 State of the Basin Report
Ground-Level Monitoring

The History of Land Subsidence in the Northeast Area

Exhibit 6-7b

Relative Change in Land Surface Altitude
as Measured by InSAR
March 2011 to March 2020

InSAR absent or incoherent

Apple Park Extensometer Facility

Chino Creek Extensometer Facility (CCX)

Wells with Piezometric Level Time Histories Plotted on Exhibit 6-8b

Benchmark Time History Point Plotted on Exhibit 6-8b

Chino-I/Chino-II Desalter Well

Chino Creek Desalter Well

Other key map features are described in the Exhibit 1-1 and 6-3 legend.

This map displays vertical ground-motion as estimated by InSAR across the Southeast Area for the period from March 2011 to March 2020. The InSAR results are generally incoherent across much of this area because the overlying agricultural land uses are not hard, consistent reflectors of radar waves. Where InSAR results are incoherent, the history of subsidence is best characterized by ground level surveys and the CCX.

In general, the occurrence of subsidence has been relatively minor across the Southeast Area, and some areas have recently experienced upward vertical ground-motion. In the north-northwest portion of the Southeast Area, about -0.11 ft of vertical ground-motion occurred from 2011 to 2020. Conversely, in the southern portion of the Southeast Area, about 0.21 ft of vertical ground-motion occurred from 2011 to 2020.

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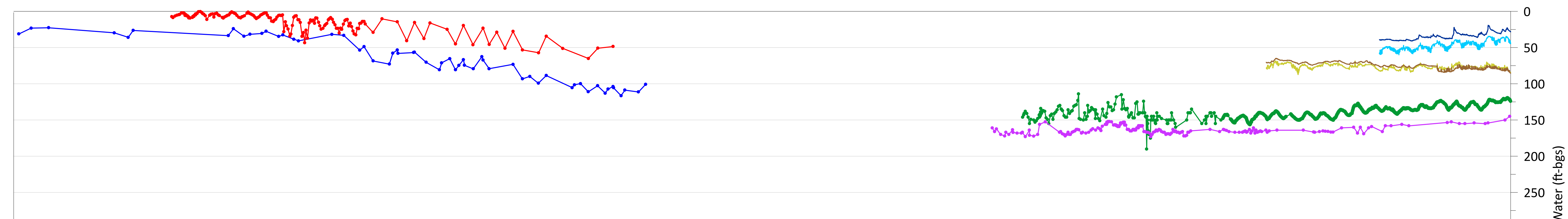
2020 State of the Basin Report
Ground-Level Monitoring

Vertical Ground-Motion across the Southeast Area
2011 to 2020

Exhibit 6-8a

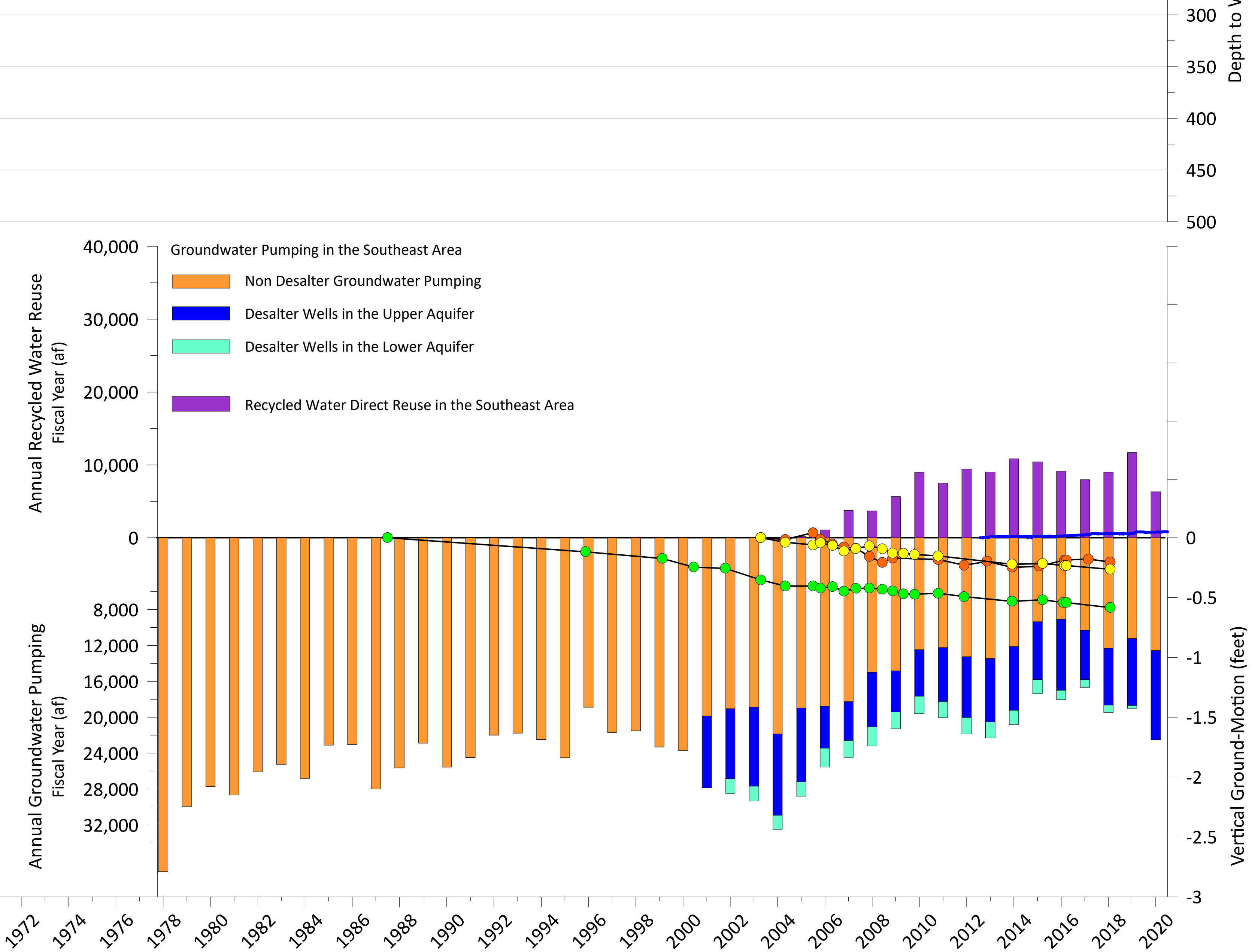


Groundwater production and supplemental-water recharge are the primary stresses that cause changes in piezometric levels in the Southeast Area. Changes in piezometric levels can cause deformation of the aquifer-system sediments, which, in turn, cause ground-motion at the land surface. This time series chart illustrates the history of vertical ground-motion, groundwater production, managed recharge, and piezometric levels at representative wells in the Northeast Area. Also shown is the direct use of recycled water in the Southeast Area, which is a recently available alternative water supply that can result in decreased groundwater production from the area.

The first ground fissures documented in the Chino Basin occurred in the Southeast Area in the early 1970s, but ground fissuring has not been observed in the area since.

Vertical ground-motion shown here is based on vertical ground-level surveys at benchmark monuments within the Southeast Area between 1987 and 2020. In the northwestern portion of the Southeast Area, the ground-level surveys indicate that about 0.58 ft of subsidence occurred from 1987 to 2018. In the southern portion of the Southeast Area, near the intersection of Euclid Avenue and Kimball Avenue, where the Chino-I Desalter wells pump groundwater from the deep confined aquifer-system, the ground-level surveys indicated that about 0.25 ft of land subsidence occurred from 2000 to 2006. The Chino-I Desalter wells began pumping in 2000 and likely caused a localized decline of piezometric levels within the deep aquifer-system, which may have caused the observed land subsidence in this area between 2000 and 2006. Watermaster installed the CCX facility in this area in 2012 to characterize the occurrence and mechanisms of the subsidence near the Chino-I Desalter well field and recorded the effects of new pumping at the CCWF on piezometric levels and land subsidence. Pumping at the CCWF wells commenced in 2014. The CCX began collecting data in July 2012 and, to date, has recorded no aquifer-system compaction.

From about 1930 to 1990, piezometric levels in the Southeast Area have continuously declined by about 100 ft. Since the 1990s, piezometric levels have been generally stable, with piezometric levels fluctuating between about 10 and 20 ft in response to groundwater production and supplemental-water recharge. Recent increases in piezometric levels in the area may be related in part to the increase in the direct use of recycled water. However, piezometric levels remain below the levels of 1930. The observed slow, but continuous land subsidence from 1987 to 2020 - particularly in the northwest portion of the Southeast Area - is not explained by the concurrent, relatively stable piezometric levels. A plausible explanation for the subsidence in this area is that thick, slowly draining aquitards are compacting in response to the historical decline of piezometric levels that occurred prior to 1990.



Author: AP, Date: 5/30/2021, K\Clients\941 CBWM\CBWM proj\SOB\Grapher\GRF\6_GLM\Fig_6-8

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Piezometric Levels at Wells (Top-Bottom Screen Interval)

- C-13 (290-720 ft-bgs)
- CH-18A (420-980 ft-bgs)
- HCMP-1/1 (135-175 ft-bgs)
- HCMP-1/2 (300-320 ft-bgs)
- XRef 8588 (Uknown)
- XRef 8589 (Uknown)
- CCPA-1 (100-130 ft-bgs)
- CCPA-2 (235-295 ft-bgs)

Vertical Ground-Motion (Cumulative Displacement)

- CCX-2 Extensometer Measures between: 50 and 610 ft-bgs
- BM 133/61*
- BM 137/61*
- BM 157/71*

*Benchmarks Last Surveyed: January 2018

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Chino Basin Watermaster
2020 State of the Basin Report
Ground-Level Monitoring

The History of Land Subsidence in the Southeast Area

Exhibit 6-8b

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7.0 REFERENCES

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APPENDIX 10b

Chino Basin OBMP,
2020 Maximum Benefit Annual Report

FINAL REPORT | APRIL 2021

Chino Basin Optimum Basin Management Program 2020 Maximum Benefit Annual Report

PREPARED FOR

Chino Basin Watermaster and the
Inland Empire Utilities Agency

PREPARED BY

WEST YOST
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PETER KAVOUNAS, P.E.
General Manager

SHIVAJI DESHMUKH, P.E.
General Manager

April 15, 2021

Regional Water Quality Control Board, Santa Ana Region
Attention: Ms. Hope Smythe
3737 Main Street, Suite 500
Riverside, California 92501-3348

Subject: Transmittal of the Chino Basin 2020 Maximum Benefit Annual Report

Dear Ms. Smythe,

The Chino Basin Watermaster (Watermaster) and Inland Empire Utilities Agency (IEUA) hereby submit the Chino Basin Maximum Benefit Annual Report for 2020. This Annual Report is in partial fulfillment of the maximum benefit commitments made by Watermaster and the IEUA as discussed in Resolution No. R8-2004-0001 and its attachment: *Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate an Updated Total Dissolved Solids (TDS) and Nitrogen Management Plan for the Santa Ana Region Including Revised Groundwater Subbasin Boundaries, Revised TDS and Nitrate-Nitrogen Quality Objectives for Groundwater, Revised TDS and Nitrogen Wasteload Allocations, and Revised Reach Designations, TDS and Nitrogen Objectives and Beneficial Uses for Specific Surface Waters*. Table 5-8a in the attachment to the Resolution identifies the Chino Basin Maximum Benefit Commitments which are specific projects and requirements that must be implemented to demonstrate that water quality consistent with maximum benefit to the people of the state will be maintained. This Annual Report describes the status of compliance with each commitment and the work performed during 2020.

If you have any questions, please do not hesitate to call.

Sincerely,

Chino Basin Watermaster

Peter Kavounas, P.E.
General Manager

Inland Empire Utilities Agency

Shivaji Deshmukh, P.E.
General Manager

Chino Basin Optimum Basin Management Program
2020 Maximum Benefit Annual Report

Prepared for

Chino Basin Watermaster and the Inland Empire Utilities Agency

Project No. 941-80-20-32

4/15/2021

Project Manager: Veva Weamer — Date

4/15/2021

QA/QC Review: Samantha Adams — Date

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FINAL REPORT | APRIL 2021

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LIST OF APPENDICIES

LIST OF ACRONYMS AND ABBREVIATIONS

afy	acre-feet per year
Basin Plan	Water Quality Control Plan for the Santa Ana River Basin
CCWF	Chino Creek Well Field
CDA	Chino Basin Desalter Authority
Chino-North	Chino-North Groundwater Management Zone
DTSC	California Department of Toxic Substance Control
ET	evapotranspiration
GMZ	groundwater management zone
GWQMP	Groundwater Quality Monitoring Program
HCMP	Hydraulic Control Monitoring Program
IEUA	Inland Empire Utilities Agency
MCL	Maximum contaminant level
mgd	million gallons per day
mgl	milligrams per liter
MWD	Metropolitan Water District of Southern California
NAWQA	National Water Quality Assessment
OBMP	Optimum Basin Management Program
PBHSP	Prado Basin Habitat Sustainability Program
PBMZ	Prado Basin Management Zone
Regional Board	Regional Water Quality Control Board, Santa Ana Region
SARWC	Santa Ana River Water Company
SARWM	Santa Ana River Watermaster
SOB Report	State of the Basin Report
SWP	State Water Project
TCE	trichloroethene
TDS	total dissolved solids
TIN	total inorganic nitrogen
TKN	Total Kjeldahl Nitrogen
USGS	United States Geological Survey
VOC	volatile organic compound
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.

1.0 INTRODUCTION

This 2020 Maximum Benefit Annual Report was prepared by the Chino Basin Watermaster (Watermaster) and the Inland Empire Utilities Agency (IEUA) pursuant to their maximum-benefit commitments, as described in the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan; California Regional Water Quality Control Board, Santa Ana Region [Regional Board], 2008).

This introductory section provides background on: 1) the Chino Basin Optimum Basin Management Program (OBMP) and Implementation Plan; 2) the Regional Board's recognition of the Chino Basin OBMP Implementation Plan; 3) the establishment of alternative, maximum-benefit groundwater-quality objectives for the Chino Basin; and 4) the commitments made by Watermaster and the IEUA when the Regional Board granted them access to the assimilative capacity created by the application of the maximum-benefit objectives for regulatory purposes. This Annual Report describes the status of compliance with each commitment and the work performed during calendar year 2020.

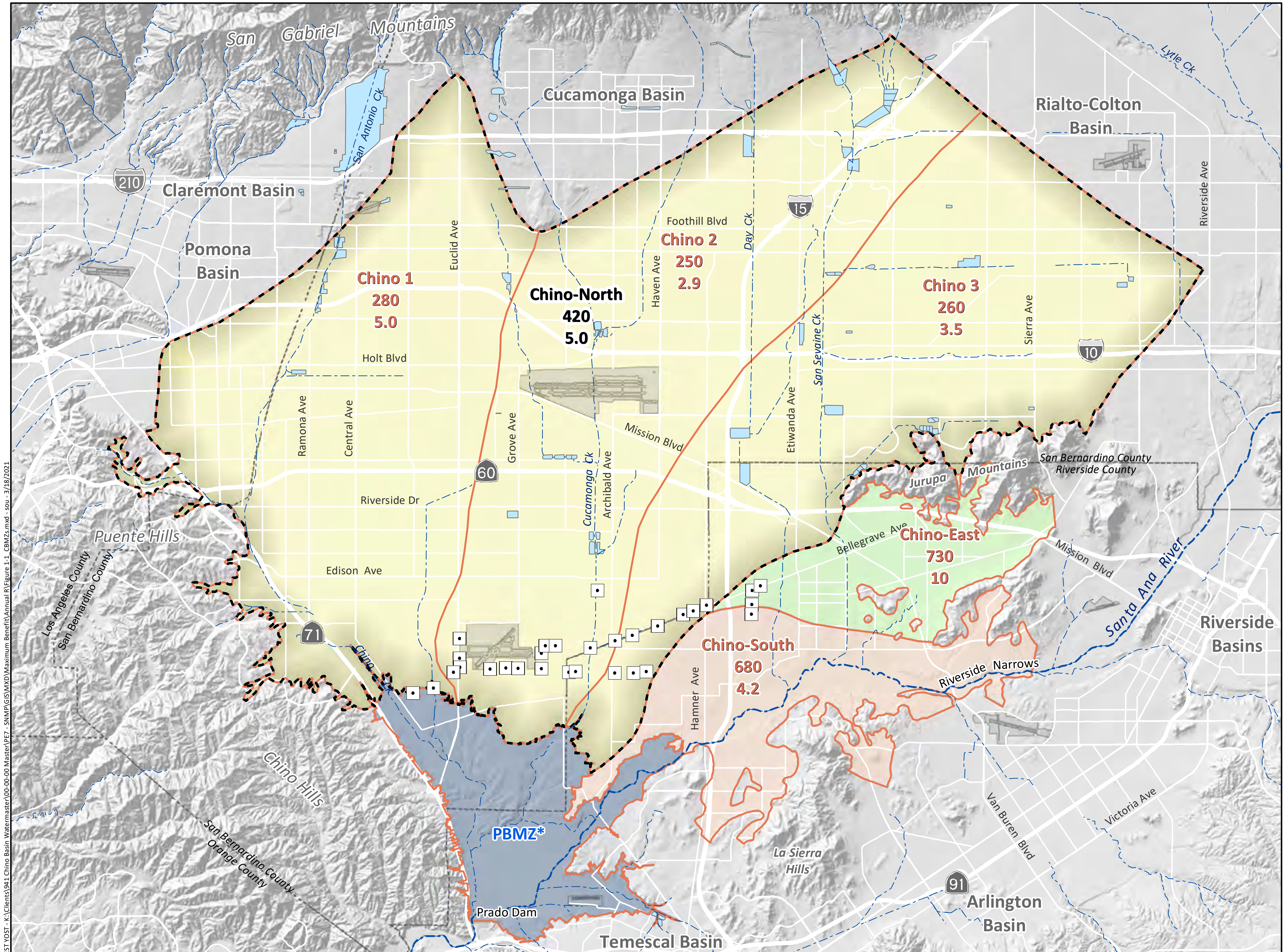
1.1 Investigations of the Relationship between Groundwater Production and Santa Ana River Discharge

Figure 1-1 is a map of the Chino Basin. Groundwater generally flows from the forebay regions in the north and east toward the Prado Basin, where rising groundwater becomes surface water in the Santa Ana River and its tributaries. Recent and past studies have provided insight into the influence of groundwater pumping in the southern Chino Basin on the Safe Yield of the Basin, and on the discharge of rising groundwater to the Prado Basin and the Santa Ana River. Several studies, as discussed below, quantify the impacts of Chino Basin Desalter well field[1] pumping on groundwater discharge to the Prado Basin and the Santa Ana River.

The desalter well fields were first described in *Nitrogen and TDS Studies, Upper Santa Ana Watershed* (James M. Montgomery, Consulting Engineers, Inc., 1991). This study matched desalter production to meet future potable demands in the southern Chino Basin through 2015. Well fields were sited to maximize the interception of rising groundwater discharge from the north and to induce streambed percolation in the Santa Ana River. The decrease in rising groundwater and increase in streambed infiltration were projected to account for 45 to 65 percent of total desalter pumping.

A design study for the Chino Basin Desalter well fields provided estimates of the volume of rising groundwater discharge intercepted by desalter production (Wildermuth Environmental, Inc. [WEI], 1993). This study used a detailed model of the southern Chino Basin to evaluate the hydraulic impacts of desalter pumping on rising groundwater discharge and groundwater levels at nearby wells. This study showed the relationship of intercepting rising groundwater discharge to well field locations and well pumping capacity. The fraction of total desalter well pumping composed of decreased rising groundwater discharge and increased streambed infiltration was estimated to range from 40 to 50 percent.

[1] Chino Basin Desalter well field pumping is intended to the replace lost agricultural pumping in the southern Chino Basin to maintain the yield of the Basin and prevent rising groundwater from the Basin to the Santa Ana River. The 2000 OBMP indicated that agricultural pumping is projected to decrease 40,000 afy as land use transitioned to urban uses.



Antidegradation Groundwater Management Zones (GMZs)

GMZ Boundary

Chino 3 — GMZ Name
260 — TDS Objective (mgl)
3.5 — Nitrate Objective (mgl)

Prado Basin Management Zone (PBMZ)

Maximum-Benefit GMZ

Chino-North

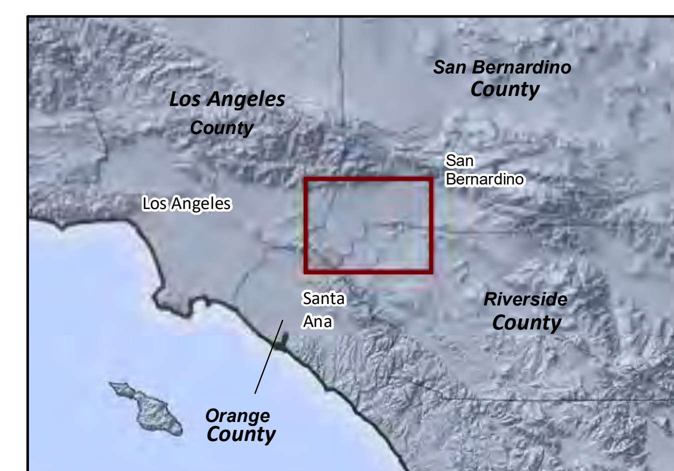
Chino-North — GMZ Name
420 — TDS Maximum-Benefit Objective (mgl)
5.0 — Nitrate Maximum-Benefit Objective (mgl)

Chino Basin Desalter Well

Rivers and Streams

Flood Control and/or Conservation Basins

*PBMZ has a surface water objective.



Prepared by:

WEST YOST Water. Engineered.

Author: SO

Date: 3/18/2021

0 2 4 Miles

0 4 8 Km

Prepared for:

Chino Basin Watermaster
2020 Maximum Benefit
Annual Report

Chino Basin Management Zones
Antidegradation and Maximum-Benefit Objectives for TDS and Nitrate

Figure 1-1

A subsequent analysis, consistent with the OBMP Implementation Plan and the Peace II Agreement, projected the increase in streambed infiltration to be about 20 percent of desalter pumping due to Watermaster's basin re-operation[2] plan alone (Wildermuth Environmental, Inc., 2009d). This projection was made using the 2007 Chino Basin Model to evaluate then-current and projected groundwater pumping at the Chino Basin Desalter wells through 2060 as envisioned in the Peace II Agreement project description.

In 2011, the Watermaster initiated the process to recalculate the safe yield, which included an update and recalibration of its groundwater model. The 2013 Chino Basin Model was used to 1) estimate the historical volumes of rising groundwater discharge to the Santa Ana River and the recharge of the Santa Ana River for the period 1961 through 2011; and 2) project the discharge and recharge volumes through 2050 (WEI, 2015c). The projected New Yield[3] from Santa Ana River recharge estimated by the 2013 Chino Basin Model was 61 percent of desalter well pumping in fiscal year 2011 and decreases to about 49 percent of total future desalter well pumping through fiscal year 2030. This New Yield induced by pumping at the desalter wells and basin re-operation is consistent with the planning estimates described in the previous studies. These studies demonstrate that the yield of the Chino Basin is enhanced by increasing groundwater pumping in the southern portion of the Basin. These studies also indicated that the Chino Basin Desalter and re-operation authorized in the Peace II Agreement and approved by the Court will 1) capture groundwater flowing south from the forebay regions of the Chino Basin; and 2) reduce the outflow of high-salinity groundwater to the Santa Ana River, thereby providing greater protection of downstream beneficial uses.

1.2 The OBMP and the 2004 Basin Plan Amendment

The Chino Basin OBMP (WEI, 1999) was developed by Watermaster and the parties to the 1978 Chino Basin Judgment (Chino Basin Municipal Water District v. City of Chino et al.) pursuant to a February 19, 1998 court ruling. The OBMP maps a strategy that provides for the enhanced yield of the Chino Basin and reliable water supplies for the development expected to occur within the Basin. The goals of the OBMP are to: enhance basin water supplies, protect and enhance water quality, enhance the management of the Basin, and equitably finance the OBMP. The OBMP Implementation Plan is the court-ordered governing document for achieving the goals defined in the OBMP. The OBMP Implementation Plan is a comprehensive, long-range water management plan for the Chino Basin and includes the use of recycled water for direct reuse and artificial recharge. It also includes the capture of increased quantities of high-quality storm water, the recharge of imported water when its total dissolved solids (TDS) concentrations are low, improving the water supply by desalting poor-quality groundwater, supporting regulatory efforts to improve water quality in the Basin, and the implementation of management activities that will result in the reduced outflow of high-TDS/high-nitrate groundwater to the Santa Ana River and the Orange County Basin, thus ensuring the protection of downstream beneficial uses and water quality.

---

[2] Re-operation as defined in Peace II Agreement "means the controlled overdraft of the Basin by the managed withdrawal of groundwater Production for the Desalters and the potential increase in the cumulative un-replenished Production from 200,000 acre-feet authorized by paragraph 3 of the Engineering Appendix Exhibit I to the Judgement, to 600,000 acre-feet for the express purpose of securing and maintaining Hydraulic Control as a component of the Physical Solution."

[3] New Yield as defined in the Peace Agreement "means proven increases in yield in quantities greater than historical amounts from sources of supply including, but not limited to, […] operations of the Desalters […] and other management activities implemented and operational after June 1, 2000." The net Santa Ana River recharge in fiscal year 2000 is the baseline from which to measure New Yield from Santa Ana River recharge in all subsequent years.

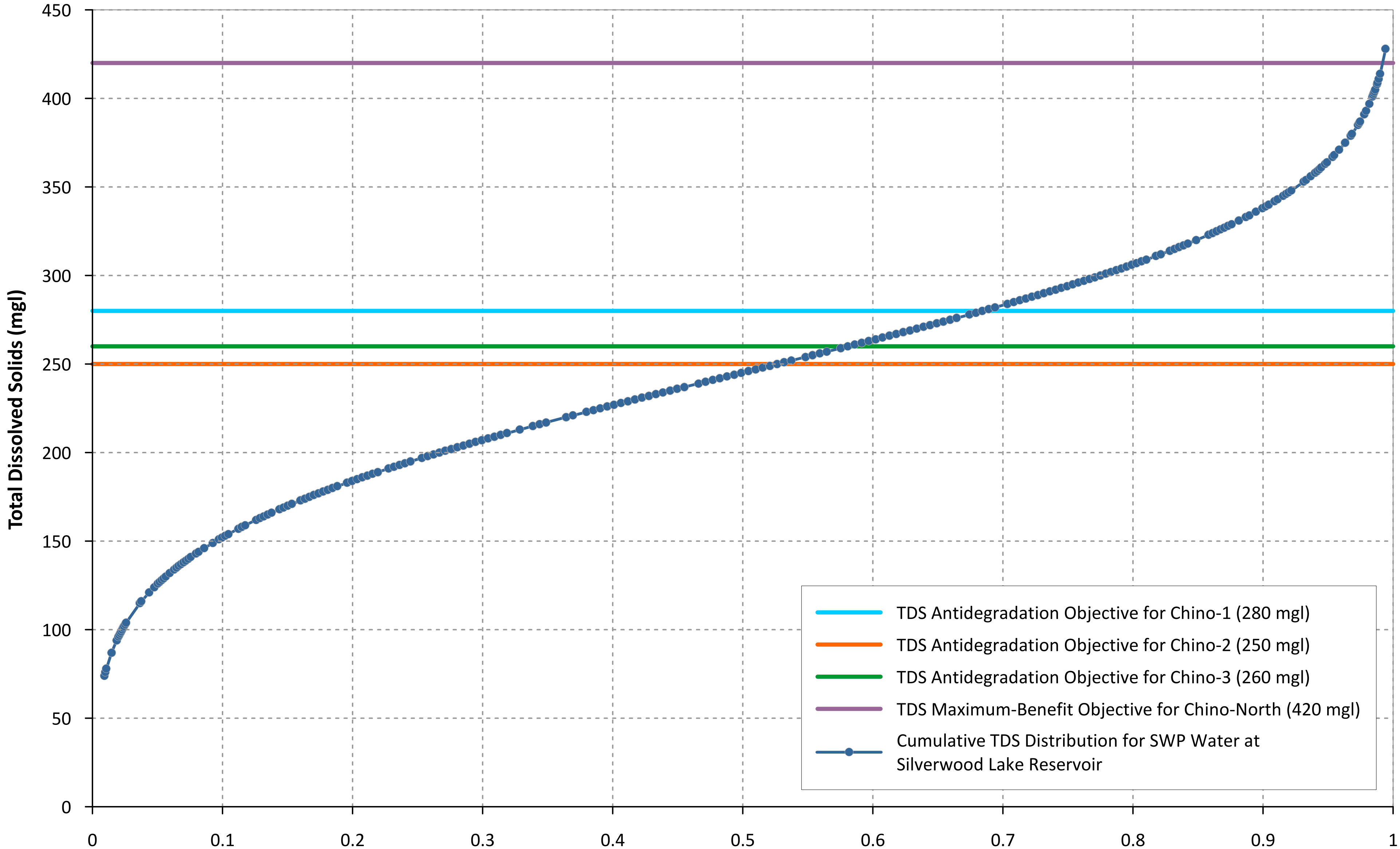
The 1995 Basin Plan contained restrictions on the use of recycled water for irrigation and groundwater recharge. In particular, it contained TDS objectives ranging from 220 to 330 milligrams per liter (mgl) over a significant portion of the Chino Basin. The ambient TDS concentrations in these areas exceeded the objectives, which meant that no assimilative capacity existed for the discharge or recharge of high-TDS water sources over the Basin. Therefore, the use of the IEUA's recycled water (which had a TDS concentration of about 490 mgl at the time) for irrigation and groundwater recharge—one of the key elements of the OBMP Implementation Plan—would require mitigation even though recycled water reuse would not materially impact future TDS concentrations or impair the beneficial uses of Chino Basin groundwater.

In 1995, in part because of these considerations, the Regional Board initiated a collaborative study with 22 water supply and wastewater agencies, including Watermaster and the IEUA, to devise a new TDS and nitrogen management plan for the Santa Ana Watershed. This study culminated in the Regional Board's adoption of a Basin Plan amendment in January 2004 (Regional Board, 2004). This amendment included revised groundwater subbasin boundaries, termed "groundwater management zones" (GMZs), revised TDS and nitrate as nitrogen (hereafter referred to as nitrate) objectives for groundwater, revised TDS and nitrogen wasteload allocations, revised surface water reach designations, and revised TDS and nitrate objectives and beneficial uses for specific surface waters. The technical work supporting the 2004 Basin Plan amendment was directed by the total inorganic nitrogen (TIN)/TDS Task Force and is summarized in *TIN/TDS Phase 2A: Tasks 1 through 5, TIN/TDS Study of the Santa Ana Watershed* (WEI, 2000).

The new TDS and nitrate objectives for the GMZs in the Santa Ana River Basin were established to ensure that water quality is maintained pursuant to the State's antidegradation policy (State Board Resolution No. 68-16). These objectives were termed "antidegradation" objectives. Figure 1-1 shows the antidegradation objectives for the five Chino Basin GMZs[4]: Chino-1, Chino-2, Chino-3, Chino-East, and Chino-South. Note that the antidegradation TDS objectives for Chino-1, Chino-2, and Chino-3 are low (250 to 280 mgl) and would restrict recycled water reuse and artificial recharge, as well as the recharge of imported water when its TDS concentration is above the objectives, without mitigation. Figure 1-2 is a cumulative distribution plot that shows the percent of time that the TDS concentration of State Water Project (SWP) water at Silverwood Lake[5] has been less than or equal to the TDS antidegradation objectives for these three GMZs based on the observed TDS concentrations from 1980 through 2020, a period of 40 years. The TDS concentrations of SWP water were less than the antidegradation objectives in the Chino-1, -2, and -3 GMZs about 67, 53, and 58 percent of the time, respectively.

[4] Note that the Prado Basin Management Zone is regulated by the Regional Board as a surface water management zone and does not have groundwater objectives assigned.

[5] Silverwood Lake in the San Bernardino Mountains is a reservoir on the east branch of the SWP that supplies the IEUA region with SWP water deliveries from the Metropolitan Water District of Southern California (MWD) via the Devil Canyon Power Plant Afterbay and Upper Feeder Pipeline.



Probability That the TDS Concentration of Imported Water from Silverwood Lake Treatment Plant is Less Than or Equal to a Specified Value

Prepared by:

WEST YOST
Water. Engineered

Author: SO
Date:2/25/20

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Prepared for:

Chino Basin Watermaster
2020 Maximum Benefit
Annual Report

Cumulative Distribution of
State Water Project TDS Concentrations
Silverwood Lake Reservoir - 1980 to 2020

Figure 1-2

To address this issue, Watermaster and the IEUA proposed, and the Regional Board accepted, alternative "maximum benefit" objectives for a new GMZ, the Chino-North GMZ (Chino-North), that combined Chino-1, Chino-2, and Chino-3 into one single management unit, as shown in Figure 1-1. All of the recharge activities that would occur as part of the OBMP Implementation Plan are within Chino-North. The TDS and nitrate maximum-benefit objectives established for Chino-North are 420 and 5 mgl, respectively. The maximum-benefit TDS objective was higher than the then-current ambient TDS concentration of 300 mgl, thus creating 120 mgl of assimilative capacity for TDS and allowing for recycled water reuse and recharge, and imported water recharge, without mitigation. Under the maximum benefit program, the TDS concentration of SWP water is projected be less than the 420 mgl maximum-benefit objective 99 percent of the time, as shown in Figure 1-2.

The maximum-benefit objectives were established based on demonstrations by Watermaster and the IEUA that the antidegradation requirements were satisfied. First, they demonstrated that beneficial uses would continue to be protected. Second, they showed that water quality consistent with maximum benefit to the people of the State of California would be maintained. Other factors consistent with California Water Code Section 13241—such as economics, the need to use recycled water, and the need to develop housing in the area—were also considered in establishing the maximum-benefit objectives.

1.3 Maximum Benefit Implementation Plan for Salt Management: Maximum-Benefit Commitments

The application of the maximum-benefit objectives is contingent upon the implementation of specific projects and programs by Watermaster and the IEUA. These projects and programs, termed the "Chino Basin maximum-benefit commitments," are described in the Maximum Benefit Implementation Plan for Salt Management in Chapter 5 of the Basin Plan and are listed in Table 5-8a therein (Regional Board, 2008). These commitments include:

- The implementation of a surface-water monitoring program.
- The implementation of a groundwater monitoring program.
- The expansion of the Chino-I Desalter to a capacity of 10 million gallons per day (mgd) and the construction of the Chino-II Desalter with a design capacity of 10 mgd.
- The additional expansion of desalter capacity (20 mgd) pursuant to the OBMP and the Peace Agreement (tied to the IEUA's agency-wide effluent concentration).[6]
- The completion of the recharge facilities included in the Chino Basin Facilities Improvement Program.
- The management of recycled water quality to ensure that the IEUA agency-wide, 12-month running average wastewater effluent quality does not exceed 550 mgl and 8 mgl for TDS and TIN, respectively.
- The management of basin-wide, volume-weighted TDS and nitrogen concentrations in artificial recharge to less than or equal to the maximum-benefit objectives.

[6] The desalter expansion of an additional 20 mgd was initially required to occur when the 12-month running average for IEUA agency-wide effluent TDS concentration exceeded 545 mgl for three consecutive months. The expansion of the desalters of an additional 20 mgd has occurred without triggering this exceedance and been driven by the implementation of the Peace II Agreement and achieving hydraulic control.

- The achievement and maintenance of the "hydraulic control" of groundwater outflow from the Chino Basin, specifically from Chino-North, to protect Santa Ana River water quality and downstream beneficial uses.
- The determination of ambient TDS and nitrate concentrations of Chino Basin groundwater every three years.

If these maximum-benefit commitments are not met, the antidegradation objectives would apply for regulatory purposes. The application of the antidegradation objectives would result in no assimilative capacity for TDS and nitrate in the Chino-1, Chino-2, and Chino-3 GMZs, and the Regional Board would require mitigation for both recycled water and imported SWP water discharges to Chino-North that exceed the antidegradation objectives. Furthermore, the Regional Board would require that Watermaster and the IEUA mitigate the effects of discharges of recycled and imported SWP water that took place in excess of the antidegradation objectives under the maximum-benefit objectives retroactively to January 2004. The mitigation for past discharges would be required to be completed within a ten-year period following the Regional Board's finding that the maximum-benefit commitments were not met.

1.4 Purpose and Report Organization

This report describes the status of compliance with the maximum-benefit commitments listed above and is organized as follows:

- Section 1.0 – Introduction. This section provides context and background regarding the development of the maximum-benefit objectives and the associated maximum-benefit commitments for the Chino Basin.
- Section 2.0 – Maximum-Benefit Commitment Compliance. Section 2.0 describes the status of compliance with each of the maximum-benefit commitments.
- Section 3.0 – Data Collected in 2020. Section 3.0 describes the data collected in 2020 as part of the maximum-benefit monitoring program.
- Section 4.0 –Influence of Rising Groundwater on the Santa Ana River. Section 4.0 characterizes the influence of rising groundwater on the flow and quality of the Santa Ana River between the Riverside Narrows and Prado Dam.
- Section 5.0 – References. Section 5.0 provides the references consulted in performing the analyses described herein and in writing this report.

2.0 MAXIMUM BENEFIT COMMITMENT COMPLIANCE

Table 2-1 lists the status of compliance for each of the nine maximum-benefit commitments outlined in the Maximum Benefit Implementation Plan for Salt Management in Chapter 5 of the Basin Plan (Regional Board, 2008) as of December 31, 2020. A discussion of ongoing activities related to commitment compliance is provided below. For this discussion, the commitments are grouped together into four main topics: hydraulic control, Chino Basin Desalters, recycled water recharge and quality, and the recomputation of ambient groundwater quality.

2.1 Hydraulic Control

The Regional Board requires that Watermaster and the IEUA achieve and maintain “hydraulic control” of groundwater outflow from Chino-North (Commitment number 8). The Basin Plan defines hydraulic control as: “[…] eliminating groundwater discharge from the Chino Basin to the Santa Ana River, or controlling the discharge to *de minimis* levels […].” In practice, Watermaster and the IEUA use a more measurable definition of hydraulic control: eliminating groundwater discharge from Chino-North to the Prado Basin Management Zone (PBMZ) or controlling the discharge to *de minimis* levels. In a letter from the Regional Board to Watermaster and the IEUA, dated October 12, 2011, the Regional Board defined the *de minimis* discharge of groundwater from Chino-North to the PBMZ as less than 1,000 acre-feet per year (afy). (Regional Board, 2011).

2.1.1 Hydraulic Control Monitoring Program

The surface-water and groundwater monitoring programs implemented for Commitments number 1 and number 2 are designed, in part[7], to collect the data necessary to determine the state of hydraulic control and are referred to collectively as the Hydraulic Control Monitoring Program (HCMP). In May 2004, Watermaster and the IEUA submitted a surface-water and groundwater monitoring program work plan to the Regional Board entitled *Final Hydraulic Control Monitoring Program Work Plan for the Optimum Basin Management Program* (Work Plan [WEI, 2004b]). The Regional Board adopted Resolution R8-2005-0064, approving the Work Plan, and required Watermaster and the IEUA to implement the HCMP.

[7] The groundwater monitoring program also supports the recomputation of ambient water quality and several of Watermaster’s OBMP activities.

Table 2-1. Status of Compliance with the Chino Basin Maximum-Benefit Commitments

Description of Commitment	Compliance Date (as soon as possible, but no later than)	Status of Compliance
1. Surface Water Monitoring Program[(a)]		
a. Submit draft Monitoring Program to Regional Board	a. January 23, 2005	a. Draft work plan submitted to the Regional Board on January 23, 2005
b. Implement Monitoring Program	b. Within 30 days from the date of Regional Board approval of the monitoring plan	b. Monitoring plan initiated prior to Regional Board approval
c. Submit Draft Revised Monitoring Program to Regional Board	c. 15 days from 2012 Basin Plan Amendment (BPA) approval	c. Draft work plan submitted to the Regional Board on February 16, 2012, six days after 2012 BPA approval
d. Implement Revised Monitoring Program	d. Upon Regional Board approval	d. Revised monitoring program began in December 2012 after the BPA was approved by the Office of Administrative Law on December 6, 2012
e. Submit Draft Revised Monitoring Program(s) (subsequent to that required in "c", above) to Regional Board	e. Upon notification of the need to do so from the Regional Board Executive Officer and in accordance with the schedule prescribed by the Executive Officer	e. No revisions requested by the Regional Board
f. Implement Revised Monitoring Program(s)	f. Upon Regional Board approval	f. N/A
g. Annual data report submittal	g. April 15th	g. All annual reports submitted by April 15 of each year since 2006
2. Groundwater Monitoring Program[(a)]		
a. Submit Draft Monitoring Program to Regional Board	a. January 23, 2005	a. Draft monitoring plan submitted to Regional Board on January 23, 2005
b. Implement Monitoring Program	b. Within 30 days from the date of Regional Board approval of the monitoring plan	b. Monitoring program initiated prior to Regional Board approval
c. Plan and schedule for demonstrating hydraulic control	c. By December 31, 2013	c. Plan and schedule for demonstrating hydraulic control submitted in the 2014 Work Plan to the Regional Board on December 23, 2013

Table 2-1. Status of Compliance with the Chino Basin Maximum-Benefit Commitments		
Description of Commitment	Compliance Date (as soon as possible, but no later than)	Status of Compliance
d. Implement hydraulic control demonstration	d. Upon Regional Board approval	d. Hydraulic control demonstration reported in all annual reports
e. Submit Draft Revised Monitoring Program(s) (subsequent to that required in "a", above) to Regional Board	e. Upon notification of the need to do so from the Regional Board Executive Officer and in accordance with the schedule prescribed by the Executive Officer	e. No revisions requested by Regional Board
f. Implement revised monitoring plans (s)	f. Upon Regional Board approval	f. N/A
g. Annual data report submittal	g. April 15th	g. All annual reports submitted by April 15 of each year
3. Chino Desalters		
a. Chino-I Desalter expansion to 10 mgd	a. Prior to the recharge of recycled water	a. Chino-I Desalter expansion to a pumping capacity of 14 mgd (15,700 afy) was completed in April 2005 and operation began in October 2005; recycled water recharge began in July 2005
b. Chino-II Desalter construction to 10 mgd capacity	b. Recharge of recycled water allowed once award of contract and notice to proceed issued for construction of desalter treatment plant	b. Contract for Chino-II Desalter awarded in early 2005; construction was completed to a pumping capacity of 10 mgd (11,00 afy), and the facility went online in June 2006

Table 2-1. Status of Compliance with the Chino Basin Maximum-Benefit Commitments

Description of Commitment	Compliance Date (as soon as possible, but no later than)	Status of Compliance
4. Submittal of future desalters plan and schedule		
	Plan due: October 1, 2005 Trigger for construction: when the IEUA agency-wide 12-month running average effluent TDS concentration exceeds 545 mgl for three consecutive months. Implement plan and schedule upon Regional Board approval	Several plans for desalter expansion have been submitted to the Regional Board since 2005. The expansions have proceed to achieve hydraulic control and to meet the pumping capacity pursuant to Peace II Agreement. Watermaster and the IEUA submitted the most recent desalter expansion plan to the Regional Board on June 30, 2015 . The plan included the construction of three additional wells to achieve the ultimate pumping capacity of 36 mgd (40,000 afy). Two wells were constructed and began operation in 2018. One well was constructed in 2020 and operation will begin in 2021. As of June 2020, the CDA facilities have a pumping capacity of 40,000 afy.
5. Recharge facilities (17) built and in operation		
	June 30, 2005	Watermaster and the IEUA partnered with the San Bernardino County Flood Control District and the Chino Basin Water Conservation District for completion of the Chino Basin Facilities Improvement Program to construct and/or improve eighteen recharge sites. There are currently 17 basins in the Chino Basin Groundwater Recharge Program.

Table 2-1. Status of Compliance with the Chino Basin Maximum-Benefit Commitments

Description of Commitment	Compliance Date (as soon as possible, but no later than)	Status of Compliance
6. Submittal of IEUA wastewater quality improvement plan and schedule		
	60 days after agency-wide, 12-month running average effluent TDS quality equals or exceeds 545 mgl for 3 consecutive months, or after agency-wide, 12-month running average TIN equals or exceeds 8 mgl in any month Implement plan and schedule upon approval by Regional Board	These threshold events have not occurred; therefore, a wastewater quality improvement plan has not been submitted (See Table 2-6, and Figures 2-6 and 2-7 of this report).
7. Recycled water will be blended with other recharge sources such that the volume-weighted, 5-year running average TDS and nitrate-nitrogen concentrations of recharge are equal to or less than the maximum benefit water quality objectives.		
	Compliance must be achieved by the end of the 5th year after initiation of recycled water recharge operations.	
a. Submit a report that documents the location, amount of recharge, and TDS and nitrogen quality of storm water recharge before the OBMP recharge improvements were constructed and what is projected to occur after the recharge improvements are completed.	a. Prior to initiation of recycled water recharge	a. No documentation of water quality data or quantity for storm water prior to OBMP initiation exists. Storm water has been monitored for flow, TDS, and nitrogen since 2005.
b. Submit documentation of the amount and TDS and nitrogen quality of all sources of recharge and recharge locations. For storm water recharge used for blending, submit documentation that the recharge is the result of OBMP enhanced recharge facilities.	b. Annually, by April 15th, after initiation of construction of basins/other facilities to support enhanced storm water recharge	b. The volume-weighted, 5-year running average TDS and nitrate-nitrogen concentrations of Chino Basin recharge are less than the maximum-benefit water quality objectives (See Table 2-5, and Figures 2-5a and 2-5b of this report).

Table 2-1. Status of Compliance with the Chino Basin Maximum-Benefit Commitments		
Description of Commitment	Compliance Date (as soon as possible, but no later than)	Status of Compliance
8. Hydraulic Control Failure		
a. Plan and schedule to correct loss of hydraulic control	a. 60 days from Regional Board finding that hydraulic control is not being maintained	a. No mitigation plan and schedule for the loss of hydraulic control has been requested.
b. Achievement and maintenance of hydraulic control	b. In accordance with plan and schedule approved by the Regional Board	b. Hydraulic control has been achieved to the east of Chino-I Desalter Well 20. Groundwater model estimates published in 2015 indicate that production at the CCWF will achieve hydraulic control in the west to de minimis levels (<1,000 afy of groundwater flow past the CCWF well field to the PBMZ). Full production at the CCWF was achieved in 2016. Watermaster and the IEUA submitted a plan on June 30, 2015 to the Regional Board to construct three additional wells to achieve the ultimate Desalter capacity of 40,000 afy. Two wells were constructed and began operation in 2018. One well was constructed in 2020 and operation will begin in 2021.
c. Mitigation plan for temporary failure to achieve/maintain hydraulic control	c. By January 23, 2005	c. Plan submitted to the Regional Board on March 3, 2005. No mitigation action has been triggered.
9. Ambient Groundwater Quality Determination		
	July 1, 2005 and every three years thereafter	Watermaster and the IEUA have participated in the regional triennial ambient water quality determination as requested by SAWPA. Watermaster and the IEUA provide their fair share of funds and substantial groundwater data for this effort.

(a) The commitments related to surface water and groundwater monitoring were revised by a Basin Plan amendment approved by the Regional Board on February 10, 2012. The commitments and status of compliance shown in this table reflect the amended commitments for surface water and groundwater monitoring.

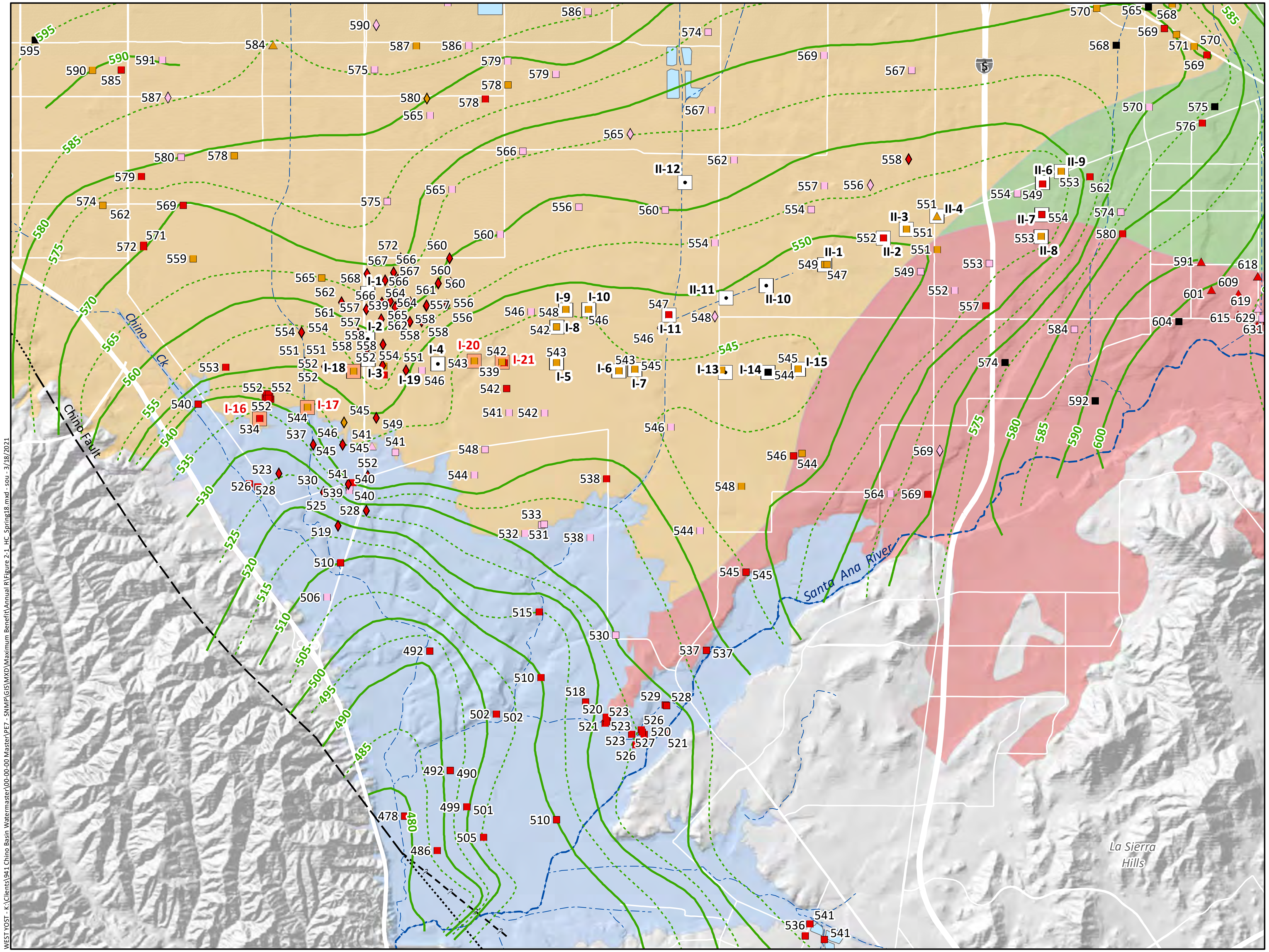
afy = acre-feet per year
mgd = million gallons per day
mgl = milligrams per liter
TDS = Total Dissolved Solids

The initial design of the HCMP included multiple lines of evidence because it was unclear whether one line of evidence would clearly demonstrate hydraulic control. The multiple lines of evidence were:

- Collect and analyze groundwater-elevation data to determine the direction of groundwater flow in the southern part of the Chino Basin and whether pumping at the Chino Basin Desalter well fields is completely capturing all groundwater that would otherwise discharge out of Chino-North and into the PBMZ.
- Collect and analyze the chemistry of basin-wide groundwater and the Santa Ana River to 1) track the migration, or lack thereof, of the South Archibald volatile organic compound (VOC) plume beyond the Chino Basin Desalter well fields; and 2) identify the source of groundwater in the area of the Chino Basin between the Santa Ana River and the Chino Basin Desalter well fields.
- Collect and analyze surface-water quality data and surface-water discharge measurements to determine if groundwater from the Chino Basin is rising as surface water and contributing to flow in the Santa Ana River or if the River is recharging the Basin.
- Use Watermaster's numerical groundwater-flow model to corroborate the results and interpretations of the first three lines of evidence.

Watermaster and the IEUA executed this surface-water and groundwater-monitoring program pursuant to the Work Plan from 2004 through 2011 and concluded that 1) hydraulic control had been achieved to the east of Chino-I Desalter Well 5; 2) hydraulic control had not been achieved to the west of Chino-I Desalter Well 5; and 3) the impact of rising groundwater discharge from Chino-North on surface-water quality in the Santa Ana River at Prado Dam has been de minimis (WEI, 2007b; 2008b; 2009a; 2010; 2011a; and 2012b). In 2010, the Chino Basin Desalter Authority[8] (CDA) began construction of the Chino Creek Well Field (CCWF), which was designed to achieve hydraulic control to the west of Chino-I Desalter Well 5 (see also Section 2.1.3 and Figure 2-1).Watermaster and the IEUA also concluded that the data collected as part of the surface-water monitoring program were not necessary to determine the state of hydraulic control and began the process of modifying the surface-water and groundwater-monitoring program and maximum-benefit commitments accordingly (WEI 2011a and 2012b).

[8] https://www.chinodesalter.org/



Groundwater-Elevation Contours (feet above mean sea-level)

Well Activity During Groundwater Level Measurement (Number Indicates Groundwater Elevation)

- Measured Static
- Interpolated Static
- Dynamic, Recovering, or Activity Unknown

Aquifer Layer Where Well Casing is Perforated (Color Code)

- Layer 1
- Layers 1 & 2
- Layers 1 & 2 & 3
- Unknown Well Construction

- HCMP Monitoring Well
- Chino Basin Desalter Well
- Chino Basin Desalter Well - CCWF
- Flood Control and/or Conservation Basins
- Streams & Flood Control Channels

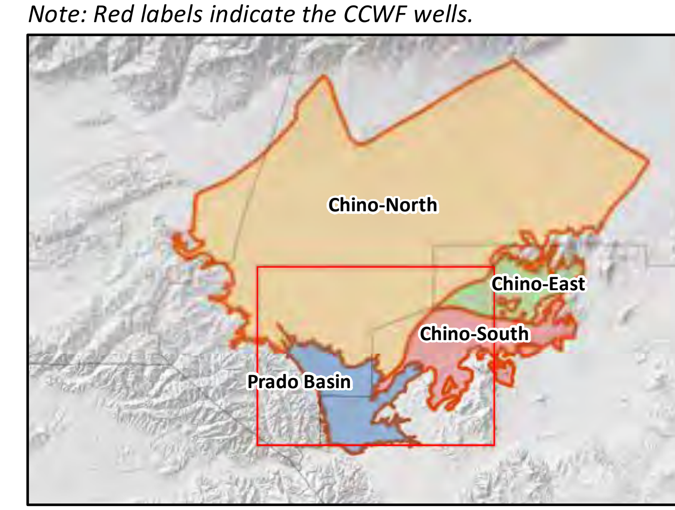
Management Zones

- Chino-North GMZ
- Chino-South GMZ
- Chino-East GMZ
- Prado Basin MZ

Faults

- Location Certain
- Location Concealed
- Location Approximate
- Location Uncertain
- Approximate Location of Groundwater Barrier

Note: Red labels indicate the CCWF wells.



Prepared by:

WEST YOST Water. Engineered.

Author: SO

Date: 3/18/2021

0 1 2 Miles

0 2 4 Km

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Chino Basin Watermaster
2020 Maximum Benefit
Annual Report

State of Hydraulic Control
Spring 2018

Figure 2-1

On February 10, 2012, the Regional Board adopted an amendment to the Basin Plan to remove all references to specific monitoring locations and sampling frequencies for the groundwater and surface-water monitoring programs and, in their place, required that Watermaster and the IEUA submit 1) an updated surface-water monitoring program by February 25, 2012; and 2) a revised groundwater monitoring program and schedule for achieving hydraulic control by December 31, 2013. Pursuant to 1), Watermaster and the IEUA submitted the *2012 Hydraulic Control Monitoring Program Work Plan* (2012 Work Plan) to the Regional Board on February 25, 2012 (WEI, 2012a). The 2012 Work Plan was adopted by the Regional Board on March 16, 2012 (Regional Board, 2012).[9] Pursuant to 2), Watermaster and the IEUA submitted the *2014 Maximum Benefit Monitoring Work Plan* (2014 Work Plan) to the Regional Board on December 23, 2013 (WEI, 2013c).[10] The 2014 Work Plan was approved by the Regional Board on April 25, 2014 (Regional Board, 2014b).

Each year, the data collected pursuant to the 2014 Work Plan is summarized and included in the Chino Basin Maximum Benefit Annual Report (see Section 3.0 of this report).

2.1.2 Hydraulic Control Monitoring Program Objectives and Methods

Based on the data collection and analyses performed to date, the ongoing questions to be answered by the HCMP are:

1. Will hydraulic control of groundwater from Chino-North be maintained east of Chino-I Desalter Well 5?
2. Will the CCWF continue to reduce groundwater discharge from Chino-North to the PBMZ past the desalter well field west of Chino-I Desalter Well 5 to the *de minimis* threshold of 1,000 afy or less?
3. Will the impact of groundwater discharge from Chino-North to the PBMZ that becomes rising groundwater on the surface-water quality in the Santa Ana River remain *de minimis*?

Watermaster and the IEUA use the following methods to answer these questions:

Method to Address Question 1: The groundwater-level monitoring program and periodic groundwater modeling will continue to be used to define the capture zone created by the Chino Basin Desalter well field east of Chino-I Desalter Well 5. These methods will be sufficient to demonstrate hydraulic control in this area in the future.

Watermaster prepares a State of the Basin (SOB) Report every two years (see WEI, 2019a for example). The SOB Report includes a spring groundwater-elevation contour map of the southern portion of Chino Basin, showing the capture zone of the Chino Basin Desalter well field, and a characterization of the state of hydraulic control based on the groundwater-elevation contours. The most up-to-date hydraulic control

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[9] The 2012 Basin Plan amendment was approved by the Office of Administrative Law on December 6, 2012, and at that time, the revised surface-water monitoring program (2012 Work Plan) was implemented.

[10] The name was changed from the Hydraulic Control Monitoring Program Work Plan to the Maximum Benefit Monitoring Program Work Plan to clarify that the 2014 Work Plan (and its predecessor) contains the monitoring and data collection strategy for complying with both the maximum-benefit monitoring directives of demonstrating hydraulic control and computing ambient water quality.

findings in the SOB Report will be referenced each year in the Chino Basin Maximum Benefit Annual Report (see Section 2.1.3 of this report).

Watermaster recalibrates and runs its groundwater-flow model at least every five years to assess the physical impacts of the implementation of the OBMP and Peace II Agreement, the state of hydraulic control, the balance of recharge and discharge, the cumulative impact of water rights transfers among the parties, and to recalculate safe yield. The most up-to-date modeling assessment of the then-current and projected state of hydraulic control will be referenced each year in the Maximum Benefit Annual Report (see Section 2.1.3 of this report).

Method to Address Question 2: The 2013 Chino Basin Model estimated that the amount of groundwater discharge from Chino-North to the PBMZ in the absence of the CCWF has been about 2,400 afy (WEI, 2014a). The model was used to estimate the discharge once the CCWF wells are in operation. The results indicated that with planned production at the CCWF (1,529 afy), the groundwater discharge from Chino-North to the PBMZ would decrease to about 900 afy by 2016, which is less than the *de minimis* threshold.

At least every five years, historical production, and groundwater-level data for the CCWF and other wells will be used to recalibrate the Chino Basin Model. The model will be used to calculate annual groundwater discharge past the CCWF since the start of CCWF operations and to estimate future groundwater discharge past the CCWF based on projected groundwater pumping in the Basin. The most up-to-date modeling assessment of the then-current and projected groundwater discharge past the CCWF will be referenced each year in the Maximum Benefit Annual Report (see Section 2.1.4 of this report).

Method to Address Question 3: The HCMP has shown that the historical and current impacts of groundwater discharge from Chino-North to the PBMZ that becomes rising groundwater on the surface-water quality of the Santa Ana River at Prado Dam is *de minimis*. Groundwater modeling shows that pumping at the CCWF will further decrease the volume of groundwater discharge from Chino-North that becomes rising groundwater in the PBMZ and thereby further reduces the impact on Santa Ana River water quality.

A 2015 mass-balance analysis estimated the impact of groundwater discharge from Chino-North to the PBMZ through the CCWF on the volume-weighted TDS concentration of the Santa Ana River at Prado Dam. The mass-balance analysis estimated that without the CCWF, rising groundwater from Chino-North would increase the TDS concentration of the Santa Ana River at Prado Dam by approximately 8 mgl (one and a half percent increase) relative to full hydraulic control in this area. The operation of the CCWF to the *de minimis* threshold reduces the impact to a 4 mgl increase (a half percent increase) relative to full hydraulic control in this area (WEI, 2016).

Continued analysis of Santa Ana River flow and quality at Below Prado Dam will help determine the nature of the impact of groundwater discharge from Chino-North that becomes rising groundwater in the PBMZ. The impact of groundwater discharge from Chino-North to the PBMZ on Reach 2 of the Santa Ana River will be characterized each year in the Chino Basin Maximum Benefit Annual Report (see Section 4.0 of this report).

2.1.3 Current Status of Hydraulic Control

Watermaster and the IEUA demonstrated in previous Annual Reports (WEI, 2007b; 2008b; 2009a; 2010; 2011a; 2012b; 2013a; 2014b; 2015a; and 2016) that complete hydraulic control has been achieved at and east of Chino-I Desalter Well 5. For the area west of Chino-I Desalter Well 5, the operation of the CCWF is intended to achieve hydraulic control to *de minimis* levels (<1,000 afy). In February 2016, the CCWF commenced full-scale operation with production at Wells I-16, I-17, I-20, and I-21 and, by definition, hydraulic control was determined to have been achieved in this area. In 2020, the CCWF wells produced a total of about 1,325 af which is less than the amount previously understood to be necessary to ensure *de minimis* outflows. Production at the CCWF has decreased since 2017 as a result of the new maximum contaminant level (MCL) for 1,2,3-TCP, which required the CDA to temporarily shut down operation of CCWF Well I-17. In 2020, Watermaster's groundwater model was used to estimate the historical (2004-2018) and projected (2019-2050) volume of groundwater discharge past the CCWF (WEI, 2020) under revised pumping conditions at the CCWF. The model-results indicate that both the estimated historical and projected discharge past the CCWF area is always below the *de minimis* threshold level of 1,000 afy (see Section 2.1.4). The model assumes an annual average pumping volume at the CCWF of 992 af from fiscal year 2019 through the remainder of the planning period. In 2021, Watermaster plans to work with the Regional Board to formally update the definition of the minimum pumping required at the CCWF to maintain hydraulic control.

Figure 2-1 shows the most current characterization of the state of hydraulic control based on groundwater-elevation contours for spring 2018 from the 2018 SOB Report (WEI, 2019a). The spring 2018 groundwater-elevation contours show a regional depression in groundwater elevation at and east of Chino-I Desalter well I-20, demonstrating that groundwater flowing from Chino-North to the PBMZ is being captured by the desalter wells in this area.

2.1.4 Future Projection of Hydraulic Control

In a letter dated January 23, 2014, the Regional Board required that Watermaster and the IEUA submit a plan detailing how hydraulic control will be sustained in the future as agricultural pumping in the southern region of Chino-North continues to decrease and how the Chino Basin Desalters will achieve the required total groundwater production level of 40,000 afy. Watermaster and the IEUA coordinated with the CDA to develop a plan to achieve 40,000 afy of desalter well pumping and submitted a final plan to the Regional Board on June 30, 2015 (Watermaster & IEUA, 2015). The plan included the construction and operation of three new wells (II-10, II-11, and II-12) for the Chino-II Desalter. Two of the three wells began operation in the second half of 2018, and the third is anticipated to begin operating in June 2021 (refer to Figure 2-4 and Section 2.2 of this Report for more details).

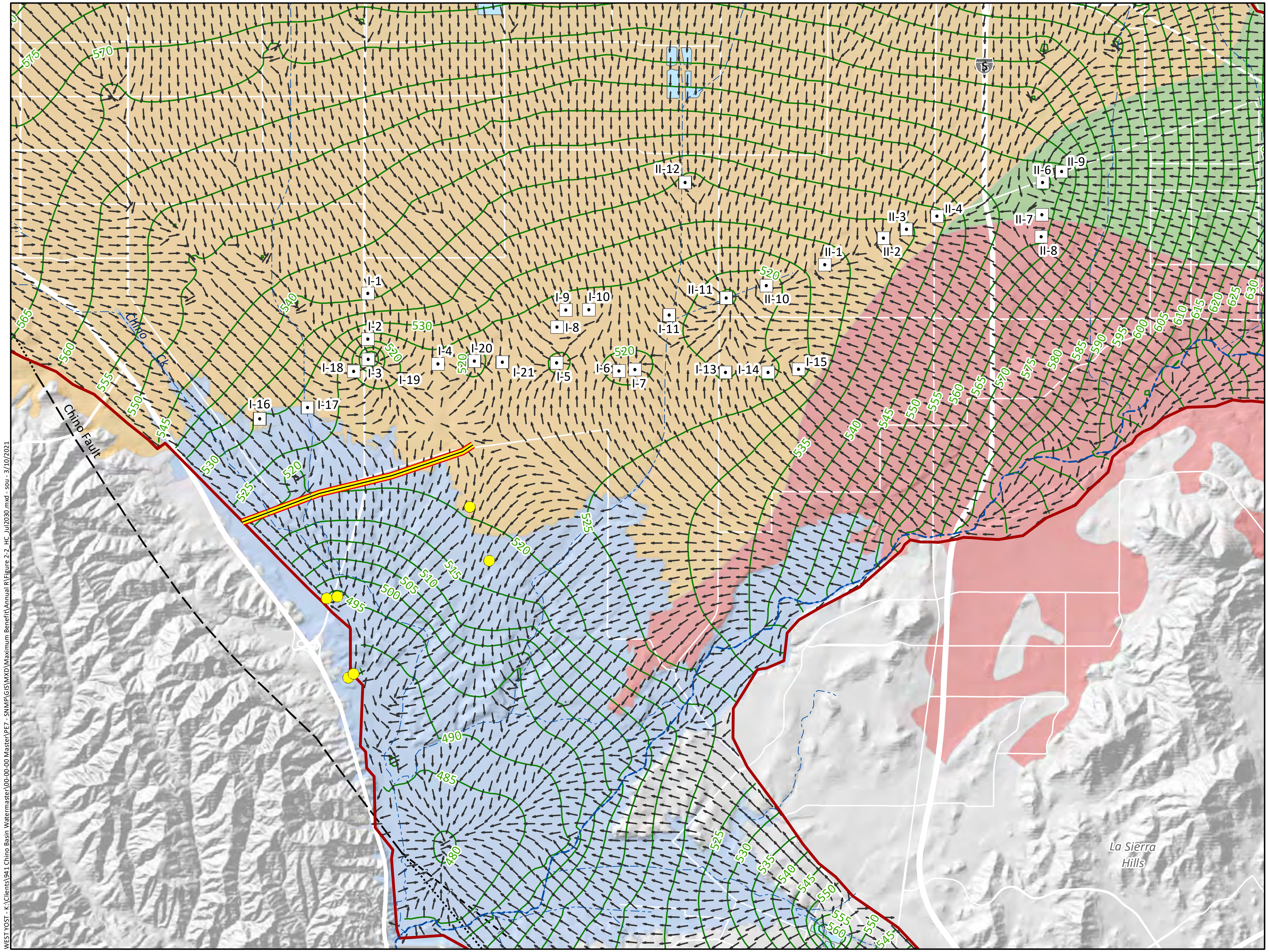
In 2020, Watermaster completed its five-year update and recalibration of the Chino Basin Model to recalculate Safe Yield of the Chino Basin (WEI, 2020). As part of the 2020 Safe Yield recalculation, the future state of hydraulic control was estimated using the updated Chino Basin Model. A planning scenario was developed to recalculate Safe Yield based on the recent planning work reported in the *2018 Storage Framework Investigation* (WEI, 2019b) and the *2020 Storage Management Plan* (WEI, 2020). This scenario, referred to herein as 2020 SYR1 is based on the water demands and water supply plans provided by the Watermaster Parties, planning hydrology that incorporates climate change impacts on precipitation and evapotranspiration (ET), and assumptions regarding cultural conditions and future groundwater replenishment. The projected state of hydraulic control was estimated with the Chino Basin Model by simulating the Chino Basin's response to the 2020 SYR1 scenario. The attainment of hydraulic control is assessed using model-predicted groundwater elevation data to evaluate whether all groundwater north of the desalter well fields is captured by the Chino Basin Desalter well fields (total hydraulic containment standard) or that groundwater discharge through the Chino Basin Desalter well fields is, in aggregate, less than 1,000 afy (*de minimis* standard).

Figure 2-2 shows the model-projected state of hydraulic control in 2030 for the 2020 SYR1 scenario. The figure includes groundwater-elevation contours for model layer 1 and groundwater flow vectors projected for July 2030. The groundwater elevations and directional flow vectors show full hydraulic containment of Chino-North groundwater at and east of Chino-I Well I-20, and groundwater discharge from the Chino-North to the PBMZ and Santa Ana River is projected to not be fully contained by the Chino Basin Desalter well field west of Well I-20.

The volume of groundwater discharge to the west of Well I-20 was estimated through the analysis of model projected discharges across a "line of control" approximately perpendicular to the groundwater flow direction past the CCWF well field area (WEI, 2020). Figure 2-2 shows the location of the line of control. Figure 2-3 is a time-history chart that shows the historical and projected volume of groundwater discharge across the line of control (2004 to 2050). Over this period, the groundwater discharge across the line of control ranges from 380 to 740 afy, averages 490 afy, and is always less than the *de minimis* discharge threshold of 1,000 afy. Additionally, as shown in Figure 2-2, there are several active private pumping wells downgradient of the line of control that further reduce rising groundwater outflow to the PBMZ. As describe above in Section 2.1.3, Watermaster plans to work with the Regional Board to formally update the definition of the minimum pumping required at the CCWF to maintain outflow from the Chino-North to *de minimis* levels.

2.2 Chino Basin Desalters

The operation of the Chino Basin Desalters is fundamental to the maximum benefit requirement of achieving hydraulic control to protect the water quality of the Santa Ana River and managing TDS and nitrate loading from. The operations are essential for maximizing the yield of the Chino Basin and minimizing the loss of stored water. The first Chino Basin Desalter, Chino-I, began operation in late 2000 and had an original design capacity of 8 mgd (8,960 afy). Commitment number 3 required the expansion of Chino-I Desalter and the construction of Chino-II Desalter. In 2005, the Chino-I Desalter was expanded to a capacity of 14 mgd (15,680 afy), and a contract was awarded for the construction of the Chino-II Desalter. The Chino-II Desalter came online in June 2006 with a capacity of 15 mgd (16,800 afy), bringing the total Chino Basin Desalter capacity to 29 mgd (32,480 afy). As articulated in the OBMP Implementation Plan, the Peace Agreement, and the 2007 Peace II Agreement, Watermaster and the IEUA are required to expand desalter well pumping to about 40,000 afy. Commitment number 4 requires the submittal of plans to construct the additional wells and facilities needed to achieve the ultimate capacity defined in the OBMP Implementation Plan, maintain hydraulic control once agricultural pumping ceases in the southern end of the Basin, and to ensure the offset of TDS and nitrate consistent with the maximum benefit proposal. The Basin Plan requires that the construction of the desalter expansion begin once the 12-month running average of the IEUA's agency-wide effluent TDS concentration reaches 545 mgl for three consecutive months.



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2030 Groundwater Flow Vectors
Model Layer 1

2030 Groundwater Elevation Contours
(feet above mean sea-level) - Model Layer 1

Line of Control for Assessment of
Hydraulic Control

Private Wells Assumed Active Downgradient
of the Line of Control

Chino Basin Desalter Well

Groundwater Flow Model Boundary

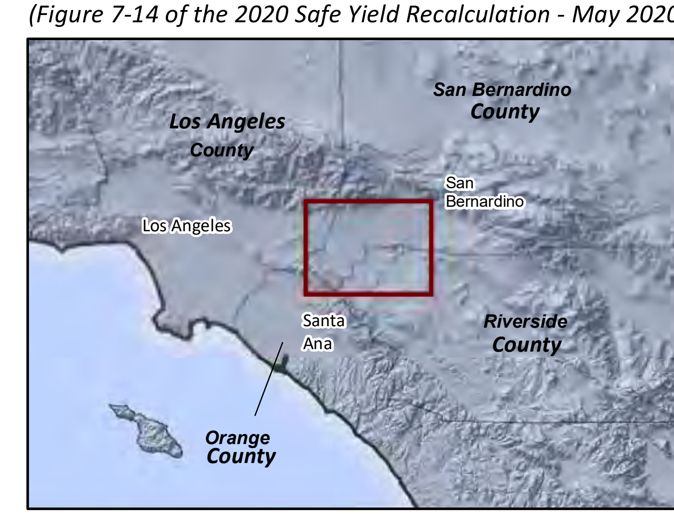
Flood Control and/or Conservation Basins

Streams & Flood Control Channels

Management Zones

Chino-North GMZ
Chino-South GMZ
Chino-East GMZ
Prado Basin MZ

(Figure 7-14 of the 2020 Safe Yield Recalculation - May 2020)



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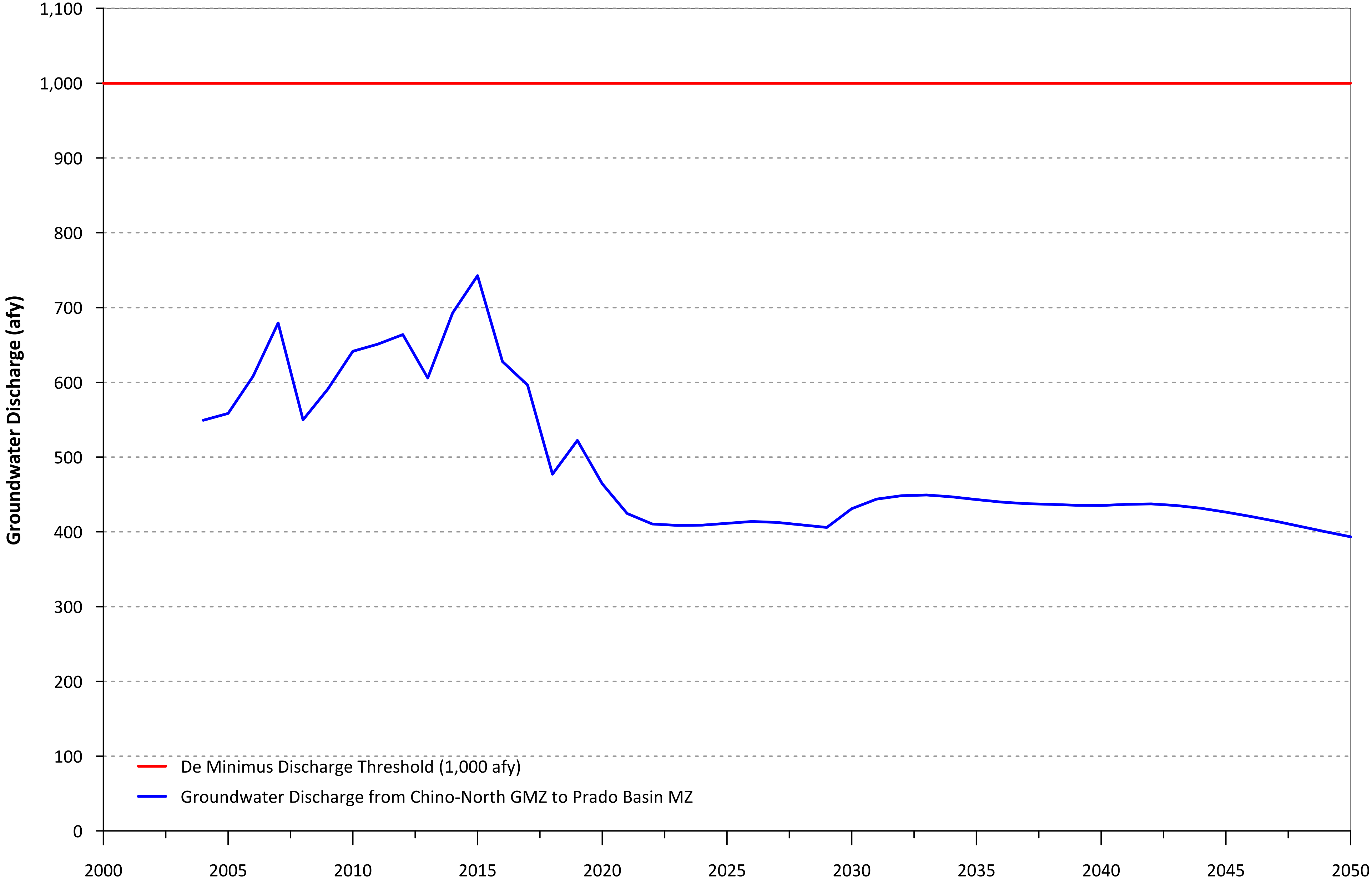
State of Hydraulic Control
July 2030

Figure 2-2



(Figure 7-15 from the Safe Yield Recalculation Report - May 2020)

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Historical and Projected Groundwater Discharge from the Chino-North GMZ to Prado Basin MZ 2005 to 2050

Figure 2-3

Although the IEUA recycled water effluent has never reached 545 mgl as a 12-month average, the Chino Desalter Authority proceeded to expand the capacity of the desalters to ensure the attainment of hydraulic control. The CCWF wells (I-16, I-17, I-18, I-20, and I-21) were constructed between September 2011 and May 2012[11] in the southwestern portion of the Chino Basin to achieve hydraulic control to the west of Well I-5 (see Section 2.1.1). The well locations are shown in Figure 2-4. Pumping at CCWF Wells I-16 and I-17 commenced in mid-2014. Pumping at CCWF Wells I-20 and I-21 commenced in February 2016. The combined pumping capacity of these four wells is about 1,529 afy (1.4 mgd). Due to the presence of VOCs at Well I-18, the CDA has not produced groundwater at this well since its construction. And as previously noted in Section 2.1.3, Well I-17 has been offline since 2017 due to the detection of 1,2,3-TCP concentrations above the new CA Primary MCL. The VOC concentrations (including 1,2,3-TCP) at CCWF Well I-17 and I-18 are associated with the Chino Airport plume. Additionally, Chino-I Desalter Wells I-1, I-2 I-3, and I-4 in the vicinity of the CCWF were also taken out of service starting in 2018 due to the presence of 1,2,3-TCP and trichloroethene (TCE) associated with the Chino Airport plume, and other contaminants. Implementation of a remedial action plan for cleanup of the Chino Airport plume is underway that includes the utilization of CCWF Wells I-16, I-17, I-18, and potentially I-20 and I-21, and Chino-I Desalter Wells I-1, I-2, I-3, and I-4, as part of a pump-and-treat system, along with ten extraction well clusters constructed by the County of San Bernardino who is the identified responsible party for the plume. Groundwater pumped from the CCWF, Chino-I Desalter wells, and County wells will be treated at the Chino-I treatment facility using new and existing treatment infrastructure. It is anticipated that pumping at CCWF Wells I-17 and I-18 will commence in July 2022 as part of this pump and treat system.

The final expansion plan to achieve the 40,000 afy of production was to construct and operate three new wells for the Chino-II Desalter (Wells II-10, II-11, and II-12)—the locations for which are shown in Figure 2-4. Due to the proximity of these wells to the South Archibald TCE plume, the CDA has been collaborating with the responsible parties of the plume to integrate these wells into a remedial solution to address groundwater cleanup of the plume while maintaining hydraulic control[12]. The plan and schedule to construct the final three wells was submitted to the Regional Board on June 30, 2015 (Watermaster & IEUA, 2015). The plan included the construction of a dedicated pipeline to convey groundwater produced from these wells to the Desalter II treatment facility which will remove VOCs via air stripping.

The construction of Wells II-10 and II-11 was completed in September 2015. In 2018, equipping of these wells was completed, and pumping initiated in July 2018 and September 2018 at Wells II-11 and II-10, respectively. The construction of Well II-12 was completed in November 2020. Equipping of Well II-12, and construction of the dedicated raw water pipeline to deliver the water from the three wells to the Chino-II Desalter is currently underway and is estimated for completion and operation by June 2021.

Figure 2-4 shows the location of the existing Chino Basin Desalter wells and the total annual pumping at the Desalter wells since 2000. In 2020, total pumping by the Chino Basin Desalter wells was 39,600 af. In

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[11] Proposed CCWF Well I-19 was not constructed because the projected pumping estimates during borehole testing were too low to warrant construction.

[12] In June 2013, the CDA entered into a Memorandum of Understanding with CDA Sponsor Agencies (Western Municipal Water District, City of Ontario, and Jurupa Community Service District), the IEUA, and the City of Upland, regarding the South Archibald TCE Plume cleanup. The CDA is working with this group and the "Airport Parties" (former industrial companies on the Ontario Airport property and the United States Army and Air Force) to find a mutually agreeable and beneficial solution to mitigate the TCE contamination.

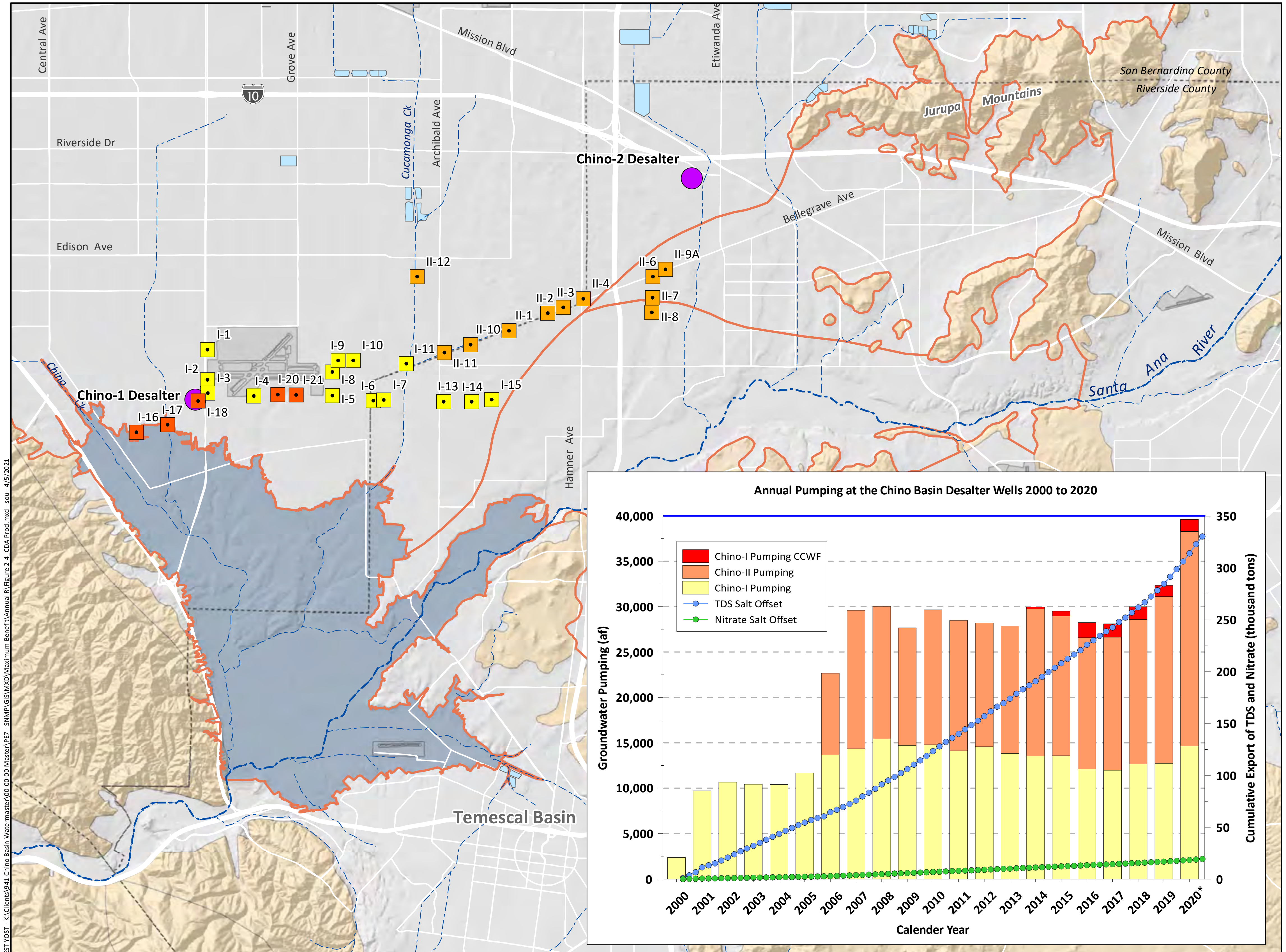
June 2020, the CDA facilities officially reached the pumping capacity necessary to meet the 40,000 afy required for hydraulic control. This pumping capacity was achieved without the inclusion of Well II-12, which was part of the final expansion plan designed to meet the 40,000 afy. As noted above, Well II-12 is still planned for operation as part of the South Archibald TCE plume remedial solution.

Since 2000, the Chino Basin Desalters have treated about 497,200 af of high-TDS/nitrate water, averaging about 23,700 afy. The cumulative export of TDS and nitrate mass to the brine line (in tons) that has resulted from pumping and treatment at the Chino Basin Desalter facilities is also shown in Figure 2-4. From 2000 to 2020, the Desalters exported about 330,400 tons of TDS and 19,400 tons of nitrate from the Chino Basin.

2.3 Recycled Water Recharge and Quality

2.3.1 Recycled Water Recharge

The recharge of recycled water, imported water, and storm water is an integral part of the OBMP Implementation Plan, and is necessary to maximize the use of the water resources of the Chino Basin. The IEUA, Watermaster, Chino Basin Water Conservation District, and San Bernardino County Flood Control District are partners in the implementation of the Chino Basin Recycled Water Groundwater Recharge Program. The IEUA manages the recharge program and performs recycled water recharge operations pursuant to Regional Board Orders R8-2007-0039 and R8-2009-0057. As required by these orders, the IEUA and Watermaster submit quarterly and annual reports to the Regional Board on the Chino Basin recycled water recharge activities. Figure 2-5 is a map of existing facilities in the Chino Basin used for imported water, storm water, and recycled water recharge. Table 2-2 summarizes the total annual recharge, by water type, from July 2005 (commencement of recycled water recharge activities) through December 2020. Since July 2005, about 185,200 af of imported water, 153,800 af of storm water, and 143,400 af of recycled water have been recharged to the Chino Basin.



Chino Basin Desalter Wells

- Chino-I Desalter Well
- Chino-I Desalter Well 5
- Chino-I CCWF Well
- Chino-II Desalter Well
- Desalter Treatment Facility
- Groundwater Management Zone Boundaries
- Prado Basin Management Zone
- Rivers and Streams
- Flood Control and/or Conservation Basins
- Airport

Geology

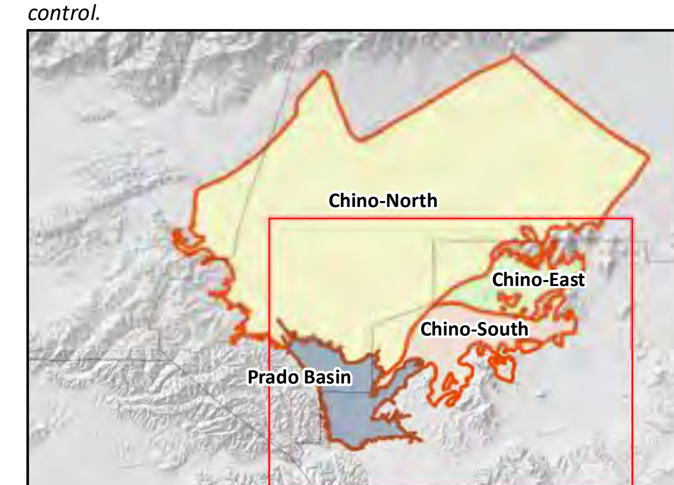
Water-Bearing Sediments

- Quaternary Alluvium
- Undifferentiated Pre-Tertiary to Early Pleistocene Igneous, Metamorphic, and Sedimentary Rocks

Faults

- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain

**Note: In June 2020, the CDA reached the pumping capacity at the desalter well fields to meet the 40,000 afy required for hydraulic control.*



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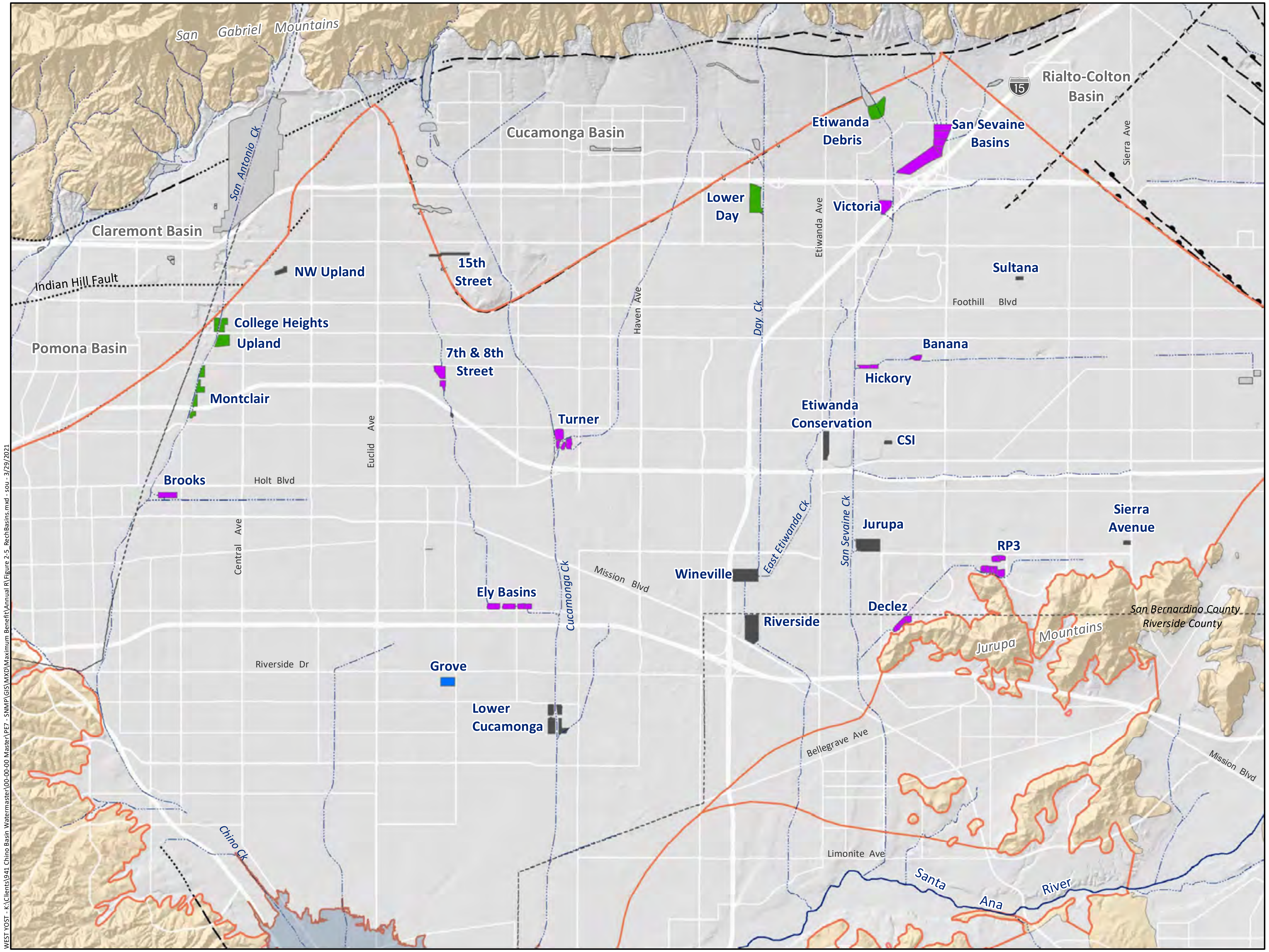
Chino Basin Desalter Wells
Annual Pumping 2000 to 2020

Figure 2-4



Recharge Basins
Symbolized by Recharged Water Type

- Storm, Imported and Recycled Water
- Storm and Imported Water
- Storm Water
- Incidental Stormwater Only
- Recharge Basins and Spreading Grounds Outside of Chino Basin

- Groundwater Management Zone Boundaries
- Chino Desalter Well
- Rivers and Streams

Water-Bearing Sediments
- Quaternary Alluvium

Consolidated Bedrock
- Undifferentiated Pre-Tertiary to Early Pleistocene Igneous, Metamorphic, and Sedimentary Rocks

Faults
- Location Certain
- Location Approximate
- Approximate Location of Groundwater Barrier
- Location Concealed
- Location Uncertain

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Chino Basin Recharge Basins
Existing Facilities by Recharge Type as of 2020

Figure 2-5

Table 2-2. Annual Groundwater Recharge at Chino Basin Facilities - 2005 to 2020

Calendar Year	Imported water, af	Storm water, af	Recycled Water, af	Total, af
2005	22,015	11,932	868	34,815
2006	47,422	11,932	2,695	62,049
2007	3,959	6,103	1,622	11,684
2008	0	10,559	2,781	13,340
2009	20	8,220	4,516	12,756
2010	4,980	19,390	8,304	32,674
2011	32,913	10,762	6,914	50,589
2012	0	9,372	7,823	17,195
2013	0	3,429	14,394	17,823
2014	795	8,166	10,997	19,958
2015	0	6,769	12,056	18,825
2016	4,260	9,812	14,310	28,382
2017	39,502	7,447	14,362	61,310
2018	5,990	6,751	12,510	25,251
2019	25,700	14,460	11,160	49,977
2020	3,638	7,167	15,509	26,313
Total	**191,193**	**152,270**	**140,821**	**482,941**

Commitment number 7 requires that the use of recycled water for artificial recharge be limited to the amount that can be blended on a volume-weighted basis with other sources of recharge to achieve five-year running-average concentrations of no more than the maximum-benefit objectives (420 mgl for TDS and 5 mgl for nitrate). Recycled water recharge began in July 2005; thus, the first five-year period for which the metric was computed was July 2005 through June 2010. This metric is computed monthly. Table 2-3 summarizes the five-year running-average volume-weighted TDS and nitrate concentrations of the combined recharge sources. The monthly recharge and water-quality data used to compute the five-year running-average TDS and nitrate metrics are plotted in Figures 2-6a and 2-6b, respectively. A table of the monthly data used to compute these metrics, by recharge source, is included as Appendix A to this report.

Table 2-3. Monthly Calculation of the Five-Year, Volume-Weighted TDS and Nitrate Concentrations of Recharge Water Sources to the Chino Basin[(a)] - 2005 to 2020

Five-Year Period	TDS, mgl	Nitrate, mgl
Jul 2005 - Jun 2010	203	1.1
Aug 2005 - Jul 2010	205	1.1
Sep 2005 - Aug 2010	207	1.1
Oct 2005 - Sep 2010	208	1.1
Nov 2005 - Oct 2010	210	1.1
Dec 2005 - Nov 2010	211	1.2
Jan 2006 - Dec 2010	213	1.1
Feb 2006 - Jan 2011	212	1.2
Mar 2006 - Feb 2011	214	1.2
Apr 2006 - Mar 2011	216	1.2
May 2006 - Apr 2011	221	1.3
Jun 2006 - May 2011	222	1.3
Jul 2006 - Jun 2011	222	1.3
Aug 2005 - Jul 2011	218	1.2
Sep 2006 - Aug 2011	215	1.2
Oct 2006 - Sep 2011	213	1.2
Nov 2006 - Oct 2011	217	1.3
Dec 2006 - Nov 2011	220	1.3
Jan 2007 - Dec 2011	218	1.4
Feb 2007 - Jan 2012	218	1.4
Mar 2007 - Feb 2012	218	1.4
Apr 2007 - Mar 2012	216	1.4
May 2007 - Apr 2012	215	1.4
Jun 2007 - May 2012	217	1.4
Jul 2007 - Jun 2012	220	1.4
Aug 2007 - Jul 2012	221	1.4
Sep 2007 - Aug 2012	221	1.4
Oct 2007 - Sep 2012	222	1.4
Nov 2007 - Oct 2012	222	1.4
Dec 2007 - Nov 2012	223	1.4
Jan 2008 - Dec 2012	224	1.5
Feb 2008 - Jan 2013	231	1.6
Mar 2008 - Feb 2013	233	1.6
Apr 2008 - Mar 2013	235	1.6
May 2008 - Apr 2013	236	1.6
Jun 2008 - May 2013	237	1.6

Table 2-3. Monthly Calculation of the Five-Year, Volume-Weighted TDS and Nitrate Concentrations of Recharge Water Sources to the Chino Basin[a] - 2005 to 2020

Five-Year Period	TDS, mgl	Nitrate, mgl
Jul 2008 - Jun 2013	239	1.7
Aug 2008 - Jul 2013	240	1.7
Sep 2008 - Aug 2013	241	1.7
Oct 2008 - Sep 2013	243	1.7
Nov 2008 - Oct 2013	245	1.7
Dec 2008 - Nov 2013	247	1.7
Jan 2009 - Dec 2013	251	1.8
Feb 2009 - Jan 2014	253	1.8
Mar 2009 - Feb 2014	257	1.8
Apr 2009 - Mar 2014	259	1.9
May 2009 - Apr 2014	261	1.9
Jun 2009 - May 2014	263	1.9
Jul 2009 - Jun 2014	264	1.9
Aug 2009 - Jul 2014	265	1.9
Sep 2009 - Aug 2014	266	1.9
Oct 2009 - Sep 2014	268	1.9
Nov 2009 - Oct 2014	269	1.9
Dec 2009 - Nov 2014	269	1.9
Jan 2010 - Dec 2014	266	1.9
Feb 2010 - Jan 2015	273	2.0
Mar 2010 - Feb 2015	279	2.0
Apr 2010 - Mar 2015	280	2.0
May 2010 - Apr 2015	283	2.0
Jun 2010 - May 2015	283	2.1
Jul 2010 - Jun 2015	285	2.1
Aug 2010 - Jul 2015	286	2.1
Sep 2010 - Aug 2015	286	2.1
Oct 2010 - Sep 2015	287	2.1
Nov 2010 - Oct 2015	287	2.1
Dec 2010 - Nov 2015	289	2.1
Jan 2011 - Dec 2015	291	2.2
Feb 2011 - Jan 2016	288	2.2
Mar 2011 - Feb 2016	290	2.2
Apr 2011 - Mar 2016	292	2.2
May 2011 - Apr 2016	293	2.2
Jun 2011 - May 2016	300	2.3

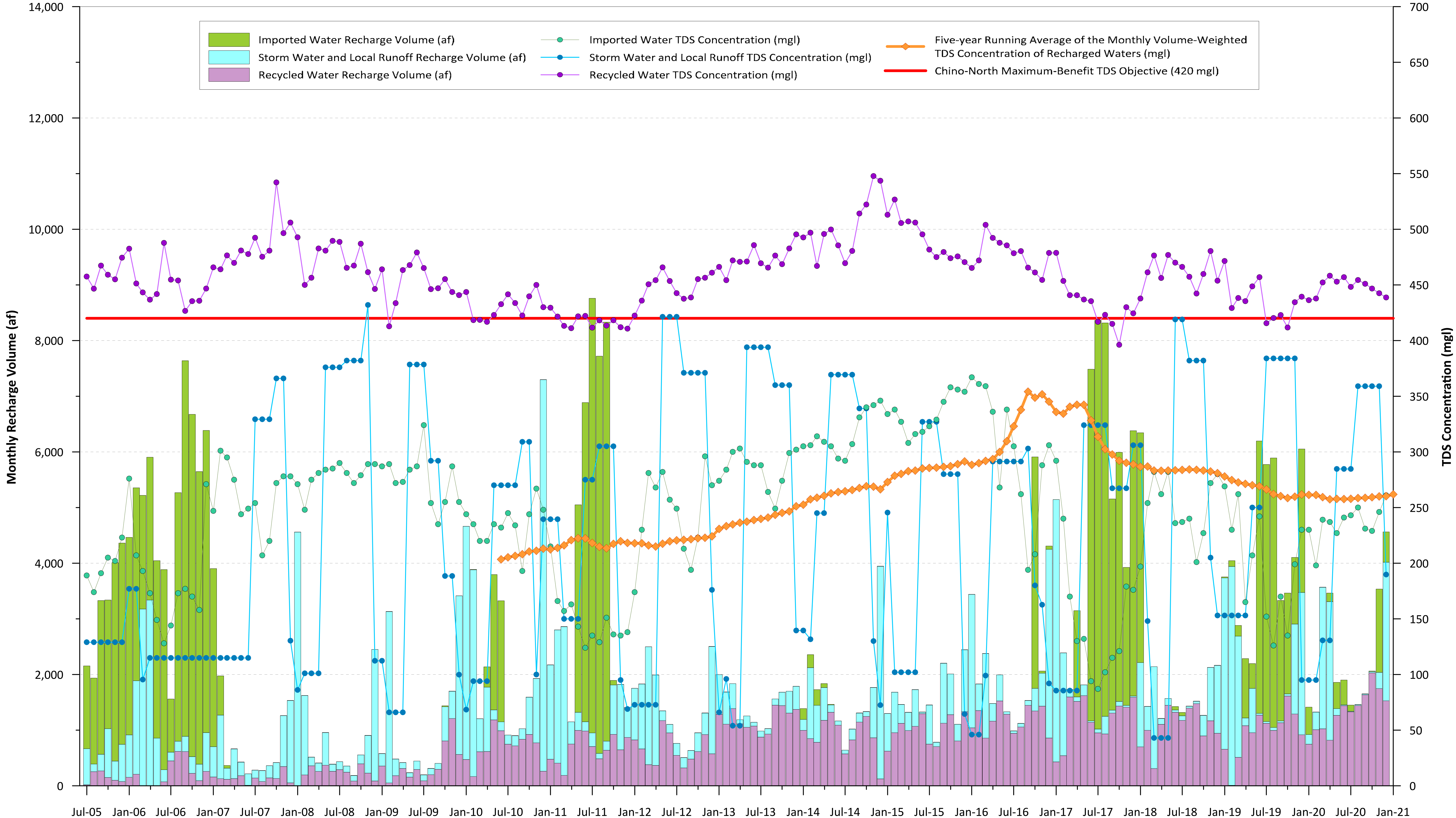
Table 2-3. Monthly Calculation of the Five-Year, Volume-Weighted TDS and Nitrate Concentrations of Recharge Water Sources to the Chino Basin[(a)] - 2005 to 2020

Five-Year Period	TDS, mgl	Nitrate, mgl
Jul 2011 - Jun 2016	310	2.4
Aug 2011 - Jul 2016	323	2.6
Sep 2011 - Aug 2016	338	2.8
Oct 2011 - Sep 2016	354	3.0
Nov 2011 - Oct 2016	349	2.9
Dec 2011 - Nov 2016	352	2.9
Jan 2012 - Dec 2016	345	2.8
Feb 2012 - Jan 2017	336	2.7
Mar 2012 - Feb 2017	334	2.7
Apr 2012 - Mar 2017	340	2.8
May 2012 - Apr 2017	342	2.8
Jun 2012 - May 2017	342	2.8
Jul 2012 - Jun 2017	328	2.6
Aug 2012 - Jul 2017	314	2.5
Sep 2012 - Aug 2017	302	2.4
Oct 2012 - Sep 2017	298	2.3
Nov 2012 - Oct 2017	292	2.3
Dec 2012 - Nov 2017	290	2.3
Jan 2013 - Dec 2017	289	2.2
Feb 2013 - Jan 2018	287	2.1
Mar 2013 - Feb 2018	287	2.1
Apr 2013 - Mar 2018	283	2.1
May 2013 - Apr 2018	283	2.1
Jun 2013 - May 2018	283	2.1
Jul 2013 - Jun 2018	283	2.1
Aug 2013 - Jul 2018	284	2.1
Sep 2013 - Aug 2018	284	2.1
Oct 2013 - Sep 2018	284	2.1
Nov 2013 - Oct 2018	283	2.1
Dec 2013 - Nov 2018	282	2.0
Jan 2014 - Dec 2018	281	2.0
Feb 2014 - Jan 2019	278	2.0
Mar 2014 - Feb 2019	275	1.9
Apr 2014 - Mar 2019	273	1.9
May 2014 - Apr 2019	271	1.9
Jun 2014 - May 2019	270	1.8

Table 2-3. Monthly Calculation of the Five-Year, Volume-Weighted TDS and Nitrate Concentrations of Recharge Water Sources to the Chino Basin[a] - 2005 to 2020

Five-Year Period	TDS, mgl	Nitrate, mgl
Jul 2014 - Jun 2019	269	1.8
Aug 2014 - Jul 2019	266	1.8
Sep 2014 - Aug 2019	262	1.7
Oct 2014 - Sep 2019	260	1.7
Nov 2014 - Oct 2019	258	1.7
Dec 2014 - Nov 2019	260	1.7
Jan 2015 - Dec 2019	262	1.7
Feb 2015 - Jan 2020	261	1.7
Mar 2015 - Feb 2020	261	1.7
Apr 2015 - Mar 2020	259	1.6
May 2015 - Apr 2020	257	1.6
Jun 2015 - May 2020	258	1.6
Jul 2015 - Jun 2020	258	1.6
Aug 2015 - Jul 2020	258	1.6
Sep 2015 - Aug 2020	258	1.6
Oct 2015 - Sep 2020	259	1.6
Nov 2015 - Oct 2020	259	1.6
Dec 2015 - Nov 2020	260	1.6
Jan 2016 - Dec 2020	260	1.6

(a) See Appendix A for more details.



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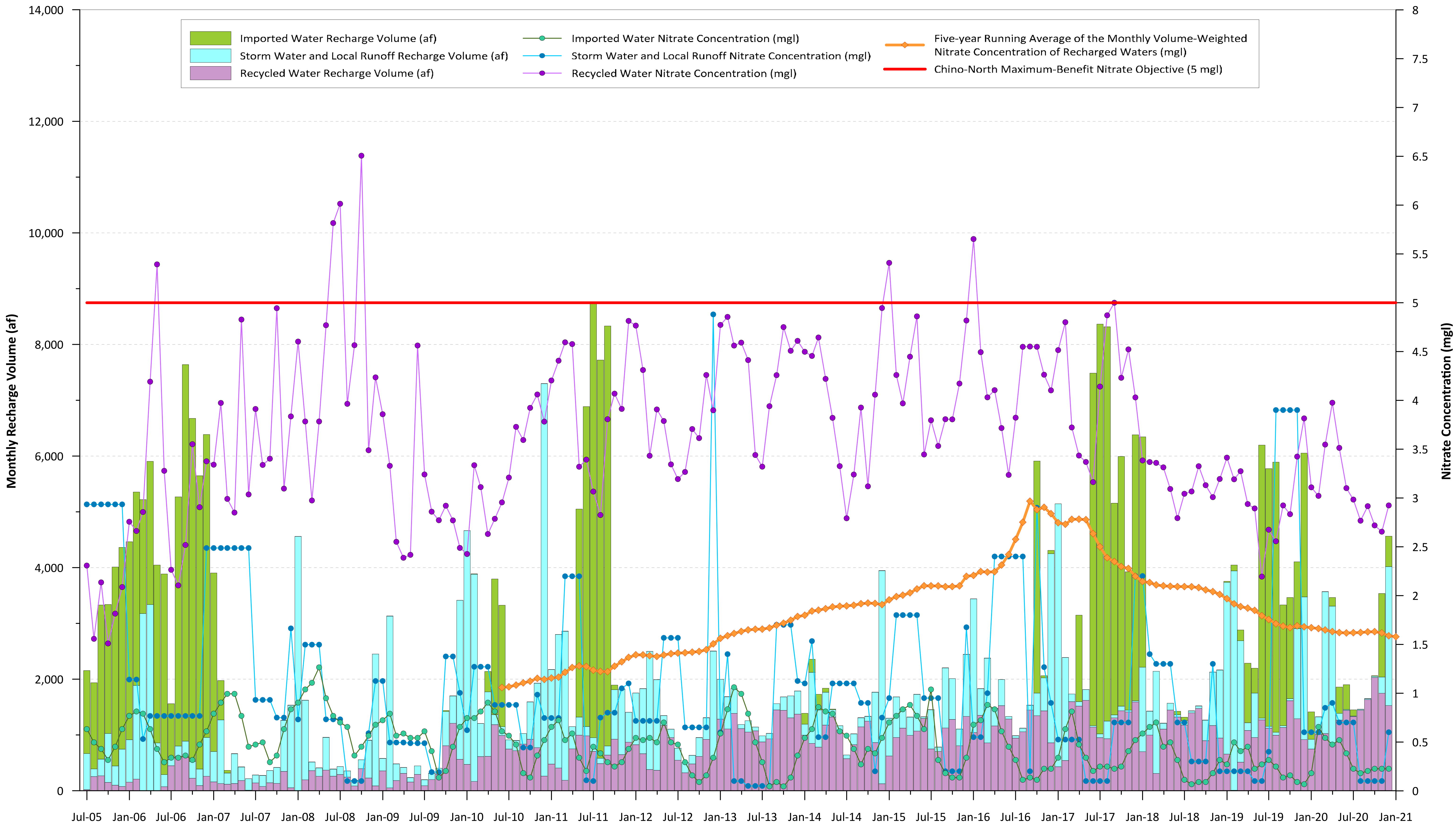
Volume and TDS Concentrations of Recharge Water Sources in Chino Basin
2005 to 2020

Figure 2-6a



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Volume and Nitrate Concentrations of Recharge Water Sources in Chino Basin
2005 to 2020

Figure 2-6b

The five-year running-average, volume-weighted TDS and nitrate concentrations have not exceeded the maximum-benefit objectives for TDS or nitrate. Since June 2010, the five-year running average, volume-weighted TDS concentrations ranged from 203 mgl to 354 mgl, averaged about 264 mgl, and was 260 mgl as of December 2020. Nitrate ranged from 1 mgl to about 3 mgl, averaged about 1.8 mgl, and was 1.6 mgl as of December 2020. The maximum five-year running average, volume-weighted TDS and nitrate concentrations were observed in September 2016 when the preceding five-year period had almost no imported water recharge.

Prior to 2016, the TDS concentration metric was increasing monotonically at a rate of about 1.3 mgl per month, primarily driven by the increasing proportion of recycled water recharge relative to imported and storm waters. Between May and September 2016, that rate increased to about 12 mgl per month, reflecting the loss of the last significant period of imported water recharge (May and September of 2011) from the 5-year period used for the metric calculation. The TDS concentration metric decreased from September 2016 through April 2020 and stabilized through 2020. This trend is due to the increase in imported water recharge that occurred from October 2016 through January 2018, March 2019 through December 2019, and November 2020 through December 2020; and the increase in storm water recharge during water year 2019. A similar trend was observed for the nitrate concentration metric, as shown in Figure 2-6b. These observations demonstrate the importance of periodic imported water recharge to complying with the long-term TDS metric contained in the maximum benefit commitments.

2.3.2 Recycled Water Quality

As described in the Basin Plan, the IEUA wastewater effluent TDS and TIN permit limits are an important component of the maximum benefit demonstration and provide a controlling point for the management of TDS and nitrate concentrations in the Chino Basin. The TDS and TIN permit limits for the IEUA are 550 mgl and 8 mgl, respectively. Compliance with these limits is based on the volume-weighted, 12-month running average of the agency-wide effluent for all IEUA wastewater treatment facilities. The volume-weighted, 12-month running average of the IEUA agency-wide effluent is referred to as the "effluent compliance metric". Commitment number 6 requires that the IEUA submit a plan and schedule to the Regional Board for the implementation of measures to ensure that the effluent compliance metric does not exceed the permit limits when the TDS effluent compliance metric exceeds 545 mgl for three consecutive months or the TIN effluent compliance metric exceeds 8 mgl in any one month. The plan must be submitted within 60 days of a finding that one of these "action limits" has been exceeded. The plan and schedule must be implemented upon Regional Board approval. The effluent compliance metric is calculated and reported by the IEUA in the Groundwater Recharge Program Quarterly Monitoring Reports.

Table 2-4 and Figure 2-7 show the monthly, volume-weighted IEUA agency-wide effluent TDS and TIN concentrations and the compliance metric for 2005 through 2020. Since the initiation of recycled water recharge in July 2005, the TDS and TIN effluent compliance metrics have ranged between 456 and 534 mgl and 3.8 and 7.6 mgl, respectively, and have never exceeded the permit limits[13]. During 2020, the TDS and TIN effluent compliance metrics ranged between 468 and 484 mgl and 3.8 and 4.2 mgl, respectively.

[13] The agency-wide 12-month running average TIN limit in the NPDES permit was decreased from 10 mgl to 8 mgl, effective July 8, 2006. This decreased limit was anticipated; therefore, secondary treatment at all facilities was optimized to attain lower TIN. The 12-Month Running Average TIN has not been above the limit of 8 mgl since the recycled water recharge program began in July 2005.

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
Jan 2005	7.3	8.4	492	486
Feb 2005	8.4	8.4	496	487
Mar 2005	7.5	8.4	516	488
Apr 2005	6.9	8.2	534	491
May 2005	6.7	8.0	513	492
Jun 2005	7.0	8.0	507	492
Jul 2005	5.4	7.8	466	492
Aug 2005	5.9	7.7	452	490
Sep 2005	5.4	7.4	469	491
Oct 2005	5.5	7.1	468	491
Nov 2005	5.5	6.7	467	490
Dec 2005	8.4	6.7	481	488
Jan 2006	9.9	6.9	491	488
Feb 2006	9.0	6.9	467	486
Mar 2006	8.8	7.1	471	482
Apr 2006	7.8	7.1	464	476
May 2006	8.3	7.2	454	471
Jun 2006	6.5	7.2	466	468
Jul 2006	6.8	7.3	472	469
Aug 2006	5.9	7.3	475	470
Sep 2006	6.5	7.4	465	470
Oct 2006	6.4	7.6	457	469
Nov 2006	6.9	7.6	456	468
Dec 2006	7.1	7.5	470	467
Jan 2007	7.7	7.3	488	467
Feb 2007	6.2	7.1	481	468
Mar 2007	6.7	6.9	490	470
Apr 2007	5.6	6.7	491	472
May 2007	5.6	6.5	489	475
Jun 2007	6.0	6.5	495	477
Jul 2007	5.1	6.3	492	479
Aug 2007	5.2	6.3	478	479
Sep 2007	5.9	6.2	478	480
Oct 2007	6.0	6.2	517	485

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
Nov 2007	7.6	6.2	514	490
Dec 2007	7.4	6.3	522	495
Jan 2008	6.8	6.2	511	481
Feb 2008	6.4	6.2	492	483
Mar 2008	6.6	6.2	515	484
Apr 2008	6.7	6.3	519	487
May 2008	7.2	6.4	502	489
Jun 2008	6.8	6.5	490	490
Jul 2008	6.1	6.6	499	491
Aug 2008	5.8	6.6	514	492
Sep 2008	8.3	6.8	510	494
Oct 2008	7.0	6.9	503	496
Nov 2008	5.7	6.7	496	498
Dec 2008	6.3	6.7	494	504
Jan 2009	6.5	6.6	497	503
Feb 2009	7.8	6.7	463	500
Mar 2009	6.9	6.8	496	499
Apr 2009	6.6	6.8	509	498
May 2009	5.8	6.6	501	498
Jun 2009	5.4	6.5	505	499
Jul 2009	5.0	6.4	512	499
Aug 2009	4.5	6.3	499	497
Sep 2009	4.0	6.0	498	497
Oct 2009	4.6	5.8	500	497
Nov 2009	4.8	5.7	489	497
Dec 2009	5.5	5.6	494	497
Jan 2010	5.7	5.6	493	496
Feb 2010	6.2	5.4	489	498
Mar 2010	6.4	5.4	482	497
Apr 2010	5.7	5.3	473	494
May 2010	5.2	5.3	471	492
Jun 2010	5.0	5.2	478	490
Jul 2010	5.1	5.2	477	487
Aug 2010	4.6	5.2	477	485

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
Sep 2010	3.7	5.2	476	483
Oct 2010	5.5	5.3	478	481
Nov 2010	5.7	5.3	479	481
Dec 2010	5.0	5.3	472	479
Jan 2011	6.4	5.4	474	477
Feb 2011	6.9	5.4	455	474
Mar 2011	6.4	5.4	468	473
Apr 2011	6.5	5.5	460	472
May 2011	6.0	5.6	462	471
Jun 2011	5.7	5.6	464	470
Jul 2011	4.3	5.5	454	468
Aug 2011	4.4	5.5	457	467
Sep 2011	5.8	5.7	457	465
Oct 2011	5.2	5.7	457	463
Nov 2011	5.9	5.7	453	461
Dec 2011	6.3	5.8	454	460
Jan 2012	6.4	5.8	465	459
Feb 2012	6.7	5.8	476	461
Mar 2012	6.7	5.8	497	463
Apr 2012	7.4	5.9	496	466
May 2012	6.4	5.9	493	469
Jun 2012	5.8	5.9	482	470
Jul 2012	5.4	6.0	477	472
Aug 2012	4.8	6.1	463	473
Sep 2012	5.1	6.0	472	474
Oct 2012	4.9	6.0	486	476
Nov 2012	6.1	6.0	485	479
Dec 2012	6.0	6.0	492	482
Jan 2013	6.1	5.9	495	484
Feb 2013	6.8	5.9	490	486
Mar 2013	6.1	5.9	493	485
Apr 2013	6.4	5.8	501	486
May 2013	6.4	5.8	503	487
Jun 2013	5.8	5.8	502	488

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
Jul 2013	5.6	5.8	496	490
Aug 2013	6.9	6.0	496	493
Sep 2013	7.3	6.2	499	495
Oct 2013	7.4	6.4	496	496
Nov 2013	6.7	6.4	507	497
Dec 2013	7.6	6.6	511	499
Jan 2014	5.9	6.6	510	500
Feb 2014	6.1	6.5	509	502
Mar 2014	5.5	6.5	497	502
Apr 2014	5.2	6.4	517	504
May 2014	5.2	6.3	524	505
Jun 2014	4.4	6.1	506	506
Jul 2014	3.5	6.0	494	505
Aug 2014	3.5	5.7	508	506
Sep 2014	4.1	5.4	524	508
Oct 2014	4.9	5.2	541	512
Nov 2014	5.9	5.1	571	518
Dec 2014	6.2	5.0	565	522
Jan 2015	7.9	5.2	546	525
Feb 2015	7.4	5.3	560	529
Mar 2015	6.2	5.4	528	532
Apr 2015	5.2	5.4	531	533
May 2015	6.1	5.4	520	533
Jun 2015	4.6	5.4	515	534
Jul 2015	5.2	5.6	500	534
Aug 2015	4.7	5.7	503	534
Sep 2015	4.8	5.7	508	532
Oct 2015	5.2	5.8	506	529
Nov 2015	5.4	5.7	505	524
Dec 2015	6.2	5.7	503	519
Jan 2016	7.3	5.7	504	515
Feb 2016	6.5	5.6	495	510
Mar 2016	5.9	5.6	521	509
Apr 2016	5.8	5.6	514	508

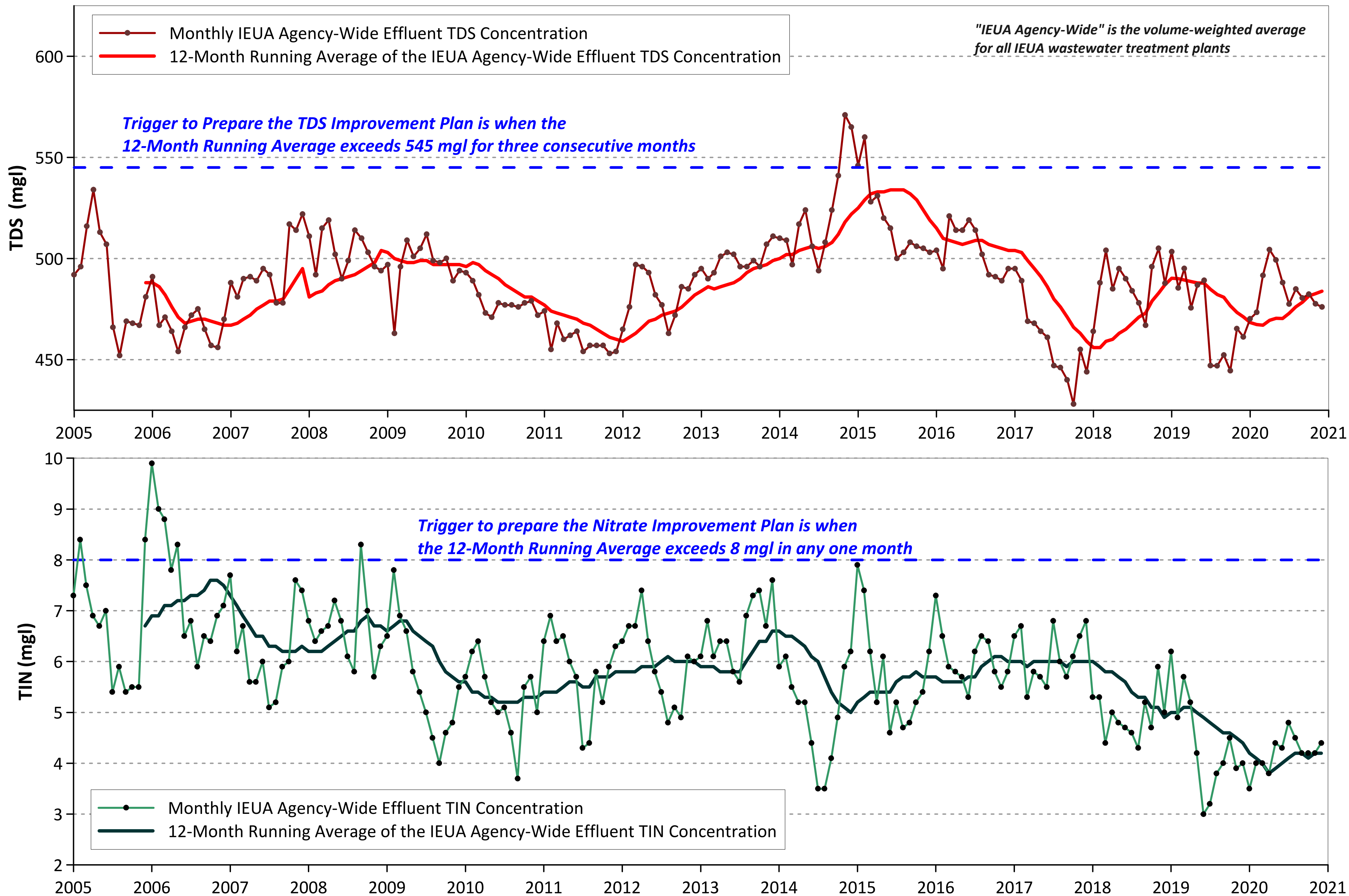
Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
May 2016	5.7	5.6	514	507
Jun 2016	5.3	5.7	519	508
Jul 2016	6.2	5.7	514	509
Aug 2016	6.5	5.9	502	509
Sep 2016	6.4	6.0	492	507
Oct 2016	5.8	6.1	491	506
Nov 2016	5.5	6.1	489	505
Dec 2016	5.8	6.0	495	504
Jan 2017	6.5	6.0	495	504
Feb 2017	6.7	6.0	489	503
Mar 2017	5.3	5.9	469	499
Apr 2017	5.8	6.0	468	495
May 2017	5.7	6.0	464	491
Jun 2017	5.5	6.0	461	486
Jul 2017	6.8	6.0	447	480
Aug 2017	6.0	6.0	446	476
Sep 2017	5.7	5.9	440	471
Oct 2017	6.1	6.0	428	466
Nov 2017	6.5	6.0	455	463
Dec 2017	6.8	6.0	444	459
Jan 2018	5.3	6.0	464	456
Feb 2018	5.3	5.9	488	456
Mar 2018	4.4	5.8	504	459
Apr 2018	5	5.8	485	460
May 2018	4.8	5.7	495	463
Jun 2018	4.7	5.6	490	465
Jul 2018	4.6	5.4	484	468
Aug 2018	4.3	5.3	478	471
Sep 2018	5.2	5.3	467	473
Oct 2018	4.7	5.1	496	479
Nov 2018	5.9	5.1	505	483
Dec 2018	5	4.9	488	487
Jan 2019	6.2	5.0	503	490
Feb 2019	4.9	5.0	485	490

Table 2-4. Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent TIN and TDS Concentrations - 2005 to 2020

Month	TIN, mgl		TDS, mgl	
	Monthly	12-Month Running Average[(a)]	Monthly	12-Month Running Average
Mar 2019	5.7	5.1	495	489
Apr 2019	5.2	5.1	476	489
May 2019	4.2	5.0	487	488
Jun 2019	3	4.9	489	488
Jul 2019	3.2	4.8	447	485
Aug 2019	3.8	4.7	447	482
Sep 2019	4	4.6	452	481
Oct 2019	4.5	4.6	445	477
Nov 2019	3.9	4.5	465	473
Dec 2019	4	4.4	461	471
Jan 2020	3.5	4.2	470	468
Feb 2020	4	4.1	473	467
Mar 2020	4	4.0	492	467
Apr 2020	3.8	3.8	504	469
May 2020	4.4	3.9	499	470
Jun 2020	4.3	4.0	488	470
Jul 2020	4.8	4.1	477	473
Aug 2020	4.5	4.2	485	476
Sep 2020	4.2	4.2	481	478
Oct 2020	4.2	4.1	482	482
Nov 2020	4.2	4.2	478	483
Dec 2020	4.4	4.2	476	484

(a) The Agency-wide 12-month running average TIN limit in the NPDES permit was decreased from 10 mgl to 8 mgl, effective July 8, 2006. This decreased limit was anticipated; therefore, secondary treatment at all facilities was optimized to attain lower TIN. The 12-Month Running Average TIN has not been above the limit of 8 mgl since the recycled water recharge program began in July 2005.



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Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent
TDS and TIN Concentrations - 2005 to 2020

Figure 2-7

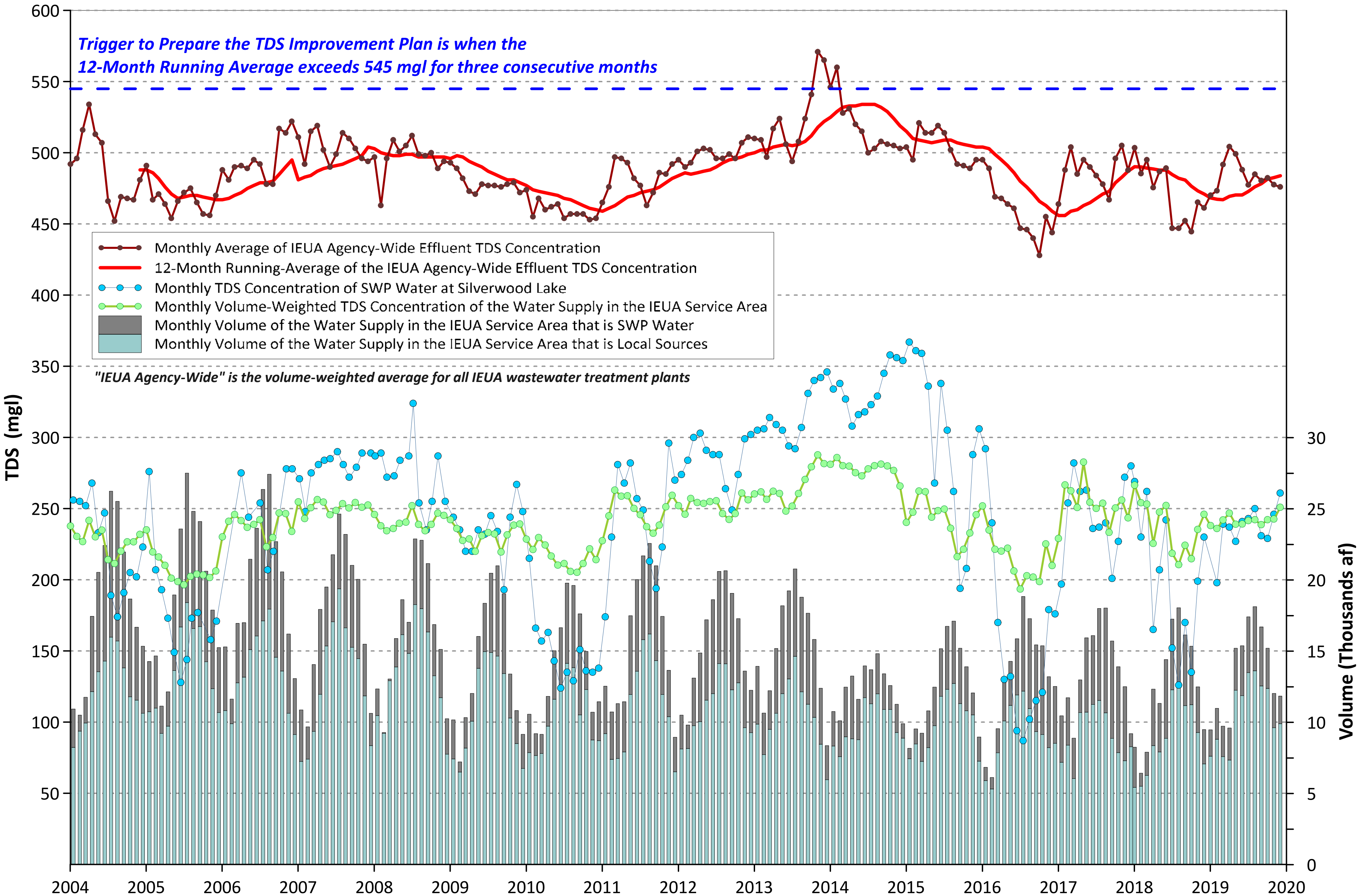
During 2015, the TDS effluent compliance metric reached a historical-high value of 534 mgl for three consecutive months in June, July, and August. This was only 11 mgl below the action limit defined in Commitment number 6.

The TDS concentration of the effluent is influenced by the volume and TDS concentration of the water supplies served in the service areas tributary to the IEUA's treatment plants. To demonstrate this, Figure 2-8 shows the monthly, volume-weighted IEUA agency-wide effluent TDS concentration and compliance metric plotted with: the monthly TDS concentrations of SWP water from Silverwood Lake;[14] the monthly, volume-weighted TDS concentrations of the combined water supplies served in the area tributary to the IEUA's treatment plants (e.g. total water supply, including SWP water); the volume of water supply served in the area tributary to the IEUA's treatment plants that is SWP water; and the volume of water supply served in the area tributary to the IEUA's treatment plants that is from local sources (groundwater and surface water). Note that:

- From 2012 through early 2016, the SWP water seasonal-high TDS concentrations continuously increased due to the statewide drought conditions that began in 2012. This increase correlates to the increase of the monthly total water supply TDS concentration, the monthly volume-weighted TDS, and the effluent compliance metric.
- The increase in the TDS concentration of the total water supply is less than the increase in TDS concentrations of the SWP supply because it includes local water supplies with lower-TDS concentrations.
- In 2015, the proportion of the total water supply that is SWP water decreased, reducing the effect of the increasing TDS concentration of SWP water on the volume-weighted TDS concentration of the total water supply.
- In 2016 and 2017, the TDS concentration of SWP water decreased due to wet-winter conditions in northern California. This also increased the availability of the SWP water supply, which resulted in a decreasing trend of the effluent compliance metric through mid-2017.
- In 2019, the wet-winter condition in California decreased both the TDS concentrations of SWP water and the total water supply, which resulted in a decreasing trend of the effluent compliance metric through 2019.
- In 2020, the proportion of the total water supply that is low-TDS SWP water decreased, which resulted in a slight increasing trend of the effluent compliance metric through 2020.

The relationships of the TDS concentrations plotted in Figure 2-8 indicate that the increase in the TDS concentration of SWP water during the drought contributed, in part, to the increase in the TDS concentration of the IEUA's effluent. Another likely cause of the increase in the effluent TDS concentration is the incorporation of the water conservation practices required by the State of California during the drought. Water conservation practices in 2015 through 2016 are evident in the decreased volume of total water supply plotted in Figure 2-8.

[14] Source of imported SWP water to the IEUA agencies.



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Monthly and 12-Month Running Average of the IEUA Agency-Wide Effluent, versus Monthly SWP
TDS Concentrations - 2005 to 2020

Figure 2-8

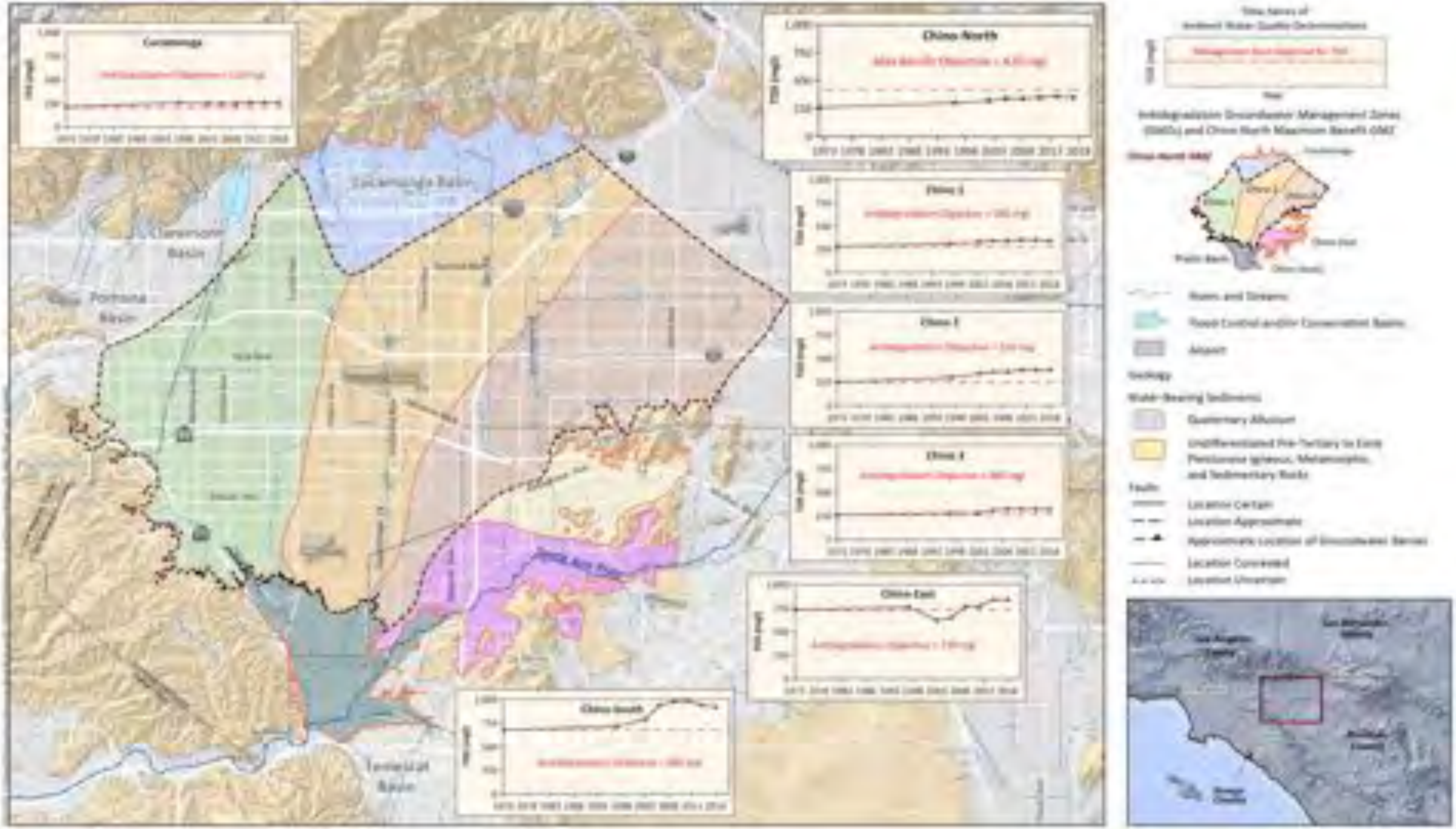
These observed water quality and water use trends suggest that drought conditions have a meaningful impact on the TDS concentrations of the water supply and recycled water and that future droughts similar to the 2012 to 2016 period could lead to short-term exceedances of the effluent compliance metric that is based on a short-term averaging period of 12-months. For this reason, Watermaster and the IEUA petitioned the Regional Board to modify the TDS compliance metric for recycled water to a longer-term averaging period. The Regional Board agreed that an evaluation of the compliance metric is warranted and directed Watermaster and the IEUA to develop a technical scope of work to analyze the impacts of the proposed change. The scope of work was submitted to the Regional Board in 2017 and includes the following tasks:

- Develop numerical modeling tools (R4, Hydrus 2D, MODFLOW, MT3D) to evaluate the projected TDS and nitrate concentrations of the Chino Basin.
- Define a baseline (status-quo) scenario and evaluate it with the new modeling tools.
- Define salinity management planning scenarios and evaluate them with the new modeling tools to compare the projected TDS and nitrate concentrations against the baseline scenario.
- Use the results to develop a draft regulatory compliance strategy that includes a longer-term average period for recycled water TDS concentrations.
- Collaborate with the Regional Board to review and finalize the regulatory strategy.
- Support the Regional Board in the preparation of a Basin Plan amendment upon approval of the regulatory strategy.

Watermaster and the IEUA began implementing the scope of work in July 2017 and have been working collaboratively with Regional Board staff to review interim work products and address new technical questions that have arisen. In 2020, Watermaster and the IEUA completed the evaluation of the baseline planning scenario, including detailed sensitivity analyses and conducted two project status and technical review meetings with the Regional Board in October and November. The draft regulatory compliance strategy is anticipated to be submitted to the Regional Board for review in 2021.

2.4 Ambient Groundwater Quality

Commitment number 9 requires that Watermaster and the IEUA recompute the ambient TDS and nitrate concentrations for the Chino Basin and Cucamonga GMZs every three years, beginning in July 2005. The method used to compute ambient TDS and nitrate concentrations was consistent with the method used by the TIN/TDS Task Force to determine the antidegradation objectives for the GMZs of the Santa Ana River Watershed. The most recent recomputation, covering the 20-year period from 1999 to 2018 was completed in July 2020 (WSC, 2020). Figures 2-9a and Figure 2-9b show trends of the current and all historical ambient TDS and nitrate concentration determinations. As of 2018, the ambient TDS concentration of Chino-North is 350 mgl, which is 10 mgl less than the 2015 ambient TDS concentration. There remains 70 mgl of assimilative capacity. The current ambient nitrate concentration of Chino-North is 10.3 mgl and there is no assimilative capacity, which has been the case since the adoption of the maximum benefit objectives in 2004.



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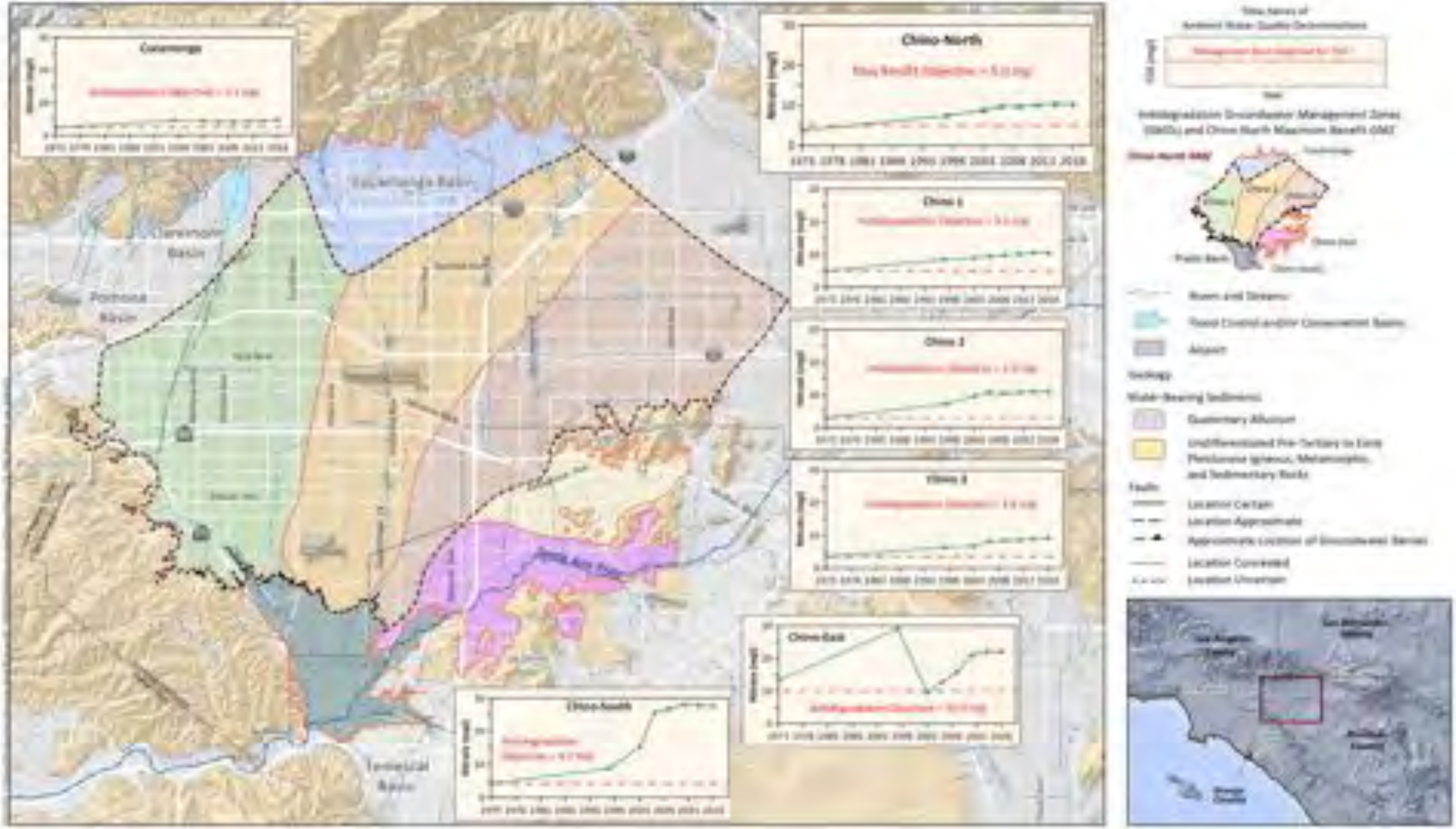
Trends in Ambient Water Quality
Determinations for Total Dissolved Solids By Groundwater Management Zone

Figure 2-9a



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Trends in Ambient Water Quality
Determinations for Nitrate
By Groundwater Management Zone

Figure 2-9b

3.0 DATA COLLECTED IN 2020

Groundwater and surface-water data collected for the Maximum-Benefit Monitoring Program pursuant to the 2014 Work Plan are used for both the maximum benefit monitoring directives of demonstrating hydraulic control and computing ambient water quality every three years. The data collected in 2020 for the Maximum-Benefit Monitoring Program include groundwater elevation, groundwater quality, and surface-water quality. The 2020 data collection efforts are described below.

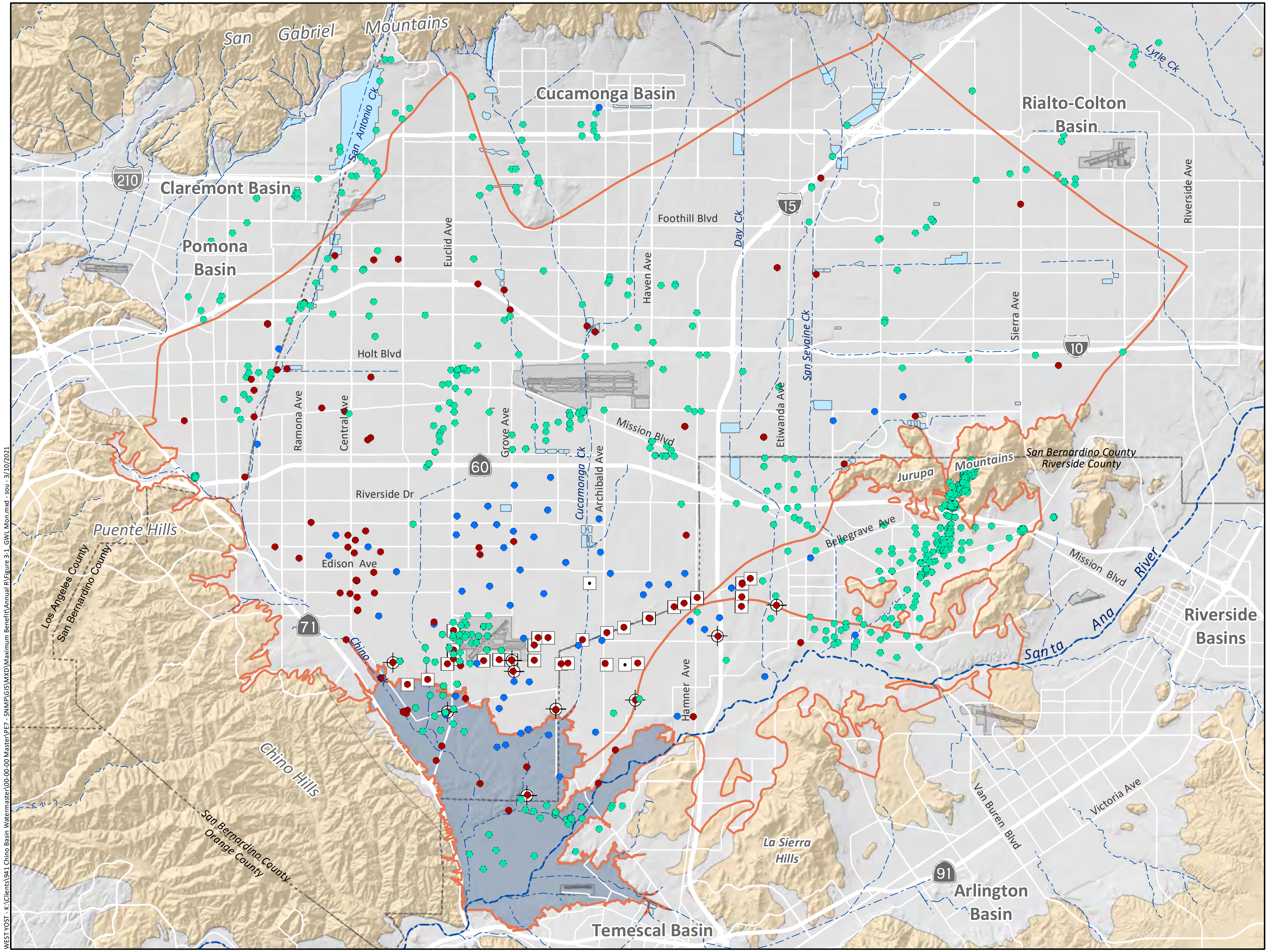
3.1 Groundwater Monitoring Program

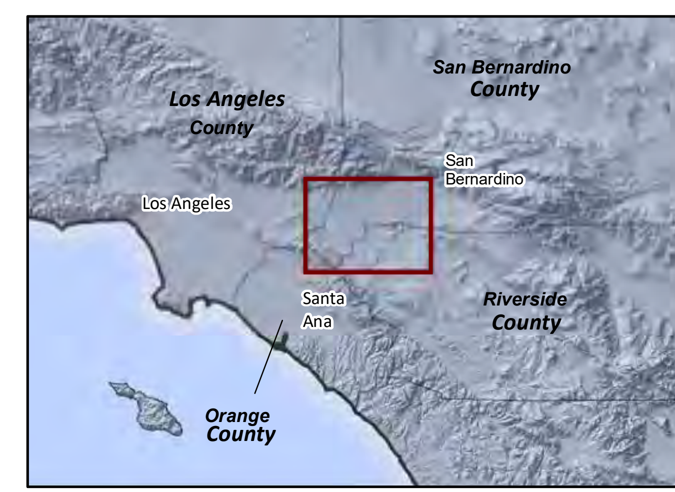
Watermaster's Groundwater Monitoring Program consists of two main components: a groundwater-level monitoring program and a groundwater-quality monitoring program. These monitoring programs were designed and implemented to support the OBMP Implementation Plan and the other regulatory requirements of Watermaster and the IEUA. Watermaster's Groundwater Monitoring Program is summarized below with specific reference to the monitoring requirements of the maximum-benefit commitments.

3.1.1 Groundwater-Level Monitoring Program

Figure 3-1 shows the locations of the 1,160wells that are included in Watermaster's groundwater-level monitoring program. The groundwater-level monitoring program supports many Watermaster management functions which include: the periodic assessment of Safe Yield, groundwater model development and recalibration, cumulative impacts of transfers, balance of recharge and discharge, subsidence management, material physical injury assessments, estimation of storage change, other scientific demonstrations required for groundwater management, and many regulatory requirements such as the demonstration of hydraulic control and the triennial ambient water quality recomputation. The wells within the southern portion of the Basin were selected for inclusion in the monitoring program to assist in Watermaster's analyses of hydraulic control, land subsidence, and desalter pumping impacts to private well owners and riparian vegetation in the PBMZ. The density of groundwater-level monitoring near the desalter well fields is greater than in outlying areas because hydraulic gradients are expected to be steeper near the desalter well fields, and these data are needed to assess the state of hydraulic control.

Figure 3-1 shows the wells where groundwater-level data were collected in 2020, symbolized by measurement frequency. At 945 of these wells, water levels are measured by well owners, including municipal water agencies, the California Department of Toxic Substance Control (DTSC), the County of San Bernardino, and various consulting firms on behalf of their clients. The measurement frequency by municipal water agencies is typically about once per month, and Watermaster compiles the data quarterly. The measurement frequency by other well owners varies, and Watermaster compiles these data twice per year. The remaining 215 wells shown in Figure 3-1 are mainly privately-owned wells or dedicated monitoring wells that are primarily located in the southern portion of the Chino Basin. Watermaster staff measures water levels at these wells using manual methods once per month or with pressure transducers with on-board data loggers that record water levels once every 15 minutes. All water-level data are reviewed by Watermaster staff and uploaded to a centralized database management system that can be accessed online through HydroDaVE℠. All water-level data collected in 2020 are contained in the Microsoft (MS) Access database that has been included with this report as Appendix B. The well location information for private wells with water-level data is excluded from the database in this report for confidentiality reasons.





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Groundwater-Level Monitoring Program
Wells Monitored in 2020

Figure 3-1

3.1.2 Groundwater-Quality Monitoring Program

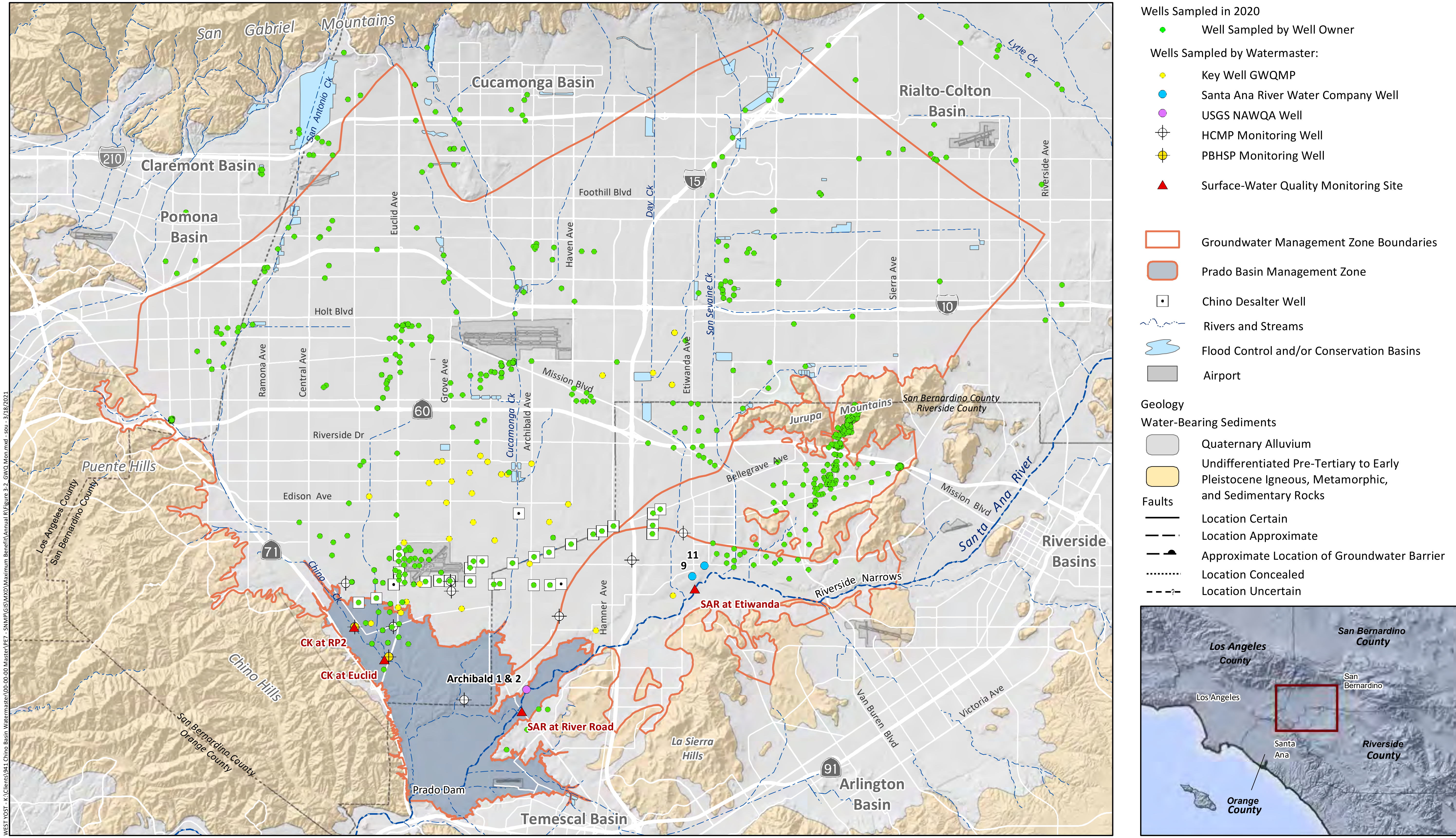
Figure 3-2 shows the locations of the 890 wells that are included in Watermaster's groundwater-quality monitoring program. Watermaster obtains groundwater-quality data, in part, to comply with two maximum-benefit commitments: the triennial ambient water quality recomputation and the analysis of hydraulic control. These data are also used to: prepare Watermaster's biennial SOB report, support ground-water modeling, characterize non-point source contamination and plumes associated with point-source discharges, and characterize present trends in groundwater quality.

Figure 3-2 shows the wells where groundwater-quality data were collected by Watermaster or well owners in 2020. At 830 of these wells, water-quality samples were collected by well owners, including municipal water agencies, the DTSC, the County of San Bernardino, and various private companies and consulting firms. The sampling frequency and constituents tested vary by well and owner. These water quality data are compiled by Watermaster twice per year. The remaining 60 wells shown in Figure 3-2 are privately owned agricultural wells or dedicated monitoring wells that were sampled by Watermaster for various purposes. All groundwater samples collected by Watermaster are tested for the analytes listed in Table 3-1. Note that VOCs are sampled only at wells within or adjacent to known contamination plumes.

Table 3-1. Analyte List for the Groundwater-Quality Monitoring Program

Analyte	Laboratory Analysis Method
Major cations: Ca, Mg, K, Si, Na	EPA 200.7
Major anions: Cl, SO_4, NO_2, NO_3	EPA 300.0
Major Trace Elements Al, As, Ba, Cr, Mn	EPA 200.8
Total Hardness	SM 2340B
Total Alkalinity (incl. Carbonate, Bicarbonate, Hydroxide)	SM 2320B
Ammonia Nitrogen	EPA 350.1
Arsenic	EPA 200.8
Boron	EPA 200.7
Chromium, Total	EPA 200.8
Hexavalent Chromium	EPA 218.6
Fluoride	SM 4500F-C
Gross Alpha/Beta	EPA 900.0
Perchlorate	EPA 314.0
pH	SM2330B/SM 4500-HB
Specific Conductance	SM 2510B
Total Dissolved Solids	EPA 160.1/SM 2540C
Total Kjeldahl Nitrogen (TKN)	EPA 351.2
Organic Nitrogen	EPA 351.2
Total Organic Carbon	SM5310C/E415.3
Total Phosphorus	SM4500-PE/EPA 365.1
Turbidity	EPA 180.1
VOCs[a]	EPA 524.2
1,2,3 -Trichloropropane (Low Detection)	CASRL 524M-TCP

(a) Only at wells within or near known VOC plumes (Chino Airport, South Archibald, Pomona, GE Flatiron, GE Testcell, Former Crown Coach Facility, Alger Manufacturing Inc., Chino Institution for Men, Milliken Landfill, Stringfellow)



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Groundwater and Surface-Water Quality Monitoring Program
Sites Monitored in 2020

Figure 3-2

During 2020, Watermaster performed the following groundwater-quality sampling:

- Annual and triennial samples were collected for the Key Well Groundwater Quality Monitoring Program (GWQMP). The Key Well GWQMP consists of a network of about 85 private wells predominantly in the southern portion of the Chino Basin and 11 monitoring wells, which include two multi-nested MZ-3 monitoring wells (six well casings), and two multi-nested former Kaiser Steel monitoring wells (five well casings). About nine of the private wells in proximity to contaminant plumes are sampled every year; the remaining private wells are sampled every three years. All of the monitoring wells are sampled every year. Watermaster is constantly evaluating and revising the private wells in the Key Well GWQMP as wells are abandoned or destroyed due to urban development. During 2020, 28 private wells and 10 monitoring wells were sampled from July through December 2020.
- Annual samples were collected from eight[15] of the nine multi-nested HCMP monitoring wells (18 well casings) in the southern portion of Chino Basin in August 2020.
- Quarterly samples were collected at four shallow monitoring wells along the Santa Ana River, which consist of two former United States Geological Survey (USGS) National Water Quality Assessment (NAWQA) Program wells (Archibald 1 and Archibald 2) and two Santa Ana River Water Company (SARWC) wells (Wells 9 and 11). Samples were collected in January, April, July, and October 2020.
- Quarterly or semi-annual samples were collected at one single-nested and one multi-nested Prado Basin Habitat Sustainability Program (PBHSP) monitoring wells (three well casings), and one monitoring well utilized for the PBHSP, in April, June, and September 2020.

All groundwater-quality data are reviewed by Watermaster staff and uploaded to a centralized database management system that can be accessed online through HydroDaVE[SM]. All publicly available water-quality data collected in 2020 are contained in the MS Access database included with this report as Appendix B. Groundwater-quality data collected at private wells in the Basin are excluded from the database in this report for confidentiality reasons.

3.2 Surface-Water Quality Monitoring Program

Watermaster collects quarterly surface-water quality samples from two sites along the Santa Ana River, *SAR at Etiwanda* and *SAR at River Road*, and quarterly or semi-annual samples[16] at two sites along Chino Creek, *CK at RP2* and *CK at Euclid,* for the PBHSP*.* Figure 3-2 shows the locations of these sites.

For surface water sites along the Santa Ana River, samples are collected on the same day as the quarterly groundwater-quality samples at the near-river NAWQA and SARWC wells. Samples were collected in January, April, July, and October 2020. Surface-water quality samples are tested for the analytes listed in Table 3-2. For the surface water sites along Chino Creek, the samples are collected on the same day as the semi-annual groundwater-quality samples at the nearby PBHSP monitoring wells. Samples were collected in April, June, and September 2020. All surface-water quality data are reviewed by Watermaster and uploaded to a centralized database management system that can be accessed online through

[15] Due to high turbidity, one well was not sampled. This well was redeveloped and sampled in early 2021.

[16] The frequency of the sampling for the PBHSP was changed from quarterly to semi-annually in 2020. Quarterly samples were collected in fiscal year 2020 (ending June 2020) and semi-annual samples were collected in fiscal year 2021 (starting July 2020).

HydroDaVE[SM]. All surface-water quality data collected in 2020 are contained in the MS Access database included with this report as Appendix B.

Table 3-2. Analyte List for the Surface-Water Quality Monitoring Program

Analytes	Laboratory Analysis Method
Major cations: K, Na, Ca, Mg	EPA 200.7
Major anions: Cl, SO_4, NO_2, NO_3	EPA 300.0
Total Hardness	SM 2340B
Total Alkalinity (incl. Carbonate, Bicarbonate, Hydroxide)	SM 2320B
Boron	EPA 200.7
Ammonia-Nitrogen	EPA 350.1
pH	SM 4500-HB
Specific Conductance	SM 2510B
Total Dissolved Solids	E160.1/SM2540C
Total Kjeldahl Nitrogen (TKN)	EPA 351.2
Organic Nitrogen	EPA 351.2
Turbidity	EPA 180.1
Total Organic Carbon	SM5310C/E415.3

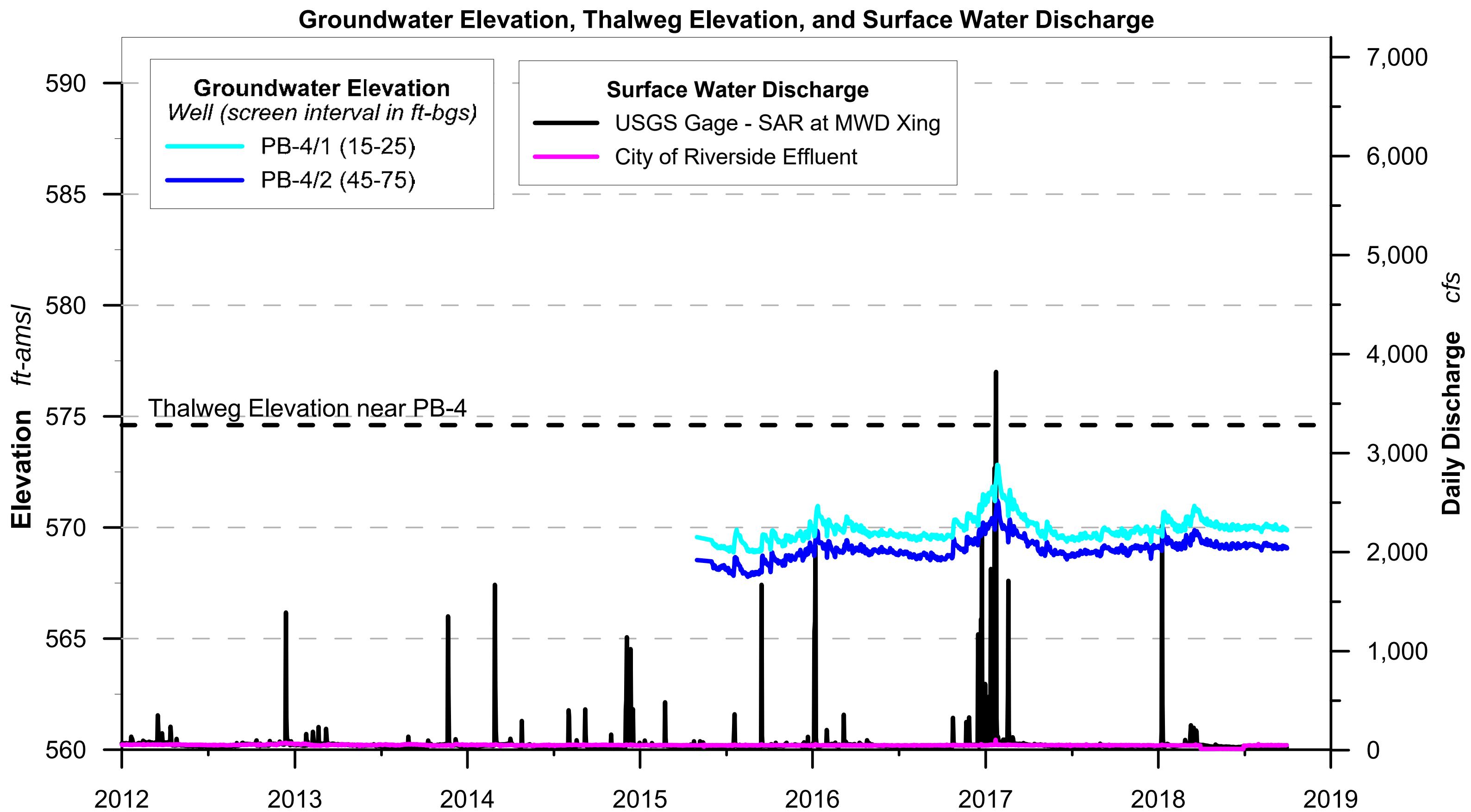
Figure 3-3 is an exhibit from the 2018 PBHSP Annual Report (WEI, 2019c) that shows the analysis of the groundwater and surface water interactions in the Santa Ana River using the surface water quality data collected at the two sites in the Santa Ana River (*SAR at Etiwanda* and *SAR at River Road*). The surface-water quality data is used along with the surface water discharge data, groundwater elevation and quality data, and model-simulated groundwater-flow directions to analyze the groundwater and surface water interactions. Note that:

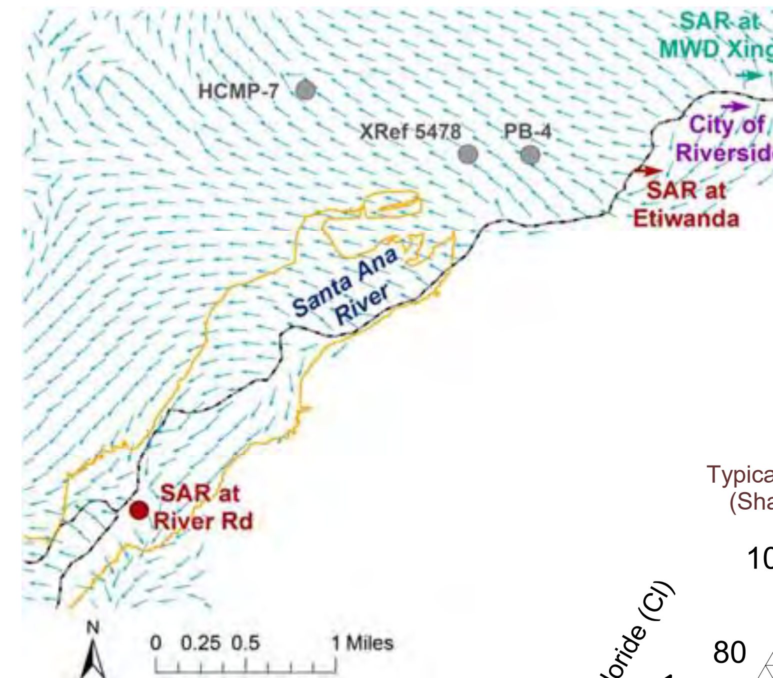
- The simulated groundwater-flow directions (arrow symbols on the map) diverge from the Santa Ana River, indicating that this is an area of streambed recharge.
- Groundwater elevations at both PB-4 wells are below the thalweg elevation of the Santa Ana River near PB-4, indicating that this is an area of streambed recharge from mid-2015 to late 2019.
- Groundwater elevations at both PB-4 wells increase slightly during and immediately after periods of stormwater discharge as measured by the USGS gage located upstream of PB-4 wells in the Santa Ana River, suggesting that stormwater discharge is a source of recharge to the shallow groundwater.
- The TDS concentrations at PB-4/1 (shallow well) fluctuate between 730-1,500 mgl; the lower TDS concentrations within this range are similar to the TDS concentrations of the baseflow in the Santa Ana River as sampled at *SAR at Etiwanda* and *SAR at River Road*, while the higher TDS concentrations are similar to the TDS concentrations of shallow groundwater at a nearby well (HCMP-7/1). This suggests that the source of groundwater sampled at PB-4/1 is influenced by streambed recharge of the Santa Ana River, the shallow regional aquifer system, and/or local return flows of precipitation and applied water. TDS concentrations at PB-4/2 (deeper well) range from 650-810 mgl which are similar to the TDS concentrations of

the baseflow in the Santa Ana River, suggesting that the source of groundwater samples at PB-4/2 is streambed recharge.

- The general-mineral chemistry for both PB-4 wells plots very close to the chemistry of surface water for *SAR at Etiwanda* and *SAR at River Road* on the Piper diagram, indicating that the source of the shallow groundwater at PB-4 is streambed recharge of the Santa Ana River, the shallow regional aquifer system, and/or local return flows of precipitation and applied water.

The analysis detailed in the 2018 PBHSP Annual Report concludes that this area of the Santa Ana River is a losing reach, characterized by streambed recharge to the Chino Basin; further demonstrating hydraulic control.



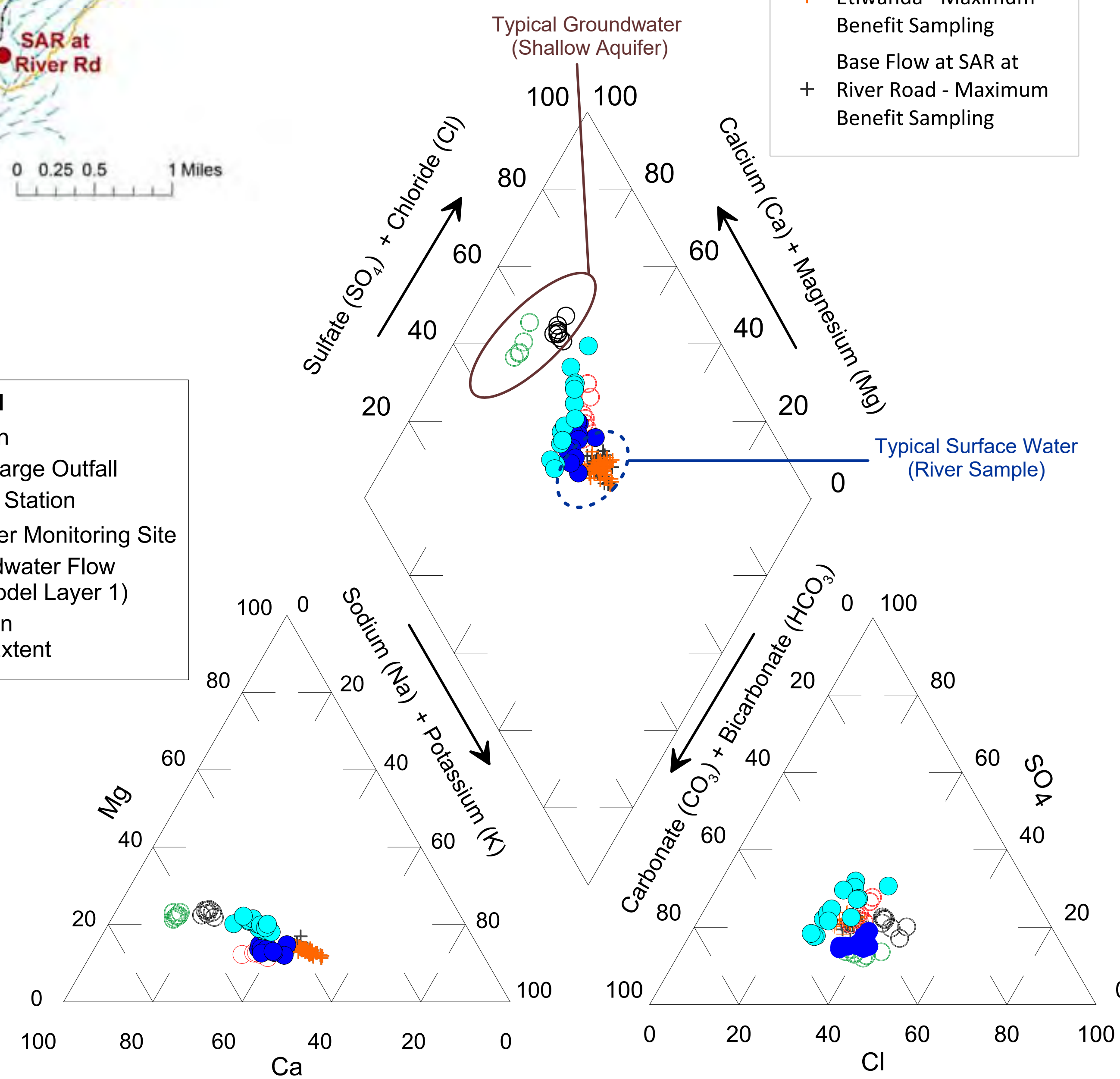


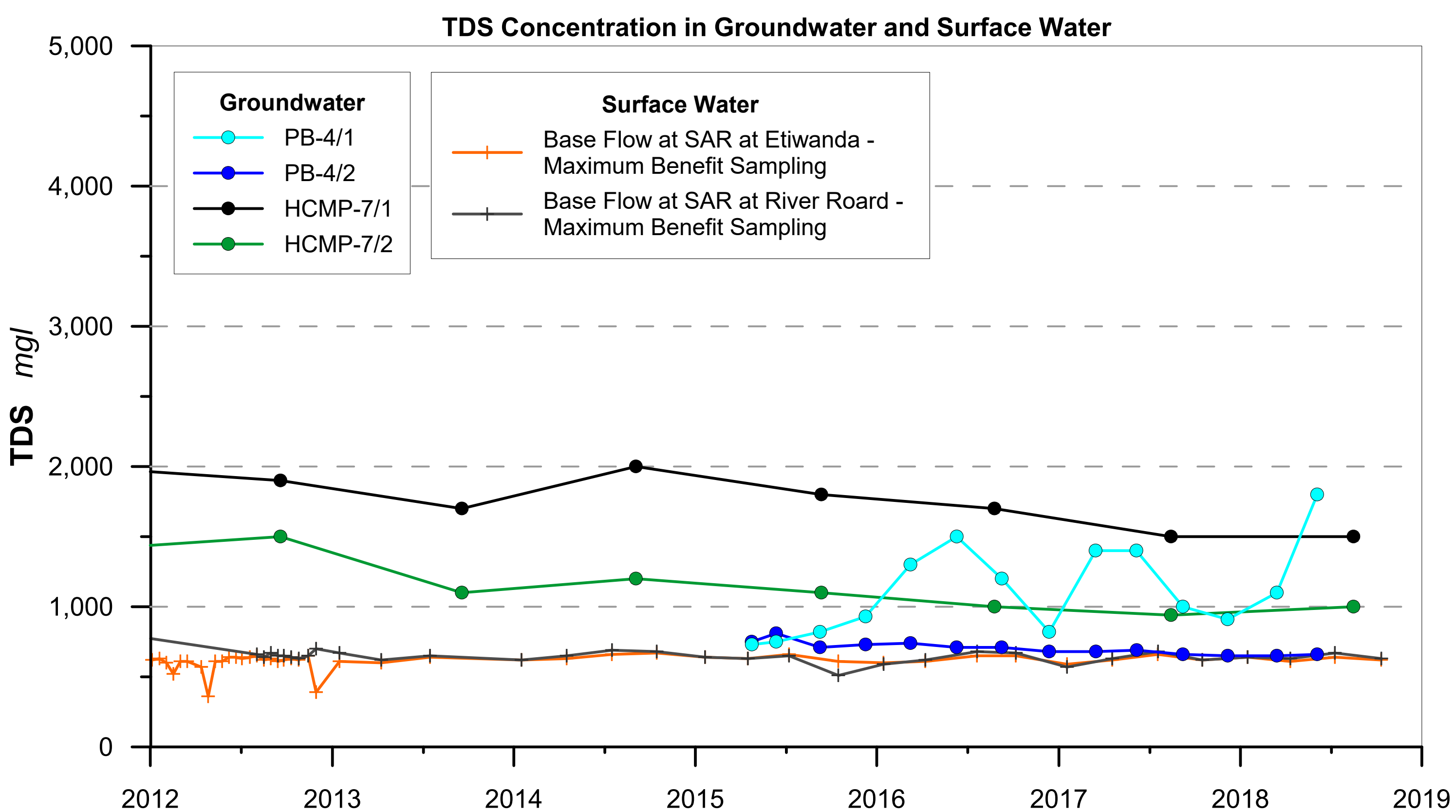
Piper Legend
Wells (screen interval in ft-bgs)

- PB-4/1 (15-25)
- PB-4/2 (45-75)
- HCMP-7/1 (70-110)
- HCMP-7/2 (200-220)
- XRef 5478 (Unknown)

Piper Legend
Surface Water

- Base Flow at SAR at Etiwanda - Maximum Benefit Sampling
- Base Flow at SAR at River Road - Maximum Benefit Sampling





Map Legend

- Well Location
- POTW discharge Outfall
- USGS Gage Station
- Surface Water Monitoring Site
- 2018 Groundwater Flow Direction (Model Layer 1)
- 2018 Riparian Vegetation Extent

Prepared by:

WEST YOST Water. Engineered.

Author: SO
Date:2/25/20

K:Chino Basin Watermaster\PE7\GRAPHER\GR\MaxBen\AnnualR\Figure3-3

(Figure 3-15h from the 2018 PBHSP Annual Report - June 2019)

Prepared for:

Chino Basin Watermaster
2020 Maximum Benefit
Annual Report

Groundwater and Surface Water Interactions
Santa Ana River Near PB-4

Figure 3-3

4.0 INFLUENCE OF RISING GROUNDWATER ON THE SANTA ANA RIVER

This section characterizes the influence of rising groundwater on the flow and quality of the Santa Ana River between the Riverside Narrows and Prado Dam (see locations in Figure 3-2). Rising groundwater from the Chino Basin to the Santa Ana River consists of groundwater from Chino-North that flows past the CCWF well field and unpumped groundwater south of and outside the influence of the Chino Basin Desalter well fields.[17]

4.1 Surface-Water Discharge Accounting

Annual estimates of the Chino Basin recharge and discharges (computational results from Watermaster's Chino Basin groundwater model) are used to evaluate the annual net contribution of rising groundwater to the Santa Ana River between the Riverside Narrows and Prado Dam. The purpose of this analysis is to estimate the magnitude of net rising groundwater in the Santa Ana River between Riverside Narrows and Prado Dam, which is the extent of the Santa Ana River flowing through Chino Basin (see Figure 1-1). Net rising groundwater is the combined losses and gains in Santa Ana River flow due to rising groundwater, streambed infiltration, and evapotranspiration (ET). Achieving hydraulic control should decrease net rising groundwater.

Table 4-1 is a water budget table from Watermaster's groundwater model that was updated and recalibrated to recalculate the safe yield in 2020 (WEI, 2020). The water budget table lists the annual recharge and discharge components for the Chino Basin as an input to, or computed by, the model for the calibration period of fiscal year 1978 to 2018, plus fiscal year 2019 and 2020 from the planning period for scenario *2020 SYR1*. Column 9, *Streambed Infiltration from the Santa Ana River*, is the annual estimate of streambed infiltration to the Chino Basin in the Santa Ana River downstream of the Riverside Narrows and the lower reaches of Chino Creek and Mill Creek. Column 19, *Rising Groundwater*, is the annual estimate of the combined groundwater discharge from Chino Basin to the Santa Ana River, Chino Creek, and Mill Creek. The net rising groundwater from Chino Basin to the Santa Ana River between Riverside Narrows and Prado Dam is calculated in Column 23 as the difference between groundwater discharge and streambed infiltration (Column 19 minus Column 9). Figure 4-1 shows the time history of this net rising groundwater calculation. With three exceptions, in 2001, 2003, and 2004, the net rising groundwater estimate is negative over the 43-year period. Negative values for net rising groundwater indicate that the volume of rising groundwater in this reach of the Santa Ana River is less than the combined volume of losses from the river due to streambed infiltration. Net rising groundwater decreased (larger negative values) as the Chino-I and Chino-II Desalters increased production in the southern Chino Basin starting in fiscal year 2005. These observations are consistent with conclusions from the monitoring data and demonstrate that hydraulic control is being achieved.

4.2 Surface-Water Quality at Prado Dam

Rising groundwater from the Chino Basin to the Santa Ana River consists of groundwater from Chino-North that flows past the CCWF well field and unpumped groundwater south of and outside the influence of the Chino Basin Desalter well fields. Groundwater discharge from Chino-North to the PBMZ is either pumped by wells, consumed by riparian vegetation in the PBMZ, or becomes rising groundwater and contributes to Santa Ana River discharge at Prado Dam. Calibration of the 2008 Wasteload Allocation

[17] See groundwater flow vectors in Figure 2-2.

Model (1994-2006) estimated that rising groundwater in the PBMZ had an average TDS concentration of about 850 mgl (WEI, 2009b). This estimate is consistent with a 2015 TDS mass-balance characterization of the Santa Ana River (WEI, 2015d) and recent sampling at PBMZ monitoring wells (WEI, 2019c).

The Santa Ana River Watermaster (SARWM) has compiled annual reports pursuant to the 1969 stipulated judgment[18] that contain annual estimates of: significant discharges to the Santa Ana River, estimates of the storm flow and base flow discharge, and the volume-weighted TDS concentration of discharge at the Riverside Narrows and at Prado Dam (SARWM, 2020). These estimates are used herein to demonstrate the impact of rising groundwater outflow on the TDS concentration of the Santa Ana River at Prado Dam. Figure 4-2 is a time-history chart of the annual discharge components in the Santa Ana River at Prado Dam and the associated annual volume-weighted TDS concentrations as reported by the SARWM. The base flow discharge is represented by two bars: 1) the SARWM estimate of base flow discharge at Prado Dam minus the rising groundwater from the Chino Basin component; and 2) the total rising groundwater discharge from the Chino Basin to the Santa Ana River estimated with the Watermaster's 2020 groundwater model update as shown in column 19 of Table 4-1 — the sum of these two terms equal the SARWM estimate of base flow discharge at Prado Dam. Figure 4-2 also shows the five-year moving average of the SARWM's estimate of the annual flow-weighted TDS concentration of the Santa Ana River at Prado Dam. This five-year moving average is the metric the Regional Board uses to determine compliance with the Basin Plan TDS concentration objective of 650 mgl for Reach 2 of the Santa Ana River (Reach 2 TDS metric) (Regional Board, 2008). Note that:

- Since about 1980, annual estimates of rising groundwater discharge from the Chino Basin to the Santa Ana River, which ranged from about 13,000 to 30,000 afy, have been a small percentage of total annual flow at Prado Dam, ranging from about three percent during wet years to about 17 percent during dry years.
- From 2005 to 2015, the model-estimated groundwater discharge from Chino-North to the PBMZ ranged from 550 afy to 740 afy without the operation of the CCWF[19], which represents a small fraction of the total rising groundwater from the Chino Basin to the Santa Ana River. It represents, on average, about four percent of rising groundwater discharge from the Chino Basin to the Santa Ana River, and about less than one percent of the total flow in the Santa Ana River at Prado Dam.
- In 2016, the CCWF commenced operation, further reducing the groundwater discharge from the Chino-North to the PBMZ to the de minimis threshold levels (less than 1,000 afy). The model-projected groundwater discharge past the CCWF ranges from about 400 to 630 afy in 2016 through 2050.[20] This represents about three percent of the total rising groundwater discharge to the Santa Ana River from the Chino Basin, and less than one percent of the total flow in the Santa Ana River at Prado Dam.
- Since about 1980, the Reach 2 TDS metric has ranged between 481 and 603 mgl and has not exceeded the TDS objective of 650 mgl—even during extended dry periods when storm

[18] The Santa Ana River was adjudicated in the 1960s, and a stipulated judgment was filed in 1969 (Orange County Water District v. City of Chino et al., Case No. 117628, County of Orange). Since the Judgment was filed, the SARWM has compiled annual reports

[19] See Figure 2-3 of this report for modeling projections of groundwater discharge from Chino-North to the PBMZ past the CCWF.

[20] See Figure 2-3 of this report for modeling projections of groundwater discharge from Chino-North to the PBMZ past the CCWF.

water dilution of the Santa Ana River is relatively little (e.g. water years 1984 through 1992, 1999 through 2004, and 2012 through 2016).

- The Reach 2 TDS metric increased continuously from water year 2006 to water year 2016, which coincides with a dry climatic period with a decrease in low-TDS stormwater flow and a steady decrease in the volume of base flow discharge. The decrease in baseflow is mostly attributable to the decrease in wastewater discharges to the Santa Ana River.
- In water year 2020, the Reach 2 TDS metric was 490 mgl, a decrease of 12 mgl from the previous year.

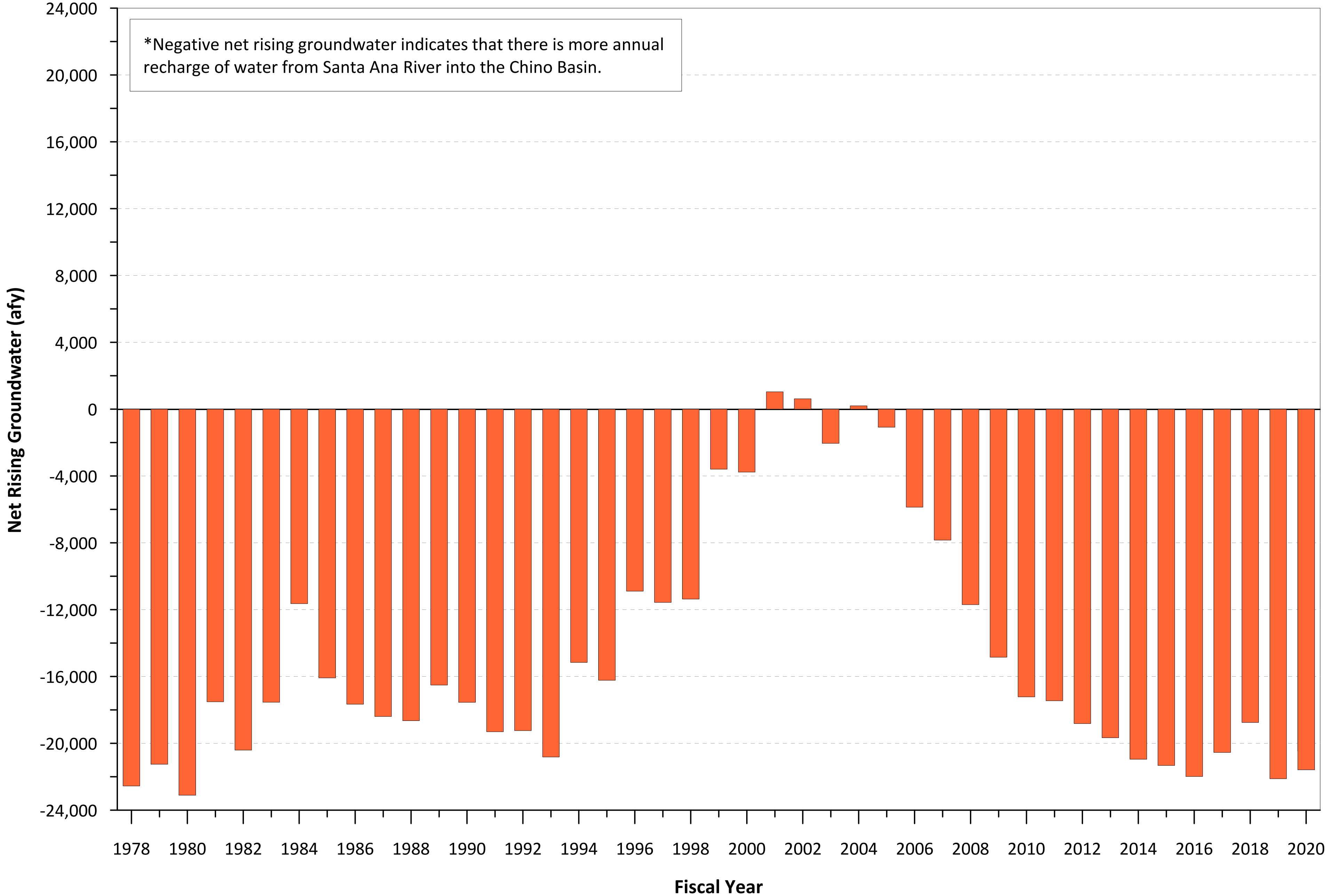
These observations suggest that the rising groundwater discharge from the Chino Basin to the Santa Ana River has had a *de minimis* impact on the flow and TDS concentration of the Santa Ana River since 1978 and has never contributed to an exceedance of the TDS objective for Reach 2. The groundwater discharge from the Chino-North to the PBMZ that becomes rising groundwater discharge in the Santa Ana River has historically been small compared to total discharge in the Santa Ana River and has further decreased with the operation of the CCWF. Based on the trends observed since 2005, the Reach 2 TDS metric will likely continue to increase as other conditions that affect the flow and quality of the Santa Ana River change over time, such as the continued reduction of wastewater effluent discharges to the River, and/or an increase in the duration and frequency of dry periods due to climate change. Given that wastewater effluent discharges are projected to further decline, the maintenance of hydraulic control of Chino-North will become increasingly important to protecting the water quality of the Santa Ana River at Prado Dam and downstream beneficial uses.

Table 4-1. Water Budget for the Chino Basin for the Calibration and Planning Periods and Estimated Net Rising Groundwater

Fiscal Year	Recharge														Discharge						Change in Storage		Net Rising Groundwater Contribution to Surface Discharge
	Subsurface Inflow							Deep Infiltration of Precipitation and Applied Water	Santa Ana River Streambed Infiltration[a]	Streambed Infiltration from the Santa Ana River Tributaries	Managed Aquifer Recharge			Total Recharge	Groundwater Pumping			Riparian Veg ET	Rising Groundwater[d]	Total Discharge	Annual	Cumulative	
	Bloomington Divide	Chino/Puente Hills, Jurupa Hills, and Rialto Basin	Net Temescal Basin	Pomona Basin	Claremont Basin	Cucamonga Basin	Spadra Basin				Storm Water	Recycled Water	Imported Water		CDA Pumping	Overlying Non Ag and Appropriative Pools[b,c]	Overlying Agricultural Pool						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23) = (19) - (9)
1978	11,404	8,811	2,502	2,278	2,277	12,032	961	117,423	37,046	24,456	5,183	3,175	6,952	234,499	0	64,771	120,072	16,951	14,495	216,289	18,210	18,210	(22,552)
1979	11,002	9,659	3,101	2,867	2,574	11,628	576	122,211	33,871	15,620	2,951	3,049	28,347	247,456	0	65,008	118,922	17,257	12,619	213,805	33,651	51,861	(21,253)
1980	12,497	10,790	3,420	2,922	2,578	11,567	498	126,236	38,002	20,253	4,662	3,232	16,537	253,195	0	69,503	110,885	16,404	14,897	211,689	41,505	93,366	(23,105)
1981	13,071	10,955	4,216	3,024	2,585	11,537	476	126,479	30,545	7,647	1,219	3,451	20,850	236,055	0	72,927	116,470	17,194	13,035	219,626	16,429	109,795	(17,510)
1982	13,337	11,289	4,987	2,892	2,470	11,401	480	126,714	33,792	11,112	3,096	3,726	21,641	246,937	0	68,404	101,624	16,868	13,389	200,284	46,652	156,447	(20,403)
1983	13,316	10,685	5,161	3,008	2,597	11,552	496	132,273	35,436	18,011	6,703	3,873	27,590	270,704	0	67,259	94,508	16,139	17,899	195,805	74,898	231,346	(17,537)
1984	14,378	9,829	6,112	3,222	2,752	11,871	511	133,497	29,048	8,724	2,472	982	22,400	245,799	0	74,726	107,238	16,642	17,412	216,018	29,782	261,127	(11,636)
1985	13,577	8,729	6,343	3,085	2,561	11,887	526	128,408	30,446	6,257	2,032	0	20,782	234,631	0	79,626	105,444	16,810	14,364	216,243	18,388	279,515	(16,082)
1986	12,428	9,439	6,192	3,007	2,456	11,668	549	127,728	33,461	6,062	2,903	0	18,327	234,221	0	83,822	105,254	16,877	15,805	221,757	12,463	291,979	(17,656)
1987	11,951	8,844	6,493	2,944	2,379	11,309	553	121,909	32,772	2,874	1,789	0	19,938	223,754	0	88,675	104,829	17,090	14,383	224,976	(1,222)	290,756	(18,389)
1988	11,385	7,674	5,839	2,790	2,274	10,771	538	122,069	34,246	2,925	2,641	0	2,485	205,637	0	94,222	95,264	17,187	15,603	222,276	(16,640)	274,117	(18,643)
1989	11,408	7,528	5,339	2,681	2,214	10,364	529	120,836	31,310	1,422	2,393	0	7,332	203,357	0	97,218	89,511	17,407	14,798	218,935	(15,578)	258,539	(16,513)
1990	11,788	7,121	4,579	2,536	2,124	10,448	509	115,495	31,487	433	1,430	0	0	187,950	0	98,914	83,775	17,482	13,942	214,113	(26,163)	232,376	(17,545)
1991	12,630	6,656	4,009	2,421	2,092	10,335	474	113,633	33,477	712	2,198	0	3,634	192,271	0	88,986	83,073	17,525	14,171	203,756	(11,484)	220,891	(19,306)
1992	13,286	7,250	3,737	2,438	2,136	10,393	442	112,979	34,141	1,028	3,598	0	5,568	196,997	0	102,664	77,336	17,736	14,905	212,640	(15,643)	205,248	(19,237)
1993	13,611	8,300	2,863	2,725	2,434	10,588	423	116,794	37,980	2,239	6,619	0	14,224	218,800	0	88,040	83,284	17,404	17,162	205,889	12,910	218,159	(20,817)
1994	13,637	8,223	3,621	2,994	2,560	10,871	425	117,935	30,748	650	1,486	0	16,448	209,597	0	93,564	72,115	18,155	15,589	199,423	10,174	228,333	(15,159)
1995	13,478	9,217	2,488	2,899	2,507	10,967	428	119,075	35,361	1,538	4,662	0	10,375	212,995	0	98,173	62,171	17,711	19,136	197,191	15,803	244,136	(16,225)
1996	13,289	9,146	3,546	3,017	2,560	11,015	455	117,398	29,441	709	2,425	0	82	193,085	0	109,609	71,220	18,429	18,553	217,811	(24,726)	219,410	(10,888)
1997	13,292	9,072	3,290	2,829	2,430	10,883	481	116,836	30,483	1,007	3,305	0	16	193,925	0	112,998	68,968	18,564	18,917	219,448	(25,523)	193,887	(11,565)
1998	13,650	8,754	2,402	2,803	2,417	10,727	503	117,046	33,821	1,637	5,780	0	8,352	207,895	0	104,141	45,302	18,238	22,456	190,138	17,757	211,644	(11,365)
1999	13,956	8,514	3,516	2,936	2,489	10,756	494	115,042	26,381	519	1,007	0	5,839	191,449	0	118,738	46,730	19,035	22,794	207,298	(15,849)	195,795	(3,587)
2000	14,451	7,890	2,858	2,707	2,341	10,563	508	109,843	27,081	499	1,985	507	997	182,232	523	133,086	46,538	18,938	23,315	222,400	(40,168)	155,628	(3,767)
2001	14,556	7,970	3,132	2,532	2,254	10,223	525	107,823	25,419	598	3,162	500	6,538	185,230	9,470	120,396	41,429	18,717	26,464	216,476	(31,245)	124,382	1,045
2002	15,177	7,242	3,565	2,467	2,206	10,028	517	102,792	25,922	230	1,148	505	6,493	178,292	10,173	129,760	38,650	18,472	26,544	223,599	(45,307)	79,075	621
2003	15,747	6,518	2,932	2,377	2,145	9,868	504	102,305	28,672	859	6,284	185	6,548	184,945	10,322	123,471	36,507	18,157	26,630	215,087	(30,142)	48,934	(2,042)
2004	16,088	6,780	1,994	2,407	2,123	9,860	492	99,010	27,465	536	3,357	49	7,607	177,768	10,480	128,548	36,809	18,069	27,669	221,574	(43,807)	5,127	204
2005	14,346	7,918	721	2,643	2,336	9,816	481	99,647	30,922	5,917	17,648	158	12,259	204,813	10,595	112,943	34,503	17,178	29,844	205,064	(251)	4,876	(1,078)
2006	14,568	7,648	1,891	3,152	2,571	9,897	467	99,823	30,439	1,806	12,940	1,303	34,567	221,073	19,819	113,553	30,812	17,561	24,576	206,321	14,752	19,627	(5,862)
2007	15,150	7,607	1,268	2,911	2,413	9,826	412	96,008	29,276	79	4,745	2,993	32,960	205,647	28,529	123,695	29,919	18,276	21,441	221,859	(16,212)	3,415	(7,835)
2008	15,044	7,346	1,173	2,627	2,240	9,842	384	93,275	31,703	1,530	10,205	2,340	0	177,709	30,116	127,696	26,280	18,358	20,003	222,453	(44,744)	-41,329	(11,700)
2009	15,271	7,363	696	2,509	2,178	9,950	414	91,489	33,318	839	7,512	2,684	0	174,220	28,456	137,345	23,386	18,561	18,475	226,223	(52,003)	-93,331	(14,843)
2010	15,584	6,402	562	2,448	2,167	9,809	441	88,512	35,285	1,939	14,273	7,210	5,000	189,632	28,964	108,983	22,038	18,686	18,067	196,739	(7,107)	-100,438	(17,218)
2011	15,960	6,889	557	2,601	2,299	9,891	452	88,763	36,213	3,358	17,052	8,065	9,465	201,564	28,941	94,413	18,042	18,739	18,765	178,901	22,663	-77,775	(17,447)
2012	15,577	6,971	1,397	2,713	2,317	9,820	441	84,009	34,463	463	9,271	8,634	22,560	198,637	28,230	108,501	22,412	19,282	15,649	194,074	4,563	-73,212	(18,814)
2013	15,144	6,651	1,516	2,676	2,203	9,748	426	80,130	33,536	243	5,271	10,479	0	168,023	27,380	111,748	24,074	17,348	13,871	194,421	(26,398)	-99,610	(19,665)
2014	15,067	6,355	1,371	2,645	2,144	9,548	440	78,395	34,301	241	4,299	13,593	795	169,195	29,626	118,849	22,131	17,426	13,348	201,380	(32,185)	-131,795	(20,953)
2015	15,230	5,760	1,217	2,547	2,096	8,721	458	75,817	34,907	421	8,001	10,840	0	166,014	30,022	104,317	17,552	17,580	13,585	183,056	(17,042)	-148,837	(21,322)
2016	15,716	5,015	1,057	2,498	2,062	7,809	449	73,547	36,134	476	9,236	13,222	0	167,221	28,191	101,301	16,908	17,824	14,147	178,371	(11,150)	-159,988	(21,987)
2017	15,967	5,587	1,529	2,462	2,056	8,311	423	72,874	35,805	1,920	11,575	13,934	13,150	185,593	28,284	98,960	16,191	17,869	15,261	176,565	9,028	-150,960	(20,544)
2018	15,711	5,385	2,306	2,510	2,072	8,041	388	69,532	32,664	2,165	4,494	13,212	35,621	194,101	30,088	93,904	16,776	18,147	13,914	172,828	21,272	-129,687	(18,750)
2019	15,538	7,731	364	2,634	2,055	6,909	363	68,367	35,862	602	12,861	11,145	6,510	164,728	31,233	84,668	15,478	18,099	14,234	166,819	(2,092)	-131,779	(22,117)
2020	15,538	7,709	754	2,664	2,132	6,867	355	70,799	35,317	602	9,966	12,952	18,103	183,757	35,630	96,570	15,722	18,268	14,844	181,033	2,725	-126,963	(20,473)

Source: Water Budget from the Chino Basin goundwater model that was updated and recalibrated to calculate Safe Yield in 2020. The period includes the calibration period of fiscal year 1978 to 2018 and fiscal year 2019 and 2020 of the planning simulation period for Scenario 2020 SYR1 with updated historical managed aquifer recharge and pumping.

(a) Streambed infiltration from Santa Ana River includes infiltration at Santa Ana River below Riverside Narrows and at lower reaches of Chino and Mill Creeks
(b) Does not include San Antonio Water Company Wells 15 and 16, and Santa Ana River Water Company Well 9.
(c) Less injection in wells by General Electric.
(d) Rising groundwater discharge to Santa Ana River and Chino and Mill Creeks.
(Red Text) Indicates negative values.



Prepared by:

WEST YOST
Water. Engineered.

Author: SO
Date:2/25/20

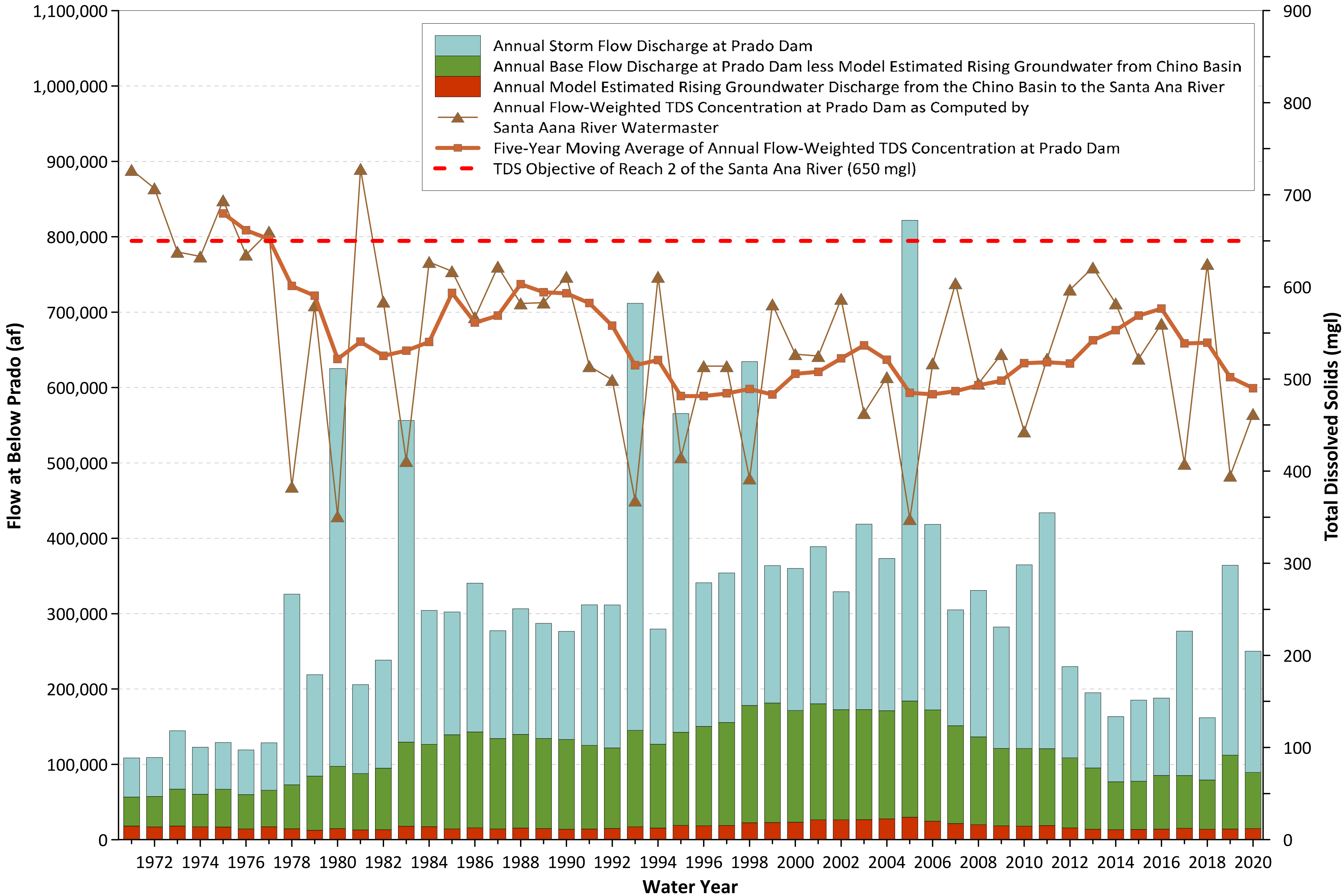
K:Chino Basin Watermaster\PE7\GRAPHER
\GR\MaxBen\AnnualR\Figure4-1

Prepared for:

Chino Basin Watermaster
2020 Maximum Benefit
Annual Report

Net Annual Rising Groundwater Contribution to Surface Discharge in Sana Ana River between Riverside Narrows and Prado Dam - 1978 to 2020

Figure 4-1



Prepared by:

Author: SO
Date:3/18/21

K:Chino Basin Watermaster\PE7\GRAPHER\GR\MaxBen\AnnualR\Figure4-2

Prepared for:

Chino Basin Watermaster
2020 Maximum Benefit
Annual Report

TDS and Components of Discharge of the Santa Ana River at Prado Dam
Water Year 1971 to 2020

Figure 4-2

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Appendix A

The IEUA Five-Year, Volume-Weighted TDS and TIN Computation for Managed Aquifer Recharge

Appendix A: TDS and NO_3-N Data Table

	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
Month	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jul-05	647	1,488	20	2,155	129	189	458	373806		2.9	0.6	2.3	2885	
Aug-05	137	1,545	254	1,936	129	174	447	399909		2.9	0.5	1.6	1564	
Sep-05	299	2,763	268	3,329	129	191	467	691278		2.9	0.4	2.1	2634	
Oct-05	876	2,313	150	3,340	129	205	459	656175		2.9	0.3	1.5	3529	
Nov-05	344	3,567	100	4,010	129	202	455	810393		2.9	0.5	1.8	2800	
Dec-05	669	3,617	77	4,362	129	223	475	929286		2.9	0.6	2.1	4408	
Jan-06	762	3,548	154	4,463	177	276	483	1188208		1.1	0.8	2.8	4015	
Feb-06	1,679	3,467	209	5,355	177	207	451	1109014		1.1	0.8	2.7	5287	
Mar-06	3,177	2,043	0	5,219	95	193	443	697408		0.5	0.8	2.9	3297	
Apr-06	3,337	2,568	0	5,905	115	173	437	827652		0.8	0.6	4.2	4182	
May-06	857	3,190	0	4,046	115	149	442	573690		0.8	0.4	5.4	2025	
Jun-06	216	3,597	73	3,886	115	128	488	520838		0.8	0.3	3.3	1460	
Jul-06	156	956	449	1,561	115	144	455	359551		0.8	0.3	2.3	1459	
Aug-06	182	4,467	619	5,269	115	173	454	1074838		0.8	0.3	2.1	2955	
Sep-06	273	6,749	616	7,638	115	177	427	1488730		0.8	0.4	2.5	4197	
Oct-06	300	6,150	224	6,675	115	170	435	1177526		0.8	0.3	3.6	2969	
Nov-06	296	5,257	93	5,646	115	158	436	905165		0.8	0.5	2.9	2989	
Dec-06	697	5,429	260	6,386	115	271	447	1667416		2.5	0.6	3.4	5918	
Jan-07	543	3,201	160	3,904	115	247	466	927308		2.5	0.8	3.3	4413	
Feb-07	1,140	706	130	1,976	115	301	464	403809		2.5	0.9	4.0	3989	
Mar-07	200	48	117	365	115	295	477	93031		2.5	1.0	3.0	895	
Apr-07	532	4	130	666	115	275	470	123292		2.5	1.0	2.8	1698	
May-07	245	0	182	427	115	244	481	115621		2.5	0.8	4.8	1487	
Jun-07	206	0	10	216	115	249	478	28445		2.5	0.5	3.0	543	
Jul-07	141	0	141	282	329	254	492	115864		0.9	0.5	3.9	683	
Aug-07	197	0	78	275	329	207	475	101948		0.9	0.5	3.3	444	
Sep-07	218	0	143	361	329	220	481	140613		0.9	0.3	3.4	690	
Oct-07	285	0	132	417	366	272	542	175777		0.7	0.4	4.9	865	
Nov-07	915	0	346	1,261	366	278	497	506679		0.7	0.6	3.1	1757	
Dec-07	1,481	0	53	1,534	130	278	506	219871		1.7	0.8	3.8	2667	
Jan-08	4,558	0	1	4,559	86	271	493	392987		0.7	0.9	4.6	3337	
Feb-08	1,427	0	196	1,623	101	248	450	232422		1.5	1.0	3.8	2878	
Mar-08	155	0	360	515	101	275	456	179969		1.5	1.1	3.0	1303	
Apr-08	150	0	260	410	101	281	483	140669		1.5	1.3	3.8	1208	
May-08	588	0	369	957	376	284	481	398503		0.7	0.9	4.8	2190	
Jun-08	128	0	261	389	376	285	490	175914		0.7	0.8	5.8	1612	
Jul-08	142	0	291	433	376	290	489	195594		0.7	0.7	6.0	1854	
Aug-08	111	0	245	356	382	281	465	156409		<0.1	0.7	4.0	982	
Sep-08	99	0	86	185	382	272	467	78001		<0.1	0.4	4.6	402	
Oct-08	161	0	395	556	382	279	487	253867		<0.1	0.5	6.5	2586	
Nov-08	677	0	229	906	432	289	461	398131		0.6	0.6	3.5	1198	
Dec-08	2,363	0	88	2,451	112	289	446	304660		1.1	0.7	4.2	3031	
Jan-09	224	0	356	580	112	287	464	190341		1.1	0.7	3.9	1625	
Feb-09	3,080	0	52	3,132	66	289	413	224746		0.5	0.8	3.3	1698	
Mar-09	299	0	182	481	66	272	434	98661		0.5	0.6	2.6	612	
Apr-09	106	0	311	417	66	273	463	151093		0.5	0.6	2.4	795	
May-09	79	0	156	235	379	284	468	102878		0.5	0.5	2.4	416	
Jun-09	153	0	293	446	379	287	479	198306		0.5	0.5	4.6	1411	
Jul-09	107	0	90	197	379	324	465	82368		0.5	0.6	3.2	344	
Aug-09	113	0	200	313	292	254	446	122229		0.2	0.4	2.9	594	
Sep-09	108	0	296	404	292	235	447	163848		0.2	0.1	2.8	841	
Oct-09	614	17	807	1,438	189	255	455	487420		1.4	0.2	2.9	3205	
Nov-09	489	3	1,210	1,702	189	287	444	629794		1.4	0.5	2.8	4026	
Dec-09	2,851	0	563	3,414	100	255	441	532946		1.0	0.7	2.5	4262	

Appendix A: TDS and NO_3-N Data Table

	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
Month	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jan-10	4,190	0	473	4,663	68	244	444	496489		0.6	0.7	2.4	3751	
Feb-10	3,715	6	167	3,888	94	235	418	420493		1.3	0.7	3.3	5281	
Mar-10	593	0	612	1,205	94	220	419	311908		1.3	0.8	3.1	2658	
Apr-10	1,156	365	617	2,138	94	220	417	446130		1.3	0.9	2.6	3421	
May-10	179	2,433	1,185	3,797	270	235	423	1121340		0.9	0.8	2.8	5436	
Jun-10	159	2,176	990	3,325	270	232	433	976102	203	0.9	0.6	3.0	4391	1.1
Jul-10	164	0	748	912	270	245	442	374597	205	0.9	0.6	3.2	2544	1.1
Aug-10	183	0	718	901	270	234	434	360817	207	0.9	0.5	3.7	2838	1.1
Sep-10	190	0	836	1,026	309	193	423	411920	208	0.4	0.2	3.6	3088	1.1
Oct-10	670	0	923	1,593	309	244	440	612919	210	0.4	0.1	3.9	3917	1.1
Nov-10	1,156	0	773	1,929	100	267	450	463450	211	1.0	0.4	4.1	4277	1.2
Dec-10	7,036	0	262	7,298	240	248	430	1797782	213	0.7	0.5	3.8	6238	1.1
Jan-11	1,695	0	478	2,173	240	215	430	611254	212	0.7	0.7	4.2	3273	1.2
Feb-11	2,395	0	407	2,802	240	166	422	745176	214	0.7	0.7	4.4	3579	1.2
Mar-11	2,673	0	188	2,861	150	157	413	478632	216	2.2	0.5	4.6	6738	1.2
Apr-11	399	0	751	1,150	150	163	411	368605	221	2.2	0.6	4.6	4313	1.3
May-11	323	3,729	997	5,049	150	143	422	1002210	222	2.2	0.3	3.3	5282	1.3
Jun-11	167	5,736	984	6,887	275	124	422	1172590	222	0.1	0.2	3.4	4521	1.3
Jul-11	244	7,810	706	8,760	275	135	412	1412035	218	0.1	0.5	3.1	5715	1.2
Aug-11	97	7,138	486	7,721	305	129	418	1153623	215	0.8	0.4	2.8	4185	1.2
Sep-11	163	7,529	639	8,331	305	151	413	1450791	213	0.8	0.3	3.8	4772	1.2
Oct-11	888	83	924	1,895	305	136	418	668564	217	0.8	0.2	4.1	4490	1.3
Nov-11	1,174	0	648	1,822	95	135	412	378506	220	1.1	0.3	3.9	3767	1.3
Dec-11	538	0	870	1,408	69	138	411	394455	218	1.1	0.4	4.8	4779	1.4
Jan-12	926	0	826	1,752	73	174	422	416352	218	0.7	0.5	4.8	4600	1.4
Feb-12	1,166	0	664	1,830	73	230	436	374306	218	0.7	0.5	4.3	3698	1.4
Mar-12	2,117	0	381	2,498	73	281	451	325796	216	0.7	0.5	3.4	2825	1.4
Apr-12	1,625	0	367	1,992	73	268	454	285010	215	0.7	0.5	3.9	2598	1.4
May-12	177	0	1,171	1,348	421	282	466	620049	217	1.6	0.7	3.8	4712	1.4
Jun-12	151	0	952	1,103	421	257	454	495353	220	1.6	0.5	3.3	3420	1.4
Jul-12	216	0	547	763	421	249	443	333110	221	1.6	0.5	3.2	2085	1.4
Aug-12	186	0	322	508	371	213	438	209899	221	0.7	0.3	3.3	1173	1.4
Sep-12	154	0	481	635	371	194	439	268173	222	0.7	0.2	3.7	1883	1.4
Oct-12	338	0	615	953	371	223	455	405346	222	0.7	0.1	3.6	2441	1.4
Nov-12	388	0	921	1,309	371	296	456	564333	223	0.7	0.2	4.3	4175	1.4
Dec-12	1928	0	576	2,504	176	270	461	604864	224	4.9	0.3	3.9	11654	1.5
Jan-13	713	0	1,284	1,997	66	274	466	645687	231	0.6	0.6	4.8	6556	1.6
Feb-13	579	0	1,107	1,686	96	284	454	558439	233	1.4	0.8	4.9	6185	1.6
Mar-13	449	0	1,387	1,836	54	300	472	678910	235	0.1	1.1	4.6	6370	1.6
Apr-13	75	0	1,113	1,188	54	303	471	527969	236	0.1	1.0	4.6	5117	1.6
May-13	204	0	1,052	1,256	394	291	471	575868	237	0.1	0.8	4.4	4652	1.6
Jun-13	68	0	1,074	1,142	394	288	486	548488	239	0.1	0.5	3.4	3698	1.7
Jul-13	108	0	876	984	394	288	469	453794	240	0.1	0.3	3.3	2914	1.7
Aug-13	98	0	930	1,028	394	264	466	471527	241	0.1	0.0	3.9	3669	1.7
Sep-13	112.1	0	1449	1,561	360	249	476	730660	243	1.7	0.1	4.3	6359	1.7
Oct-13	242	0	1441	1,683	360	274	469	762469	245	1.7	0.0	4.7	7255	1.7
Nov-13	394	0	1307	1,701	360	299	483	772794	247	1.7	0.1	4.5	6561	1.7
Dec-13	414	0	1374	1,788	140	302	495	738433	251	1.1	0.4	4.6	6798	1.8

Appendix A: TDS and NO_3-N Data Table

	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
Month	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jan-14	196	195	997	1,388	140	305	493	578128	253	1.1	0.5	4.5	4805	1.8
Feb-14	1,274	235	848	2,357	132	306	497	661107	257	1.5	0.6	4.5	5879	1.8
Mar-14	665	282	782	1,729	245	314	467	616698	259	0.6	0.9	4.6	4239	1.9
Apr-14	589	72	1,177	1,838	245	309	496	749989	261	0.6	0.8	4.2	5349	1.9
May-14	131	11	1,322	1,464	369	305	500	712383	263	1.1	0.8	3.8	5203	1.9
Jun-14	76	0	1,090	1,166	369	294	486	557325	264	1.1	0.6	3.3	3708	1.9
Jul-14	67	0	574	641	369	292	470	294238	265	1.1	0.6	2.8	1676	1.9
Aug-14	195	0	825	1,020	369	307	481	468433	266	1.1	0.4	3.2	2887	1.9
Sep-14	163	0	1145	1,308	339	331	514	643986	268	0.9	0.3	3.9	4641	1.9
Oct-14	87	0	1247	1,334	339	340	522	680739	269	0.9	0.4	3.1	3968	1.9
Nov-14	903	0	864	1,767	130	342	548	590670	269	0.2	0.4	4.1	3686	1.9
Dec-14	3820	0	126	3,946	73	346	544	345444	266	0.8	0.5	4.9	3488	1.9
Jan-15	676	0	623	1,299	246	334	513	485557	273	1.0	0.7	5.4	4011	2.0
Feb-15	729	0	954	1,683	102	338	527	576798	279	1.8	0.8	4.3	5375	2.0
Mar-15	339	0	1,123	1,462	102	327	506	602367	280	1.8	0.8	4.0	5067	2.0
Apr-15	327	0	994	1,321	102	308	507	537312	283	1.8	0.9	4.4	5008	2.0
May-15	660	0	1,069	1,729	102	316	506	608234	283	1.8	0.8	4.9	6383	2.1
Jun-15	30	0	1,296	1,326	327	318	495	651848	285	1.0	0.6	3.4	4494	2.1
Jul-15	702	0	750	1,452	327	323	482	590867	286	1.0	1.0	3.8	3514	2.1
Aug-15	79	0	705	784	327	329	475	360708	286	1.0	0.3	3.5	2565	2.1
Sep-15	1,078	0	1,125	2,203	280	345	480	841340	287	0.2	0.2	3.8	4498	2.1
Oct-15	732	0	1,278	2,010	280	358	474	810732	287	0.2	0.1	3.8	5009	2.1
Nov-15	300	0	806	1,106	280	356	476	467334	289	0.2	0.1	4.2	3422	2.1
Dec-15	1,112	0	1,333	2,445	65	354	470	698826	291	1.7	0.3	4.8	8283	2.2
Jan-16	2,398	0	1,042	3,440	46	367	465	595099	288	0.6	0.7	5.7	7209	2.2
Feb-16	478	0	1,352	1,830	46	361	472	660132	290	0.6	0.7	4.5	6337	2.2
Mar-16	1,519	0	858	2,377	99	359	504	582813	292	1.0	0.9	4.0	4977	2.2
Apr-16	317	0	1,162	1,479	291	336	492	664347	293	2.4	0.8	4.1	5529	2.2
May-16	468	0	1,525	1,993	291	268	488	880267	300	2.4	0.6	3.7	6789	2.3
Jun-16	45	0	1,286	1,331	291	338	486	637463	310	2.4	0.5	3.2	4269	2.4
Jul-16	43	0	944	987	291	305	479	464231	323	2.4	0.3	3.8	3711	2.6
Aug-16	64	0	1,057	1,121	291	262	480	526390	338	2.4	0.1	4.5	4961	2.8
Sep-16	87	0	1,447	1,534	303	194	466	699940	354	0.2	0.1	4.6	6602	3.0
Oct-16	405	4160	1,345	5,910	180	208	461	1558536	349	2.9	0.1	4.5	7761	2.9
Nov-16	591	40	1,432	2,063	163	288	454	758363	352	1.3	0.2	4.3	6861	2.9
Dec-16	3,389	60	860	4,309	92	306	479	741934	345	0.9	0.2	4.1	6591	2.8
Jan-17	4712	0	431	5,143	86	292	479	609244	336	0.5	0.3	4.5	4419	2.7
Feb-17	1846	0	542	2,388	86	240	454	403660	334	0.5	0.6	4.8	3571	2.7
Mar-17	136	0	1598	1,734	86	170	441	715947	340	0.5	0.8	3.7	6018	2.8
Apr-17	81	1551	1517	3,149	86	130	441	877108	342	0.5	0.5	3.4	5987	2.8
May-17	194	0	1620	1,814	324	132	437	770616	342	<0.1	0.3	3.4	5477	2.8
Jun-17	26	6319	1141	7,486	324	94	435	1099173	328	<0.1	0.2	3.2	4895	2.6
Jul-17	68	7346	952	8,366	324	87	417	1057919	314	<0.1	0.2	4.1	5772	2.5
Aug-17	317	7068	932	8,317	324	102	423	1217994	302	<0.1	0.2	4.9	6326	2.4
Sep-17	53	3794	1307	5,154	267	115	415	992861	298	0.7	0.2	5.0	7428	2.3
Oct-17	83	4477	1433	5,993	267	121	396	1131570	292	0.7	0.2	4.2	7231	2.3
Nov-17	32	2480	1413	3,926	267	179	430	1060282	290	0.7	0.4	4.5	7422	2.3
Dec-17	23	4768	1591	6,381	306	176	424	1521360	289	2.2	0.5	4.0	8937	2.2

Appendix A: TDS and NO_3-N Data Table

	Volume (acre-feet)				TDS (mg/L)					NO_3-N (mg/L)				
Month	SW/LR	IW	RW	Total	SW/LR (Mean)	IW	RW	Σ (Vol x TDS)	5-yr Avg	SW/LR (Mean)	IW	RW*	Σ (Vol x TDS)	5-yr Avg
Jan-18	1514	4130	701	6,344	306	197	438	1583606	287	2.2	0.6	3.4	8126	2.1
Feb-18	428	0	998	1,426	148	254	461	523722	287	1.4	0.7	3.4	3960	2.1
Mar-18	1832	0	310	2,142	43	282	476	226292	283	1.3	0.7	3.4	3422	2.1
Apr-18	105	0	1105	1,210	43	262	456	508798	283	1.3	0.5	3.3	3799	2.1
May-18	122	0	1447	1,569	43	282	477	695296	283	1.3	0.5	3.1	4632	2.1
Jun-18	42	62	1321	1,425	419	236	470	653092	283	0.7	0.3	2.8	3739	2.1
Jul-18	82	60	1176	1,318	419	237	466	596863	284	0.7	0.1	3.0	3642	2.1
Aug-18	36	0	1397	1,432	382	240	457	652387	284	0.3	0.1	3.1	4293	2.1
Sep-18	43	0	1477	1,520	382	201	442	669458	284	0.3	0.1	3.3	4923	2.1
Oct-18	369	0	898	1,267	382	227	460	553690	283	0.3	0.1	3.1	2921	2.1
Nov-18	959	0	1168	2,128	205	272	480	757967	282	1.3	0.2	3.0	4761	2.0
Dec-18	1219	0	945	2,164	153	280	454	615408	281	0.2	0.3	3.2	3263	2.0
Jan-19	3079	19	657	3,754	153	269	472	785796	278	0.2	0.3	3.4	2862	2.0
Feb-19	3932	106	9	4,047	153	230	429	629649	275	0.2	0.5	3.2	867	1.9
Mar-19	2177	192	512	2,881	153	262	438	607781	273	0.2	0.4	3.3	2189	1.9
Apr-19	139	1068	1080	2,286	153	165	435	667610	271	0.2	0.5	2.9	3682	1.9
May-19	796	447	955	2,197	250	207	449	719663	270	<0.1	0.2	2.9	2941	1.8
Jun-19	31	4896	1270	6,197	250	242	457	1772872	269	<0.1	0.3	2.2	4115	1.8
Jul-19	31	4620	1123	5,774	384	152	416	1180771	266	0.4	0.3	2.7	4476	1.8
Aug-19	54	4841	995	5,890	384	126	420	1048907	262	3.9	0.2	2.6	3957	1.7
Sep-19	32	2165	1134	3,331	384	170	423	859840	260	3.9	0.1	2.9	3732	1.7
Oct-19	38	1813	1614	3,465	384	135	412	923797	258	3.9	0.2	2.8	5008	1.7
Nov-19	1616	1198	1290	4,104	384	199	434	1419377	260	3.9	0.1	3.4	10827	1.7
Dec-19	2557	2577	918	6,052	95	230	439	1239023	262	0.6	0.1	3.8	5211	1.7
Jan-20	174	492	748	1,414	95	230	436	455946	261	0.6	0.2	3.1	2518	1.7
Feb-20	316	0	1008	1,324	95	198	438	471329	261	0.6	0.7	3.0	3235	1.7
Mar-20	2543	0	1025	3,568	131	239	452	795874	259	0.9	0.5	3.5	5797	1.6
Apr-20	2490	155	820	3,464	131	237	458	737484	257	0.9	0.5	4.0	5571	1.6
May-20	121	473	1266	1,860	285	227	453	715037	258	0.7	0.5	3.5	4777	1.6
Jun-20	17	444	1440	1,901	285	241	457	769942	258	0.7	0.4	3.1	4648	1.6
Jul-20	11	110	1330	1,451	285	243	448	625797	258	0.7	0.2	3.0	3998	1.6
Aug-20	18	0	1442	1,460	359	250	454	661647	258	<0.1	0.2	2.8	3992	1.6
Sep-20	18	0	1634	1,652	359	231	451	743306	259	<0.1	0.2	2.9	4765	1.6
Oct-20	24	9	2030	2,063	359	229	447	917518	259	<0.1	0.2	2.7	5522	1.6
Nov-20	290	1498	1749	3,536	359	246	443	1246288	260	<0.1	0.2	2.7	5008	1.6
Dec-20	2490	545	1528	4,563	190	246	439	1277043	260	0.6	0.2	2.9	6083	1.6

SW/LR (Mean): Stormwater / Local Runoff (Mean) is a monthly average value of all SW/LR data collected during the month. For months without data available, previous month's data is carried down

SW/LR (Max): Stormwater / Local Runoff (Max) is a monthly maximum value of all SW/LR data collected during the month. For months without data available, previous month's data is carried down

IW: Imported Water based on monthly Table D data received from the Metropolitan Water District. For months without data available, previous month's data is carried down

RW: Recycled Water based on a monthly average of all available RP-1 & RP-4 effluent data and RP-1/RP-4 RW Blend at NRG Turnout data

* 25% nitrogen loss coefficient has been applied to calculate recycled water nitrate-nitrogen quality per Basin Plan Amendment

Maximum Benefit Water Quality Objectives in Chino North Management Zone for TDS is 420 mg/L and nitrate-nitrogen is 5 mg/L, based on a 5-year running average

Appendix B

2020 Maximum Benefit Database

Concord

1001 Galaxy Way, Suite 310
Concord CA 95420
925-949-5800

Davis

2020 Research Park Drive, Suite 100
Davis CA 95618
530-756-5905

Eugene

1650 W 11th Avenue, Suite 1-A
Eugene OR 97402
541-431-1280

Lake Forest

23692 Birtcher Drive
Lake Forest CA 92630
949-420-3030

Lake Oswego

5 Centerpointe Drive, Suite 130
Lake Oswego OR 97035
503-451-4500

Oceanside

804 Pier View Way, Suite 100
Oceanside CA 92054
760-795-0365

Phoenix

4505 E Chandler Boulevard, Suite 230
Phoenix AZ 85048
602-337-6110

Pleasanton

6800 Koll Center Parkway, Suite 150
Pleasanton CA 94566
925-426-2580

Sacramento

8950 Cal Center Drive, Bldg. 1, Suite 363
Sacramento CA 95826
916-306-2250

San Diego

11939 Rancho Bernardo Road, Suite 100
San Diego CA 92128
858-505-0075

Santa Rosa

2235 Mercury Way, Suite 105
Santa Rosa CA 95407
707-543-8506

APPENDIX 11

Noise Data Sheets

Roadway Construction Noise Model (RCNM),Version 1.

Report date: 10/25/2021
Case Description: CBP Project Category 1 - Wells

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Auger Drill Rig	No	20		84.4	25	0
Generator	No	50		80.6	25	0
Pumps	No	50		80.9	25	0

Results

		Calculated (dBA)	
Equipment		*Lmax	Leq
Auger Drill Rig		90.4	83.4
Generator		86.7	83.6
Pumps		87	84
	Total	90.4	88.4

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 1 - Wells

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
25 Feet	Residential	65	45	45

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Auger Drill Rig	No	20		84.4	50	0
Generator	No	50		80.6	50	0
Pumps	No	50		80.9	50	0

Results

Equipment		Calculated (dBA) *Lmax	Leq
Auger Drill Rig		84.4	77.4
Generator		80.6	77.6
Pumps		80.9	77.9
	Total	84.4	82.4

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: #########

Case Description: CBP Project Category 1 - Wells

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
25 Feet	Residential	65	45	45

Equipment

Description	Impact Device	Usage(%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Auger Drill Rig	No	20		84.4	100	0
Generator	No	50		80.6	100	0
Pumps	No	50		80.9	100	0

Results

Equipment		Calculated (dBA) *Lmax	Leq
Auger Drill Rig		78.3	71.3
Generator		74.6	71.6
Pumps		74.9	71.9
	Total	78.3	76.4

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 1 - Wells

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
25 Feet	Residential	65	45	45

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Auger Drill Rig	No	20		84.4	225	0
Generator	No	50		80.6	225	0
Pumps	No	50		80.9	225	0

Results

Equipment		Calculated (dBA) *Lmax	Leq
Auger Drill Rig		71.3	64.3
Generator		67.6	64.6
Pumps		67.9	64.9
	Total	71.3	69.4

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 2 - Pipelines/Turnouts

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
25 Feet	Residential	65	45	45

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Excavator	No	40		80.7	25	0
Compactor (ground)	No	20		83.2	25	0
Concrete Saw	No	20		89.6	25	0

Results

Equipment		Calculated (dBA) *Lmax	Leq
Excavator		86.7	82.8
Compactor (ground)		89.3	82.3
Concrete Saw		95.6	88.6
	Total	95.6	90.3

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.

Report date: 10/25/2021
Case Description: CBP Project Category 2 - Pipelines/Turnouts

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Excavator	No	40		80.7	50	0
Compactor (ground)	No	20		83.2	50	0
Concrete Saw	No	20		89.6	50	0

Results

		Calculated (dBA)	
Equipment		*Lmax	Leq
Excavator		80.7	76.7
Compactor (ground)		83.2	76.2
Concrete Saw		89.6	82.6
	Total	89.6	84.3

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 2 - Pipelines/Turnouts

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Excavator	No	40		80.7	100	0
Compactor (ground)	No	20		83.2	100	0
Concrete Saw	No	20		89.6	100	0

Results

	Calculated (dBA)	
Equipment	*Lmax	Leq
Excavator	74.7	70.7
Compactor (ground)	77.2	70.2
Concrete Saw	83.6	76.6
Total	83.6	78.3

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 2 - Pipelines/Turnouts

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
25 Feet	Residential	65	45	45

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Excavator	No	40		80.7	225	0
Compactor (ground)	No	20		83.2	225	0
Concrete Saw	No	20		89.6	225	0

Results

Equipment		Calculated (dBA) *Lmax	Leq
Excavator		67.6	63.7
Compactor (ground)		70.2	63.2
Concrete Saw		76.5	69.5
	Total	76.5	71.3

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: #########

Case Description: CBP Project Category 2 - Reservoirs/Pump Stations

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
25 Feet	Residential	65	45	45

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	25	0
Backhoe	No	40		77.6	25	0
Front End Loader	No	40		79.1	25	0

Results

Equipment		Calculated (dBA) *Lmax	Leq
Crane		86.6	78.6
Backhoe		83.6	79.6
Front End Loader		85.1	81.2
	Total	86.6	84.7

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.

Report date: 10/25/2021
Case Description: CBP Project Category 2 - Reservoirs/Pump Stations

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Crane	No	16		80.6	50	0
Backhoe	No	40		77.6	50	0
Front End Loader	No	40		79.1	50	0

Results

		Calculated (dBA)	
Equipment		*Lmax	Leq
Crane		80.6	72.6
Backhoe		77.6	73.6
Front End Loader		79.1	75.1
	Total	80.6	78.7

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 2 - Reservoirs/Pump Stations

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Crane	No	16		80.6	100	0
Backhoe	No	40		77.6	100	0
Front End Loader	No	40		79.1	100	0

Results

		Calculated (dBA)	
Equipment		*Lmax	Leq
Crane		74.5	66.6
Backhoe		71.5	67.6
Front End Loader		73.1	69.1
	Total	74.5	72.6

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 2 - Reservoirs/Pump Stations

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Crane	No	16		80.6	225	0
Backhoe	No	40		77.6	225	0
Front End Loader	No	40		79.1	225	0

Results

		Calculated (dBA)	
Equipment		*Lmax	Leq
Crane		67.5	59.5
Backhoe		64.5	60.5
Front End Loader		66	62.1
	Total	67.5	65.6

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Descripti(CBP Project Category 4 - Water Treatment Facilities

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Grader	No	40	85		25	0
Front End Loader	No	40		79.1	25	0
Compactor (ground)	No	20		83.2	25	0

Results

	Calculated (dBA)	
Equipment	*Lmax	Leq
Grader	91	87
Front End Loader	85.1	81.2
Compactor (ground)	89.3	82.3
Total	91	89.1

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 4 - Water Treatment Facilities

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Grader	No	40	85		50	0
Front End Loader	No	40		79.1	50	0
Compactor (ground)	No	20		83.2	50	0

Results

	Calculated (dBA)	
Equipment	*Lmax	Leq
Grader	85	81
Front End Loader	79.1	75.1
Compactor (ground)	83.2	76.2
Total	85	83

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 10/25/2021
Case Description: CBP Project Category 4 - Water Treatment Facilities

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

			Equipment			
			Spec	Actual	Receptor	Estimated
	Impact		Lmax	Lmax	Distance	Shielding
Description	Device	Usage(%)	(dBA)	(dBA)	(feet)	(dBA)
Grader	No	40	85		100	0
Front End Loader	No	40		79.1	100	0
Compactor (ground)	No	20		83.2	100	0

Results

		Calculated (dBA)	
Equipment		*Lmax	Leq
Grader		79	75
Front End Loader		73.1	69.1
Compactor (ground)		77.2	70.2
	Total	79	77

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: #########
Case Description: CBP Project Category 4 - Water Treatment Facilities

---- Receptor #1 ----

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
25 Feet	Residential	65	45	45

Equipment

Description	Impact Device	Usage(%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Grader	No	40	85		225	0
Front End Loader	No	40		79.1	225	0
Compactor (ground)	No	20		83.2	225	0

Results

		Calculated (dBA)	
Equipment		*Lmax	Leq
Grader		71.9	68
Front End Loader		66	62.1
Compactor (ground)		70.2	63.2
	Total	71.9	70

*Calculated Lmax is the Loudest value.