Regional Sewerage Program
Special Technical Committee Workshop

In effort to prevent the spread of COVID-19, the Regional Sewerage Program Technical Committee Workshop will be held remotely by teleconference

Teleconference: 1-415-856-9169/Conference ID: 909 854 673#

AGENDA
Wednesday, April 29, 2020
11:00 a.m.
Teleconference Call

Call to Order and Roll Call

Additions/Changes to the Agenda

1. **Informational Items**
   A. Recycled Water Regulatory Challenges

2. **Adjournment**

DECLARATION OF POSTING

I, Laura Mantilla, Executive Assistant of the Inland Empire Utilities Agency, A Municipal Water District, hereby certify that a copy of this agenda has been posted to the IEUA Website at www.ieua.org and posted in the foyer at the Agency's main office at 6075 Kimball Avenue, Building A, Chino, CA, on Wednesday, April 29, 2020.

Laura Mantilla

Recycled Water Regulatory Challenges

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Special Technical Committee Meeting
April 29, 2020

Agenda

REGULATORY CHALLENGES

COMPLIANCE RISK & RECOMMENDATIONS

NEXT STEPS

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Stakeholder Engagement

- Over 20 workshops related to Salinity in Recycled Water since 2014
  - Updates on salinity and RW permit compliance challenges since 2014 to the Joint Tech and Water Managers Meeting
  - Updates through Chino Basin Program Workgroup Meetings since 2018
  - Updates through Basin Plan Amendment since 2019

- Groundwater Recharge Regulations established 2014
  - Exceedances in 1,2,3-TCP MCL and PFAS NL in recycled water for groundwater recharge beginning 2019

Recycled Water (RW) · 1,2,3 – Trichloro propane (TCP) · Per- and polyfluoroalkyl substances (PFAS)
Maximum Contaminant Level (MCL) · Notification Level (NL)

Regulatory Challenges

REGULATORY CHALLENGES

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Prepared by:
Inland Empire Utilities Agency
GEI Consultants

Table of Contents

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Chapter 4: Regulatory Requirements

Water, recycled water & wastewater quality management in Chino Basin is governed by:

- Basin Plan
- IEUA NPDES Permit
- GWR Permit
- 2014 Title 22 Groundwater Replenishment Regulation

Regulatory Challenges for Recycled Water:

- Salinity (TDS)
- 1,2,3-TCP
- PFAS
- Microplastics
- Constituents of Emerging Concerns (CECs)

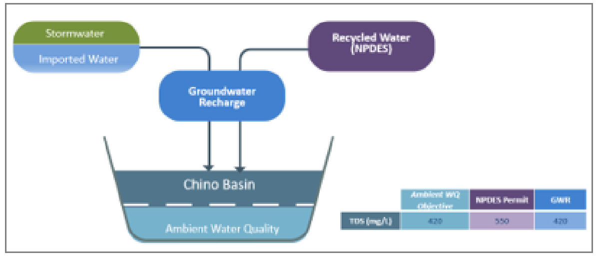

***Figure 4**: Regulatory Overview Diagram*

The analysis will focus first on the challenges arising from salinity, and then focus on the 2014 GRRP Title 17 and Title 22 Regulations.

4.1 *Basin Plan*

The regulatory framework that establishes the salinity management requirements and permit limitations are derived primarily from the Basin Plan. Based on the objectives that are established in the Basin Plan, IEUA's NPDES permit conditions and recycled water GWR requirements are established by the RWQCB.

Basin planning was a new requirement nationwide, including the implementation of the National Pollution Discharge Elimination System, after the passing of the federal Clean Water Act and the state's Porter-Cologne Act. This led to state water boards enacting their own water quality objectives and standards for basin management in 1967 leading to the original "Basin Plans" which would become a guide for basin related supplies and anti-degradation objectives (becoming State Board Resolution No. 68-16).

The Santa Ana River Watershed Regional Water Quality Control Board developed the first Basin Plan in 1975 and has updated it several times since then. The plan defined TDS objectives ranging from 220 to 330 mg/L over a substantial portion of the Basin. The ambient TDS concentrations in these areas exceeded the objectives, and therefore, restricted the use of IEUA's recycled water for irrigation and groundwater recharge. The use of recycled water in the basin would require mitigation.

To address this and similar regulatory compliance challenges across the groundwater basins in the Santa Ana Watershed, in the mid-1990's a Task Force consisting of 22 water resources agencies in the Santa Ana River Watershed was formed, and along with the RWQCB studied the impacts of Total Inorganic Nitrogen (TIN) and TDS on water resources in the watershed. This

Take Away

If regulatory requirements are not met, prohibits use of recycled water and subject to penalties on effluent discharge

Chapter 4.1: Basin Plan

Maximum Benefit

- Unmitigated use of RW contingent on compliance
- Provides Chino Basin TDS objective of 420 mg/L vs. anti-degradation objective (~250mg/L)
- Region has been working for the past 20+ years

Table 1*: TDS Regulations for Chino-North GMZ*

Chino-North GMZ	Anti-Degradation Objective TDS (mg/L)	Maximum Benefit TDS Objectives and Limits (mg/L)		
		Ambient Water Quality Objective	IEUA Wastewater Discharge NPDES Permit Limit (Effluent and RW)	Groundwater Recharge Objective
Chino 1	280			
Chino 2	250	420	550	420
Chino 3	260			

Unmitigated use and recharge of recycled water in the Chino Basin is contingent upon compliance with the maximum benefit objectives. If compliance is not demonstrated, lower, more stringent limits consistent with the State and Federal anti-degradation objectives would apply. These lower limits effectively prohibit use of recycled water at worst or require a combination of purchase of dedicated SWP supplies with low TDS from MWD and treatment to reduce TDS concentrations at best. TDS management within Chino Basin is thus critical to ensure continued use of recycled water within IEUA's service area.

IEUA and CBWM have demonstrated commitment to TDS management within the Chino Basin, dating back decades. In 2000, the OBMP included foundational efforts to monitor and manage salinity in the region. The Chino I Desalter, located in the City of Chino began operation in 2000. In 2001, the Chino Basin Desalter Authority (CDA) was formed as a Joint Powers Authority by a group of seven local water agencies, including IEUA. In coordination with the CDA, IEUA supports the operation of desalters to treat saline groundwater extracted from the southern portion of the Chino Basin. The desalters are a critical component of the maximum benefit commitments under the Basin Plan and a long-term salinity management strategy that enables the region to use recycled water in the Chino Basin.

Salinity Management Commitment Progress

Region has been working for the past 20+ years to meet Maximum Benefit Commitments

- Surface and groundwater quality monitoring
- Chino Basin Desalters
- Recharge facilities and master planning
- Hydraulic control
- Ambient groundwater quality determinations
- Self-generating water softener use ordinance
- Brine line discharge for high-TDS industrial users
- Securing high quality supplemental water
- Chemical use optimization in the WWTP

Take Away

Non-Compliance with Max Benefit could result in Anti-degradation limits, which:

- Effectively prohibit use of RW
- Require a combination of purchase of imported water supplies and advanced treatment of RW

Chapter 4.1.1: Ambient Water Quality TDS

- Long-term increasing trend in ambient water quality in TDS
- Reduced assimilative TDS capacity
- The need to address RW TDS is inevitable

4.1.1 Ambient Water Quality - TDS

Ambient water quality, a statistical construct that represents an estimate of the volume-weighted TDS concentration of groundwater within a GMZ based on 20 years of data, is a metric used by the RWQCB to determine if assimilative capacity for degradation exists in the GMZ. When the current ambient TDS concentration of the Chino-North GMZ exceeds the maximum benefit objective, it triggers salt management actions within the GMZ. Every three years, the Basin Monitoring Program Task Force (Task Force) assembled through the Santa Ana Watershed Project Authority (SAWPA) is required to recompute the ambient TDS concentrations in all of the GMZs in the Santa Ana River Watershed, including the Chino-North GMZ. The 2004 Basin Plan amendment set the maximum benefit objective for Chino-North GMZ at 420 mg/L. Degradation of ambient TDS concentration in the Chino-North GMZ causes the TDS concentration in recycled water to increase and it will, at some point in the future, cause an exceedance of IEUA and CBWM's permit TDS limit and mitigation of recycled water TDS in excess of permit limits.

The Task Force is completing its 2018 recomputation. Over the last several years, the ambient TDS concentration in the Chino-North GMZ has seen a slow rise, however the maximum benefit objective of 420 mg/L has not yet been reached (**Figure 5**). The long-term increasing trend demonstrates a decrease in the available assimilative capacity, and thus, IEUA and CBWM's need for future increases in recycled water TDS concentration is inevitable.

"The effluent limits for IEUA … are a cornerstone of the maximum benefit demonstration … The TDS in IEUA's effluent is expected to reach 550 mg/L before the groundwater in Chino North … reaches the 'maximum benefit' objective of 420 mg/L…" (Basin Plan, 2004).

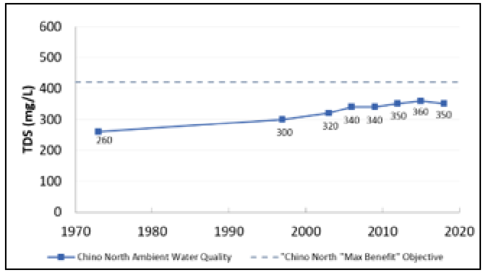

***Figure 5:** Chino-North GMZ Ambient Water Quality TDS*
Source: Triennial Ambient Water Quality Recomputation, 2018

4.1.2 NPDES Permit - TDS

IEUA's wastewater discharge NPDES permit defines the discharge limitations for IEUA's wastewater that is treated by regional water recycling plants. Of relevance, the permit requires "the 12-month flow weighted running average TDS constituent concentration and mass emission

"The effluent limits for IEUA … are a cornerstone of the maximum benefit demonstration … The TDS in IEUA's effluent is expected to reach 550 mg/L before the groundwater in Chino North … reaches the 'maximum benefit' objective of 420 mg/L…"

- (Basin Plan, 2004)

Chapter 4.1.2 NPDES Permit - TDS

- Trends in RW TDS projected to exceed by 2030
- In 2014, RW TDS reached 535 mg/l in 18 months
- Drought, climate change, etc. may exacerbate TDS

4.1.2.2.2 Statistical Model: Results and Interpretations

The analyses demonstrate increasing trends in TDS concentrations for the water supply and recycled water. Based on the analysis, the recycled water trend envelop has an average increase of 1.36 mg/L per year. IEUA's internal Trigger Limit (530 mg/L) was reached in 2015 and, based on the trends, the statistical model forecasts exceedance of the RWQCB TDS Action Limit (545 mg/L) and Maximum Limit (550 mg/L) within the next 11 to 14 years, respectively (**Figure 13**).

Figure 13: *Recycled Water Statistical Model Trend Envelop Results*

4.1.2.2.3 Simulation (Repeat of History): Results and Interpretations

IEUA also prepared a model simulation to identify when a potential exceedance could occur if historical TDS concentrations patterns were repeated. For this simulation, data for the past 15 years (2005 – 2019) was repeated as depicted in **Figure 14**. The historical pattern was simulated to begin starting in 2020. With this method, the recycled water TDS concentrations is projected to exceed the NPDES Maximum Limit in 2030, or in the next 10 years.

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Regulatory Challenges
April 2020

Take Away

- Continue work with regulatory agencies to modify permit and compliance approach
- Accelerate construction of Advanced Water Purification Facility (AWPF) to be online before 2030

Chapter 4.1.3 Groundwater Recharge

- Imported water purchase for blending requirements is not currently planned
- Imported water recharged primarily from DYY Program
- RW GWR without imported water will exceed TDS limit

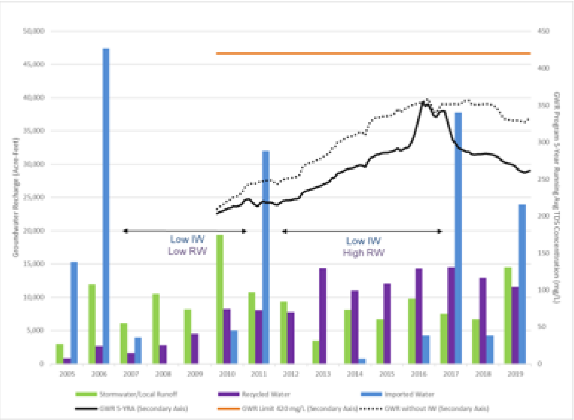


***Figure 16:** Groundwater Recharge Program Historical Recharge*

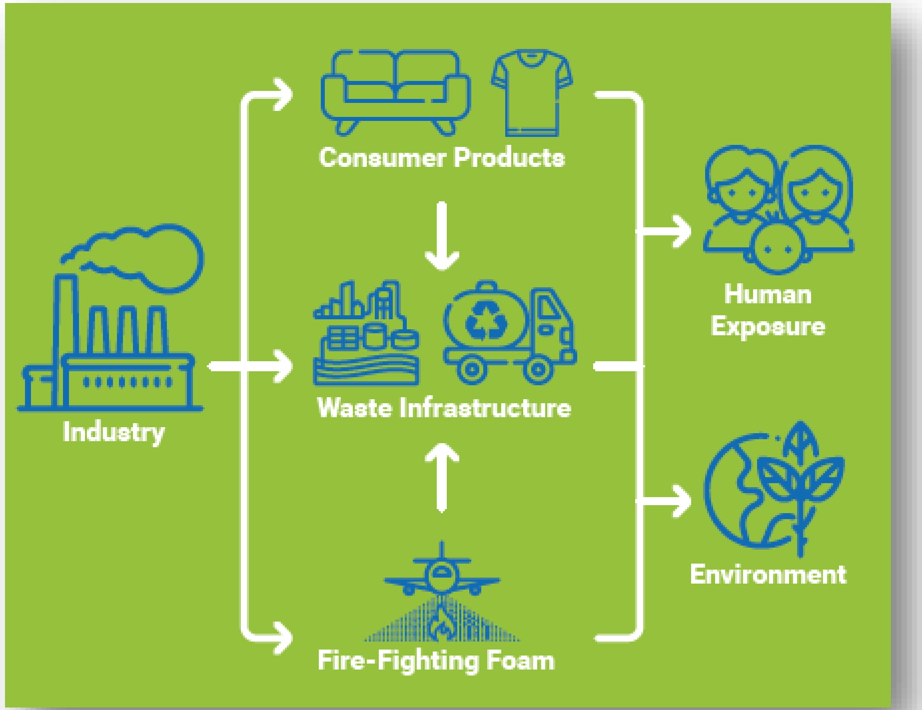
IEUA, its member agencies, and others have significantly invested to support GWR within the region. These investments have successfully supported the region by providing water supply resiliency. The program also has its associated TDS permit limit that requires that the program maintain a 5-YRA TDS concentration below 420 mg/L, based on the volume weighted blending of stormwater/local runoff, imported water and recycled water that was utilized for groundwater recharge. **Figure 16** also shows the 5-YRA TDS of the volume weighted blended water for the groundwater recharge program and associated 420 mg/L limit, both on the secondary axis. **Figure 16** demonstrates the following:

Take Away

- Plan for imported water purchases for GWR blending or reduce recycled water recharge
- Accelerate construction of Advanced Water Purification Facility (AWPF) to be online by 2030

Chapter 4.2 Title 22 GRRPs Regulation

- RW GWR Program required to comply with drinking water regulations
- 2019 RW Recharge Challenges:
  - 1,2,3-TCP Maximum Contaminant Level exceeded
  - Exceeded perfluorooctanoic acid (PFOA) Notification Level
- Water recycling facilities are not designed to remove 1,2,3-TCP, PFOA, microplastics, other CEC



Take Away

- If GWR regulations are not met, could prohibit recycled water recharge
- Advanced Water Purification Facility (AWPF) online before 2030

Chapter 5: Compliance Risk & Recommendations

RW NPDES TDS permit limit projected to be exceeded by 2030

Drought and climate change may expedite TDS exceedance

RW recharge regulatory MCL exceeded for 1,2,3-TCP and NL for PFAS

Ambient TDS water quality increasing trends demonstrates reduced assimilative capacity

Recommendations

Continue pursuit of permit modification

Purchase supplemental low TDS water

AWPF online by 2030

Develop local water supplies

Chapter 6: Timeline & Next Steps

RW Regulatory Challenge Solutions	IRP 2015	RW Program Strategy 2015	Ten Year Forecast 2020	Chino Basin Program 2020
Advanced Water Purification Facility	✓ 2030+	✓ 2030+	✓ 2034	✓ 2026
Injection Wells for GWR	✓ 2030+			✓ 2026
Acquiring Additional Supplies	✓ 2015+	✓ 2015+		✓ 2026
Regional Water Pipeline	✓ 2020+			✓ 2026
Increase reliance on Imported Water	**Contradicts Objective of Reducing Reliance on Imported Water**			

Take Away

AWPF is needed by 2030

- NPDES RW TDS limit
- GWR Regulations
- Wastewater Discharge limit

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EST. 70 1950

Next Steps

March 2020

Workshop:

- *Salinity and Regulations*
- *Region's Master Plan Alternatives*

April 2020

Special Regional Technical Committee Meeting

Regulatory Challenges Technical Memorandum (TM)

May 2020

Regional Technical Committee Meeting

Receive TM Comments by May 18th

June 2020

Regional Policy Committee Meeting

Fall 2020

Draft Implementation Schedule

Alternatives Analysis

Life Cycle Cost Analysis

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REGULATORY CHALLENGES

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Prepared by:

Inland Empire Utilities Agency

GEI Consultants

APRIL 23, 2020

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1 Executive Summary

As one of the stewards responsible for managing water and wastewater in the region, the Inland Empire Utilities Agency (IEUA) continuously evaluates challenges and develops solutions to address them, all with the goal of securing a reliable, high-quality water supply in a cost-effective manner. This goal involves the use of various water sources, including imported water, stormwater, groundwater, and recycled water.

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. Today, recycled water makes up approximately 15% 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 total dissolved solids (TDS) in IEUA's recycled water and groundwater recharge. In the event of non-compliance, assets would become stranded, and IEUA would need to supplement the water supply portfolio with more expensive and/or less reliable sources.

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. Time is not in the region's corner. 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. These contaminants are making their way into IEUA's recycling plants, which are not designed for their removal. 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 even if advanced treatment is not needed for TDS compliance, it may be needed to address other regulatory challenges within the region. IEUA

Over the last twenty years, IEUA has implemented a number of actions to manage salinity including the construction and operation of desalters, implementing a water softener removal program, maximizing usage of the high-TDS Brine Line, and others. Though IEUA is familiar with the historical challenges associated with TDS, and the management actions needed to address these challenges, this is an unprecedented time for the region – without implementing new solutions, IEUA will lose access to the highly beneficial resource that is recycled water it has come to depend on. IEUA and local partners have long-term plans to implement a variety of new infrastructure to meet future needs for wastewater treatment and potable water supplies, while increasing resiliency and sustainability of regional water resources management. These plans are ongoing and will continue into the future to ensure that the region is able to reap the multiple benefits provided by this valuable resource.

2 Introduction

The Inland Empire Utilities Agency (IEUA) is a wholesale distributor of imported water supplies from the Metropolitan Water District of Southern California (MWD). IEUA is also a regional wastewater agency that owns and operates five water recycling plants: Regional Water Recycling Plant No. 1 (RP-1), Regional Water Recycling Plant No. 2 (RP-2), Regional Water Recycling Plant No. 4 (RP-4), Regional Water Recycling Plant No. 5 (RP-5), and the Carbon Canyon Water Recycling Facility (CCWRF). These facilities provide tertiary-treated wastewater, also known as recycled water. Recycled water supplies can be used for direct non-potable uses, groundwater recharge for the Chino Basin, and for other regional discharge obligations.

The Chino Basin Optimum Basin Management Program (OBMP), as overseen by the Chino Basin Watermaster (CBWM) was adopted in 2000 to provide a framework to maximize recycled water use within the region. Within the region, direct use and recharge of recycled water is allowed by the Regional Water Quality Control Board (RWQCB) through the Santa Ana River Basin Water Quality Control Plan, also known as the Basin Plan, as well as a number of permits. These permits define requirements for the use of recycled water (both direct use and recharge), including but not limited to uses, water quality limits, and monitoring requirements.

3 Background

The Chino Basin retail water agencies' water supply portfolio includes imported and recycled water provided by IEUA, in addition to groundwater from both the Chino and surrounding basins, and local surface water from various creeks which flow through the service area that originate in the San Gabriel Mountains. IEUA has served wholesale imported water since 1950 and recycled water since 1972. **Figure 1** below shows IEUA's historical imported water deliveries which are exclusively State Water Project (SWP) water through the Metropolitan Water District. IEUA is uniquely positioned as one of the few MWD member agencies that can only currently receive SWP water. Being an exclusive SWP water receiver can create an additional vulnerability to the region. The availability of this imported water supplies is heavily dependent on hydrology and environmental regulations and results in highly variable annual imported water supplies to the IEUA service area. Because imported water rates are increasing and imported supplies are not as reliable as they were historically, IEUA and the region are committed to develop local reliable water supplies to provide greater reliability and resiliency for the region.

In the mid-1990s, IEUA identified recycled water as one of the critical components to provide a resilient water supply for the region, a hydrology-independent and reliable local supply source. This set the path for the development of a regional recycled water program. To date approximately $300 million has been invested into the regional recycled water program, including approximately $180 million received in grant funds and low interest loans.

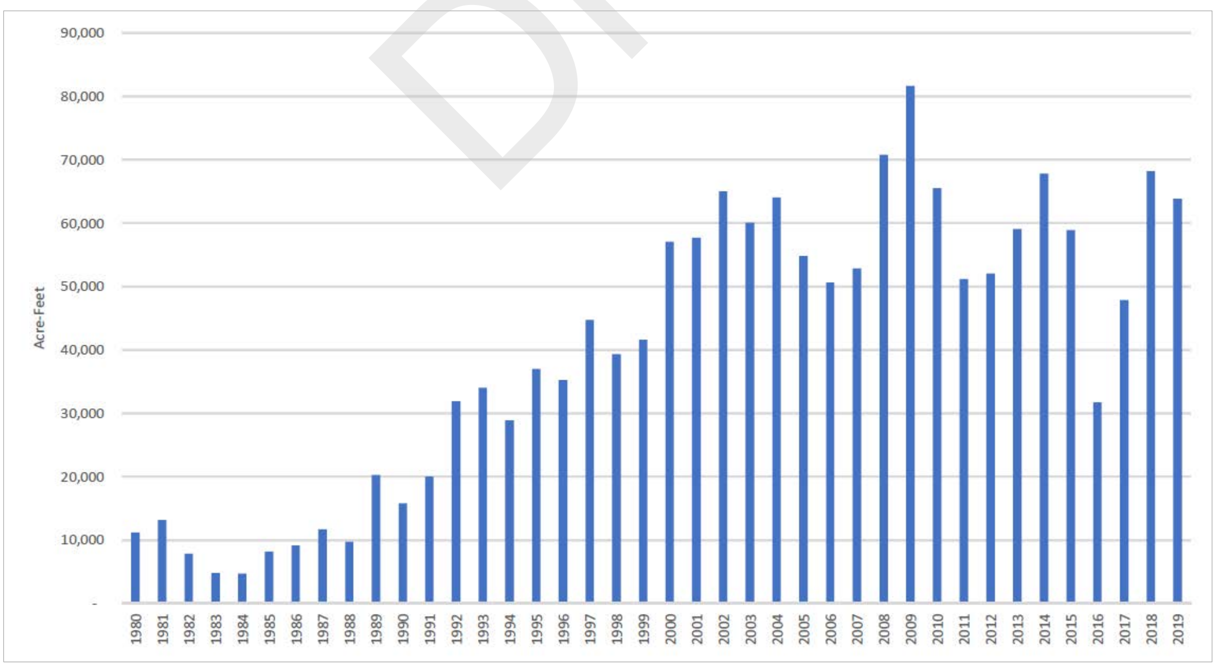

***Figure 1**: IEUA Imported Water Deliveries Historical Data (1980– 2019)*

Recycled water has become a notable portion of IEUA's water supply and groundwater recharge portfolio. Recycled water from the IEUA facilities through a regional recycled water distribution system is used directly for agricultural irrigation, industrial processes, irrigation of parks, parkways, schools, golf courses, commercial landscape sites, construction sites, and groundwater recharge. As seen in **Figure 2** below, direct use of recycled water was approximately 3,000 acre-feet (AF) in the year 2000, prior to the construction of IEUA's regional recycling plants. This usage nearly quadrupled once IEUA's recycling plants were online in 2010. Since then, recycled water use has increased by as much as seven times in relation to usage in 2000, with usage in recent years hovering around 20,000 AF per year. Similarly, groundwater recharge of recycled water has also increased in the last ten years, with recent volumes hovering around three times higher than what was recharged in 2010.

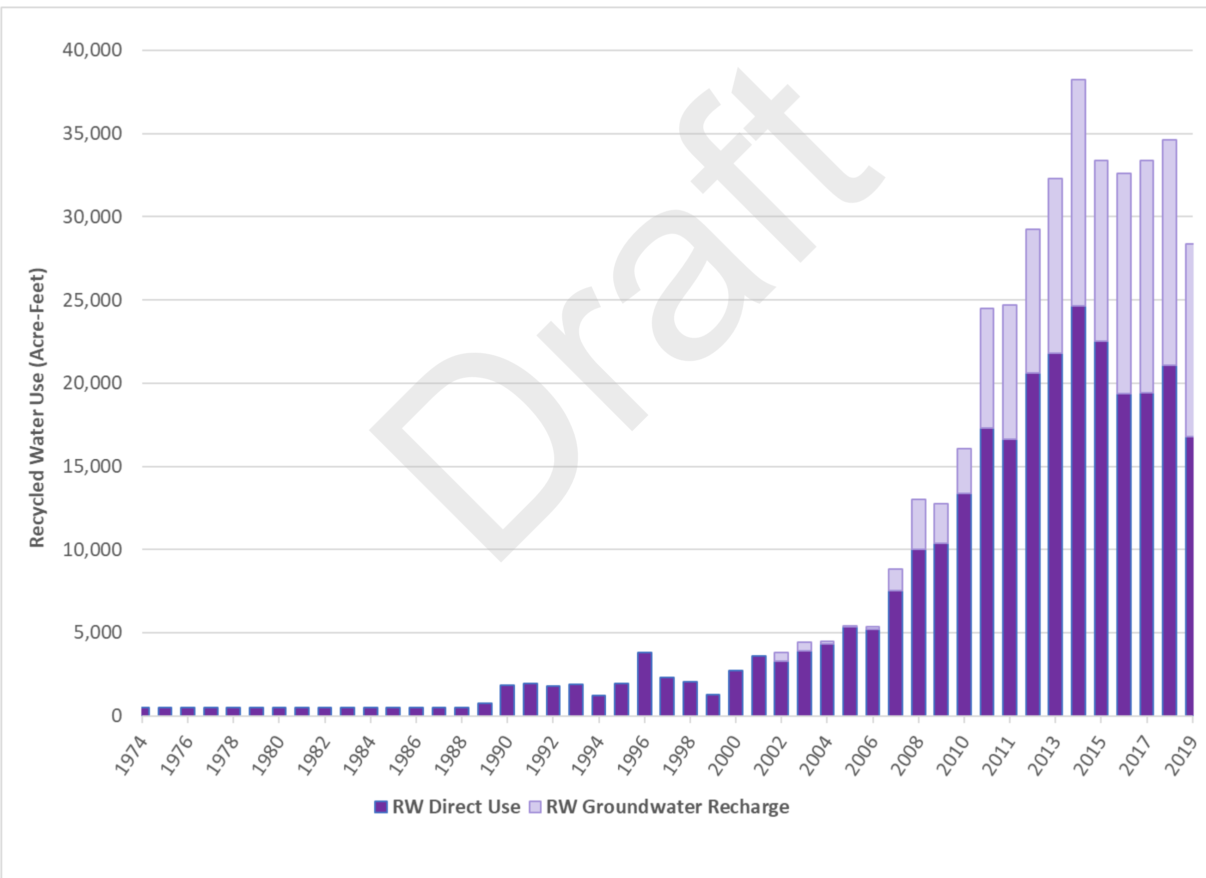

***Figure 2**: Recycled Water Historical Annual Reuse (1974 – 2019)*

4 Regulatory Requirements

Water and wastewater quality management in the Chino Basin is generally governed by:

1. RWQCB Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin;

a. Regional Water Quality Control Board (RWQCB) National Pollutant Discharge Elimination System (NPDES) *Waste Discharge Requirements and Master Reclamation Permit for IEUA's Regional Water Recycling Facilities, Surface Water Discharges and Recycled Water Use*, Order No. R8-2015-0036, NPDES No. CA8000409 (IEUA wastewater discharge NPDES permit);
b. RWQCB *Water Recycling Requirements for IEUA and CBWM, Chino Basin Recycled Water Groundwater Recharge (GWR) Program Phase I and Phase II Projects*, Order No. R8-2007-0039, and subsequent amendments (IEUA recycled water GWR permit); and,
c. State Water Resources Control Board – Division of Drinking Water (DDW) *Title 22 California Code of Regulations, Division 4, Chapter 3. Article 5.1 "Indirect Potable Reuse: Groundwater Replenishment - Surface Application"* sections §60320.100 through 60320.130 for Groundwater Replenishment Reuse Projects (GRRPs).

Among other requirements, these permits define limits for TDS present in recycled water used for groundwater recharge, irrigation, and discharge, and define actions required when ambient groundwater quality exceeds Basin Plan objectives for TDS or nitrogen. To continue using recycled water within the region, IEUA must comply with these limits or face the loss of this valuable resource. 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 GRRP Title 17 and Title 22 Regulations

Figure 4 is a simplified conceptual Regulatory Overview Diagram for the purpose of highlighting and discussing these TDS water quality challenges.

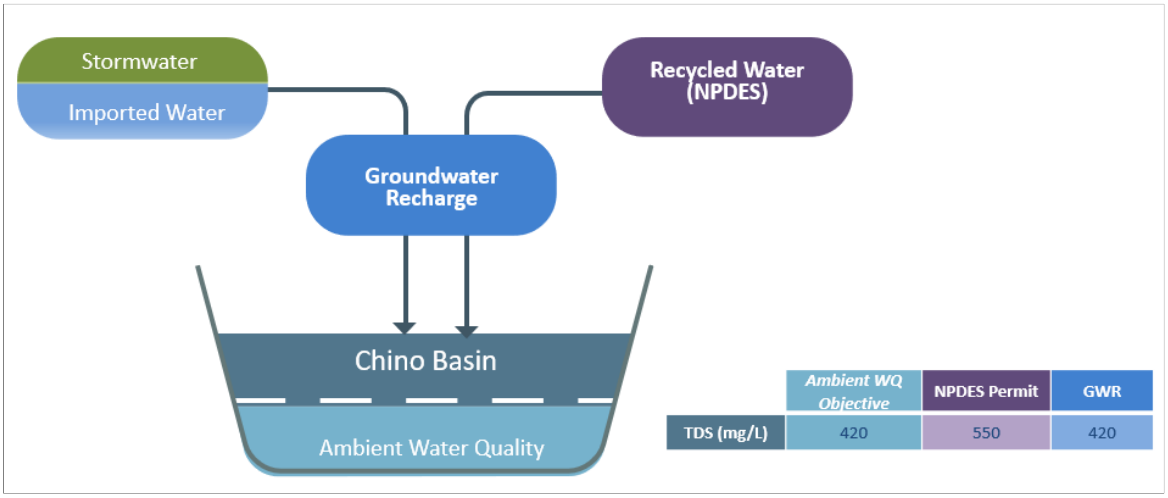

***Figure 3**: Regulatory Overview Diagram*

The analysis will focus first on the challenges arising from salinity, and then focus on the 2014 GRRP Title 17 and Title 22 Regulations.

4.1 *Basin Plan*

The regulatory framework that establishes the salinity management requirements and permit limitations are derived primarily from the Basin Plan. Based on the objectives that are established in the Basin Plan, IEUA's NPDES permit conditions and recycled water GWR requirements are established by the RWQCB.

Basin planning was a new requirement nationwide, including the implementation of the National Pollution Discharge Elimination System, after the passing of the federal Clean Water Act and the state's Porter-Cologne Act. This led to state water boards enacting their own water quality objectives and standards for basin management in 1967 leading to the original "Basin Plans" which would become a guide for basin related supplies and anti-degradation objectives (becoming State Board Resolution No. 68-16).

The Santa Ana River Watershed Regional Water Quality Control Board developed the first Basin Plan in 1975 and has updated it several times since then. The plan defined TDS objectives ranging from 220 to 330 mg/L over a substantial portion of the Basin. The ambient TDS concentrations in these areas exceeded the objectives, and therefore, restricted the use of IEUA's recycled water for irrigation and groundwater recharge. The use of recycled water in the basin would require mitigation.

To address this and similar regulatory compliance challenges across the groundwater basins in the Santa Ana Watershed, in the mid-1990's a Task Force consisting of 22 water resources agencies in the Santa Ana River Watershed was formed, and along with the RWQCB studied the impacts of Total Inorganic Nitrogen (TIN) and TDS on water resources in the watershed. This culminated in the RWQCB's adoption of the 2004 Basin Plan amendment. This amendment included revised groundwater subbasin boundaries, termed "groundwater management zones" (GMZs or MZs), revised TDS and nitrate-nitrogen objectives for groundwater, revised TDS and nitrogen wasteload allocations, revised surface water reach designations, and revised TDS and nitrogen objectives and beneficial uses for specific surface waters. The technical work supporting the 2004 Basin Plan amendment was directed by the 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).

To promote the use of recycled water and manage artificial recharge of storm, imported, and recycled water, IEUA and CBWM proposed less stringent TDS limits and alternative GMZ delineations. IEUA and CBWM also proposed a set of nine commitments that when combined with proposed TDS limits and new GMZs, provided the "maximum benefits" to the state. The RWQCB approved IEUA and CBWM's proposal and less stringent objective for the new Chino-North GMZ (**Figure 3**). These less stringent limits, known as the "maximum benefit" objectives, were adopted by the RWQCB in 2004 and effectively allowed for recycled water reuse and recharge by defining assimilative capacity within the Basin. The maximum benefit objectives are contingent upon IEUA and CBWM meeting the nine maximum benefit commitments as outlined in the Basin Plan and IEUA's NPDES permit. Specifically, numeric limitations for TDS are imposed upon recycled water (550 mg/L) and groundwater recharge (420 mg/L). Actions that must be performed when the ambient water quality of the Chino Basin exceeds the maximum benefit objective (420 mg/L) are also defined. Refer to **Table 1** for a summary of these limits.

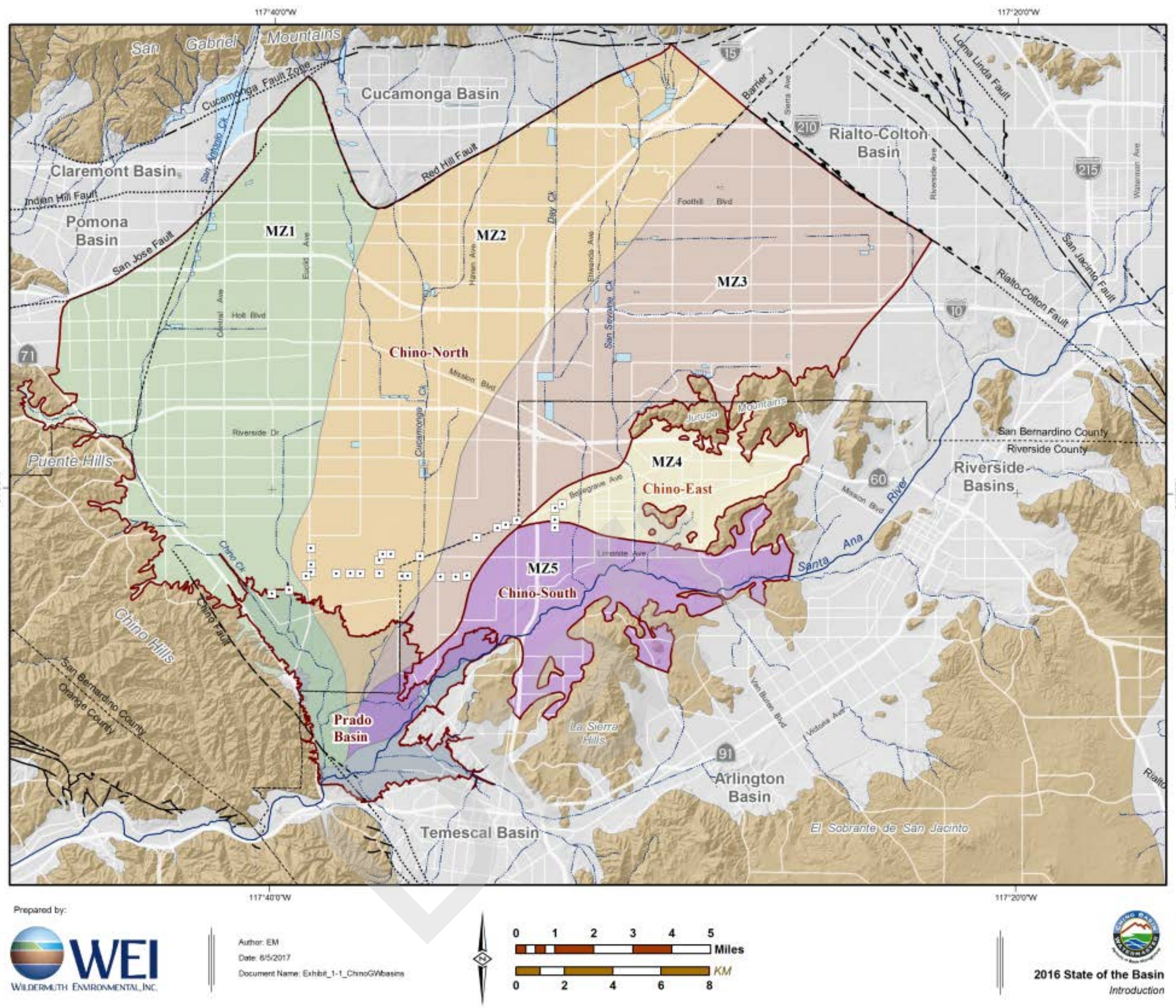

***Figure 4**: Chino Groundwater Basin Maximum Benefit Management Zones*

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IEUA and CBWM have demonstrated commitment to TDS management within the Chino Basin, dating back decades. In 2000, the OBMP included foundational efforts to monitor and manage salinity in the region. The Chino I Desalter, located in the City of Chino began operation in 2000. In 2001, the Chino Basin Desalter Authority (CDA) was formed as a Joint Powers Authority by a group of seven local water agencies, including IEUA. In coordination with the CDA, IEUA supports the operation of desalters to treat saline groundwater extracted from the southern portion of the Chino Basin. The desalters are a critical component of the maximum benefit commitments under the Basin Plan and a long-term salinity management strategy that enables the region to use recycled water in the Chino Basin.

Salinity Management Commitment Progress

Region has been working for the past 20+ years to meet Maximum Benefit Commitments

- Surface and groundwater quality monitoring
- Chino Basin Desalters
- Recharge facilities and master planning
- Hydraulic control
- Ambient groundwater quality determinations
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- Securing high quality supplemental water
- Chemical use optimization in the WWTP

4.1.1 Ambient Water Quality - TDS

Ambient water quality, a statistical construct that represents an estimate of the volume-weighted TDS concentration of groundwater within a GMZ based on 20 years of data, is a metric used by the RWQCB to determine if assimilative capacity for degradation exists in the GMZ. When the current ambient TDS concentration of the Chino-North GMZ exceeds the maximum benefit objective, it triggers salt management actions within the GMZ. Every three years, the Basin Monitoring Program Task Force (Task Force) assembled through the Santa Ana Watershed Project Authority (SAWPA) is required to recompute the ambient TDS concentrations in all of the GMZs in the Santa Ana River Watershed, including the Chino-North GMZ. The 2004 Basin Plan amendment set the maximum benefit objective for Chino-North GMZ at 420 mg/L. Degradation of ambient TDS concentration in the Chino-North GMZ causes the TDS concentration in recycled water to increase and it will, at some point in the future, cause an exceedance of IEUA and CBWM's permit TDS limit and mitigation of recycled water TDS in excess of permit limits.

The Task Force is completing its 2018 recomputation. Over the last several years, the ambient TDS concentration in the Chino-North GMZ has seen a slow rise, however the maximum benefit objective of 420 mg/L has not yet been reached (**Figure 5**). The long-term increasing trend demonstrates a decrease in the available assimilative capacity, and thus, IEUA and CBWM's need for future increases in recycled water TDS concentration is inevitable.

> *"The effluent limits for IEUA … are a cornerstone of the maximum benefit demonstration … The TDS in IEUA's effluent is expected to reach 550 mg/L before the groundwater in Chino North … reaches the 'maximum benefit' objective of 420 mg/L…"* (Basin Plan, 2004).

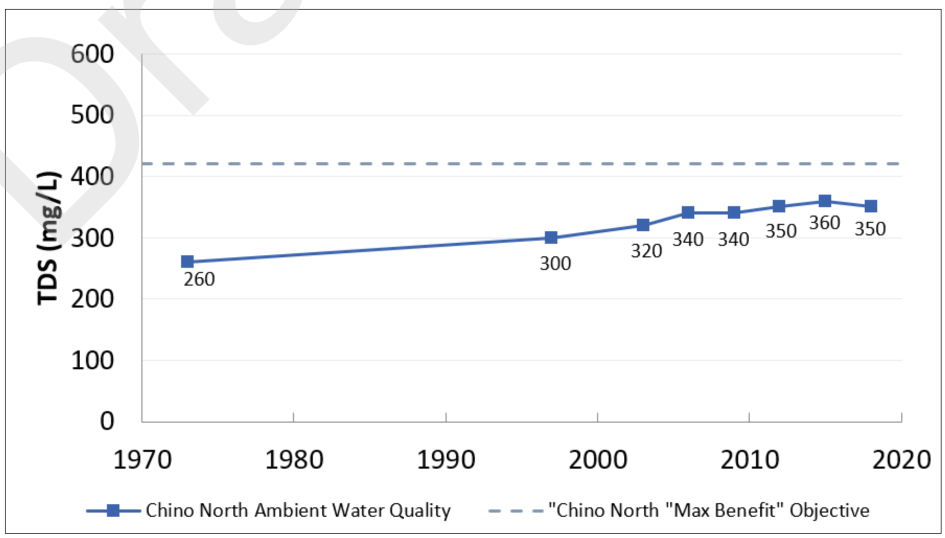

***Figure 5**: Chino-North GMZ Ambient Water Quality TDS*

Source: Triennial Ambient Water Quality Recomputation, 2018

4.1.2 NPDES Permit - TDS

IEUA's wastewater discharge NPDES permit defines the discharge limitations for IEUA's wastewater that is treated by regional water recycling plants. Of relevance, the permit requires "the 12-month flow weighted running average TDS constituent concentration and mass emission rates shall not exceed 550 mg/L and 366,960 lbs/day, respectively. This limitation may be met on an agency-wide basis using flow-weighted averages of the discharges from the Discharger's RP-1, RP-4, RP-5 and CCWRF." NPDES[1] permit-driven TDS limits are closely tracked by IEUA. In addition to the NPDES permit limit, the Basin Plan establishes an "Action Limit" of 545 mg/L, which requires IEUA to submit a plan and schedule to the RWQCB when the 12-month running average (MRA) agency-wide recycled water flow-weighted TDS concentration exceeds 545 mg/L for three consecutive months. The plan and schedule must detail measures to ensure that the TDS concentration remains below the permit limit of 550 mg/L. In addition to these permit limits, IEUA internally tracks a "Trigger Limit" of 530 mg/L used for initiating an evaluation. The Trigger Limit allows IEUA sufficient time to analyze, plan, design, construct and implement solutions to ensure TDS concentrations remain compliant with the NPDES and Basin Plan limits.

Maintaining permit compliance is a critical priority for IEUA. 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 Santa Ana River (SAR). Discharge to the SAR above 550 mg/L will also be above the discharge limitation, which is also 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 facilities 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.

4.1.2.1 Preliminary TDS Evaluation

Increasing TDS levels in recycled water have been exacerbated by climate change, conservation and episodic periods of drought over the last twenty years. In 2015, there was a period where every month was setting a record-high recycled water TDS concentration. As a result, recycled water TDS exceeded the internal Trigger Limit in 2015, prompting an internal evaluation which

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[1] For further details, refer to the 2015 NPDES Permit and 2004 Basin Plan Amendment.

was prepared in 2016 (**Figure 6** and **Figure 7**). As demonstrated in **Figure 6**, recycled water TDS concentration over time shows a pattern of peaks and valleys, with a gradual increase over time. This 2016 preliminary evaluation also demonstrated that TDS concentrations in water and wastewater supplies, and therefore recycled water, are steadily increasing, and drought conditions and conservation exacerbate TDS concentrations in both (**Figure 7**). Based on this evaluation, IEUA concluded that implementation of Advanced Water Purification Facilities (AWPF) will be needed at some point to address increasing salinity. Furthermore, postponing treatment poses risks to maintaining the region's maximum benefit objectives, and consequently IEUA's compliance for its wastewater treatment. IEUA and CBWM raised these concerns to the RWQCB, who requested modeling and analysis to investigate the salinity challenge and explore alternative TDS compliance metrics that are protective of beneficial uses and that could be incorporated into the Basin Plan and subsequently IEUA and CBWM permits.

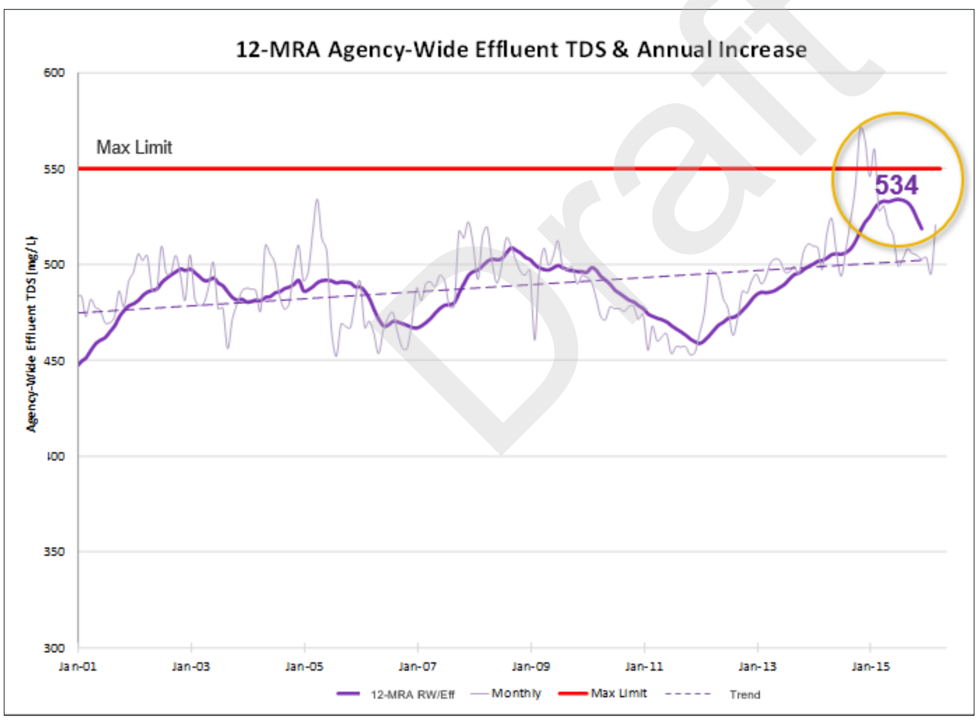


Figure 6: *Agency-wide Recycled Water Effluent TDS Concentration (2001 – 2016)*

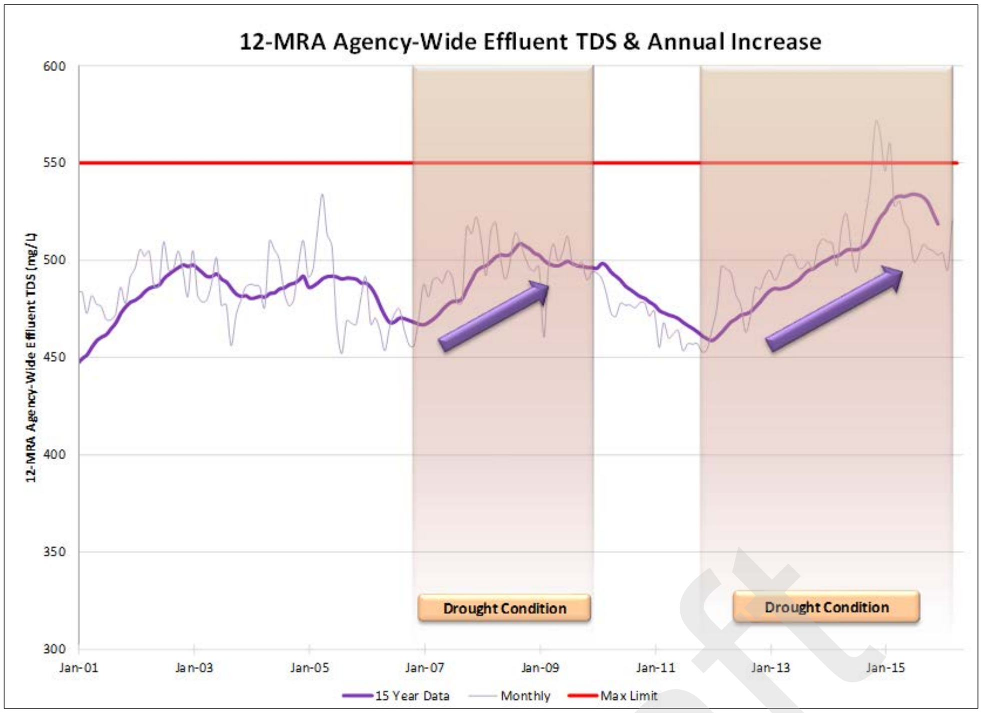


Figure 7: *Drought & Recycled Water Effluent TDS Relationship*

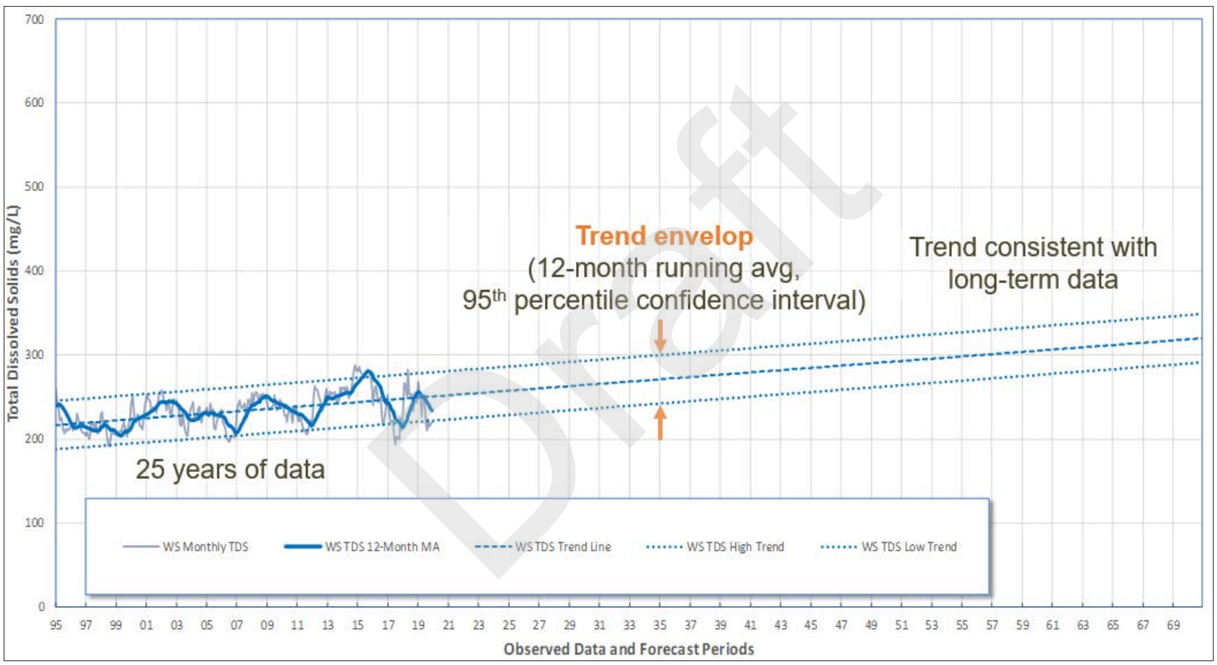
4.1.2.2 Updated TDS Analysis

Subsequent to the 2016 Preliminary Evaluation, further analysis was completed to update TDS data in support of regional planning efforts. Two approaches were used to update the Salinity analysis: 1) statistical model and 2) "Repeat of history" simulation. The primary objective for these analyses was to project when the recycled water TDS concentration will exceed the Action Limit and, if unmitigated, when the recycled water TDS concentration would exceed the permit limit. It is important to note that the analyses did not include the effects of climate change, and it is likely that the time for recycled water to reach the permit limits is shorter than the projections described below.

4.1.2.2.1 Statistical Model: Methods, Data, and Assumptions

The TDS analysis includes a statistical model, which was developed using **water supply** data from 1995 through 2019. Next, the **incremental TDS** (or TDS waste increment), defined as the TDS contributions from households and treatment processes, was similarly included. To arrive at the recycled water trend, incremental TDS was added to the water supply. The **recycled water TDS trend** includes a 95-percentile confidence envelop which is then superimposed on the historical recycled water data; the 95-percentile confidence interval captures 95% of the data. The following trends do not consider factors that can further impact salinity, such as climate change, future droughts, capital project implementation, and other potential impacts.

Water Supply: The drinking water supply for the IEUA agencies in the Chino Basin is a blend of imported water, groundwater, local surface water and desalter product water. As shown in **Figure 8**, the average monthly water supply TDS data from IEUA's member agencies was plotted and statistical methods were used to show the average linear 12-MRA trendline, as well as the lower and upper bounds of a 95% confidence interval trend envelop. **Figure 9** shows the individual water supply source TDS concentrations for the period for which observed data is available. Groundwater and desalter product water demonstrate a narrow fluctuation (± 25 mg/L) in TDS over time. In contrast, the TDS concentrations in imported water demonstrate wider fluctuations (± 100 mg/L). The desalter TDS target is 350 mg/L.



Notes
WS: water supply

Figure 8: *Water Supply Historical Data TDS Trend (1995 – 2019)*

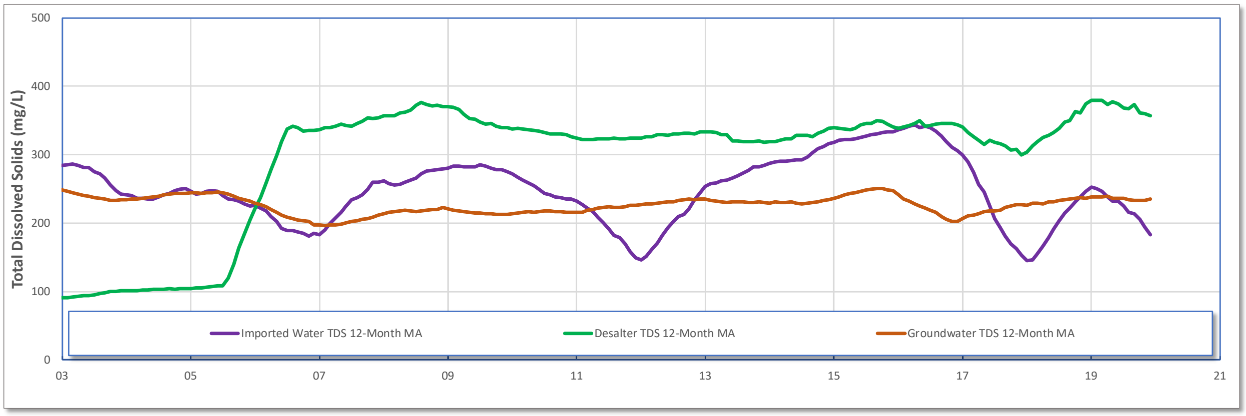
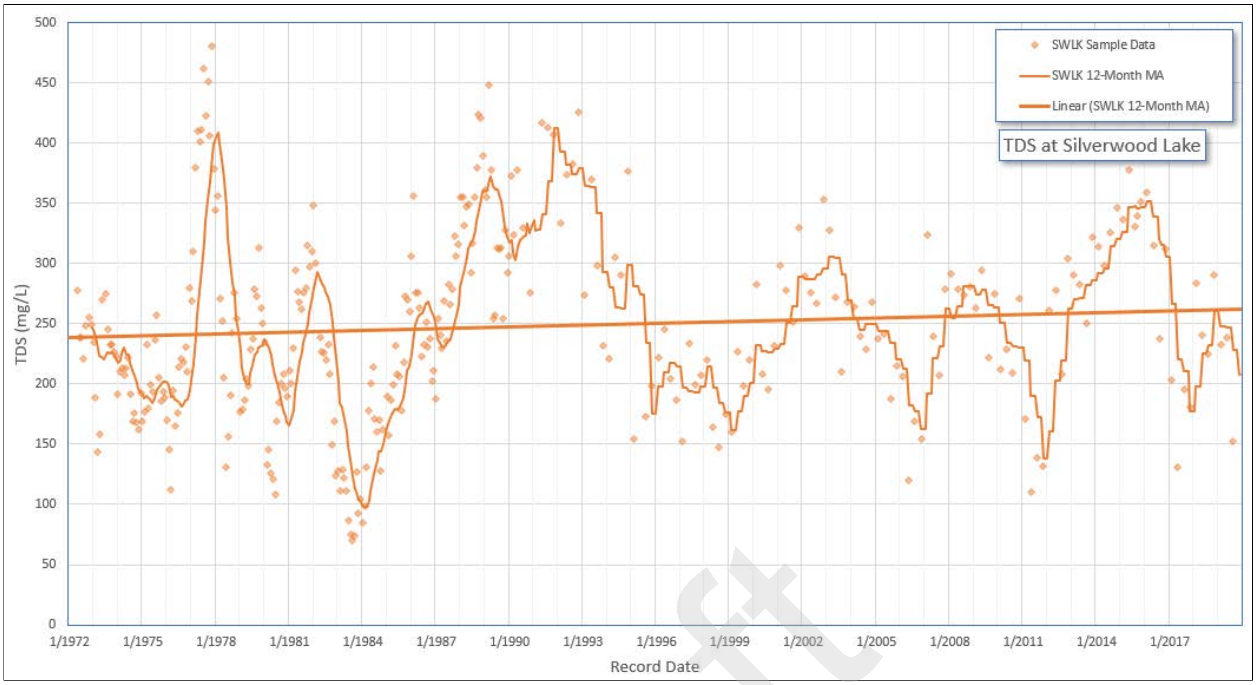


Figure 9: *Source Water Supply Historical Data TDS (2003 – 2019)*

Imported water TDS concentrations were also reviewed and plotted for the period of 1972 through 2019. IEUA's water supply portfolio is comprised of 20-30% imported water. Silverwood Lake is the region's primary imported water storage reservoir for SWP supplies from Metropolitan Water District of Southern California's (MWD) Rialto Pipeline and IEUA's service area. IEUA only takes SWP water from MWD because higher TDS levels in Colorado River water would cause permit violations in recycled water. **Figure 10** shows the time history of TDS concentrations at Silverwood Lake. Inspection of **Figure 10** reveals a slight TDS concentration increase over time. The variability in the TDS shown in the figure below is a result of SWP operations that are influenced by hydrology and environmental constraints. A few notable points in the figure below is the spike observed in the mid-1970s, the steady and rapid TDS concentration climb from 1984 through 1992, and the cyclic pattern of the last 20 years.



Notes
SWLK: Silverwood Lake
MA: Monthly average

Figure 10: *Silverwood Lake Imported Water Supply Data TDS Trend (1972 – 2019)*

Incremental TDS, defined as the TDS contributions from households and treatment processes, was estimated for the period 1972 through 2019 by subtracting the monthly water supply TDS concentration from the TDS concentration of treated wastewater. **Figure 11** shows the time history of incremental TDS concentration and its trendline. Incremental TDS was observed to be relatively constant between 2002 and 2019. Data prior to 2002 were ignored as the data after 2001 is consistent and representative of current and future conditions. The incremental TDS during this period is about 245 mg/L, which is less than the 250 mg/L incremental TDS limit in the Basin Plan and IEUA's NPDES permit limit. The Department of Water Resources has recommended values for the maximum incremental TDS that should be allowed through use, based on a detailed study of water supplies and wastewater quality in the region, and as a result the Basin Plan and NPDES limit is set to 250 mg/L.

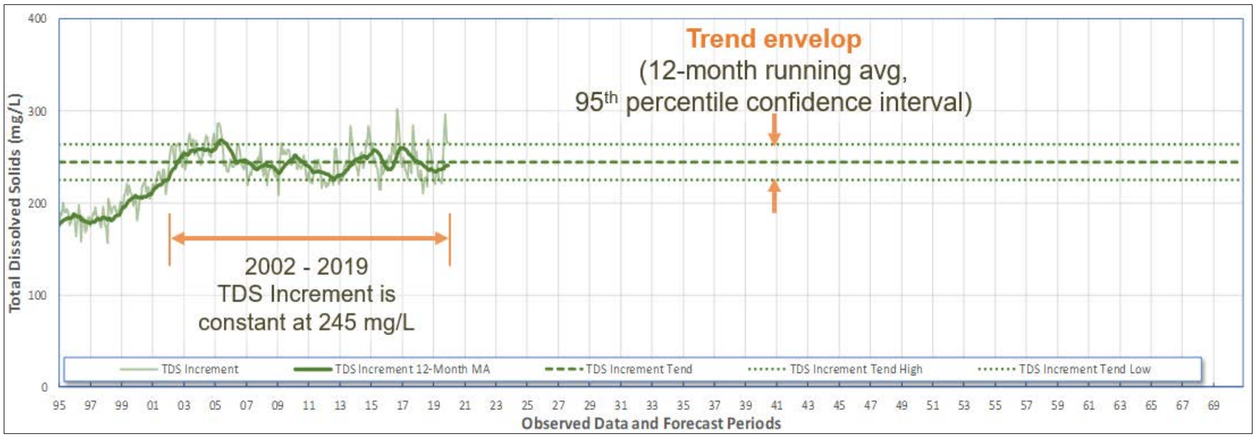


Figure 11: *Water Supply Incremental Use Data TDS Trend (1995 – 2019)*

To forecast TDS concentration in recycled water, the model utilized the following equation:

Recycled Water TDS = Water Supply TDS + Incremental TDS

Using a constant value of 245 mg/L, incremental TDS was added to the water supply TDS trend to generate a **recycled water TDS trend (Figure 12**). As shown in **Figure 12**, the RW TDS data fits within the trend envelop for the 2002-2019 data. Similar to the water supply trend, the recycled water trend does not consider other potential factors that may impact or exacerbate TDS concentrations.

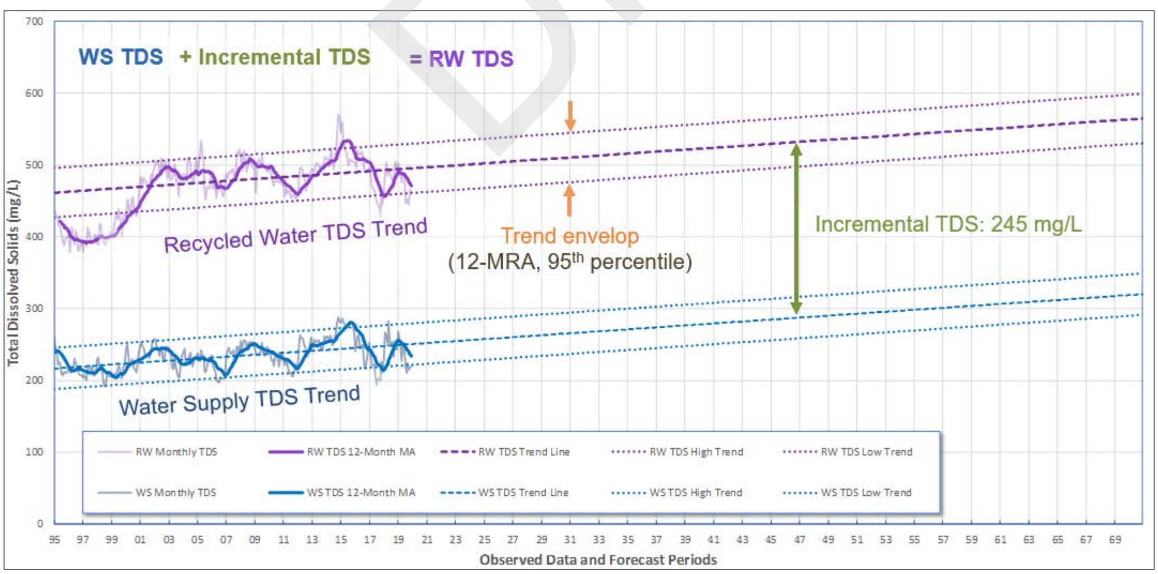


Figure 12: *Water Supply and Recycled Water Effluent Data TDS Trends (1995 – 2019)*

4.1.2.2.2 Statistical Model: Results and Interpretations

The analyses demonstrate increasing trends in TDS concentrations for the water supply and recycled water. Based on the analysis, the recycled water trend envelop has an average increase of 1.36 mg/L per year. IEUA's internal Trigger Limit (530 mg/L) was reached in 2015 and, based on the trends, the statistical model forecasts exceedance of the RWQCB TDS Action Limit (545 mg/L) and Maximum Limit (550 mg/L) within the next 11 to 14 years, respectively (**Figure 13**).

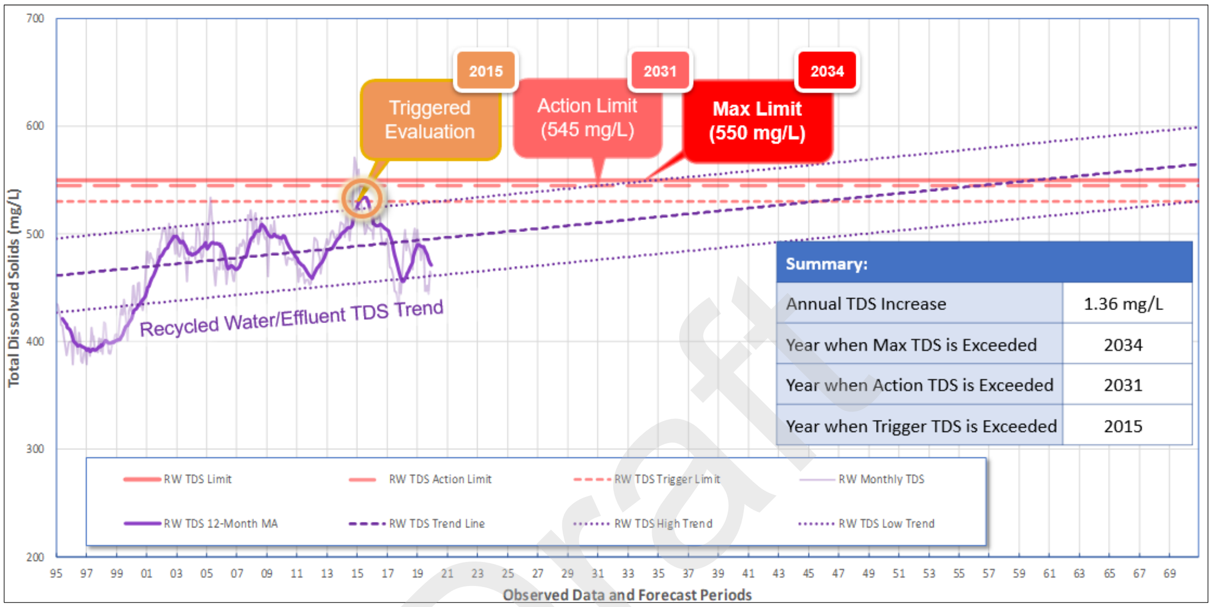


***Figure 13:** Recycled Water Statistical Model Trend Envelop Results*

4.1.2.2.3 Simulation (Repeat of History): Results and Interpretations

IEUA also prepared a model simulation to identify when a potential exceedance could occur if historical TDS concentrations patterns were repeated. For this simulation, data for the past 15 years (2005 – 2019) was repeated as depicted in **Figure 14**. The historical pattern was simulated to begin starting in 2020. With this method, the recycled water TDS concentrations is projected to exceed the NPDES Maximum Limit in 2030, or in the next 10 years.

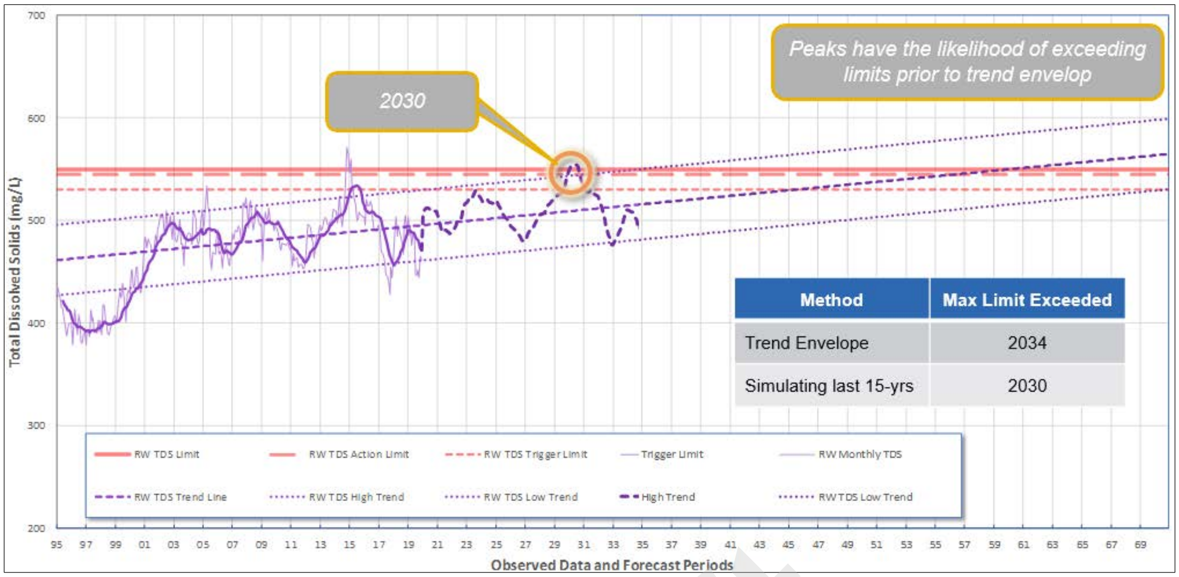


Figure 14: *Recycled Water 15-Year Repeat of History Simulation Results*

4.1.2.3 NPDES Permit Modification

Although the absolute projections from the two approaches differ, both suggest that IEUA should plan to address TDS concerns in the next 10 years. As one of the potential solutions to manage salinity in the recycled water (recharge and effluent), IEUA 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-MRA basis for permit compliance. Computing averages over a longer period (such as a 5-year running average [YRA]) could provide an average that is less susceptible 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-YRA.

Providing longer-term averaging periods for computing compliance metrics could significantly extend the timeframe until permit exceedances occur, potentially beyond the planning horizon of over 25 years. However, the process to modify the existing NPDES permit could take several years for the regulatory approval process and may not be successful if the modeling results do not with confidence show that the recommended salinity management plan will ensure protection of beneficial uses. If the modeling results support the extended averaging period for TDS, the NPDES permit modification could address the immediate concern of exceeding the NPDES permit limit; however, this modification would not address other challenges, such as the increasing TDS concentrations in GWR, and ambient water quality in the basin discussed below. There is also potential for new maximum benefit commitments to be added to the Basin Plan to ensure long term protection of the basin and of the downstream users.

Statistical analysis of the long-term data set from 1995 – 2019 with a 5-YRA instead of the 12-MRA was performed to develop a long-term trend analysis. **Figure 15** depicts a scenario that could potentially provide permit coverage past the planning horizon of 25 years, without consideration to 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, as stated earlier. At the request of the RWQCB, IEUA and CBWM are continuing their current effort with Wildermuth Environmental Inc. to include climate change considerations and impacts to source water quality in the groundwater modeling 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.

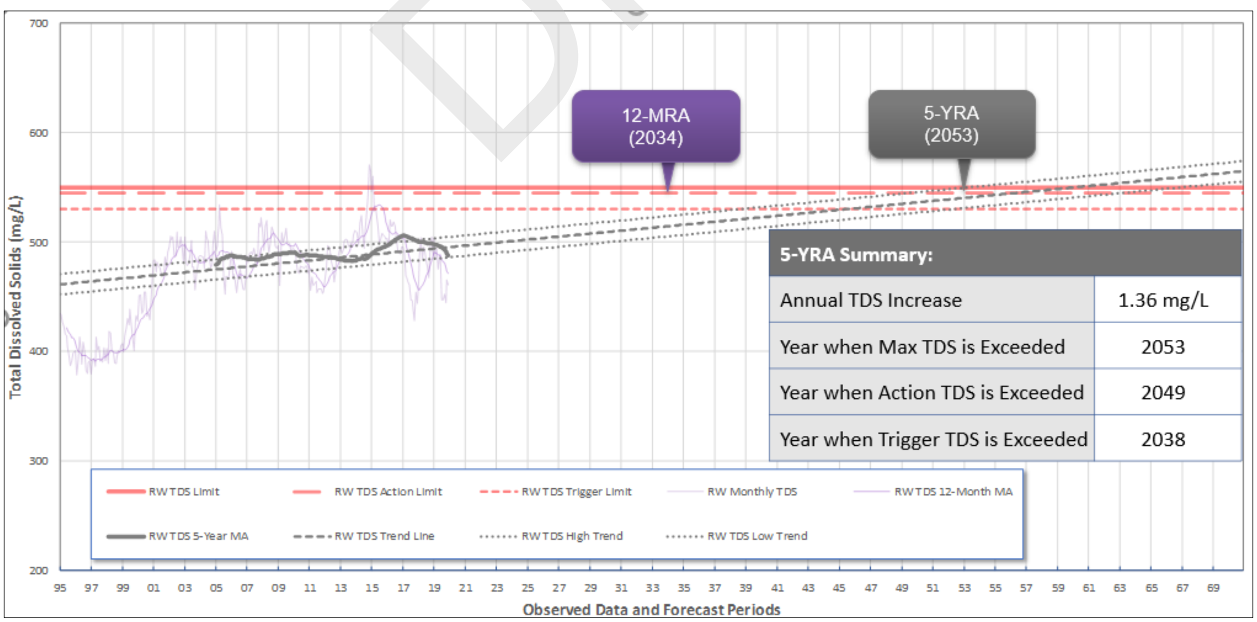


Figure 15: *Recycled Water with 12-MRA and 5-YRA Compliance Metrics*

4.1.3 Groundwater Recharge - TDS

Recycled water recharge in the Chino-North GMZ must be blended with imported water and stormwater such that the volume-weighted basis TDS concentration is less than the maximum benefit objective of 420 mg/L. TDS concentrations in groundwater recharge are computed on a five-year volume-weighted running average (YRA) basis for comparison against this limit. Per the Groundwater Recharge Program permit, Order No. R8-2007-0039, and in accordance with the Chino Basin Maximum Benefit Commitment No.7:

> *"Recycled water will be blended with other recharge sources so that the 5-year running average TDS and nitrate-nitrogen concentrations of water recharged are equal to or less than the 'maximum benefit' water quality objectives for the Chino North Management Zone, i.e., 420 mg/L and 5 mg/L, respectively."*

As the five YRA TDS concentration approaches permit limits this will require a reduction in recycled water recharge (resulting in additional discharge to SAR, stranded investments), purchase of imported water (if available, and more expensive) and/or additional treatment to reduce TDS in the recycled water.

Although the imminent concerns with IEUA's NPDES permit is of primary concern due to the anticipated 10-year expected exceedance timeline, TDS restrictions on groundwater recharge may also significantly impact IEUA's operations. IEUA has partnered with CBWM, Chino Basin Water Conservation District, and the San Bernardino County Flood Control District in the Groundwater Recharge Program since 2005. Recharge of recycled water, imported water and stormwater is integral to the Basin Plan, the OBMP, IEUA's operational strategy and the region's water supply resiliency as demonstrated with the significant investment and resulting recharge volumes shown in **Figure 16.**

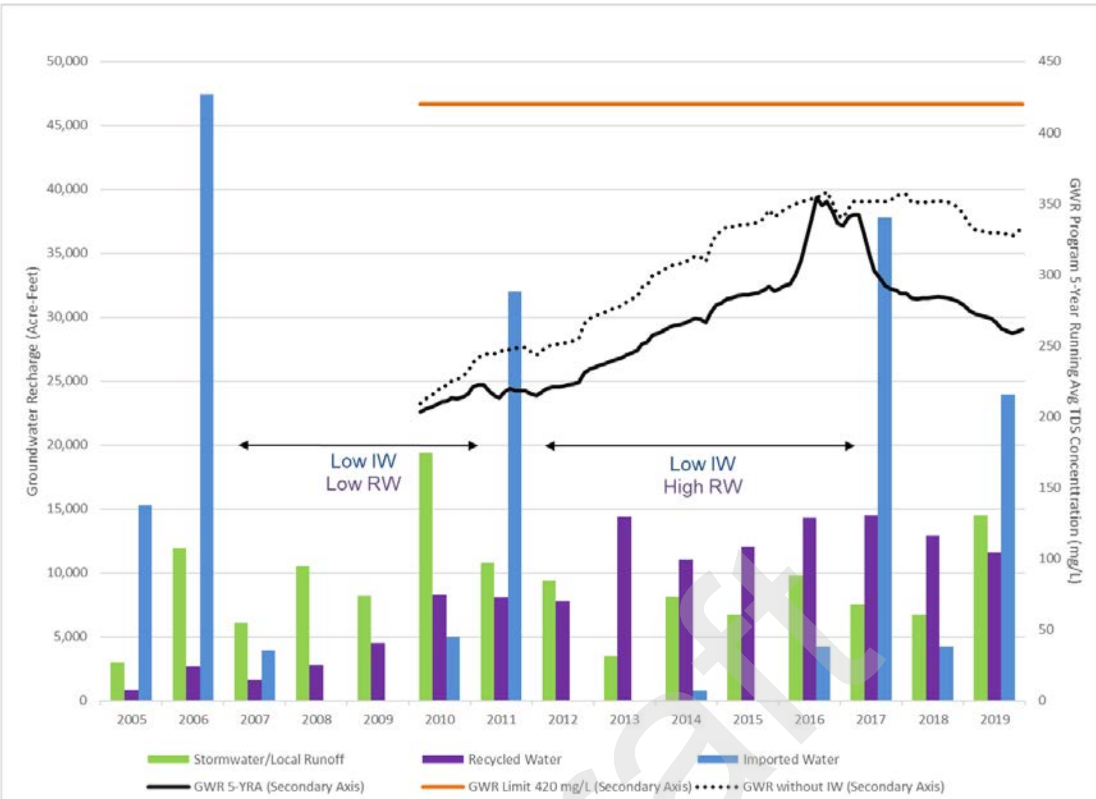


Figure 16: *Groundwater Recharge Program Historical Recharge*

IEUA, its member agencies, and others have significantly invested to support GWR within the region. These investments have successfully supported the region by providing water supply resiliency. The program also has its associated TDS permit limit that requires that the program maintain a 5-YRA TDS concentration below 420 mg/L, based on the volume weighted blending of stormwater/local runoff, imported water and recycled water that was utilized for groundwater recharge. **Figure 16** also shows the 5-YRA TDS of the volume weighted blended water for the groundwater recharge program and associated 420 mg/L limit, both on the secondary axis. **Figure 16** demonstrates the following:

a) IEUA implemented the recycled water groundwater recharge program in 2005. Between 2005 and 2013 this program was expanded significantly resulting in a steady increase in the blended TDS concentration, which impacted the 5-YRA until 2018;

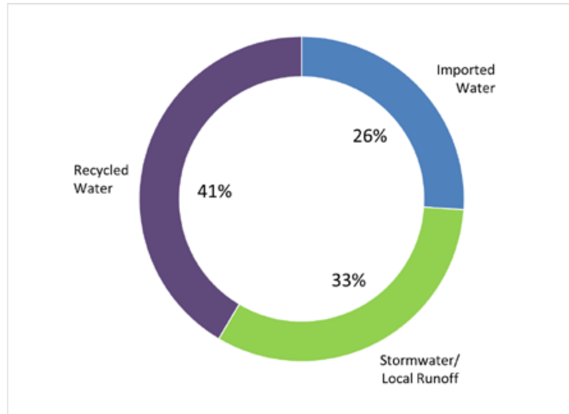


Figure 17: *Groundwater Recharge Program Volume Contributions (2013-2019)*

b) Since 2013, the annual recycled water recharge ranges between 10 thousand acre-feet per year (TAFY) and 14 TAFY. The stormwater and local runoff contribution fluctuate between dry and wet years and the imported water contributions are sporadic depending on the availability of surplus imported water (i.e., typically in wet years). **Figure 17** shows the average volumetric blend of the three groundwater sources for the 2013-2019 period; and,

c) The contribution of imported water (at an average monthly TDS concentration of 245 mg/L compared to the recycled water TDS concentration of 460 mg/L) to the recharge program plays a significant role in managing the blended TDS concentration (see 5-YRA TDS with and without the imported water in **Figure 16**). Since 2013, imported water, largely through Metropolitan Water District's Dry Year Yield (MWD DYY) program, has made up over 20% of the overall water recharged. However, imported water contribution is sporadic depending on weather conditions, availability and TDS concentrations, causing spikes in the blended 5-YRA TDS concentration as observed in 2016-2017 – see **Figure 16**.

When looking to the future the following changes in the program and impacts on the TDS can be expected:

- Based on IEUA's 2015 *Integrated Water Resources Plan,* the target is to increase the recycled water recharge program to 18.7 TAFY by 2025. Because of the higher recycled water TDS concentration, it is anticipated that the 5-YRA TDS concentration will increase with an increase in the recycled water recharge contribution.
- It is anticipated that the recycled water TDS concentration will increase with time (see **Figure 12**), which will increase the recycled water's TDS contribution to the 5-YRA TDS concentration.
- According to the current MWD DYY program agreement, the MWD DYY program will end in 2028. If the MWD DYY program agreement is not extended or replace with some other comparable recharge commitment with similar quantities of low-TDS water, the 5-YRA TDS concentration will increase significantly and likely exceed the permit limit.

- With the implementation of AWPF with an expected effluent concentration of 100 mg/L, the recycled water TDS will be significantly reduced, which could offset the impact of a discontinued MWD DYY program.

4.2 *Regulatory Challenge: Title 22, Division 4, Chapter 3. Article 5.1 "Indirect Potable Reuse: Groundwater Replenishment - Surface Application"*

The Chino Basin Recycled Water GWR Program is an existing permitted Groundwater Replenishment Reuse Project (GRRP) that has been recharging recycled water since. However, the 2014 GRRP regulation requires existing programs permitted on or before June 18, 2014, like the Chino Basin GWR Program, to submit a report to the DDW and the RWQCB assessing its compliance with the new requirements, and overall to ensure compliance with more stringent future regulations.

During 2019, recycled water used for groundwater recharge exceeded the 1,2,3-Trichloropropane (1,2,3-TCP) maximum contaminant level (MCL) and perfluorooctanoic acid (PFOA) Notification Level (NL) and went into an accelerated monitoring schedule for 16 consecutive weeks. Corrective action reports were submitted to the DDW and RWQCB in February 2020 in accordance with §60320.112.(d)(2)(A) for 1,2,3-TCP and §60320.120.(b)(1) for PFOA. Source evaluation for both compounds is ongoing.

1,2,3-TCP is a chlorinated hydrocarbon with high chemical stability that is very persistent in groundwater. The DDW established a MCL of 0.005 µg/L that became effective on December 14, 2017. 1,2,3-TCP is no longer a commonly used substance and contamination in the groundwater in parts of Chino Basin is a known issue. It is entering the regional water recycling facilities that were not designed to remove 1,2,3-TCP and could result in the need for advanced treatment to address impending/future regulations.

PFOA is a manufactured chemical that is part of a larger group of chemicals called per- and polyfluoroalkyl substances (PFAS). PFOA has been used in stain-resistant carpets and fabrics, nonstick cookware, and other products that resist heat, oil, stains, grease, and water. The DDW established a NL of 5.1 ng/L on August 23, 2019. PFOA is no longer a commonly manufactured substance. However, it is still present in consumer products and is entering the regional water recycling facilities that were not designed to remove PFOA. Similar to 1,2,3-TCP, advanced treatment may be required to address impending/future regulations.

There are other contaminants of emerging concern, such as microplastics, which are likely to emerge over the next ten years which could also require advanced treatment to continue recharge of recycled water. The challenges associated with the 2014 GRRP regulations further underscore the need for advanced treatment in the region. Even if these facilities are not required to maintain compliance with the Basin Plan, they may be needed to treat recycled water to continue current and for future groundwater recharge.

5 Compliance Risk and Recommendations

5.1 *Compliance Risk*

The analysis performed to date indicates that IEUA could exceed the NPDES TDS permit limits for recycled water within the next 10 years, and possibly the groundwater recharge permit limit in the near future if no actions are taken. This is of concern since infrastructure that may be needed to curtail TDS levels and compounds such as 1,2,3-TCP and PFOA can take years to plan, design, fund, and implement.

There is little flexibility to respond and manage changes in TDS concentration due to drought conditions, and the timeframe by which drought conditions can impact recycled water TDS concentration is short. Expected recycled water TDS concentration is 500 mg/L, considering contributions from household use and treatment processes and imported water. In periods of drought, recycled water TDS concentration is susceptible to increases, with imported water TDS concentration reaching up to 400 mg/L, and the desalter operating at 350 mg/L. This demonstrates the lack of assimilative capacity to respond to effluent limitations during drought conditions, which is further exacerbated by the steadily increasing ambient water quality of the Chino Basin and a heavier reliance on recycled water. Further, from the onset of the drought in 2014, it took approximately 18 months for IEUA to start approaching its action level. This demonstrates the need to have AWPF in place to provide certain and reliable compliance during varying conditions.

The risks associated with compliance to the 2014 GRRP regulations for recycled water recharge is more difficult to assess. The regulatory landscape for new constituents of emerging concern is fast paced, with regulatory limitations imposed within a couple of years of assessing human health risks in many instances.

Although the statistical model considered long term trends based on data sets of 20+ years and historical drought patterns, significant potential drivers, such as climate change, are not evaluated in these projections. These potential drivers further support the need for salinity management within the next 10 years.

There is also compliance risk in relying on the pursuit of an NPDES permit modification to a longer averaging period. A permit modification requires substantial time, modeling and RWQCB/State Water Resources Control Board approval. There is a high potential that a permit modification could result in a Basin Plan Amendment that includes new commitments for IEUA and CBWM for basin water quality/salinity objectives; the proposed NPDES permit modifications for TDS may not adequately address the compliance risk associated with the groundwater recharge program or the challenges associated with ambient water quality as it relates to TDS.

5.2 *Recommendations*

Clearly, the nexus between ambient water quality, groundwater recharge, and recycled water requires the existing comprehensive long-term salinity management plan be updated implemented. Considering the timeline for design, construction and implementation of salinity management strategies and projects, it is imperative that efforts continue moving forward to allow sufficient time to determine the most effective means. Unmitigated, these compliance risks will directly impact IEUA's and the region's: ability to respond to changing water quality regulations, ability to use recycled water supplies for direct use and groundwater recharge, and reliance on imported water supplies.

IEUA can pursue a number of options to address the regulatory challenges of TDS and constituents of emerging concern in recycled water to ensure continued use of recycled water:

- Since groundwater recharge is a blend of imported water, recycled water, and stormwater, IEUA could purchase more low-TDS imported SWP water to offset the high TDS concentration in recycled water, bringing the groundwater recharge into compliance. This solution does not help achieve IEUA and the region's goal of reducing dependence on imported water supplies.
- Another option is a reduction in recycled water that is recharged. This is not a prudent option, since recycled water is a secure water supply and imported water supplies are expensive and vulnerable to drought and climate change.
- A third option is to increase the recharge of stormwater, which is also low in TDS in comparison to recycled water; however, this is not a viable option to IEUA at this time as stormwater is a variable water supply.
- A fourth option would be to pursue a permit modification with the RWQCB. Though this option doesn't directly control TDS concentration in groundwater recharge or recycled water, it might provide some temporary relief to IEUA in terms of exceeding the recycled water TDS concentration limit but does not address constituents of emerging concern in groundwater recharge of recycled water.

Though there are a number of solutions that IEUA could implement to address the groundwater recharge challenges associated with TDS and the emerging constituents, none are as optimal as implementation of advanced treatment. This solution would address TDS levels for both direct use of recycled water and groundwater recharge and could also help address the challenges associated with the 2014 GRRP regulations. There are a number of short-term advanced treatment solutions, such as satellite treatment facilities, for recycled water recharge compliance. However, other processes, such as advanced water purification, that are centrally located and have the potential to be integrated in the future as direct potable reuse, are more desirable and efficient than these short-term solutions and are being aggressively pursued by IEUA.

6 Timeline and Next Steps

This is a critical time for the region. IEUA's recycled water program has a number of benefits, including increasing use of the climate resilient water supply, enhancing groundwater quality, and reducing dependence on imported water. The continuation of this program and the realization of these benefits hinges on compliance with regulatory TDS limits and the GRRP regulations; IEUA must continue on its path forward to pursue capital projects and other strategies to address regulatory challenges in recycled water within the region. Going forward, IEUA plans to continue with efforts related to the development of an implementation plan for the various alternatives to address the regulatory risks. These efforts will continue to advance in parallel with its other capital improvement plan forecasts, as needed, to ensure this vital resource is available for future use within the region.

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Appendix A

Preliminary Evaluation of Agency-Wide TDS Increase, 2016

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Subject:	**Preliminary Evaluation of Agency-Wide TDS Increase**
Date:	**July 13, 2016**
Prepared By:	**Planning & Environmental Resources Department**

The purpose of the preliminary evaluation is to:

- Analyze the Agency-wide Total Dissolved Solids (TDS) increase over the past 15 years,
- Forecast TDS trends through 2040 and identify potential TDS compliance challenges, and
- Explore opportunities for salinity management in a regionally planned and cost effective manner

Executive Summary

- Water supply annual average TDS increase: 1.8, 4.4, and 12.5 mg/L for the past 15, 10, and 5 years, respectively
- Wastewater effluent (effluent) TDS trends follow those of the water supply, increasing annually at average rates of 1.9, 3.3, and 15.7 mg/L for the past 15, 10, and 5 years, respectively
- Based on the TDS trends, effluent TDS limit of 550 mg/L will be exceeded between 2017-2027
- Agency-wide ultraviolet (UV) disinfection of tertiary effluent may reduce final effluent TDS by ~50 mg/L, delay the need for reverse osmosis (RO) by at least 4 years, and reduce RO capacity
- Based on the annual average TDS trends, RO is needed between 2-10 years
- When RO is implemented, most recycled water will be utilized for direct use, groundwater recharge, and RO, with no water available for alternative projects, such as vadose zone injection
- Water supply source optimization will provide the greatest buffer for salinity management; for instance, a 5% reduction in State Water Project (imported water) supply may result in an effluent TDS reduction of 5 mg/L (using 350 mg/L TDS for imported water)
- Preliminary recommendations are threefold: 1) Prepare TDS forecasting through the RP-1/RP-5 Preliminary Design Report, 2) Evaluate short- and long-term TDS reduction strategies, and 3) Implement RO within the 5-10 year timeframe

TDS Increase Evaluation

The evaluation first analyzed the annual rate of increase of the Agency-wide water supply (WS) and effluent TDS. The following is a summary of the findings:

- Increase in effluent TDS is correlated to an increase in water supply TDS
- Average incremental TDS: WS to plant influent is 246 mg/L, plant influent to effluent is 6 mg/L
- Most recent 5-year WS annual TDS increase is 12.5 mg/L (7x the 15-year trend)
- Continued 5-year trend of annual WS TDS increase of 12 mg/L may result in reaching the effluent TDS limit in late 2017-2018

Table 1: Agency-Wide Water Supply and Effluent TDS Trends

Sample Period	Water Supply TDS Annual Increase	Effluent TDS Annual Increase	Year Effluent TDS Limit is Reached
15 Years	1.8 mg/L	1.9 mg/L	2026 - 2027
10 Years	4.4 mg/L	3.3 mg/L	2020 - 2022
5 Years	12.5 mg/L	15.7 mg/L	2017 - 2018

** Range for "Year Effluent TDS Limit is Reached" corresponds to the range of Rate of Increase (WS and Eff), and based on an Agency-wide Water Supply of 281 mg/L (12-Month Running Average record high, Year 2015).*

Advanced Water Treatment Timeline

To understand the potential TDS reduction through alternative treatment systems, UV disinfection and RO were considered for future implementation. The following is a summary of the findings:

- UV disinfection can reduce TDS by ~50 mg/L and postpone RO implementation
- UV/RO combination reduces RO capacity, allows for phasing, and provides future flexibility
- RO treatment above 12 MGD may utilize all remaining reuse supply through year 2025

Table 2: TDS Annual Increase vs. TDS Limit Timeline

Water Supply Annual TDS Increase	Effluent TDS Limit is Reached	Year Limit is Reached with UV Only[1]	Reverse Osmosis Capacity [2]	Remaining Reuse Supply after RO in 2025[3]
1 mg/L	2036	2081	1 MGD	(8,000) – 12,000
5 mg/L	2020	2030	14 MGD	(22,000) – (2,100)
10 mg/L	2018	2023	26 MGD	(36,000) – (15,000)
15 mg/L	2017	2021	34 MGD	(45,000) – (24,000)

1. *Agency-wide UV implementation may decrease the effluent TDS by 53 mg/L, replacing sodium hypochlorite and sodium bisulfite currently used.*
2. *Based on no UV implementation, RO treatment to 100 mg/L TDS, and sized to maintain effluent TDS compliance (550 mg/L) through year 2040.*
3. *Supply based on RWPS (ultimate: 78k-88k AFY), Obligation discharge at 14,000 AFY, Direct Use based on IRP, External Supply of 5,000 AFY.*

Short-Term Opportunities

To combat the increasing TDS levels, short-term opportunities can be explored in terms of imported water (IW) supply, and in-plant process optimization. The following is a summary of the findings:

- 5% reduction in IW decreases Agency-wide WS and effluent TDS by 5 mg/L
- IW reduction to 10% of portfolio still requires further mitigation by 2018 at 15 mg/L increase
- Further operational opportunities may include pursuing: Desalter RO treatment improvements, lower Concentration-Time (CT) disinfection, UV disinfection, ferric dosing into digesters at RP-1, and TIN reduction through carbon denitrification

Table 3: Imported Water Impact on Water Supply Portfolio*

% Imported Water	Current Water Supply TDS	Current Effluent TDS	Year Effluent TDS Limit is Reached			
			1 mg/L	5 mg/L	10 mg/L	15 mg/L
25%	285 mg/L	537 mg/L	2032	2019	2017	2017
20%	280 mg/L	532 mg/L	2038	2020	2018	2017
15%	275 mg/L	527 mg/L	2043	2021	2018	2017
10%	270 mg/L	522 mg/L	2047	2022	2019	2018

** Assumptions: Total water demand of 200,000 AFY, Imported Water TDS of 350 mg/L, starting with a 65% Groundwater supply (250 mg/L) and varying based on the Imported Water Supply percentage, and fixed 10% Desalter water supply (350 mg/L).*

Vadose Zone Injection

As an alternative groundwater recharge strategy, the Agency is considering shallow injection into the unsaturated (vadose) zone. The following should be considered prior to moving forward with vadose zone injection (VZI):

- RO may be implemented within 10 years, and can directly inject into the water table
- When RO is implemented:
    - RO-treated water can be directly injected into the water table and will not require VZI
    - Limited or no remaining reuse supply may be available for VZI

Conclusion

With the forecasted TDS expected to exceed the limit in 2017-2027, further analysis is needed to address salinity management, including: 1) Forecast the imported water TDS levels, 2) Better define and quantify the potential treatment opportunities at water recycling facilities, 3) Water supply source optimization, and 4) Other project implementation, such as low impact development or stormwater capture.

APPENDIX

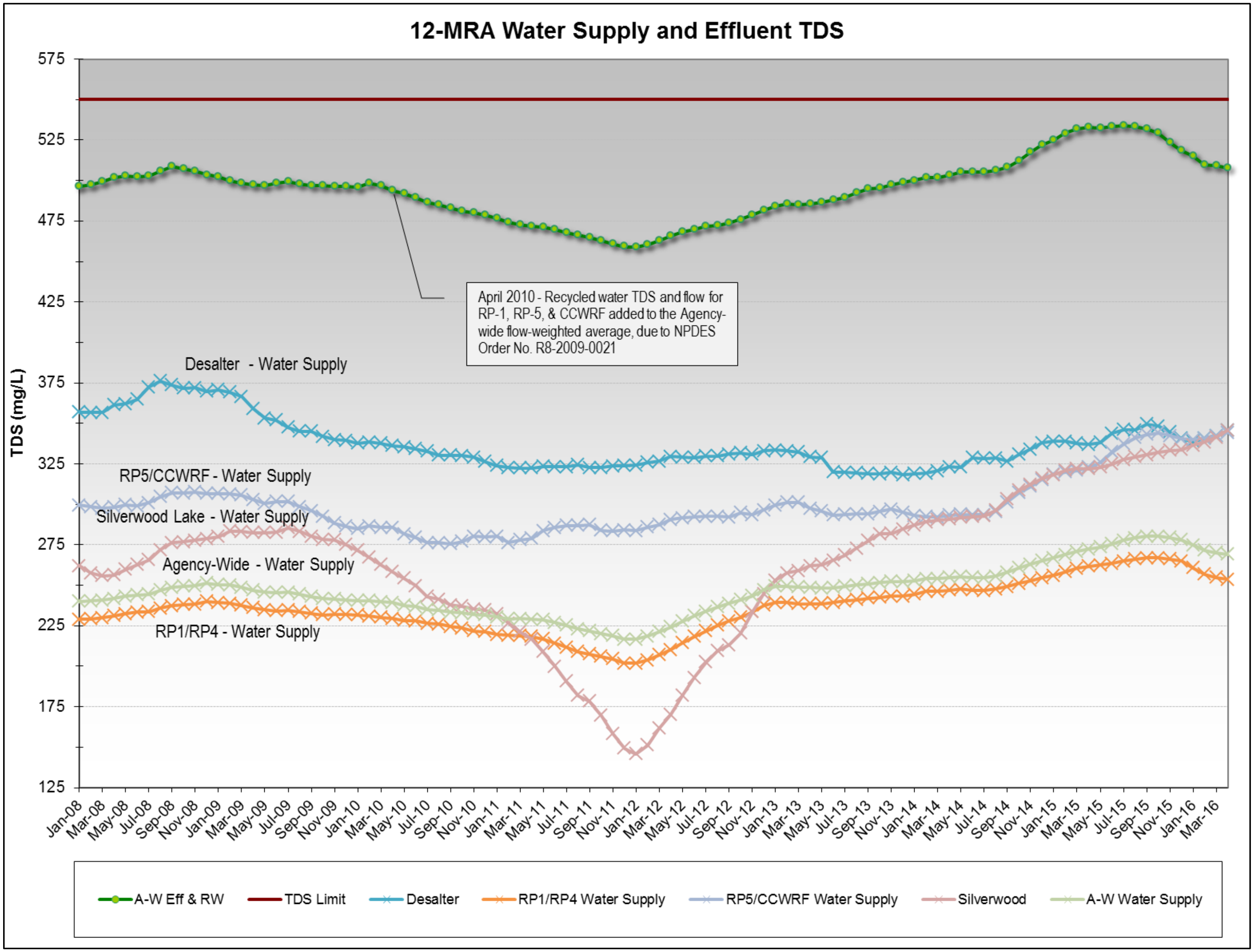

Figure 1: 12-Month Running Average Agency-Wide Water Supply and Effluent TDS

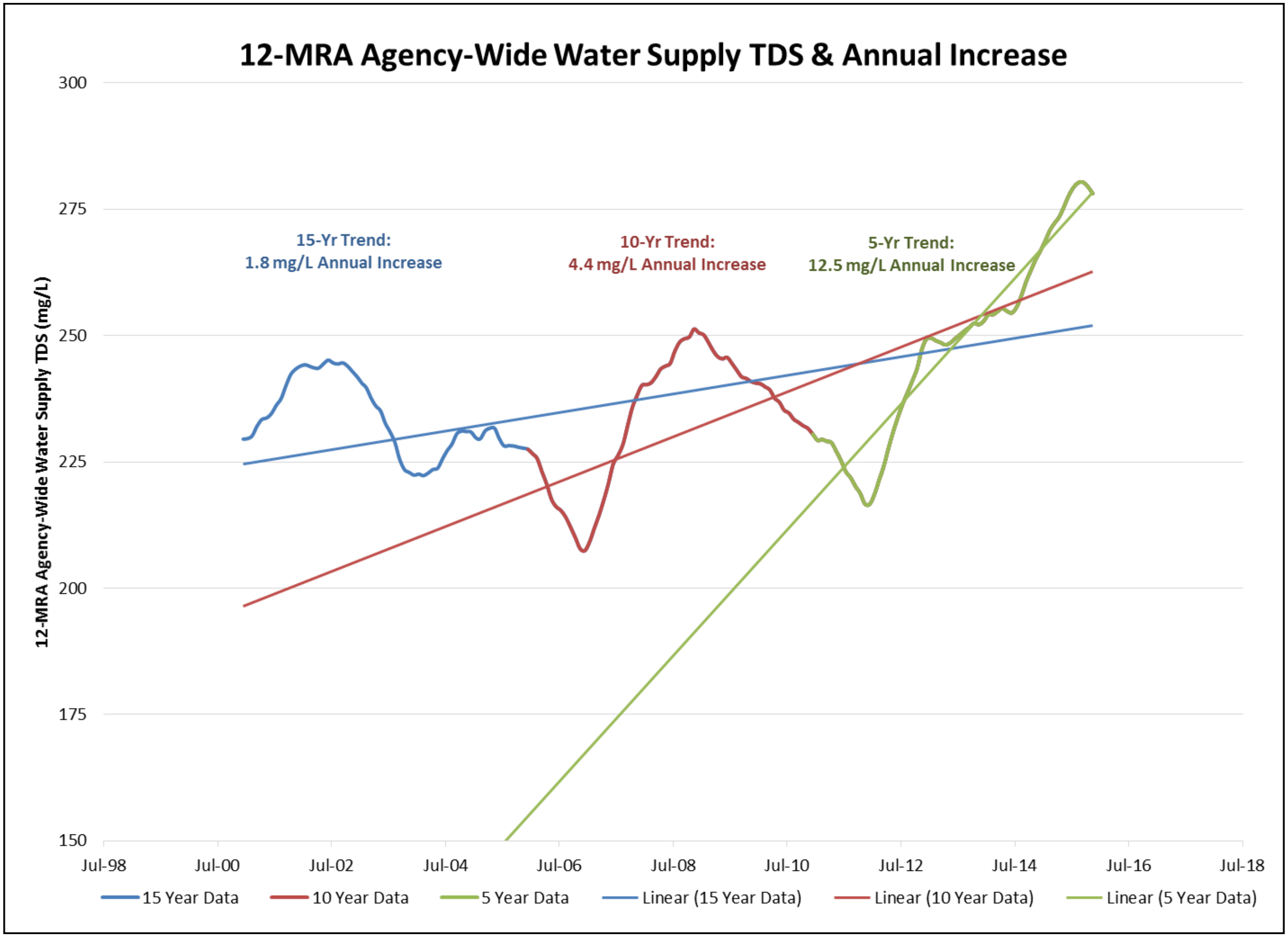

Figure 2: 12-Month Running Average Agency-Wide Water Supply TDS and Annual Increase

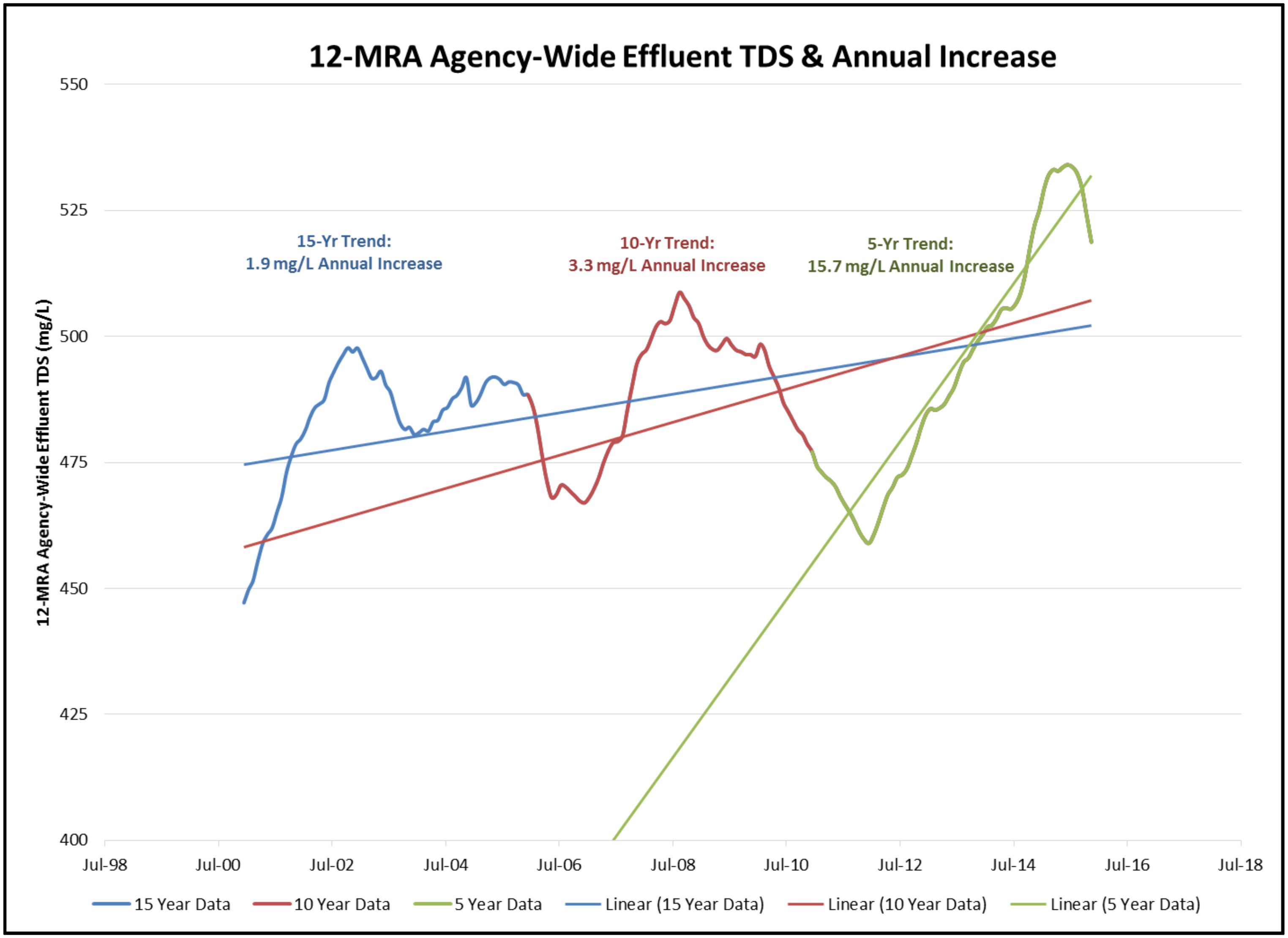

Figure 3: 12-Month Running Average Agency-Wide Effluent TDS and Annual Increase

Table A1: Water Supply Portfolio Sensitivity

Scenario	Imported Water	Ground-water	Desalter Water	Water Supply (mg/L)	Annual TDS Increase (mg/L)	Reach TDS 550 mg/L Limit (Year)	Convert RP-5 to UV (Year)	Convert All to UV (Year)	RO Capacity (MGD)
1A-1	-	-	-	281	1	2036	2053	2081	1
1A-5	-	-	-	281	5	2020	2022	2030	14
1A-10	-	-	-	281	10	2018	2019	2023	26
1A-15	-	-	-	281	15	2017	2017	2021	34
2A-1	350	250	350	285	1	2032	2050	2088	2
2A-5	350	250	350	285	5	2019	2021	2030	15
2A-10	350	250	350	285	10	2017	2018	2023	25
2A-15	350	250	350	285	15	2017	2018	2020	34
2B-1	375	250	350	291	1	2025	2042	2074	3
2B-5	375	250	350	291	5	2017	2020	2028	15
2B-10	375	250	350	291	10	2017	2018	2023	26
2B-15	375	250	350	291	15	2016	2016	2020	34
2C-1	400	250	350	298	1	2017	2033	2072	4
2C-5	400	250	350	298	5	2016	2018	2027	16
2C-10	400	250	350	298	10	2016	2017	2021	27
2C-15	400	250	350	298	15	2016	2016	2019	35
2D-1	425	250	350	304	1	2016	2023	2068	5
2D-5	425	250	350	304	5	2016	2017	2026	17
2D-10	425	250	350	304	10	2016	2016	2021	27
2D-15	425	250	350	304	15	2016	2016	2016	35
3A-1	350	250	300	280	1	2038	2060	2086	1
3A-5	350	250	300	280	5	2020	2022	2031	14
3A-10	350	250	300	280	10	2018	2018	2023	25
3A-15	350	250	300	280	15	2017	2017	2021	34
3B-1	350	250	250	275	1	2044	2066	2092	0
3B-5	350	250	250	275	5	2021	2023	2032	14
3B-10	350	250	250	275	10	2018	2019	2024	25
3B-15	350	250	250	275	15	2017	2018	2021	33

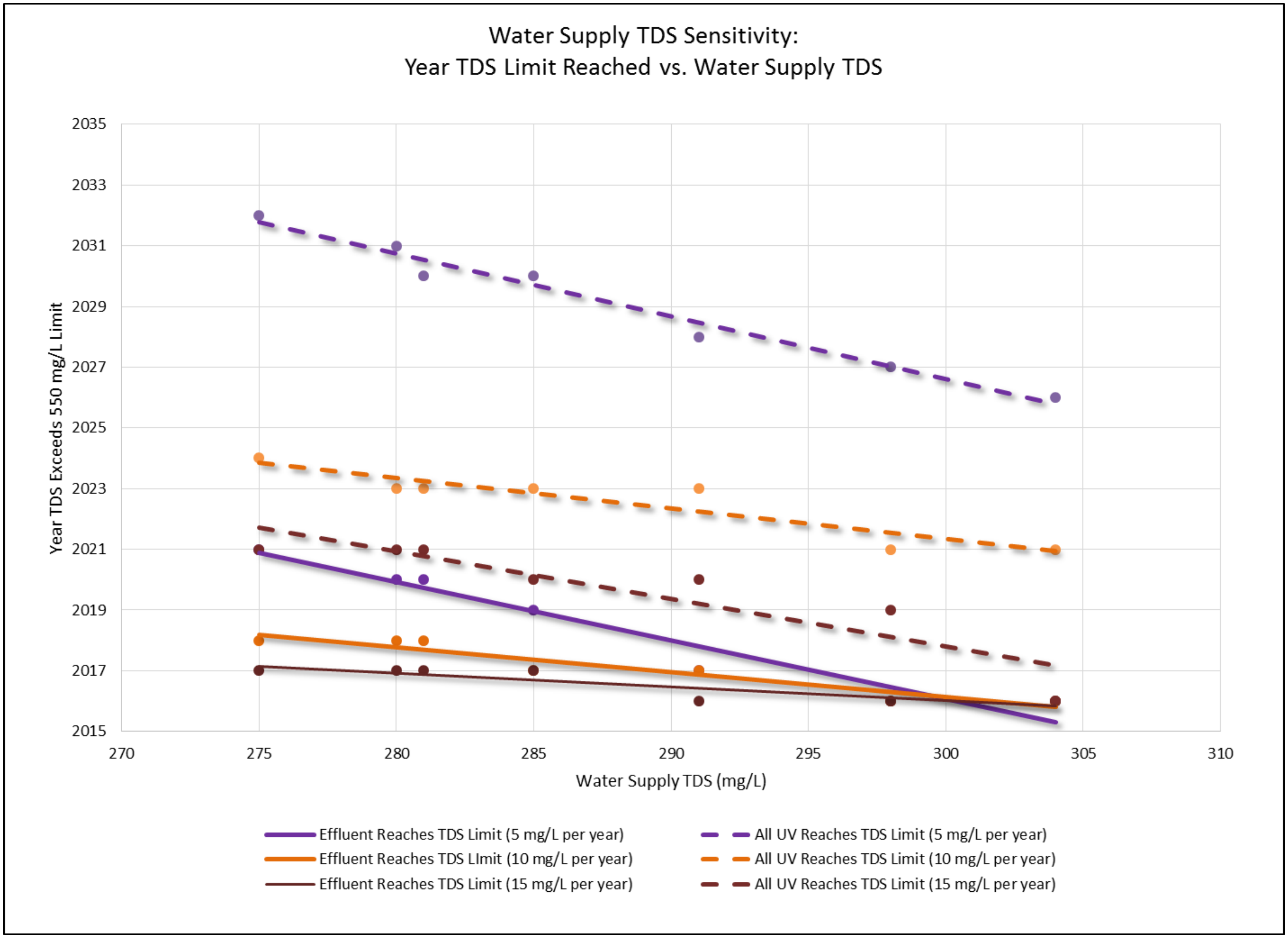

Figure 4: Water Supply TDS Sensitivity – Year TDS Limit is Reached vs. Water Supply TDS

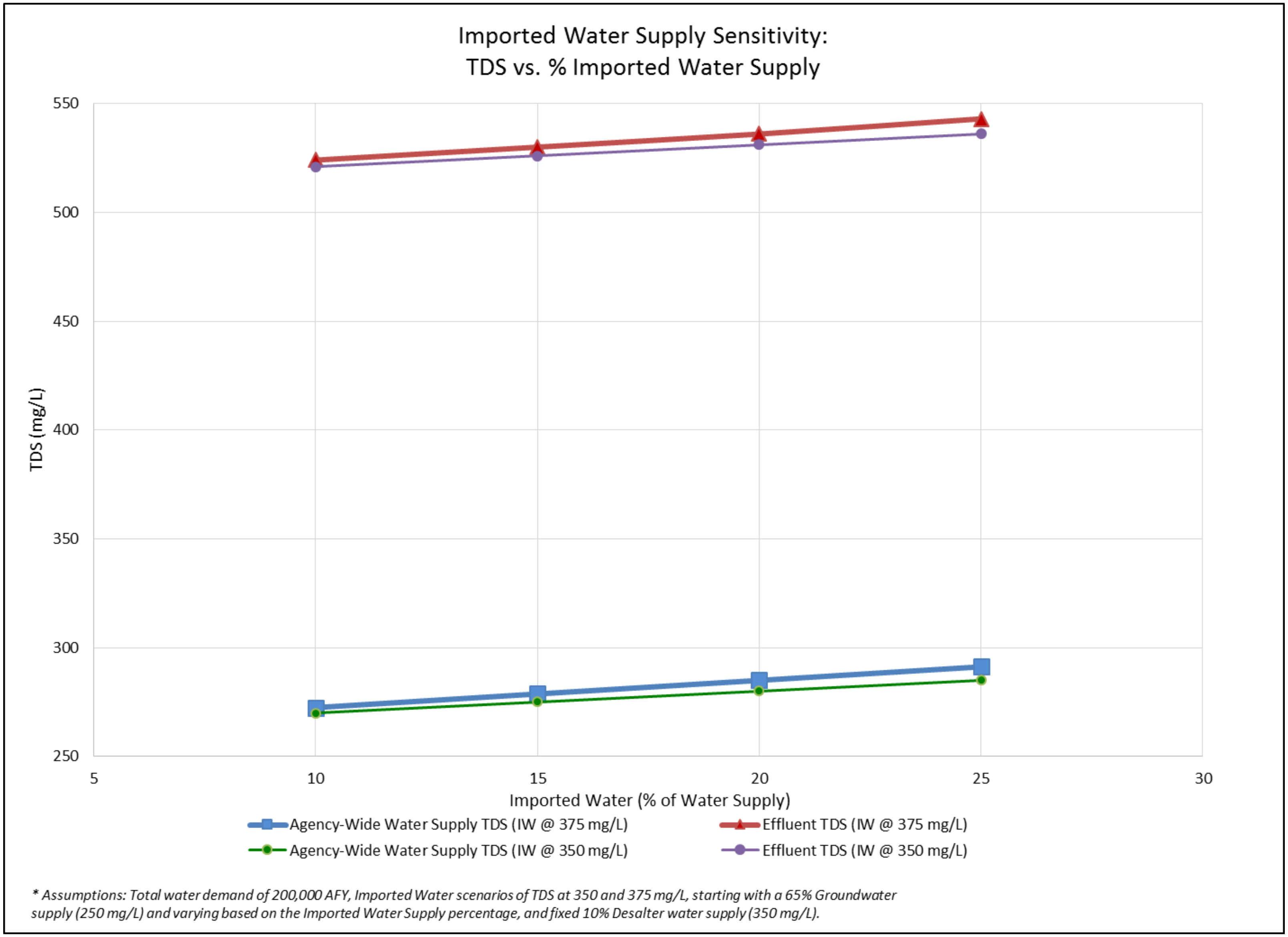

Figure 5: Imported Water Supply Sensitivity – TDS vs % Imported Water Supply

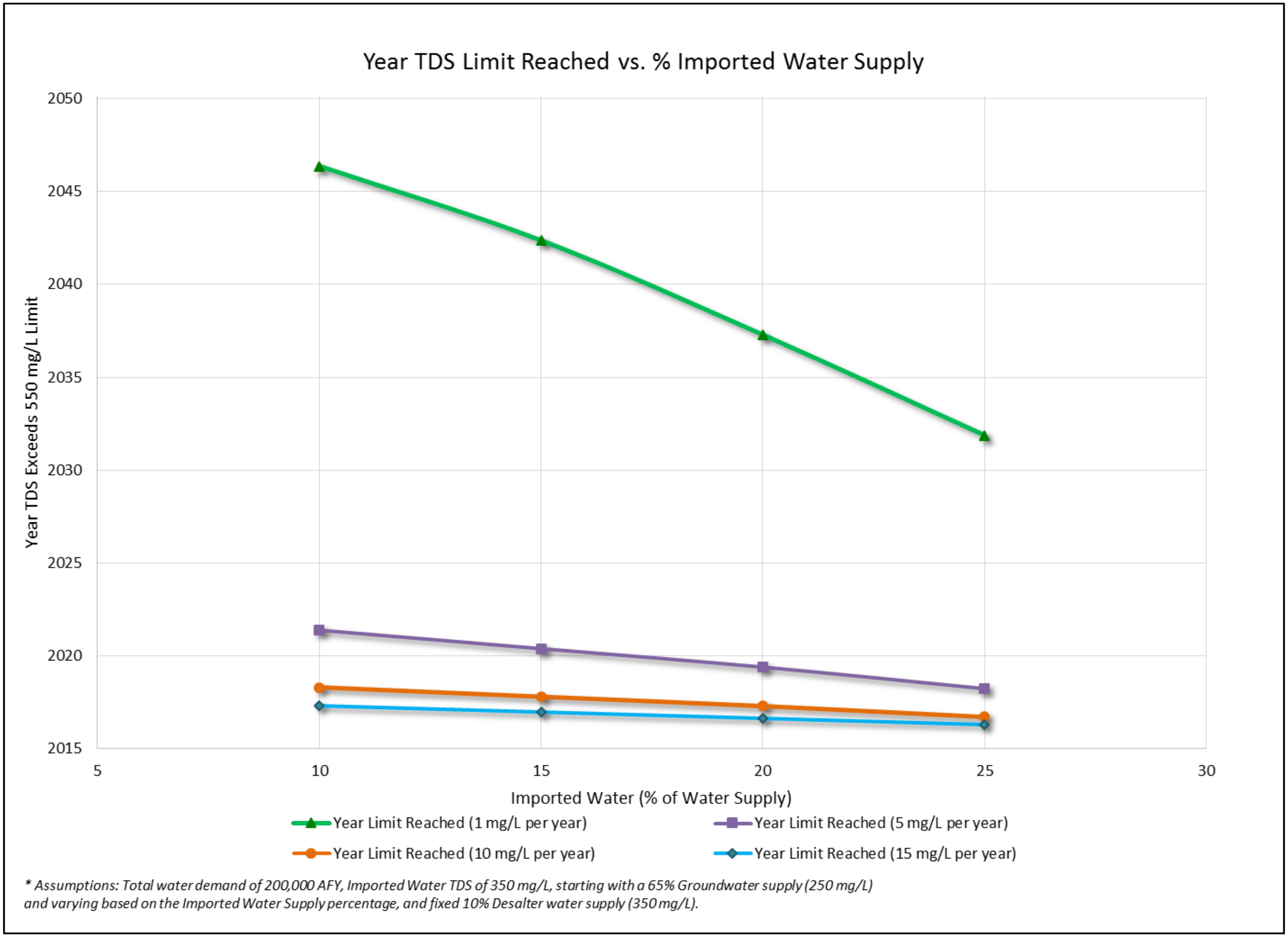

Figure 6: Year TDS Limit is Reached vs. % Imported Water Supply

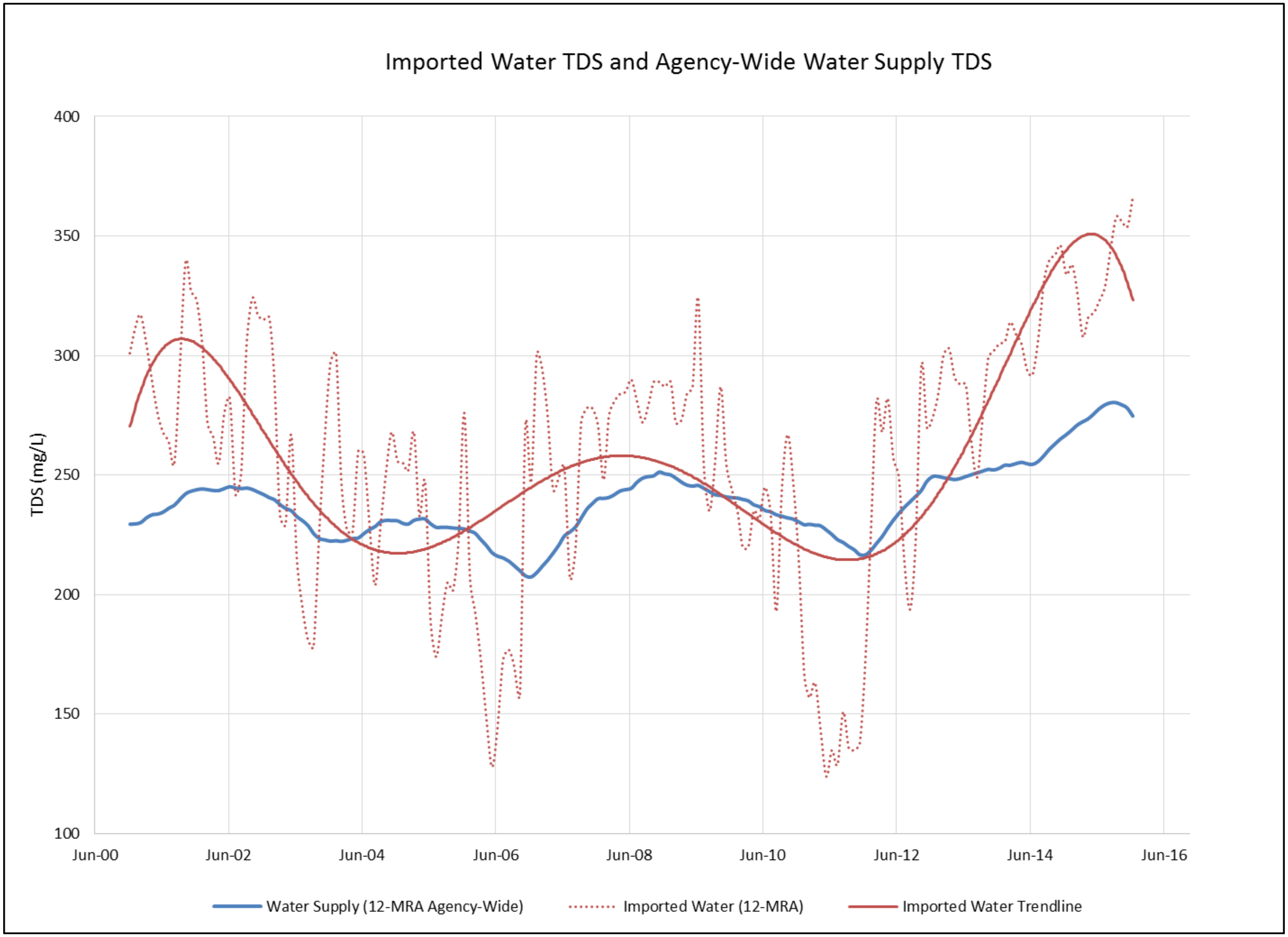

Figure 7: Imported Water TDS and Agency-Wide Water Supply TDS

Table A2: Sensitivity of Imported Water % on Water Supply

Scenarios: Varying % Imported Water of Water Supply		Total Water Demand	Imported Water			Groundwater			Desalter Water			Water Supply	1 mg/L Annual Increase		5 mg/L Annual Increase		10 mg/L Annual Increase		15 mg/L Annual Increase	
													Effluent	TDS Limit Reached (550 mg/L)	Effluent	TDS Limit Reached (550 mg/L)	Effluent	TDS Limit Reached (550 mg/L)	Effluent	TDS Limit Reached (550 mg/L)
		AFY	%	AFY	TDS (mg/L)	%	AFY	TDS (mg/L)	%	AFY	TDS (mg/L)	TDS (mg/L)	TDS (mg/L)	Mon/Yr	TDS (mg/L)	Mon/Yr	TDS (mg/L)	Mon/Yr	TDS (mg/L)	Mon/Yr
Current	IW @ 25%	200,000	25	50,000	**375**	65	130,000	250	10	20,000	350	291	543	11/2025	543	8/2017	543	1/2017	544	10/2016
1	IW @ 20%	200,000	20	40,000	375	70	140,000	250	10	20,000	350	285	536	11/2032	537	4/2019	537	9/2017	537	4/2017
2	IW @ 15%	200,000	15	30,000	375	75	150,000	250	10	20,000	350	279	530	8/2039	530	8/2020	531	5/2018	531	9/2017
3	IW @ 10%	200,000	10	20,000	375	80	160,000	250	10	20,000	350	273	524	12/2046	524	11/2021	525	1/2019	525	2/2018
Current	IW @ 25%	200,000	25	50,000	**350**	65	130,000	250	10	20,000	350	285	536	11/2032	537	3/2019	537	9/2017	537	4/2017
1	IW @ 20%	200,000	20	40,000	350	70	140,000	250	10	20,000	350	280	531	4/2038	532	5/2020	532	4/2018	532	8/2017
2	IW @ 15%	200,000	15	30,000	350	75	150,000	250	10	20,000	350	275	526	5/2043	527	5/2021	527	10/2018	527	12/2017
3	IW @ 10%	200,000	10	20,000	350	80	160,000	250	10	20,000	350	270	521	5/2047	522	5/2022	522	4/2019	522	4/2018

Table A3: Recycled Water Supply & Use – High Supply & Low Demand

Description	Recycled Water Supply & Use (AFY) High Supply - Low Demand					
	Year					
	2015	2020	2025	2030	2035	2040
RW Supply	56,384	66,312	71,913	77,514	82,330	88,817
External Supply	-	5,000	5,000	5,000	5,000	5,000
SARBF Obligation Discharge	14,000	14,000	14,000	14,000	14,000	14,000
Direct Use Demand Forecast	22,580	28,800	30,700	30,700	30,700	30,700
Available GWR Supply	19,804	28,512	32,213	37,814	42,630	49,117
GWR Basin Deliveries	13,600	18,700	18,700	18,700	18,700	18,700
Remaining Reuse Supply	**6,204**	**9,812**	**13,513**	**19,114**	**23,930**	**30,417**
Reverse Osmosis @ 12 MGD	-	13,440	13,440	13,440	13,440	13,440
Potential Remaining Supply	-	(3,628)	73	5,674	10,490	16,977

**Reverse osmosis was selected at 12 MGD since this is the capacity that leaves almost no potential remaining supply in 10 years.*

Table A4: Recycled Water Supply & Use – Low Supply & High Demand

Description	Recycled Water Supply & Use (AFY) Low Supply - High Demand					
	Year					
	2015	2020	2025	2030	2035	2040
RW Supply	56,384	59,681	64,722	69,763	74,097	78,000
External Supply	-	-	-	-	-	-
SARBF Obligation Discharge	17,000	17,000	17,000	17,000	14,000	17,000
Direct Use Demand Forecast	24,655	30,000	36,000	40,000	43,000	45,000
Available GWR Supply	14,729	12,681	11,722	12,763	17,097	16,000
GWR Basin Deliveries	13,600	16,881	18,700	18,700	18,700	18,700
Remaining Reuse Supply	**1,129**	**(4,200)**	**(6,978)**	**(5,937)**	**(1,603)**	**(2,700)**
Reverse Osmosis @ 12 MGD	-	13,440	13,440	13,440	13,440	13,440
Potential Remaining Supply	-	(17,640)	(20,418)	(19,377)	(15,043)	(16,140)

**Reverse osmosis was selected at 12 MGD since this is the capacity in the High-Supply Low-Demand table that leaves almost no potential remaining supply in 10 years.*

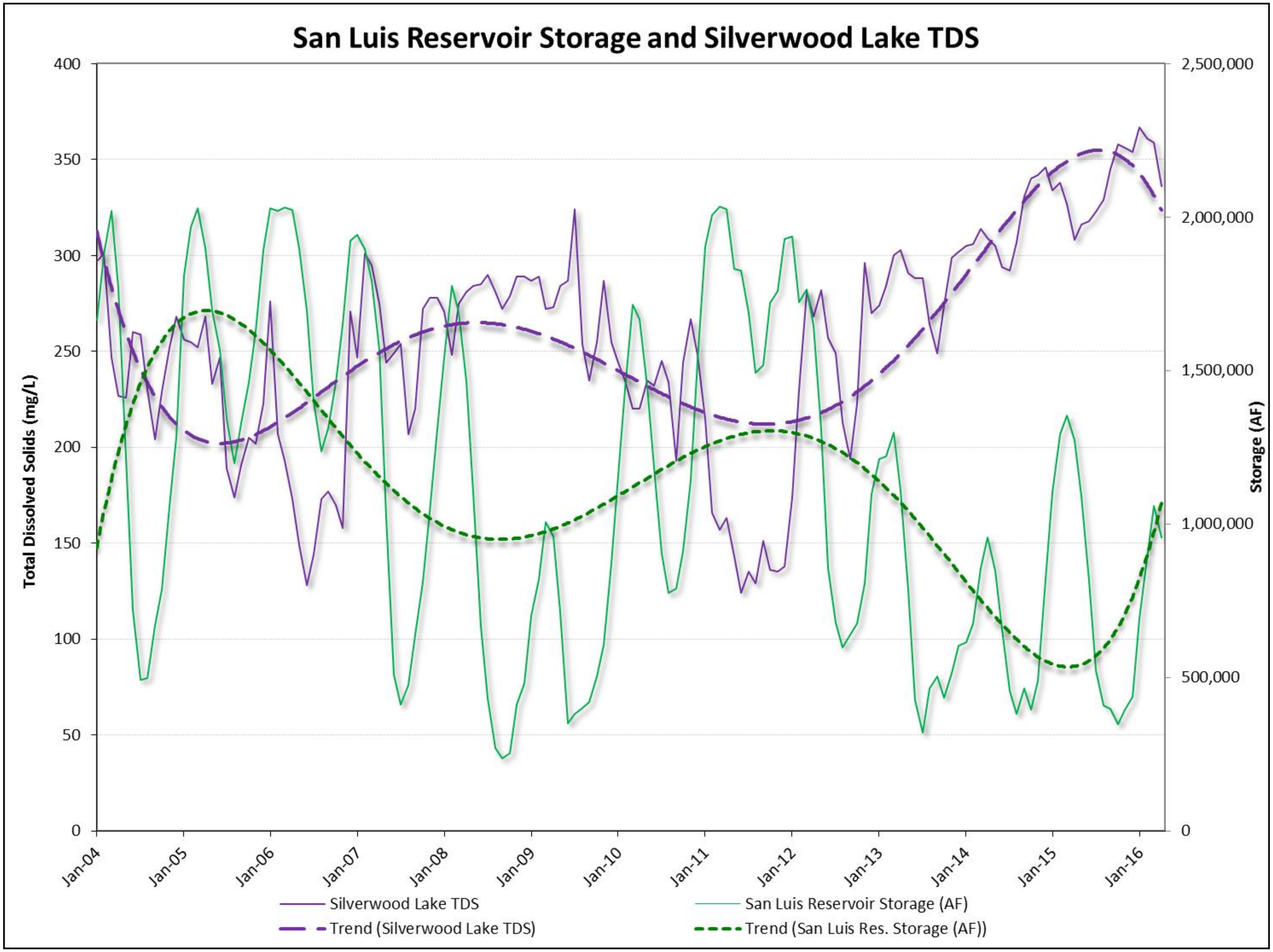

Figure 8: San Luis Reservoir Storage and Silverwood Lake TDS

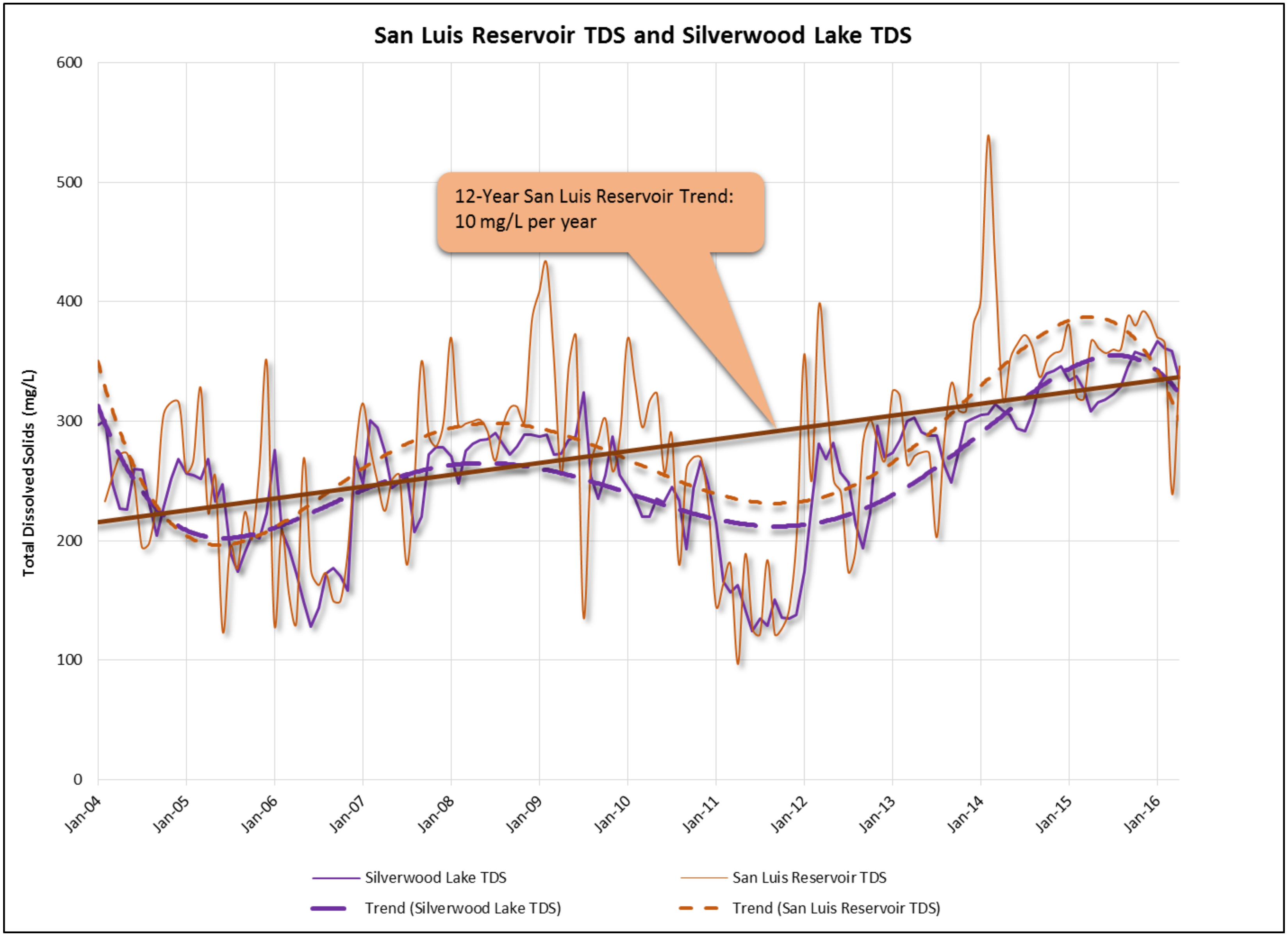

Figure 9: San Luis Reservoir TDS and Silverwood Lake TDS

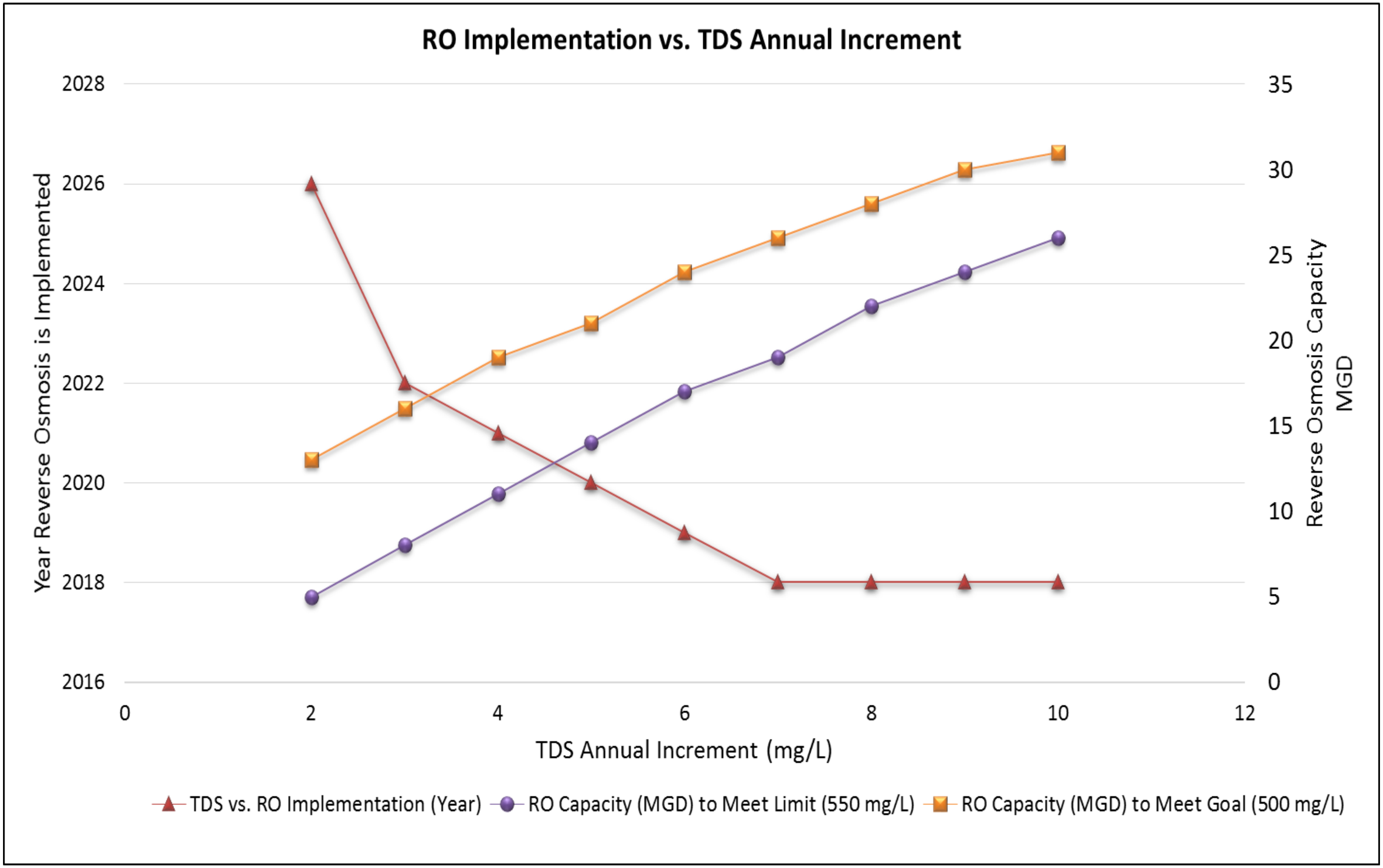

Figure 10: Reverse Osmosis Implementation vs. TDS Annual Increment

Table A5: Potential Short-Term Opportunities

Item	*Description*	*Location*
1	Operate the Desalter at a higher RO treatment level to lower the blended product water TDS. The current Desalter blended water TDS goal is 350 mg/L, which may have the potential to be reduced.	*Desalter*
2	Pursue site specific Concentration-Time (CT) disinfection that is significantly less than 450 mg-min/L. Other agencies, such as LACSD have been successful in demonstrating disinfection with a reduced CT and modal contact time through demonstration tests. If pursued, this pilot demonstration may take anywhere between 1½ - 3 years.	*Water Recycling Facilities*
3	Install fabric covers at CCWRF and RP-5's chlorine contact basins to reduce bleach burn off. Previous research and quotations have been received with the installation costs at approximately $125,000 per site. Previous Agency tests conducted in 2011 showed up to 6 mg/L loss of chlorine due to UV exposure. More analysis would be needed to quantify effluent TDS levels based on a reduced hypochlorite dosage.	*CCWRF, RP-5*
4	Consider UV to meet Title 22 disinfection requirements. The preliminary analysis conducted in this evaluation showed, depending on annual TDS increase, UV disinfection at all facilities could potentially reduce the effluent TDS by approximately 50 mg/L by reducing the TDS currently added through sodium hypochlorite and sodium bisulfite.	*Water Recycling Facilities*
5	Consider dosing ferric at RP-1 directly into the digesters for hydrogen sulfide control instead of at the headworks and continue discharging the centrate to the NRW. Ferric injection at RP-1 headworks may be contributing to higher TDS levels. More analysis would be needed to quantify the potential reduction in effluent TDS based on dosing ferric in the digesters and removing it from the mainstream effluent by sending it into the NRW.	*RP-1*
6	Evaluate reducing Total Inorganic Nitrogen (TIN) (mostly nitrate) from approximately 8 to 3 ppm by optimizing denitrification using an external carbon source. A 5 ppm reduction in NO3-N may translate to approximately 20 ppm reduction in TDS. This opportunity may apply to all water recycling facilities. This option would require further in-depth analysis to quantify TDS reduction and process impacts.	*Water Recycling Facilities*