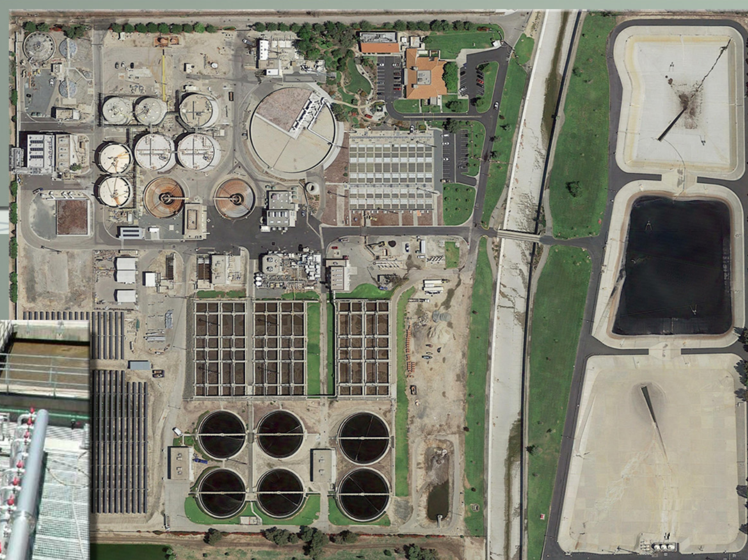
FINAL

# Wastewater Facilities Master Plan Update Report

Volume 2 of 2



Submitted to:

Inland Empire Utilities Agency

Submitted by:

CH2MHILL

In Association With:

carollo

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June 2015

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*Final Report*

# Wastewater Facilities Master Plan Update Report Volume 2 of 2

Prepared for

**Inland Empire Utilities Agency**

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June 2015

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*Final Report*

# Wastewater Facilities Master Plan Update Report Volume 2 of 2

Submitted to

## Inland Empire Utilities Agency


SIGNED: 06–03–15

June 2015



WT0326151012SCO

# Contents

**Section**

# Acronyms and Abbreviations

| | |
|---|---|
| µg/L | micrograms per liter |
| ADWF | average dry weather flow |
| AF | acre-feet |
| AFY | acre feet per year |
| AL | Agency Laboratory |
| AQMD | Air Quality Management District |
| AWT | Advanced Water Treatment |
| B/C | benefit to cost |
| BNR | biological nutrient removal |
| BOD | biological oxygen demand |
| $CaCO_3$ | calcium carbonate |
| CCI | Construction Cost Index |
| CCWRF | Carbon Canyon Water Recycling Facility |
| CDPH | California Department of Public Health |
| CEPT | chemically enhanced primary treatment |
| CIP | Capital Improvement Program |
| CIW | Chino Institute for Women |
| CM | construction management |
| CT | concentration and time |
| CVWD | Cucamonga Valley Water District |
| d/D | ratio of maximum flow depth to pipe diameter |
| DAF | dissolved air flotation |
| DAFT | dissolved air floatation thickener |
| DCS | Distributed Control System |
| DDB | DDB Engineering, Inc. |
| DO | dissolved oxygen |
| DP | Discharge Point |
| DT/d | dry tons per day |
| ENR | *Engineering-News Record* |
| EPS | extended-period simulation |
| ESCI | Environ Strategy Consultants, Inc. |
| ESRI | Environmental Systems Research Incorporated |
| FGDS | Federal Geographic Data Standards |

| | |
|---|---|
| ft | foot/feet |
| ft/s | feet per second |
| $ft^2$ | square feet |
| FY | fiscal year |
| GIS | Geographic Information System |
| gpd | gallons per day |
| gpd/$ft^2$ | gallons per day per square foot |
| gph | gallons per hour |
| gpm | gallons per minute |
| gpm/$ft^2$ | gallons per minute per square foot |
| gpm/m | gallons per minute per meter |
| GWR | Groundwater Recharge |
| HQ | Agency Headquarters |
| HRT | hydraulic retention time |
| HVAC | heating, ventilation, and air conditioning |
| ID | Identification Designation |
| IEBL | Inland Empire Brine Line |
| IERCA | Inland Empire Regional Composting Authority |
| IERCF | Inland Empire Regional Composting Facility |
| IEUA | Inland Empire Utilities Agency |
| IMLR | internal mixed liquor return |
| IRP | Integrated Water Resources Plan |
| IWA | International Water Association |
| JWPCF | Joint Water Pollution Control Facility |
| klb | kilopound(s) |
| LAFCO | Local Area Formation Commission |
| lb | pound(s) |
| lb/d/$ft^2$ | pounds per day per square foot |
| lb/d/$ft^3$ | pounds per day per cubic foot |
| lb/day | pounds per day |
| lb/hr/m | pounds per hour per meter |
| LCC | life-cycle costs |
| LEED | Leadership in Energy and Environmental Design |
| LF | linear feet |
| LS | Agency Lift Stations |

| | |
|---|---|
| MBR | membrane bioreactor |
| MF | microfiltration |
| MG | million gallons |
| mg/L | milligrams per liter |
| mgd | million gallons per day |
| mg-min/L | milligrams per minute per liter |
| mL/g | milliliters per gram |
| MLE | Modified Ludzack-Ettinger |
| MLSS | mixed liquor suspended solids |
| MLVSS | mixed liquor volatile suspended solids |
| MPN | most probable number |
| MVWD | Monte Vista Water District |
| N/A | not applicable |
| NH3-N | ammonia as nitrogen |
| NMC | New Model Colony |
| NO2-N | nitrite as nitrogen |
| NO3-N | nitrate as nitrogen |
| NPDES | National Pollutant Discharge Elimination System |
| NRW | Non-Reclaimable Wastewater |
| NRWS | Non-Reclaimable Wastewater System |
| NTU | nephelometric turbidity unit(s) |
| OCSD | Orange County Sanitation District |
| PAC | Process Automation Control |
| PDF | peak day flow |
| PE EQ | primary effluent equalization |
| PF | peaking factor |
| PS | primary sludge |
| R&R | rehabilitation and replacement |
| RAS | return activated sludge |
| RC | Regional Conveyance System |
| RO | reverse osmosis |
| RP | Regional Water Recycling Plant |
| 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 |
| RSS | Regional Sewer System |
| RW | Recycled Water Distribution |
| RWQCB | Regional Water Quality Control Board |
| RWRP | Regional Water Recycling Plant |
| SANBAG | San Bernardino Association of Governments |
| Sanitation Districts | Sanitation Districts of Los Angeles County |
| SCADA | supervisory control and data acquisition |
| SCAG | Southern California Association of Governments |
| scfm | standard cubic feet per minute |
| SHS | Solids Handling Site |
| SMART | Simple Multi-Attribute Rating Technique |
| SOI | sphere of influence |
| SRT | solids retention time |
| SS | suspended solids |
| SSO | sanitary sewer overflow |
| SVI | sludge volume index |
| TDS | total dissolved solids |
| TIN | total inorganic nitrogen |
| TKN | total Kjeldahl nitrogen |
| TM | Technical Memorandum |
| TN | total nitrogen |
| TOC | total organic carbon |
| tph | tons per hour |
| TS | thickened solids |
| TSS | total suspended solids |
| USACE | United States Army Corps of Engineers |
| WAN | Wide Area Network |
| WAS | waste activated sludge |
| WFMP | Wastewater Facilities Master Plan |
| WT/d | wet tons per day |

# TM 1 Existing Facilities

# IEUA Wastewater Facilities Master Plan
# TM 1 Existing Facilities

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: Carollo Engineers, Inc.

REVIEWED BY: CH2M HILL

DATE: April 2015

# Executive Summary

The Inland Empire Utilities Agency (IEUA) is a regional agency that provides wastewater treatment, biosolids handling, and recycled water service. Its service area includes the cities of Upland, Montclair, Ontario, Fontana, Chino, and Chino Hills; and Cucamonga Valley Water District, which services the city of Rancho Cucamonga and some unincorporated areas of San Bernardino County.

IEUA's existing wastewater treatment facilities include wastewater collection, wastewater treatment, recycled water distribution, and biosolids handling. Wastewater within IEUA's service area is collected by two collection systems—the Non-Reclaimable Wastewater (NRW) System and the Regional Trunk Sewer System. The NRW System collects industrial and high-salinity wastewater for transport to the Sanitation Districts of Los Angeles County (Sanitation Districts) or the Orange County Sanitation District (OCSD) for treatment and ocean disposal. The Regional Trunk Sewer System collects municipal/domestic wastewater and conveys it to IEUA's regional water recycling plants. Municipal/domestic wastewater is treated at one of four regional water recycling plants: 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). The liquid treatment facilities at these plants are designed to produce Title 22 water that can be reused or recharged into the groundwater. Recycled water is distributed from each facility into six different recycled water pressure zones for reuse. Recycled water in excess of the recycled water demand is dechlorinated and discharged to streams that are tributary to the Santa Ana River.

Biosolids are produced at the four liquid treatment facilities that require stabilization and disposal. The IEUA operates two solids treatment processes located at RP-1 and Regional Water Recycling Plant No. 2 (RP-2). The RP-1 solids handling process treats biosolids produced at RP-1 and RP-4, and the RP-2 solids handling process treats biosolids produced at RP-5 and CCWRF. Biosolids are thickened, stabilized, and dewatered at each facility, then are trucked to the Inland Empire Regional Composting Facility (IERCF) for composting. The IERCF is operated by the Inland Empire Regional Composting Authority, which was created by a joint powers agreement between IEUA and the Sanitation Districts. The IERCF accepts biosolids from both the IEUA and the Sanitation Districts treatment facilities and produces a high-quality soil amendment.

# 1.0 Background and Objectives

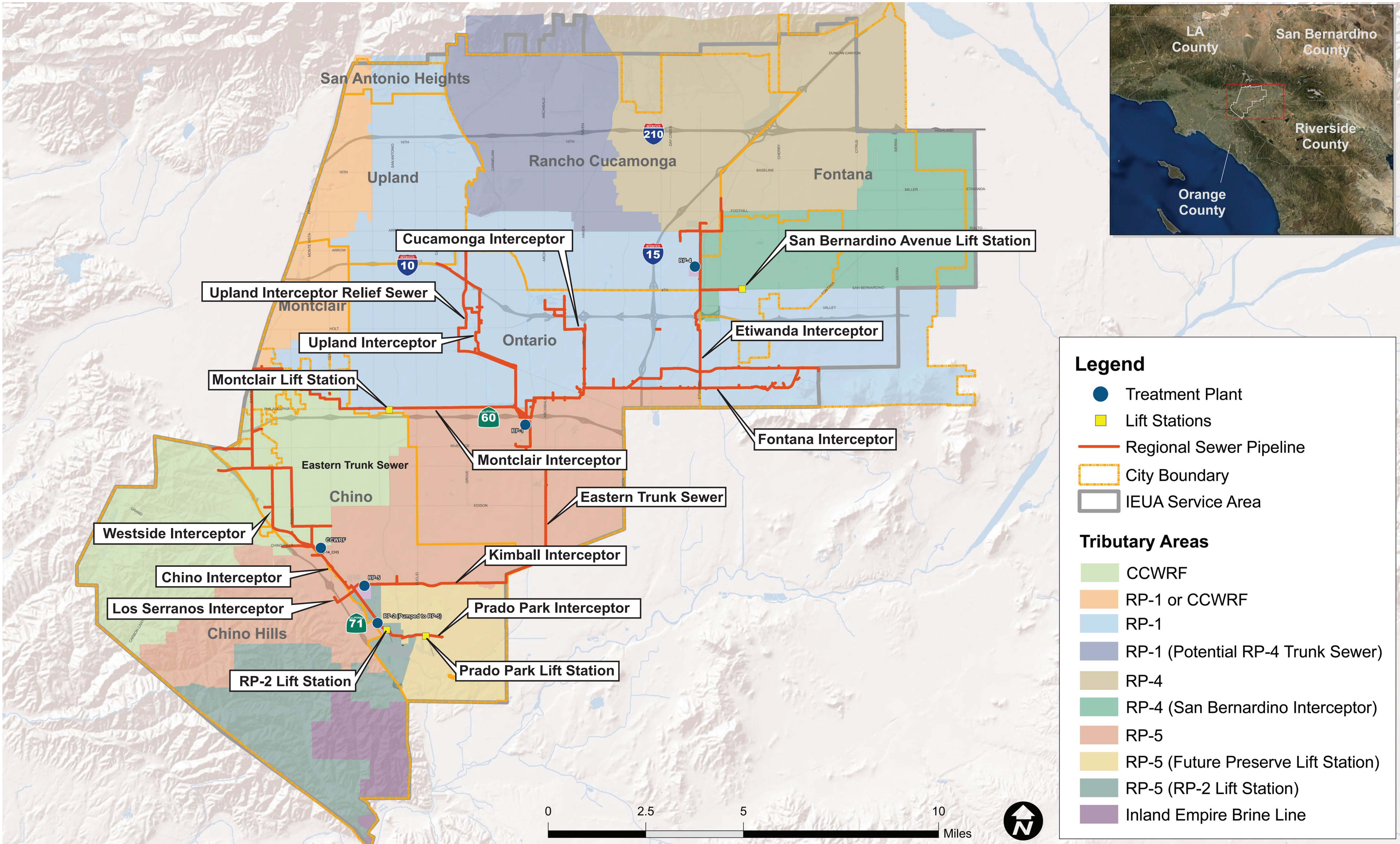
The purpose of this technical memorandum is to describe the existing wastewater resources within IEUA's service area. The information in this memorandum was obtained from as-built drawings, previous reports, and IEUA staff input. These data were used as a basis for the development of subsequent memoranda that form the Wastewater Facilities Master Plan (WFMP).

# 2.0 Wastewater Conveyance

The IEUA's wastewater conveyance system is separated into two networks—the Regional Trunk Sewer System and the NRW System. The Regional Trunk Sewer System collects municipal/domestic wastewater and conveys it to IEUA's regional wastewater treatment facilities, and the NRW System collects brines and other high-strength wastes and transports them to the Sanitation Districts or OCSD for treatment and ocean disposal.

## 2.1 Existing Trunk Sewer System

The existing trunk sewer system consists of gravity interceptors, lift stations, force mains, and diversions. Figure 1-1 provides a map of the Regional Trunk Sewer System. The map shows the route of the major trunk lines, highlights their tributary areas, and indicates the locations of the lift stations and regional treatment plants.




Data Source: RMC // Prepared by: IEUA // Date Created: 12/24/13

FIGURE 1-1

## REGIONAL TRUNK SEWER SYSTEM

INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

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20-IEUA-1-14F1-1-9370A00.AI

### 2.1.1 Gravity Interceptors

The Regional Trunk Sewer System consists of 10 major interceptor systems. Existing infrastructure data for each of these systems are summarized in Table 1-1.

TABLE 1-1
**Existing Regional Trunk Sewer System**

| Interceptor | Year Built | Pipe Size (inches) | Pipe Length (feet) |
|---|---|---|---|
| **Etiwanda Interceptor System** | | | |
| Etiwanda Interceptor | 1987 | 15-42 | 31,087 |
| **Upland Interceptor System** | | | |
| Upland Interceptor Sewer | 1957 | 21-30 | 13,966 |
| Upland Interceptor Relief Sewer | 1991 | 12-27 | 5,850 |
| Grove Avenue Trunk Sewer | 1961 | 18-21 | 3,906 |
| Freeway Trunk Sewer | 1961 | 18-33 | 5,985 |
| RP-1 Influent Lines: | | | |
| Philadelphia Ave. Project | 1968 | 33-42 | 1,965 |
| Philadelphia Ave. Diversion | 1988<br>1948 | 54-60 | 1,750<br>250 |
| **Cucamonga Interceptor System** | | | |
| Cucamonga Trunk Sewer | 1964 | 24-36 | 8,000 |
| Cucamonga Trunk Relief Sewer | 1985 | 24-39 | 12,865 |
| Archibald Avenue Trunk Sewer | 1964 | 18-24 | 12,972 |
| Archibald Avenue Trunk Relief | 1981 | 24-54 | 5,217 |
| Turner Avenue Trunk Sewer | 1964 | 24 | 2,618 |
| Cucamonga Interceptor Sewer | 1974 | 24-42 | 11,471 |
| Cucamonga Interceptor Relief | 1988 | 42 | 12,431 |
| Cucamonga Relocation | 1990 | 42 | 1,385 |
| **Fontana Interceptor System** | | | |
| Fontana Interceptor Sewer | 1984 | 21-39 | 34,806 |
| Fontana Interceptor Relief | 1989 | 21-78 | 32,432 |
| **Montclair Interceptor System** | | | |
| Montclair Interceptor | 1977 | 18-36 | 39,476 |
| **Westside Interceptor System** | | | |
| Westside Interceptor | 1976 | 10-24 | 24,117 |
| Westside Interceptor Relief | 1994 | 15-54 | 39,970 |
| **Chino Interceptor System** | | | |
| Chino Interceptor | 1960 | 24-30 | 13,957 |
| Chino Interceptor Diversion | 2001 | 42 | 2,576 |
| Los Serranos Trunk Sewer | 1974 | 30-36 | 2,350 |
| Kimball Interceptor System | 2001 | 42-66 | 19,866 |
| Prado Park Interceptor System | 1976 | 8-10 | 9,356 |

Source: Parsons, 2002

## 2.1.2 Pump Stations and Force Mains

IEUA currently operates four pump stations and force mains within its service area—the San Bernardino Avenue Lift Station, Montclair Interceptor Lift Station, Prado Park Lift Station, and RP-2 Lift Station.

### San Bernardino Avenue Lift Station

The San Bernardino Avenue Lift Station was built in 2009. Approximately 4 million gallons per day (mgd) of flow that is tributary to RP-1 is pumped to RP-4 for treatment. Design criteria for the San Bernardino Avenue Lift station are summarized in Table 1-2.

TABLE 1-2
**San Bernardino Avenue Lift Station System**

| Parameter | Units | Value |
|---|---|---|
| **Lift Station Pumps** | | |
| Type | - | Vertical Turbine |
| Number | - | 2 |
| Capacity, each | gpm | 2,800 |
| Number | - | 2 |
| Capacity, each | gpm | 6,250 |

gpm = gallons per minute
Source: IEUA, 2013

### Montclair Interceptor Lift Station and Force Main

The Montclair Interceptor Lift Station was built in 1975. The lift station conveys wastewater from the cities of Montclair, Upland, and Chino to RP-1. Since the construction of the Carbon Canyon Wastewater Recycling Facility, flows from Montclair and Upland can be diverted from the lift station, depending on operational constraints and recycled water demand. Therefore, a limited amount of flow is typically handled by the lift station. Design criteria for the Montclair Interceptor Lift Station are shown in Table 1-3.

TABLE 1-3
**Montclair Interceptor Lift Station System**

| Parameter | Units | Value |
|---|---|---|
| **Lift Station Pumps** | | |
| Type | - | Chopper, centrifugal |
| Number | - | 3 |
| Capacity, each | gpm | 3,600 |

Source: IEUA, 2013

### Prado Park Lift Station

The Prado Park Lift Station was built in 1977 and was designed to transfer wastewater from the Chino Institute for Women (CIW) and the Prado Regional Park to the RP-2 Lift Station. Several years ago, the CIW flow was disconnected from the IEUA regional sewer system and was sent to the Inland Empire Brine Line. When the city of Chino constructs the future Preserve Lift Station, it will accept the flow from the CIW, Prado Regional Park, and the Preserve new housing development in the city of Chino. The flow will be pumped from the Preserve Lift Station through a new city-owned force main to a new connection to IEUA’s Kimball Interceptor on Kimball Avenue just east of Euclid Avenue. Design criteria for the Prado Park Lift station are summarized in Table 1-4.

TABLE 1-4
**CIW Lift Station System**

| Parameter | Units | Value |
|---|---|---|
| **Lift Station Pumps** | | |
| Type | - | Centrifugal |
| Number | - | 2 |
| Capacity, each | gpm | 330 |

Source: IEUA, 2013

### RP-2 Lift Station and Force Main

The RP-2 Lift Station was built to divert wastewater flows that would normally be tributary to RP-2. These flows are diverted from RP-2 to RP-5. All liquid flows tributary to RP-2 were diverted to RP-5 due to the increase of the inundation level of the Prado Dam. Design criteria for the RP-2 Lift Station are summarized in Table 1-5.

TABLE 1-5
**RP-2 Lift Station System**

| Parameter | Units | Value |
|---|---|---|
| **Lift Station Pumps** | | |
| Type | - | Non-clog, submersible, centrifugal |
| Number | - | 3 |
| Capacity, each | gpm | 2,300 |

Source: Carollo Engineers, Inc., 2000

## 2.1.3 Flow Bypasses and Diversions

The Regional Trunk Sewer System has the capability to divert flows within the collection system at several locations. The flow bypasses and diversions are used to direct flow to various treatment facilities based on available treatment capacity and recycle water needs.

### Montclair/Westside Interceptor Diversion

The Montclair/Westside Interceptor Diversion Structure is located near the intersection of Roswell Avenue and Grand Avenue in the city of Montclair. This diversion structure connects the Westside Interceptor, the Montclair Interceptor, and the Northern NRW System. At this diversion structure, flows can be directed to RP-1 via the Montclair Interceptor Lift Station, the CCWRF via the Westside Interceptor, or the NRW System. Currently, 3 mgd of flow is diverted from RP-1 to the CCWRF to reduce flows in the Montclair Interceptor and at RP-1.

### Regional Treatment Plant Bypasses

The Regional Trunk Sewer System and Regional Treatment Plants have the ability to bypass flows from upstream plants to downstream sewers. RP-4 and CCWRF are configured to bypass flows to RP-1 and RP-5, respectively, and primary effluent flows from RP-1 can be diverted to RP-5, if needed. Additionally, influent flows to RP-5 and CCWRF can be bypassed to the Inland Empire Brine Line (IEBL) under emergency conditions.

## 2.2 Non-Reclaimable Wastewater System

The NRW System was started in 1964 and was installed to encourage industry to locate within the IEUA's service area. The primary function of the NRW System is to export high-salinity wastewater out of IEUA's service area. The NRW System is a key element in the IEUA's salinity management program. Exporting the high-salinity wastewater improves recycled water quality and helps reduce the impacts of these waters on the groundwater basin.

The NRW System is divided into two zones—a northern collection system that conveys wastewater to the Sanitation Districts for treatment and ocean disposal, and a southern collection system that conveys wastewater to OCSD for treatment and ocean disposal, via the IEBL. A map of the NRW System is shown in Figure 1-2. As shown, the NRW System collects wastewater from several industries within IEUA's service area. The IEUA discharges the centrate produced in the RP-1 dewatering process, which has a high concentration of ammonia, to the NRW System. Additionally, domestic wastewater can be bypassed to the NRW System, if needed.

# 3.0 Wastewater Treatment

The IEUA owns and operates five treatment plants within its service area—RP-1, RP-2, RP-4, RP-5, and CCWRF. Liquid wastewater streams are treated at RP-1, RP-4, RP-5, and CCWRF, and solids produced at the treatment facilities are processed at RP-1 and RP-2.

## 3.1 Regional Water Recycling Plant No. 1

RP-1 was originally constructed in 1948, and has undergone many expansions and improvements over the years to serve the needs of the cities of Ontario, Rancho Cucamonga, Upland, Fontana, Montclair, and Chino. The treatment plant includes preliminary, primary, secondary, and tertiary liquid treatment facilities and primary and secondary solids treatment facilities. The liquid facilities are rated to treat an annual average flow of 44 mgd and produce an effluent quality meeting Title 22 standards for spray irrigation, nonrestricted recreational and landscape impoundments, and groundwater recharge. The solids handling facilities are operated to achieve Class B biosolids, which are trucked to IERCF for further treatment and composting. A schematic of the RP-1 facility is shown in Figure 1-3.

### 3.1.1 Liquid Treatment Facilities

The liquid treatment facilities at RP-1 consist of preliminary, primary, secondary, and tertiary treatment. These facilities are designed to treat an annual average flow of 44 mgd.

#### Preliminary Treatment

The preliminary treatment process at RP-1 consists of flow measurement using two Parshall flumes, screening consisting of four mechanical and two manual bar screens, and grit removal consisting of an aerated grit chamber and a vortex-type grit basin. Foul air from the preliminary and primary treatment facilities is sent to a chemical scrubber or biofilter for treatment and discharge. Design criteria for the RP-1 preliminary treatment facilities are summarized in Table 1-6.

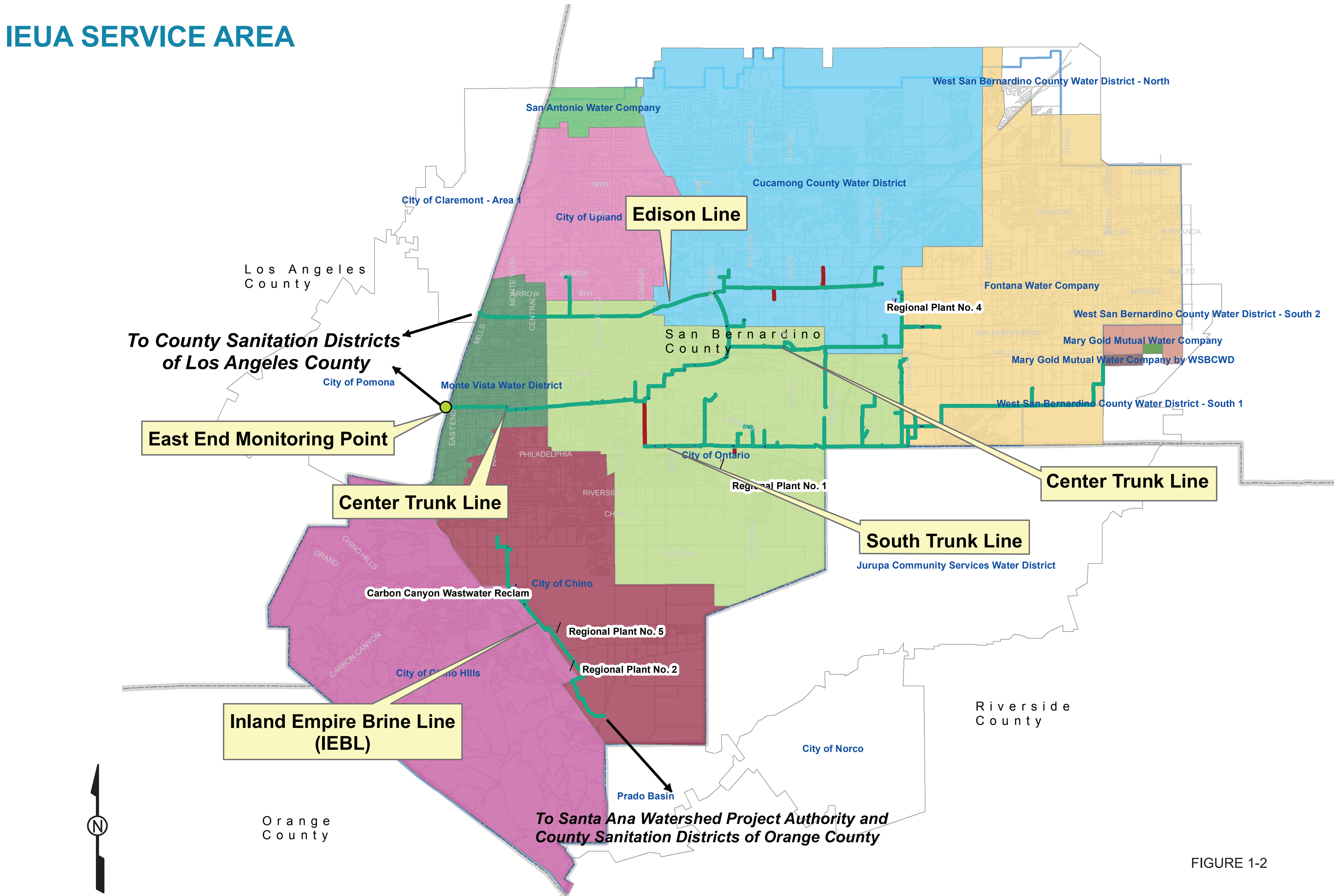


FIGURE 1-2

## NON-RECLAIMABLE WASTEWATER SYSTEM

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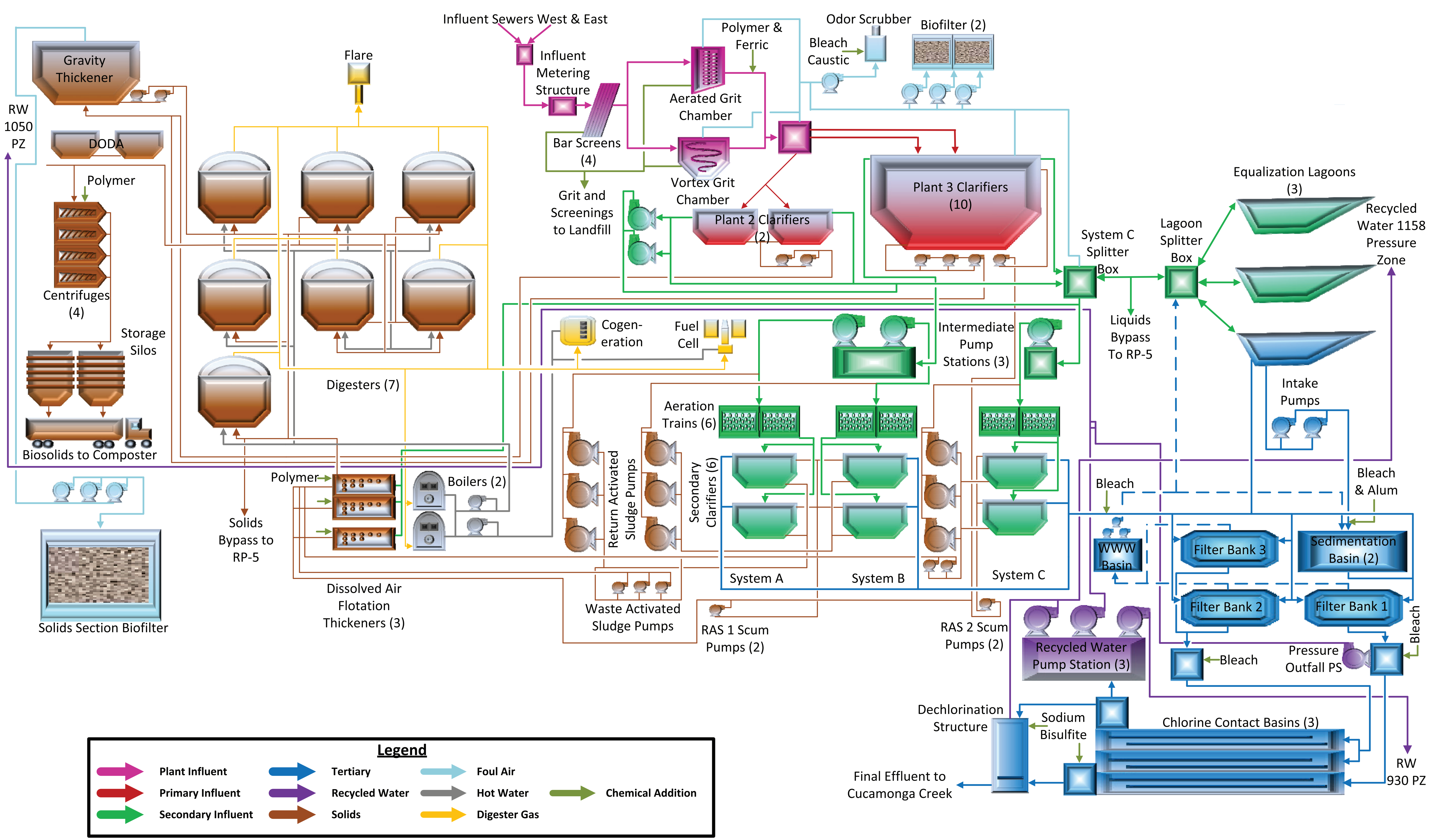


FIGURE 1-3

**REGIONAL WATER RECYCLING PLANT NO. 1**
**PROCESS FLOW SCHEMATIC**

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*WASTEWATER FACILITIES MASTER PLAN*

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TABLE 1-6
**Regional Plant No. 1 Preliminary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Parshall Flumes** | | |
| Number | - | 2 |
| Throat Size | inches | 60 |
| **Mechanical Bar Screens** | | |
| Number | - | 4 |
| Channel Width | feet | 6 |
| Channel Depth | feet | 8 |
| Effective Area | % | 40 |
| **Manual Bar Screens** | | |
| Number | | 2 |
| Channel Width | feet | 6 |
| Channel Depth | feet | 8 |
| **Grit Removal** | | |
| Type | - | Vortex |
| Number | - | 1 |
| Diameter | feet | 20 |
| Type | - | Aerated |
| Number | - | 1 |
| Dimensions, L x W | feet x feet | 20 x 16 |
| **Odor Control** | | |
| Chemical Scrubber | | |
| Number | - | 1 |
| Capacity | scfm | 8,000 |
| Biofilter | | |
| Number | - | 2 |
| Capacity | scfm | 28,750 |

scfm = standard cubic feet per minute
Source: DDB Engineering, Inc., 2010a; IEUA, 2014

## Primary Treatment

Primary treatment at RP-1 consists of 10 rectangular primary clarifiers and 2 circular primary clarifiers. Ferric chloride and polymer are added upstream of the primary clarifiers to improve settling performance and reduce hydrogen sulfide and odors in digester gas in the solids handling facilities. Additionally, primary effluent flow can be equalized using two equalization basins to provide consistent flow to downstream processes. Design criteria for the RP-1 primary treatment facilities are summarized in Table 1-7.

TABLE 1-7
**Regional Plant No. 1 Primary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Rectangular Primary Clarifiers** | | |
| Number | - | 10 |
| Dimensions, L x W x D[a] | feet x feet x feet | 175 x 20 x 11 |
| Total Surface Area | $ft^2$ | 35,000 |
| **Circular Primary Clarifiers** | | |
| Number | - | 2 |
| Diameter | feet | 100 |
| Side Water Depth | feet | 9 |
| Total Surface Area | $ft^2$ | 15,700 |
| **Primary Sludge Pumps** | | |
| Plant 2 | | |
| Number | - | 2 |
| Plant 3 | | |
| Number | - | 4 |
| **Ferric Chloride Storage and Feed Facilities** | | |
| Storage Tanks | | |
| Number | - | 1 |
| Total Storage Volume | gallons | 13,000 |
| Feed Pumps | | |
| Number | - | 2 |
| Dosage | mg/L | 13 |
| **Polymer Storage and Feed Facilities** | | |
| Storage Tanks | | |
| Number | - | 2 |
| Total Storage Volume | gallons | 550 |
| Feed Pumps | | |
| Number | - | 1 |
| Dosage | mg/L | 0.1 |
| **Flow Equalization** | | |
| Number of basins | - | 2 |
| Volume per basin | MG | 1@5.82, 1@6.18 |
| Total Volume | MG | 12 |

[a] Side water depth
$ft^2$ = square feet
mg/L = milligrams per liter
MG = million gallons
Source: DDB Engineering, Inc., 2010a; and IEUA, 2014

## Secondary Treatment

The secondary treatment facilities consist of three parallel, suspended-growth treatment systems (A, B, and C). Each system has two aeration basins and two circular secondary clarifiers. Systems A and B are identical, but System C has two slightly larger secondary clarifiers. The aeration basins are equipped with fine-bubble diffused-aeration panels that are supplied by four centrifugal blowers. The function of the secondary treatment process is to achieve nitrification and denitrification to meet IEUA discharge limits for ammonia and total inorganic nitrogen (TIN). Design criteria for the secondary treatment process are summarized in Table 1-8.

TABLE 1-8
**Regional Plant No. 1 Secondary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Aeration Basins A, B, C** | | |
| Anoxic Zone | - | |
| Number | - | 6 |
| Dimensions, L x W x D[a] | feet x feet x feet | 120 x 60 x 17.8 |
| Total Volume | MG | 1.92 |
| Aerobic Zone | - | |
| Number | - | 6 |
| Dimensions, L x W x D[a] | feet x feet x feet | 120 x 60 x 17.8 |
| Total Volume | MG | 1.92 |
| Aeration Diffusers | - | Fine-Bubble Panels |
| Hydraulic Retention Time | Hours | 6.5 |
| Solids Retention Time | Days | 18 |
| **Secondary Clarifiers A and B** | | |
| Number | - | 4 |
| Diameter | feet | 120 |
| Side Water Depth | feet | 14 |
| Total Surface Area | $ft^2$ | 45,200 |
| **Secondary Clarifier C** | | |
| Number | - | 2 |
| Diameter | feet | 130 |
| Side Water Depth | feet | 14 |
| Total Surface Area | $ft^2$ | 26,550 |
| **Return Activated Sludge (RAS) Pumps** | | |
| Type | - | Horizontal non-clog |
| Number | - | 9 |
| Capacity, each | gpm | 5,600 |
| **Waste Activated Sludge (WAS) Pumps** | | |
| Type | - | Horizontal non-clog |
| Number | - | 3 |
| Capacity, each | gpm | 450 |
| Type | - | Horizontal non-clog |
| Number | - | 2 |
| Capacity, each | gpm | 600 |

TABLE 1-8
**Regional Plant No. 1 Secondary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Aeration Blowers** | | |
| Type | - | Centrifugal |
| Number | - | 4 |
| Capacity, each | scfm | 13,400 |

[a] Side water depth
Source: DDB Engineering, Inc., 2010a; IEUA, 2014.

## Tertiary Treatment

The tertiary treatment process at RP-1 consists of filtration, coagulation, and flocculation/sedimentation of filter backwash, disinfection, and distribution of the tertiary effluent. Filtration is achieved using 26 dual-media gravity filters, and alum is added in-line upstream of the filters to enhance filtration. Additionally, polymer can be added to the filter influent when needed to achieve the plant's discharge limits. Typically, waste filter backwash is sent to the flocculation/clarification system prior to being recycled via the tertiary process. The flocculation/clarification system can also be used to treat a portion of the filter influent flow if the plant is experiencing high turbidity in the secondary effluent; however, this operation is rare. RP-1 typically operates without the use of the upstream flocculation/clarification system.

At RP-1, disinfection is achieved using sodium hypochlorite, which can be added to either or both the filter influent and the filter effluent. The filter effluent is fed to one of three chlorine contact tanks, where the effluent remains for the proper contact time. The disinfected recycled water can then be discharged directly to Cucamonga Creek or directed to the RP-1 Recycled Water Pump Station. RP-1 recycled water in excess of the recycled water demands supplied by the South Zone Recycled Water Pump Station is discharged to Prado Lake. Recycled water that is discharged to Cucamonga Creek or Prado Lake is dechlorinated using sodium bisulfite prior to discharge. Design criteria for the tertiary treatment process are summarized in Table 1-9.

TABLE 1-9
**Regional Plant No. 1 Tertiary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Tertiary Filters** | | |
| Type | - | Dual Media |
| Number | - | 26 |
| Surface Area (each cell) | $ft^2$ | 299 |
| Maximum Title 22 Loading Rate | $gpm/ft^2$ | 5 |
| **Flocculation/Sedimentation** | | |
| Flocculation Basins | | |
| Number | - | 2 |
| Total Volume | MG | 0.55 |
| Detention Time | minutes | 15-20 |
| Sedimentation Basins | | |
| Number | - | 2 |
| Dimensions, L x W x D[a] | feet x feet x feet | 120 x 39.3 x 12 |
| Total Surface Area | $ft^2$ | 9,430 |

TABLE 1-9
**Regional Plant No. 1 Tertiary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Tertiary Alum System** | | |
| Alum Storage | | |
| Total Storage Volume | gallons | 80,000 |
| Alum Pumps | | |
| Number | - | 4 |
| Capacity | gph | 60 |
| **Chlorine Contact Tanks No. 1 and No. 2** | | |
| Number of Basins | - | 2 |
| Dimensions, L x W x D (Each Pass) | feet x feet x feet | 310 x 8.3 x 13.5 |
| Number of Passes | - | 5 |
| Total Volume | MG | 2.6 |
| **Chlorine Contact Tank No. 3** | | |
| Number of Basins | - | 1 |
| Dimensions, L x W x D (Each Pass) | feet x feet x feet | 310 x 12.5 x 13 |
| Number of Passes | - | 3 |
| Total Volume | MG | 1.1 |
| **Sodium Hypochlorite Feed System** | | |
| Sodium Hypochlorite Storage | | |
| Number of Tanks | - | 3 |
| Storage Volume | gallons | 30,000 |
| Sodium Hypochlorite Pumps | | |
| Number | - | 4 |
| Capacity, each | gph | 100 |

[a] Side water depth
gph = gallons per hour
gpm/ft$^2$ = gallons per minute per square foot
Source: DDB Engineering, Inc., 2010a; IEUA, 2014

## Recycled Water Pump Station

The RP-1 Recycled Water Pump Station features three sets of pumps—Zone 1158 pumps (Zone 2B), Zone 1050 pumps (Philadelphia Line), and Zone 930 pumps (South Zone) Station. The Zone 1158 pumps discharge recycled water from RP-1 into the existing RP-4 outfall pipeline between RP-4 and RP-1, converting the outfall line to a pressurized pipeline. The Zone 1050 pumps convey recycled water to irrigation users and groundwater recharge, as well as to potential future users along Philadelphia Avenue. The Zone 930 Pump Station is interconnected to the CCWRF Recycled Water Pump Station and the RP-5 Recycled Water Pump Station; any water conveyed by these stations can be discharged to Prado Lake Dechlorination Station. Design criteria for the RP-1 Recycled Water Pump Station are summarized in Table 1-10.

TABLE 1-10
**Regional Plant No. 1 Recycled Water Pump Station System**

| Parameter | Units | Value |
|---|---|---|
| **South Zone (Zone 930) Pumps** | | |
| Type | - | Vertical Turbine |
| Number | - | 3 |
| Capacity, each | gpm | 2,790 |
| Type | - | Vertical Turbine |
| Number | - | 2 |
| Capacity, each | gpm | 9,330 |
| **Philadelphia (Zone 1050) Pumps** | | |
| Type | - | Vertical Turbine |
| Number | - | 3 |
| Capacity, each | gpm | 3,750 |
| **Zone 2B (Zone 1158) Pumps** | | |
| Type | - | Vertical Turbine |
| Number | - | 4 |
| Capacity, each | gpm | 2,700 |

Source: DDB Engineering, Inc., 2010a; IEUA, 2014

### 3.1.2 Solids Handling Facilities

Solids removed from RP-1 and RP-4 liquid streams are processed in the RP-1 solids handling facilities. RP-4 solids are discharged into sewers downstream of the RP-4 treatment facility and flow to RP-1. RP-4 solids are removed in the RP-1 primary and secondary treatment processes. The RP-1 solids handling facilities consist of thickening, stabilization, and dewatering processes. Two thickening processes are in operation at RP-1—gravity thickening for primary solids, and dissolved air flotation (DAF) thickening for secondary solids. Thickened biosolids from the primary and secondary processes are stabilized in a three-stage anaerobic digestion process, which consists of mesophilic-acid, thermophilic, and mesophilic digestion stages.

The digestion system has the flexibility to operate digesters under different conditions. Digesters No. 1 and No. 2 can be operated as mesophilic-acid digesters. Digesters No. 2 through No. 7 can be operated as either thermophilic or mesophilic digesters. The methane gas produced during the stabilization process is sent to the cogeneration facility where energy is recovered to offset power costs at RP-1. Digested biosolids are then dewatered using centrifuges. The centrate, which has high ammonia content, is discharged to the NRW System. Dewatered biosolids are loaded onto trucks and delivered to the IERCF for composting. Foul air from the solids handling facilities is diverted to a biofilter for treatment. Design criteria for the RP-1 solids handling facilities are summarized in Table 1-11.

TABLE 1-11
**Regional Plant No. 1 Solids Handling Facility System**

| Parameter | Units | Value |
|---|---|---|
| **Gravity Thickeners** | | |
| Number | - | 1 |
| Diameter | feet | 70 |
| Side Water Depth | feet | 14 |
| Total Surface Area | $ft^2$ | 3,850 |
| **Dissolved Air Floatation Thickeners** | | |
| Number | - | 3 |
| Dimensions, L x W (each) | feet x feet | 46.5 x 1 5 |
| Total Surface Area | $ft^2$ | 2,100 |
| **Digester No. 1** | | |
| Diameter | feet | 69 |
| Depth | feet | 30 |
| Volume | MG | 0.84 |
| **Digester No. 2** | | |
| Diameter | feet | 69 |
| Depth | feet | 30 |
| Volume | MG | 0.84 |
| **Digesters No. 3 and No. 4** | | |
| Diameter | feet | 65 |
| Depth | feet | 30 |
| Volume | MG | 0.84 |
| **Digester No. 5** | | |
| Diameter | feet | 80 |
| Depth | feet | 30 |
| Volume | MG | 1.25 |
| **Digesters No. 6 and No. 7** | | |
| Diameter | feet | 90 |
| Depth | feet | 30 |
| Volume | MG | 1.68 |
| **Centrifuges** | | |
| Number | - | 4 |
| Capacity | gpm | 340 |
| **Belt Filter Presses (to be demolished)** | | |
| Number | - | 4 |
| Nominal Belt Width | feet | 6.6 |
| Hours of Operation | hours/day | 12 |

TABLE 1-11
**Regional Plant No. 1 Solids Handling Facility System**

| Parameter | Units | Value |
|---|---|---|
| **Odor Control** | | |
| Biofilter | | |
| Number | - | 1 |
| Capacity | scfm | 18,300 |

Source: DDB Engineering, Inc., 2010a; IEUA, 2014

## 3.2 Regional Water Recycling Plant No. 2

RP-2 was constructed in the 1960s and was purchased from the city of Chino at the onset of the regional wastewater program. RP-2 has both liquid treatment and solids handling facilities. However, due to flooding events at RP-2 and the United States Army Corps of Engineers (USACE) decision to raise the elevation of the Prado Dam, the RP-2 liquid treatment capacity was relocated to RP-5. IEUA has decided to continue to use the RP-2 solids handling facilities until the end of their useful lives because they were constructed in 1990 and were above the 100-year floodplain at the time. Since that decision was made, USACE has nearly completed raising Prado Dam. When the Prado Dam elevation change is complete, the RP-2 solids handling facilities will be at risk of being inundated by a flood because they will be below the new 100-year flood elevation. For that reason, this WFMP will evaluate the decision of when to relocate the RP-2 solids handling facilities. A schematic of the RP-2 facility is shown in Figure 1-4.

### 3.2.1 Liquid Treatment Facilities

Liquid treatment at RP-2 has been suspended, and all wastewater tributary to RP-2 is diverted to RP-5 for treatment. Wastewater that originates downstream of RP-5 flows to the RP-2 Lift Station and is pumped to RP-5.

### 3.2.2 Solids Handling Facilities

Solids removed from the RP-5 and CCWRF liquid streams are processed in the RP-2 solids handling facilities. RP-5 and CCWRF primary and secondary solids are individually conveyed to RP-2 for treatment. The RP-2 solids handling facilities consist of thickening, stabilization, and dewatering processes. There are two thickening processes in operation at RP-2—gravity thickening for primary solids, and DAF thickening for secondary solids. Thickened biosolids from the primary and secondary processes are stabilized in a two-stage anaerobic digestion process, which consists of mesophilic-acid and mesophilic digestion stages. Methane gas that is produced during the stabilization process is sent to the cogeneration facility where energy is recovered to offset power costs at RP-5 and the Chino I Desalter Facility. Digested biosolids are then dewatered using belt filter presses or centrifuges. Currently, the belt filter presses are in operation with the centrifuges on standby. Dewatered biosolids are loaded onto trucks and delivered to the IERCF for composting. Design criteria for the RP-1 solids handling facilities are summarized in Table 1-12.

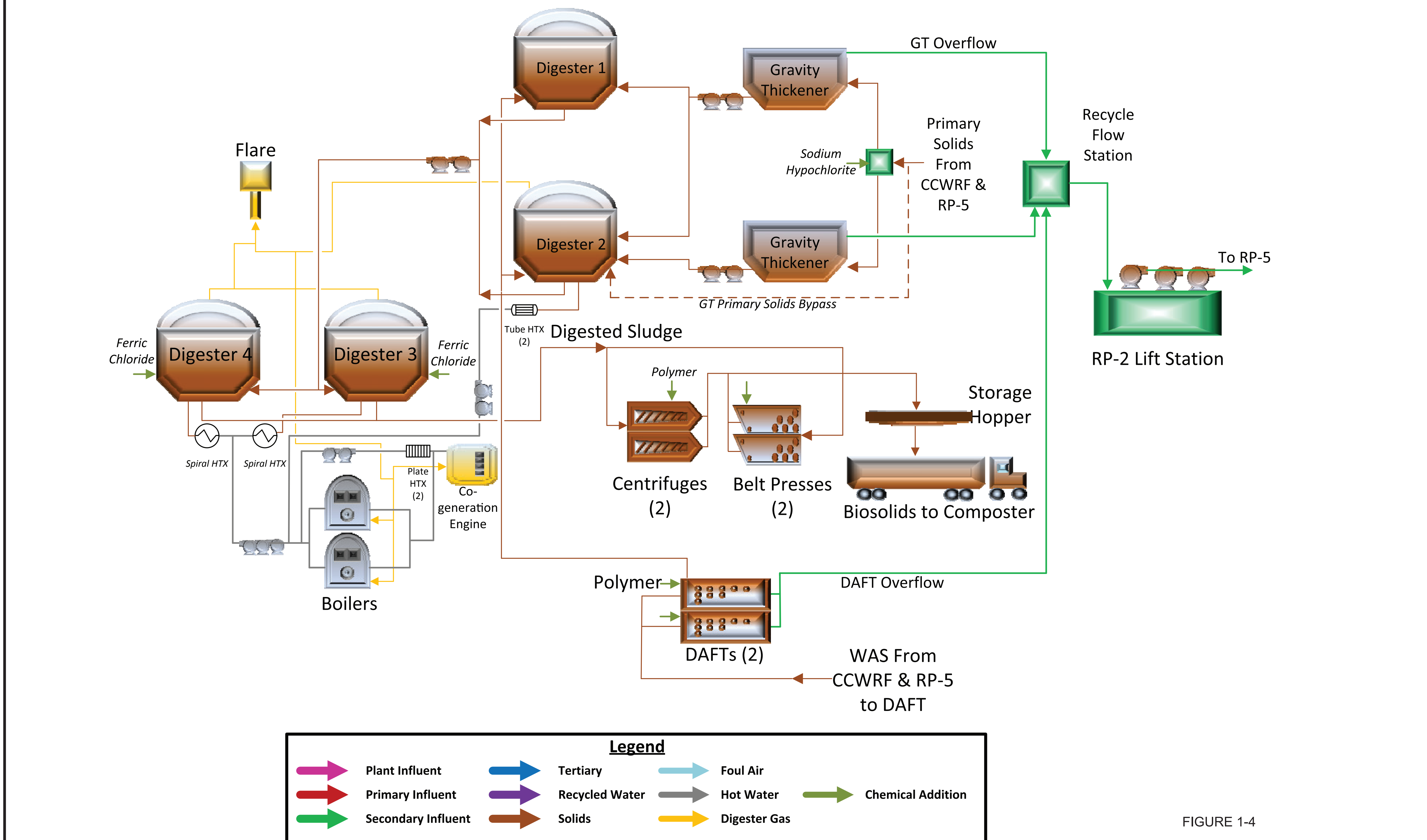


FIGURE 1-4

**REGIONAL WATER RECYCLING PLANT NO. 2**
**PROCESS FLOW SCHEMATIC**

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TABLE 1-12
**Regional Plant No. 2 Solids Handling Facility System**

| Parameter | Units | Value |
|---|---|---|
| **Gravity Thickeners** | | |
| Number | - | 2 |
| Diameter | feet | 45 |
| Side Water Depth | feet | 10 |
| Total Surface Area | $ft^2$ | 3,180 |
| **Dissolved Air Floatation Thickeners** | | |
| Number | - | 2 |
| Diameter | feet | 30 |
| Total Surface Area | $ft^2$ | 1,410 |
| **Digester No. 2** | | |
| Diameter | feet | 52 |
| Depth | feet | 28 |
| Volume | MG | 0.44 |
| **Digester No. 3** | | |
| Diameter | feet | 90 |
| Depth | feet | 33 |
| Volume | MG | 1.6 |
| **Digester No. 4** | | |
| Diameter | feet | 90 |
| Depth | feet | 33 |
| Volume | MG | 1.6 |
| **Belt Filter Presses** | | |
| Number | - | 2 |
| Nominal Belt Width | feet | 6.6 |
| Capacity, each | gpm | 150 |
| **Centrifuge** | | |
| Number | - | 2 |
| Capacity | gpm | 200-325 |

Source: IEUA, 2014

## 3.3 Regional Water Recycling Plant No. 4

RP-4 has been in operation since 1997. The facility provides services for the cities of Rancho Cucamonga and Fontana and for unincorporated areas of San Bernardino County. RP-4 serves as an upstream satellite facility to RP-1 by scalping flow from the Etiwanda sewer that is tributary to RP-1. The treatment plant includes preliminary, primary, secondary, and tertiary liquid treatment facilities. The liquid facilities are rated to treat an annual average flow of 14 mgd and produce an effluent quality meeting Title 22 standards for spray irrigation, nonrestricted recreational and landscape impoundments, and groundwater recharge. Solids produced at RP-4 are returned to the collection system and conveyed to RP-1 for treatment. A schematic of the RP-4 facility is shown in Figure 1-5.

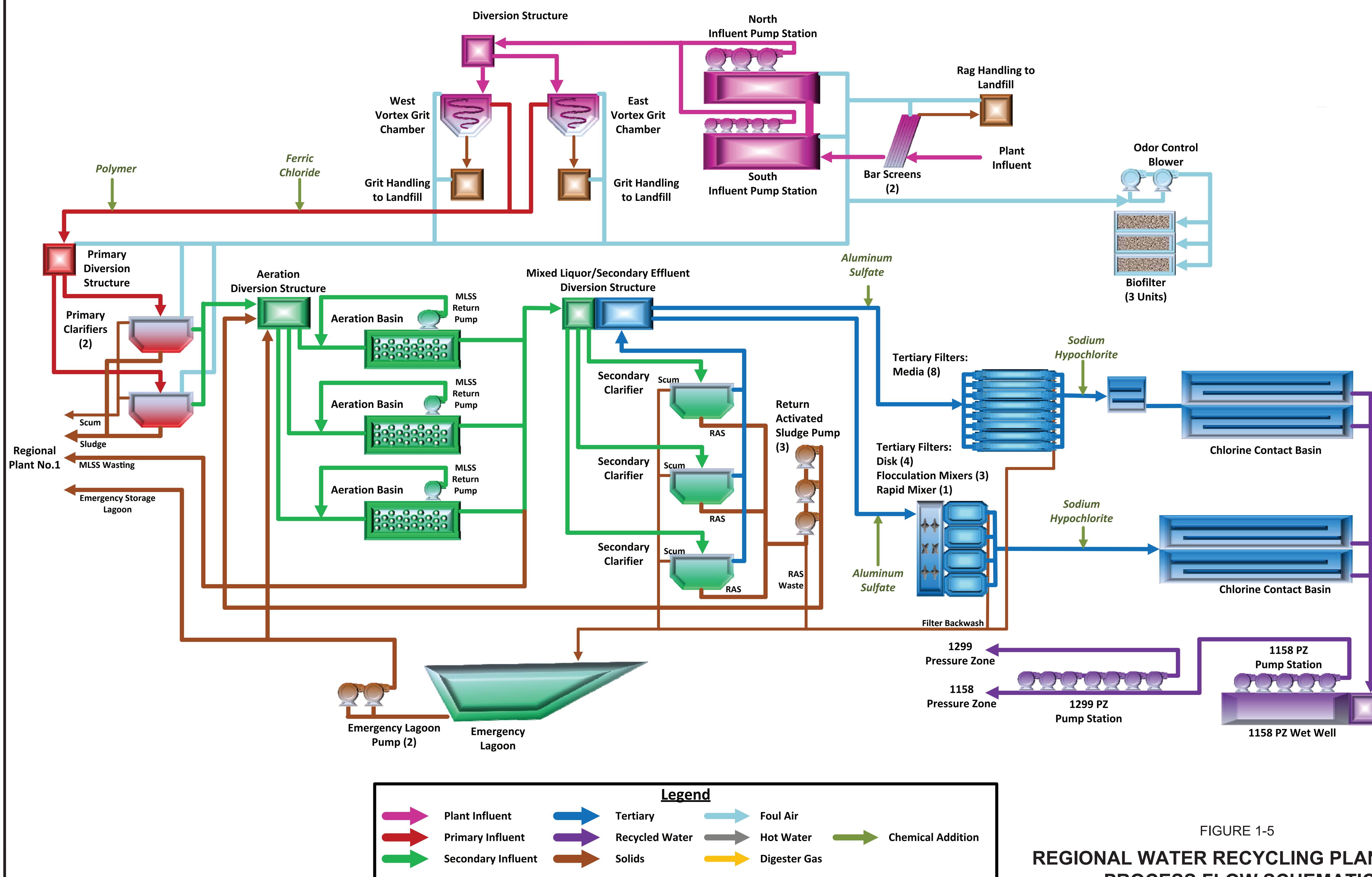


FIGURE 1-5

**REGIONAL WATER RECYCLING PLANT NO. 4**
**PROCESS FLOW SCHEMATIC**

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### 3.3.1 Liquid Treatment Facilities

The liquid treatment facilities at RP-4 consist of preliminary, primary, secondary, and tertiary treatment processes that are designed to treat an annual average flow of 14 mgd.

#### Preliminary Treatment

The preliminary treatment process at RP-4 includes screening consisting of two mechanical bar screens, influent pumping, flow measurement using a 42-inch-diameter magnetic flowmeter, and grit removal by two vortex-type grit chambers. Diversion manholes and the influent pump station control the raw wastewater flow entering RP-4. Flows exceeding the designated influent pumping rate are diverted to the Etiwanda Trunk Sewer and conveyed to RP-1. As flow enters RP-4, the wastewater passes through the screening process upstream of the influent pump station. The influent wastewater is pumped to the headworks splitter box passing through the 42-inch magnetic flowmeter. The headworks splitter box divides the influent flow between the two vortex grit basins. Foul air from the preliminary and primary treatment facilities is sent to a biofilter for treatment and discharge. Design criteria for the RP-4 preliminary treatment facilities are summarized in Table 1-13.

TABLE 1-13
**Regional Plant No. 4 Preliminary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Mechanical Bar Screens** | | |
| Number | - | 2 |
| Channel Width | feet | 6 |
| Channel Depth | feet | 18 |
| Bar Clear Opening | inches | 3/8 |
| **Influent Pump Station** | | |
| Type | - | Centrifugal |
| Number | - | 5 |
| Capacity, each | gpm | 3,275 |
| Type | - | Submersible |
| Number | - | 3 |
| Capacity, each | gpm | 6,000 |
| **Flow Measurement** | | |
| Type | - | Magnetic |
| Size | inches | 48 |
| **Grit Removal** | | |
| Type | - | Vortex |
| Number | - | 2 |
| Diameter | feet | 16 |
| **Odor Control** | | |
| Biofilter | | |
| Number | - | 3 |
| Total Capacity | scfm | 25,000 |

Source: DDB Engineering, Inc., 2009; IEUA, 2014

## Primary Treatment

Primary treatment at RP-4 consists of two circular primary clarifiers. Ferric chloride and polymer are added upstream of the primary clarifiers to improve settling performance and reduce odors in the solids handling facilities. Design criteria for the RP-4 primary treatment facilities are summarized in Table 1-14.

TABLE 1-14
**Regional Plant No. 4 Primary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Circular Primary Clarifiers** | | |
| Number | - | 2 |
| Diameter | feet | 105 |
| Side Water Depth | feet | 13 |
| Total Surface Area | $ft^2$ | 17,300 |
| **Ferric Chloride Storage and Feed Facilities** | | |
| Storage Tanks | | |
| Number | - | 1 |
| Total Storage Volume | gallons | 13,000 |
| Feed Pumps | | |
| Number | - | 2 |
| Dosage | mg/L | 13 |
| **Polymer Storage and Feed Facilities** | | |
| Storage Tanks | | |
| Number | - | 2 |
| Total Storage Volume | gallons | 550 |
| Feed Pumps | | |
| Number | - | 1 |
| Dosage | mg/L | 0.1 |

Source: DDB Engineering, Inc., 2009; IEUA, 2014

## Secondary Treatment

The secondary treatment process at RP-4 includes three parallel, multi-stage Bardenpho activated sludge treatment systems and three circular clarifiers. Three anoxic basins and three oxidation ditches were converted to the three multi-stage Bardenpho activated sludge treatment systems. Each system consists of an anoxic basin and an aeration basin. Each aeration basin is divided into two trains, and each train is further divided into four zones—an extended anoxic zone, oxic zone, anoxic zone, and oxic zone. The aerobic zones of the aeration basins are equipped with fine-bubble diffused air strips that are supplied by three centrifugal blowers. The secondary treatment process is operated to achieve nitrification and denitrification to meet the IEUA ammonia and TIN discharge limits. Design criteria for the secondary treatment process are summarized in Table 1-15.

TABLE 1-15
**Regional Plant No. 4 Secondary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Anoxic Basins** | **-** | |
| Number | - | 3 |
| Volume, each | MG | 0.16 |
| **Aeration Basins** | **-** | |
| Number of Basins | - | 3 |
| Number of Trains per Basin | - | 2 |
| Dimensions, each train, L x W x D | feet x feet x feet | 384 x 35 x 16 |
| Volume, each train | MG | 1.54 |
| Aeration Diffusers | - | Fine-Bubble Air Strips |
| **Mixed-Liquor Return Pumps** | | |
| Type | - | Propeller |
| Number | - | 6 |
| Capacity, each | gpm | 4,860 |
| **Secondary Clarifiers** | | |
| Number | - | 3 |
| Diameter | feet | 145 |
| Side Water Depth | feet | 18 |
| Total Surface Area | $ft^2$ | 49,500 |
| **RAS Pumps** | | |
| Type | - | Horizontal non-clog |
| Number | - | 3 |
| Capacity, each | gpm | 6,100 |
| **Aeration Blowers** | | |
| Number | - | 3 |
| Type | - | Centrifugal |
| Total Capacity | scfm | 24,000[a] |

[a] Total blower capacity. Each blower has a unique design capacity.
Source: DDB Engineering, Inc., 2009; IEUA, 2014

## Tertiary Treatment

The tertiary treatment process at RP-4 consists of coagulation/flocculation, filtration, and disinfection. Secondary effluent is split between two tertiary treatment trains of equal capacity. In the first train, the coagulation/flocculation and filtration processes are achieved using US Filter's Trident process. Alum is added upstream of an upflow "contra-clarifier," followed by dual media filtration. Then, the filter effluent is sent to two chlorine contact basins that are operated in series. In the second train, alum is added upstream of three flocculation basins that are operated in series and followed by cloth disc filtration. Then, the filter effluent is directed to a chlorine contact basin. The disinfected tertiary effluent from each train is combined and conveyed to the Recycled Water Pump Station. Filter backwash from each train is sent to the Emergency Lagoon where it can be pumped to the sewer and conveyed to RP-1 or to the splitter box ahead of the RP-4 anoxic basins. The Emergency Lagoon can also be used to store secondary effluent, filter effluent, or final effluent during short-term emergency conditions.

At RP-4, disinfection is achieved using sodium hypochlorite, which is added to the filter effluent of each tertiary train and then fed to one of three chlorine contact tanks where the effluent remains for the proper contact time. The disinfected recycled water is pumped to the distribution system for reuse. Any excess effluent from RP-4 is combined with the effluent from RP-1 and then dechlorinated at RP-1 before being discharged to Cucamonga Creek or Prado Lake. Dechlorination facilities consisting of sodium bisulfite storage and addition are installed at RP-4, but these facilities are rarely used. Design criteria for the tertiary treatment process are summarized in Table 1-16.

TABLE 1-16
**Regional Plant No. 4 Tertiary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Tertiary Treatment Train 1** | | |
| Coagulation/Flocculation | | |
| Type | - | Upflow “Contra-clarifier” |
| Number | - | 8 |
| Dimensions, L x W x D[a] | feet x feet x feet | 14 x 10 x 9.5 |
| Tertiary Filters | | |
| Type | - | Dual Media |
| Number | - | 8 |
| Surface Area (each cell) | $ft^2$ | 313 |
| Maximum Title 22 Loading Rate | $gpm/ft^2$ | 5 |
| Chlorine Contact Basin No. 1A | | |
| Number of Basins | - | 1 |
| Dimensions, L x W x D (Each Pass) | feet x feet x feet | 65.5 x 7.3 x 13 |
| Number of Passes | - | 5 |
| Total Volume | MG | 0.23 |
| Chlorine Contact Basin No. 1B | | |
| Number of Basins | - | 1 |
| Dimensions, L x W x D (Each Pass) | feet x feet x feet | 163 x 7.5 x 16 |
| Number of Passes | - | 6 |
| Total Volume | MG | 0.88 |
| **Tertiary Treatment Train 2** | | |
| Coagulation/Flocculation | | |
| Type | - | Vertical Impeller |
| Number | - | 3 |
| Dimensions, each, L x W x D | feet x feet x feet | 16.5 x 16.5 x 10.8-12.1 |
| Tertiary Filters | | |
| Type | - | Cloth |
| Number | - | 4 |
| Surface Area (each cell) | $ft^2$ | 645 |
| Maximum Title 22 Loading Rate | $gpm/ft^2$ | 6 |

TABLE 1-16
**Regional Plant No. 4 Tertiary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| Chlorine Contact Basin No. 2 | | |
| Number of Basins | - | 2 |
| Dimensions, L x W x D (Each Pass) | feet x feet x feet | 188 x 7.5 x 16 |
| Number of Passes, each basin | - | 3 |
| Total Volume | MG | 1.01 |
| **Tertiary Alum System** | | |
| Alum Storage | | |
| Number of Bulk Tanks | - | 1 |
| Storage Volume | gallons | 1,800 |
| Number of Day Tanks | - | 2 |
| Storage Volume, each | gallons | 400 |
| Total Storage Volume | gallons | 2,600 |
| Alum Pumps | | |
| Number | - | 2 |
| **Sodium Hypochlorite Feed System** | | |
| Sodium Hypochlorite Storage | | |
| Number of Tanks | - | 3 |
| Storage Volume | gallons | 6,750 |
| Sodium Hypochlorite Pumps | | |
| Number | - | 2 |
| Capacity, each | gph | 180 |
| Number | - | 2 |
| Capacity, each | gph | 124 |
| **Emergency Lagoon** | | |
| Number | - | 1 |
| Volume | MG | 4.0 |

[a] Side water depth
Source: DDB Engineering, Inc., 2009; IEUA, 2014

## Recycled Water Pump Station

The RP-4 Recycled Water Pump Station features two pump stations that can deliver water to recycled water users in Pressure Zones 1158 (RP-4 outfall) and 1299. Design criteria for the RP-4 Recycled Water Pump Station are summarized in Table 1-17.

TABLE 1-17
**Regional Plant No. 4 Recycled Water Pump Station System**

| Parameter | Units | Value |
|---|---|---|
| **1158 Pressure Zone Pumps** | | |
| Type | - | Vertical Turbine |
| Number | - | 2 |
| Capacity, each | gpm | 7,280 |
| Type | - | Vertical Turbine |
| Number | - | 3 |
| Capacity, each | gpm | 2,700 |
| **1299 Pressure Zone Pumps** | | |
| Type | - | Vertical Turbine |
| Number | - | 7 |
| Capacity, each | gpm | 4,600 |

Source: DDB Engineering, Inc., 2009; IEUA, 2014

### 3.3.2 Solids Handling Facilities

RP-4 does not have onsite solids treatment facilities. All primary solids, secondary WAS, and scum are returned to the trunk sewer for conveyance to RP-1 for removal, treatment, and disposal.

## 3.4 Regional Water Recycling Plant No. 5

RP-5 began operation in March 2004 to replace the liquid treatment process at RP-2. RP-5 treats domestic and commercial/industrial wastewater from the cities of Chino, Chino Hills, Ontario, Montclair, and Upland. In addition, RP-1 and CCWRF have the capability to divert influent peak flows to RP-5. The liquid treatment facilities include influent pumping, preliminary, primary, secondary, and tertiary treatment and are designed to treat an annual average flow of 15 mgd plus 1.3 mgd of return flows from the RP-2 Lift Station. Recycled water from RP-5 is discharged to IEUA's recycled water distribution system for landscape irrigation and other approved recycled water uses. Recycled water produced from RP-5 in excess of the demand is dechlorinated and discharged to Chino Creek. A schematic of the RP-5 facility is shown in Figure 1-6.

### 3.4.1 Liquid Treatment Facilities

The liquid treatment facilities at RP-5 provide preliminary, primary, secondary, and tertiary treatment. The facilities are designed to treat an annual average flow of 16.3 mgd.

#### Influent Pump Station

The RP-5 Influent Pump Station receives raw sewage from its service area and raw sewage or primary effluent that has been diverted from CCWRF and RP-1. The RP-2 Lift Station contributes another 1.3 mgd of influent flow that is combined with the Influent Pump Station discharge upstream of the bar screens. The discharge flow from each pump station is measured using magnetic flowmeters and summed to determine the RP-5 influent flow. Design criteria for the influent Pump Station are presented in Table 1-18.

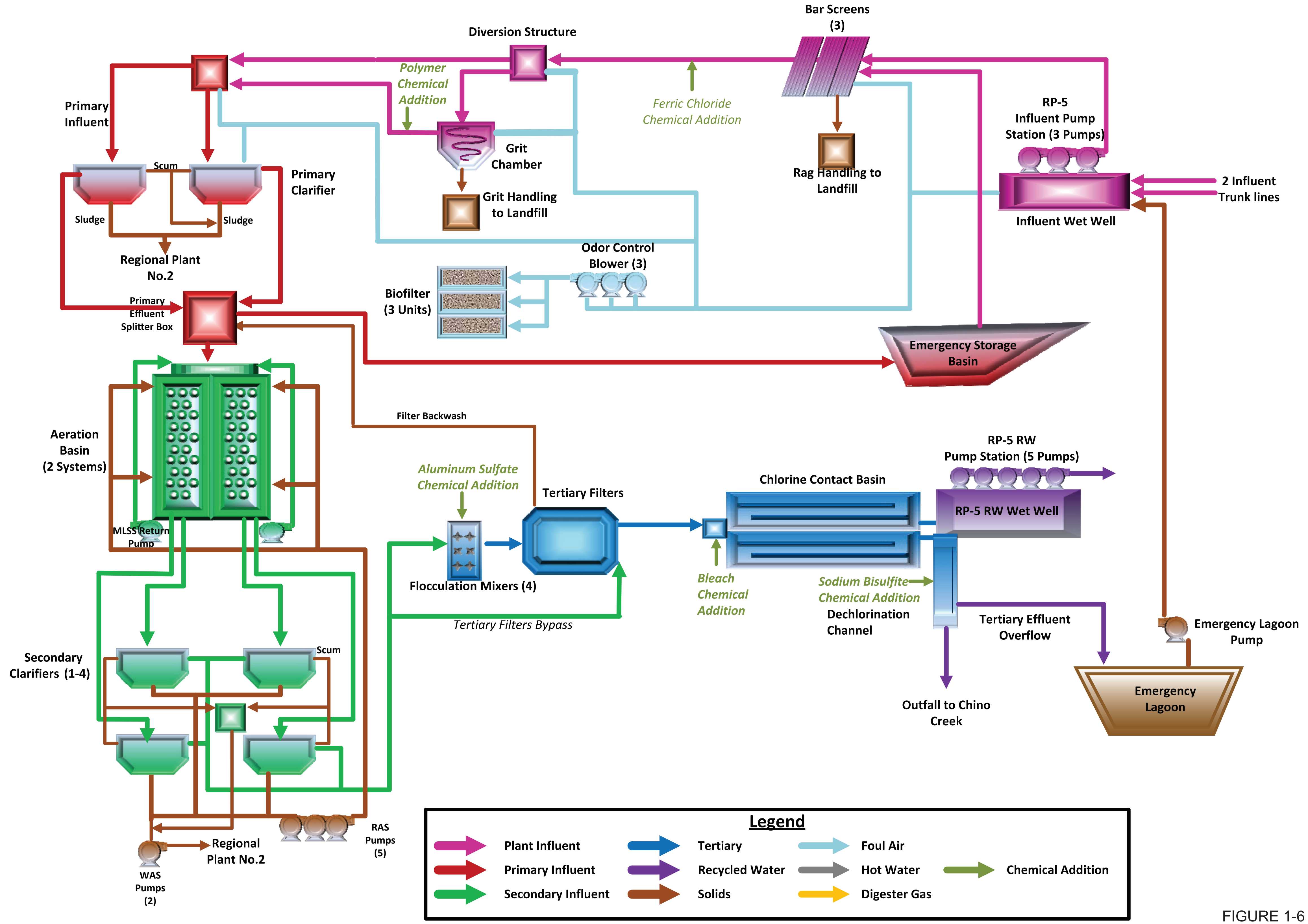


FIGURE 1-6

**REGIONAL WATER RECYCLING PLANT NO. 5**
**PROCESS FLOW SCHEMATIC**

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TABLE 1-18
**Regional Plant No. 5 Influent Pump Station System**

| Parameter | Units | Value |
|---|---|---|
| **Influent Pump Station** | | |
| Type | - | Wet-pit submersible, non-clog centrifugal |
| Number | - | 3 |
| Capacity, each | gpm | 8,333 |

Source: DDB Engineering, Inc., 2010b; IEUA, 2014

## Preliminary Treatment

The preliminary treatment process at RP-5 includes screening and grit removal. Raw wastewater flow entering RP-5 is pumped from the influent pump station and RP-2 Lift Station. Additionally, primary effluent can be returned to the headworks from the emergency storage basin. As flow enters RP-5, the wastewater passes through the screening process, which consists of one manual and two mechanical bar screens. The screened influent is then conveyed to one vortex grit basin. Foul air from the preliminary and primary treatment facilities is sent to a biofilter for treatment and discharge. Design criteria for the RP-5 preliminary treatment facilities are summarized in Table 1-19.

TABLE 1-19
**Regional Plant No. 5 Preliminary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Mechanical Bar Screens** | | |
| Type | | Climber |
| Number | - | 2 |
| Channel Width | feet | 6 |
| Channel Depth | feet | 6 |
| Bar Clear Opening | inches | 1/2 |
| **Manual Bar Screens** | | |
| Number | - | 1 |
| Channel Width | feet | 6 |
| Channel Depth | feet | 6 |
| Bar Clear Opening | inches | 2 |
| **Grit Removal** | | |
| Type | - | Vortex |
| Number | - | 1 |
| Diameter | feet | 18 |
| **Odor Control** | | |
| Biofilter | | |
| Number | - | 3 |
| Total Capacity | scfm | 39,600 |

Source: DDB Engineering, Inc., 2010b; IEUA, 2014

## Primary Treatment

Primary treatment facilities at RP-5 consist of two 100-foot-diameter, circular primary clarifiers and a primary effluent emergency storage basin. The clarifiers are center feed, peripheral draw-off with sludge hoppers and scum removal. The two clarifiers have a common sludge and scum pump station, which currently pumps solids to RP-2 for processing. The primary clarifiers are designed to allow advanced primary treatment by adding ferric chloride and polymer upstream and downstream of the grit chambers, respectively. Design criteria for the primary treatment process are summarized in Table 1-20.

TABLE 1-20
**Regional Plant No. 5 Primary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Circular Primary Clarifiers** | | |
| Number | - | 2 |
| Diameter | feet | 100 |
| Side Water Depth | feet | 12 |
| Total Surface Area | $ft^2$ | 15,700 |
| **Primary Sludge Pumps** | | |
| Type | - | Progressive Cavity |
| Number | - | 3 |
| Capacity, each | gpm | 230 |
| **Ferric Chloride Storage and Feed Facilities** | | |
| Storage Tanks | | |
| Number | - | 1 |
| Total Storage Volume | gallons | 9,600 |
| Feed Pumps | | |
| Number | - | 2 |
| Capacity | gph @ psi | 53 @ 150 |
| Dosage | mg/L | 5-8 |
| **Polymer Storage and Feed Facilities** | | |
| Storage Tanks | | |
| Number | - | 2 Totes |
| Total Storage Volume | gal | 550 |
| Feed Pumps | | |
| Number | - | 2 |
| Capacity | gph @ psi | 4 @ 100 |
| Dosage | mg/L | 0.15 |

gph @ psi = gallons per hour at pounds per square inch
Source: DDB Engineering, Inc., 2010b; IEUA, 2014

## Secondary Treatment

The secondary treatment process at RP-5 includes two parallel, two-stage, biological nutrient removal activated sludge treatment trains and four circular secondary clarifiers. The aerobic zones of the aeration basins are equipped with fine-bubble diffused aeration panels that are supplied by two centrifugal blowers. The secondary treatment process is operated to achieve nitrification and denitrification to meet IEUA ammonia and TIN discharge limits. Design criteria for the secondary treatment process are summarized in Table 1-21.

TABLE 1-21
**Regional Plant No. 5 Secondary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Aeration Basins** | - | |
| Number | - | 2 |
| Dimensions, each basin, L x W x D | feet x feet x feet | 343 x 123 x 19 |
| Volume, each | MG | 5.16 |
| Anoxic Volume | % | 17-58 |
| Solids Retention Time (SRT) | Days | 30 |
| **Mixed-Liquor Return Pumps** | | |
| Type | - | Propeller |
| Number | - | 2 |
| Capacity, each | gpm | 6,300 |
| **Secondary Clarifiers** | | |
| Number | - | 4 |
| Diameter | feet | 130 |
| Side Water Depth | feet | 17 |
| Total Surface Area | $ft^2$ | 53,000 |
| **RAS Pumps** | | |
| Type | - | Screw Centrifugal |
| Number | - | 5 |
| Capacity, each | gpm | 2,500 |
| **WAS Pumps** | | |
| Type | - | Positive Displacement |
| Number | - | 2 |
| Capacity, each | gpm | 100 |
| **Aeration Blowers** | | |
| Type | - | Centrifugal |
| Number | - | 2 |
| Capacity | scfm | 5,600 |

Source: DDB Engineering, Inc., 2010b; IEUA, 2014

## Tertiary Treatment

The tertiary treatment process at RP-5 consists of coagulation/flocculation, filtration, and disinfection. Secondary effluent is fed to a rapid-mix basin where alum is added upstream of four flocculation basins that are operated in series and followed by 12 upflow, continuous backwash filters. The filter effluent is then directed to a chlorine contact basin. The disinfected tertiary effluent from each train is then conveyed to the Recycled Water Pump Station. Filter backwash is sent to the Filter Recycle Pump Station and pumped to the aeration basins.

At RP-5, disinfection is achieved using sodium hypochlorite, which is added to the filter effluent fed to one of two chlorine contact tanks, where the effluent remains for the proper contact time. The disinfected recycled water is pumped to the distribution system for reuse, or is dechlorinated and discharged to Chino Creek. Design criteria for the tertiary treatment process are summarized in Table 1-22.

TABLE 1-22
**Regional Plant No. 5 Tertiary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Coagulation/Flocculation** | | |
| Rapid Mixer | | |
| Type | | Vertical Impeller |
| Number | | 1 |
| Dimensions, each, L x W x D | feet x feet x feet | 6 x 6 x 19.5 |
| Velocity Gradient | 1/second | 300 |
| Flocculators | | |
| Type | - | Vertical Impeller |
| Number | - | 4 |
| Dimensions, each, L x W x D | feet x feet x feet | 21.3 x 14.1 x 15 |
| Tertiary Filters | | |
| Type | - | Upflow, Continuous Backwash |
| Number | - | 12 |
| Surface Area (each cell) | $ft^2$ | 300 |
| Maximum Title 22 Loading Rate | $gpm/ft^2$ | 5 |
| Chlorine Contact Basins | | |
| Number of Basins | - | 2 |
| Dimensions, L x W x D (Each Pass) | feet x feet x feet | 125 x 12.5 x 1 5.5 |
| Number of Passes, each basin | - | 5 |
| Total Volume | MG | 1.8 |
| **Tertiary Alum System** | | |
| Alum Storage | | |
| Number of Tanks | - | 1 |
| Storage Volume | gallons | 560 |
| Alum Pumps | | |
| Number | - | 2 |
| Capacity, each | gph | 14 |
| **Sodium Hypochlorite Feed System** | | |
| Sodium Hypochlorite Storage | | |
| Number of Tanks | - | 4 |
| Total Storage Volume | gallons | 10,500 |
| Sodium Hypochlorite Pumps | | |
| Number | - | 4 |
| Capacity, each | gph | 77 |

TABLE 1-22
**Regional Plant No. 5 Tertiary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Dechlorination System** | | |
| Sodium Bisulfite Storage | | |
| Number of Tanks | - | 2 |
| Total Storage Volume | gallons | 10,400 |
| Sodium Bisulfite Pumps | | |
| Number | - | 2 |
| Capacity, each | gph @ psi | 53 @ 150 |

Source: DDB Engineering, Inc., 2010b; IEUA, 2014

### Recycled Water Pump Station

The RP-5 Recycled Water Pump Station features five pumps that can deliver water to recycled water users in Pressure Zone 800. The pump station has three constant-speed and two variable-speed pumps. The pump station is connected to Pressure Zone 930; any recycled water in excess of the recycled water demand can be discharged to the Prado Lake Dechlorination Station. Design criteria for the RP-5 Recycled Water Pump Station are summarized in Table 1-23.

TABLE 1-23
**Regional Plant No. 5 Recycled Water Pump Station System**

| Parameter | Units | Value |
|---|---|---|
| **800 Pump Station** | | |
| Type | - | Vertical Turbine, Constant Speed |
| Number | - | 3 |
| Capacity, each | gpm | 1,925 |
| Type | - | Vertical Turbine, Variable Speed |
| Number | - | 2 |
| Capacity, each | gpm | 1,925 |

Source: DDB Engineering, Inc., 2010b; IEUA, 2014

## 3.4.2 Solids Handling Facilities

Solids removed in the primary and secondary treatment processes at RP-5 are piped to the regional solids handling facility at RP-2 for solids treatment.

## 3.5 Carbon Canyon Water Recycling Facility

CCWRF began operation in 1992. The facility treats domestic and commercial/industrial wastewater from the cities of Chino, Chino Hills, Ontario, Montclair, and Upland. The liquid treatment facilities include influent pumping, preliminary, primary, secondary, and tertiary treatment and are designed to treat an annual average flow of 11.4 mgd. Recycled water from CCWRF is discharged to IEUA's recycled water distribution system for landscape irrigation and other approved recycled water uses. Recycled water produced from CCWRF in excess of the demand is dechlorinated and discharged to Chino Creek. A schematic of the CCWRF facility is shown in Figure 1-7.

### 3.5.1 Liquid Treatment Facilities

The liquid treatment facilities at CCWRF provide preliminary, primary, secondary, and tertiary treatment. The facilities are designed to treat an annual average flow of 11.4 mgd.

#### Preliminary Treatment

The preliminary treatment process at CCWRF includes influent diversion, flow measurement, screening, and grit removal. Raw wastewater flow enters the plant through the influent diversion structure where a portion of the flow can be diverted to RP-5 and/or the IEBL. From the influent diversion structure, the flow enters the headworks where it is split between two mechanical bar screens. A manual bar screen is also available to provide standby capacity for the mechanical units. Following screening, flow is directed to a vortex grit chamber. After grit removal, the flow is metered by a Parshall flume. Foul air from the preliminary and primary treatment facilities is sent to a chemical scrubber for treatment and discharge. Design criteria for the CCWRF preliminary treatment facilities are summarized in Table 1-24.

TABLE 1-24
**CCWRF Preliminary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Mechanical Bar Screens** | | |
| Number | - | 2 |
| Channel Width | feet | 4 |
| Channel Depth | feet | 13.7 |
| Bar Clear Opening | inches | 1/2 |
| **Manual Bar Screens** | | |
| Number | - | 1 |
| Channel Width | feet | 4 |
| Channel Depth | feet | 5.2 |
| Bar Clear Opening | inches | 1 |
| **Grit Removal** | | |
| Type | - | Vortex |
| Number | - | 1 |
| Diameter | feet | 16 |
| **Parshall Flumes** | | |
| Number | - | 1 |
| Throat Size | inches | 48 |
| **Odor Control** | | |
| Chemical Scrubber | | |
| Number | - | 3 |
| Total Capacity | scfm | 15,300 |

Source: DDB Engineering, Inc., 2014; IEUA, 2014

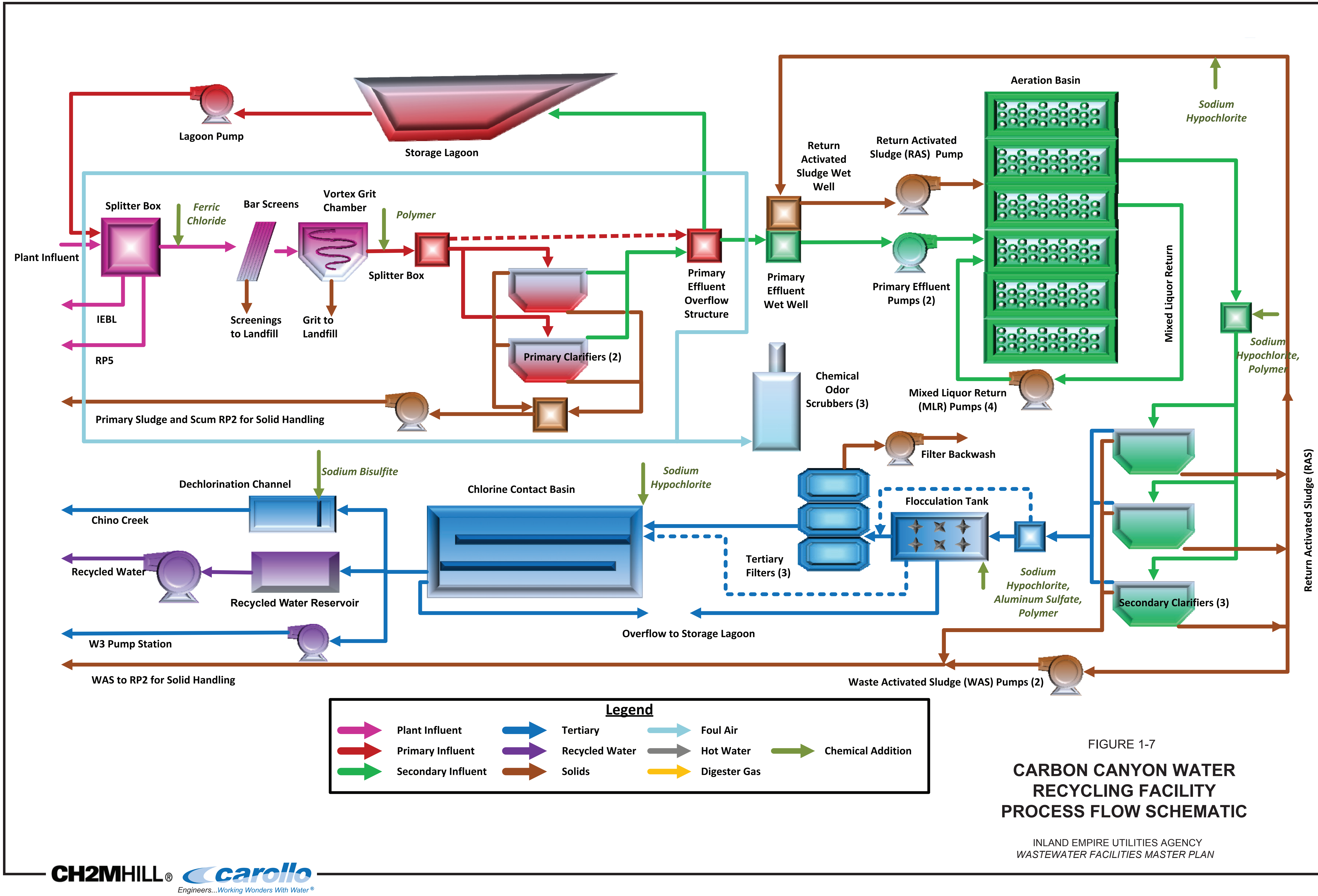


FIGURE 1-7

**CARBON CANYON WATER RECYCLING FACILITY PROCESS FLOW SCHEMATIC**

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## Primary Treatment

Primary treatment facilities at CCWRF consist of two 95-foot-diameter, circular primary clarifiers. Ferric chloride is added upstream of the headworks at the influent diversion structure to enhance settling performance in the primary treatment. Polymer can also be added, but it is typically not used. The two clarifiers have a common sludge and scum pump station, which currently pumps solids to RP-2 for processing. Additionally, primary effluent can be diverted to an emergency storage pond. Stored flow can then be pumped to the primary clarifier splitter box for treatment. Design criteria for the primary treatment process are summarized in Table 1-25.

TABLE 1-25
**CCWRF Primary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Circular Primary Clarifiers** | | |
| Number | - | 2 |
| Diameter | feet | 95 |
| Side Water Depth | feet | 12 |
| Total Surface Area | $ft^2$ | 14,200 |
| **Primary Sludge Pumps** | | |
| Number | - | 2 |
| Capacity, each | gpm | 220 |
| **Ferric Chloride Storage and Feed Facilities** | | |
| Storage Tanks | | |
| Number | - | 1 |
| Total Storage Volume | gallons | 7,000 |
| Feed Pumps | | |
| Number | - | 2 |
| Dosage | mg/L | 15 |
| **Emergency Storage** | | |
| Number of basins | - | 1 |
| Total Volume | MG | 9 |

Source: DDB Engineering, Inc., 2014; IEUA, 2014

## Secondary Treatment

The secondary treatment process at CCWRF includes six parallel, two-stage biological nutrient removal activated sludge treatment trains and three circular secondary clarifiers. The aerobic zones of the aeration basins are equipped with fine-bubble tube diffusers that are supplied by three centrifugal blowers. The secondary treatment process is operated to achieve nitrification and denitrification to meet IEUA's ammonia and TIN discharge limits. Design criteria for the secondary treatment process are summarized in Table 1-26.

TABLE 1-26
**CCWRF Secondary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Aeration Basin No. 1** | **-** | |
| Number | - | 1 |
| Dimensions, each basin, L x W x D | feet x feet x feet | 190 x 50 x 21 |
| Volume, each | MG | 1.5 |
| Anoxic Volume | % | 29 |
| **Aeration Basins No. 2 – No. 6** | **-** | |
| Number | - | 5 |
| Dimensions, each basin, L x W x D | feet x feet x feet | 190 x 50 x 21 |
| Volume, each | MG | 1.5 |
| Anoxic Volume | % | 40 |
| **Mixed Liquor Return Pumps** | | |
| Type | - | Propeller |
| Number | - | 4 |
| Capacity, each | gpm | 7,425 |
| **Secondary Clarifiers** | | |
| Number | - | 3 |
| Diameter | feet | 120 |
| Side Water Depth | feet | 15 |
| Total Surface Area | $ft^2$ | 34,000 |
| **RAS Pumps** | | |
| Type | - | Vertical Turbine, Solids Handling |
| Number | - | 1 |
| Capacity, each | gpm | 12,200 |
| **WAS Pumps** | | |
| Type | - | Horizontal Centrifugal |
| Number | - | 2 |
| Capacity, each | gpm | 350 |
| **Aeration Blowers** | | |
| Number | - | 3 |
| Type | - | Centrifugal |
| Capacity, each | scfm | 6,000 |
| Number | - | 1 |
| Type | - | Centrifugal |
| Capacity, each | scfm | 6,400 |

Source: DDB Engineering, Inc., 2014; IEUA, 2014

## Tertiary Treatment

The tertiary treatment process at CCWRF consists of coagulation/flocculation (not typically used), filtration, and disinfection. Secondary effluent is fed to a rapid-mix basin upstream of a baffled, serpentine flocculation basin. Typically, secondary effluent passes through the rapid-mix and flocculation basin without mixing, coagulation, or flocculation. Alum and polymer facilities are installed, but they are typically not used. After passing through the flocculation basin, the secondary effluent is fed to one of three continuous backwash, shallow bed, traveling bridge filters. The filter effluent is then directed to a chlorine contact basin and filter backwash is pumped to the aeration basins. The disinfected tertiary effluent is then conveyed to the Recycled Water Pump Station.

At CCWRF, disinfection is achieved using sodium hypochlorite, which is added to either the filter influent or effluent and fed to the contact tank, where the effluent remains for the proper contact time. The disinfected recycled water is sent to a recycled water storage reservoir prior to being pumped to the distribution system for reuse. Excess effluent is dechlorinated using sodium bisulfite and discharged to Chino Creek. Design criteria for the tertiary treatment process are summarized in Table 1-27.

TABLE 1-27
**CCWRF Tertiary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| **Coagulation/Flocculation** | | |
| Rapid Mixer | | |
| Type | | Vertical Impeller |
| Number | | 1 |
| Velocity Gradient | 1/second | 300 |
| Flocculation Basin | | |
| Type | - | Serpentine |
| Number | - | 1 |
| Dimensions, each, L x W x D[a] | feet x feet x feet | 49 x 18 x 7.6 |
| Tertiary Filters | | |
| Type | - | Shallow Bed, Continuous Backwash |
| Number | - | 3 |
| Surface Area, each | $ft^2$ | 1,600 |
| Maximum Title 22 Loading Rate | $gpm/ft^2$ | 4 |
| Chlorine Contact Basins | | |
| Number of Basins | - | 1 |
| Dimensions, L x W x D (Each Pass) | feet x feet x feet | 115 x 11.6 x 13.25 |
| Number of Passes, each basin | - | 8 |
| Total Volume | MG | 1.05 |
| **Sodium Hypochlorite Feed System** | | |
| Sodium Hypochlorite Storage | | |
| Number of Tanks | - | 2 |
| Total Storage Volume | gallons | 20,000 |

TABLE 1-27
**CCWRF Tertiary Treatment System**

| Parameter | Units | Value |
|---|---|---|
| Sodium Hypochlorite Pumps | | |
| Number | - | 4 |
| Capacity, each | gph | 77 |
| **Dechlorination System** | | |
| Sodium Bisulfite Storage | | |
| Number of Tanks | - | 2 |
| Total Storage Volume | gallons | 11,000 |
| Sodium Bisulfite Pumps | | |
| Number | - | 3 |
| Capacity, each | gph | 77 |

[a] Side water depth

Source: DDB Engineering, Inc., 2014; IEUA, 2014

### Recycled Water Storage Reservoir and Pump Station

The CCWRF Recycled Water Storage Reservoir and Pump Station can store 0.75 MG of recycled water before being pumped to the distribution system. The pump station has four pumps that can deliver water to recycled water users in Pressure Zone 930. The pump station is connected to the RP-1 Zone 930 Recycled Water Pump Station, and any recycled water in excess of the recycled water demand can be discharged to the Prado Lake Dechlorination Station. Design criteria for the CCWRF Recycled Water Pump Station are summarized in Table 1-28.

TABLE 1-28
**CCWRF Recycled Water Storage Reservoir and Pump Station System**

| Parameter | Units | Value |
|---|---|---|
| **930 Pump Station** | | |
| Type | - | Vertical Turbine |
| Number | - | 5 (2 variable + 3 constant speed) |
| Capacity, each | gpm | 2,585 |
| **Recycled Water Storage Reservoir** | | |
| Number | - | 1 |
| Usable Volume | MG | 0.75 |

Source: DDB Engineering, Inc., 2014; IEUA, 2014

## 3.5.2 Solids Handling Facilities

The CCWRF does not have onsite solids treatment facilities. Primary sludge, scum, and WAS are pumped from the CCWRF to RP-2 for treatment.

# 4.0 Biosolids Management Facilities

Biosolids produced at IEUA's RP-1 and RP-2 regional solids treatment facilities are trucked to the Inland Empire Regional Composting Authority (IERCA) composting facility. The IERCA was created in February 2002 by a joint powers agreement between IEUA and the Sanitation Districts to construct, operate, and maintain a regional composting facility. Both IEUA and the Sanitation Districts send biosolids to the facility for processing and reuse as a high-quality soil amendment. Additionally, IEUA owns and leases a food-waste processing facility located at the RP-5 complex that is used for the treatment of dairy and food waste.

## 4.1 RP-5 Solids Handling Facility

To help reduce the impacts of manure from dairy farms on local groundwater and produce energy, IEUA built a 5-MG plug flow digester at the RP-5 complex. This facility began accepting manure in 2001. In 2005, two aboveground stirred digesters were added to allow food-waste processing in addition to dairy waste. In 2009, IEUA shut down the food-waste processing unit and began looking for a third party operator. In 2010, IEUA signed a 10-year lease agreement with Environ Strategy Consultants, Inc. (ESCI). ESCI operates the food-waste processing facility and sells power to IEUA.

## 4.2 Composting Facility

The IERCA operates North America's largest indoor biosolids composting facility. The IERCF encompasses 24 acres, of which 445,275 square feet are dedicated to the compost process building. The IERCF receives and processes 200,000 wet tons per year, including approximately 150,000 tons of biosolids and 60,000 tons of amendment materials such as green waste, wood waste, and stable bedding. Biosolids are provided by the Sanitation Districts and IEUA. The IERCF produces approximately 240,000 cubic yards (90,000 tons) of high-quality compost each year. The compost is marketed under the name of SoilPro Premium Products and sold to landscapers, farmers, and gardeners around the region.

Figure 1-8 provides a process flow diagram for the IERCF, showing the operations and material flow from receiving to production of high-quality compost. The IERCF has two types of hoppers, Biosolids Hoppers and Amendment Hoppers, which receive and convey the biosolids and amendment materials to the pug mills via belt conveyors for mixing. After mixing in the pug mills, the material flows via belt conveyors to the Active Compost area and is piled using front-end loaders for approximately 21 days of active composting. Compost materials are then transferred via front-end loader to the curing area for approximately 30 days of curing. The cured materials are then transported to the screening belt conveyor using front-end loaders. After screening, the product flows via belt conveyors to the product load-out area where it is loaded onto trucks and hauled to customers.

The IERCF includes an indoor storage facility located on the east side of the compost building. The storage facility is approximately 145,000 square feet and 35 feet high, covered with a canopy on the top that is open on the sides for loader and truck access. The excess composted material (product) is transported to the storage facility, which is used as a buffer to keep the material receiving and composting process moving at the desired rates. Design criteria for the IERCF are shown in Table 1-29.

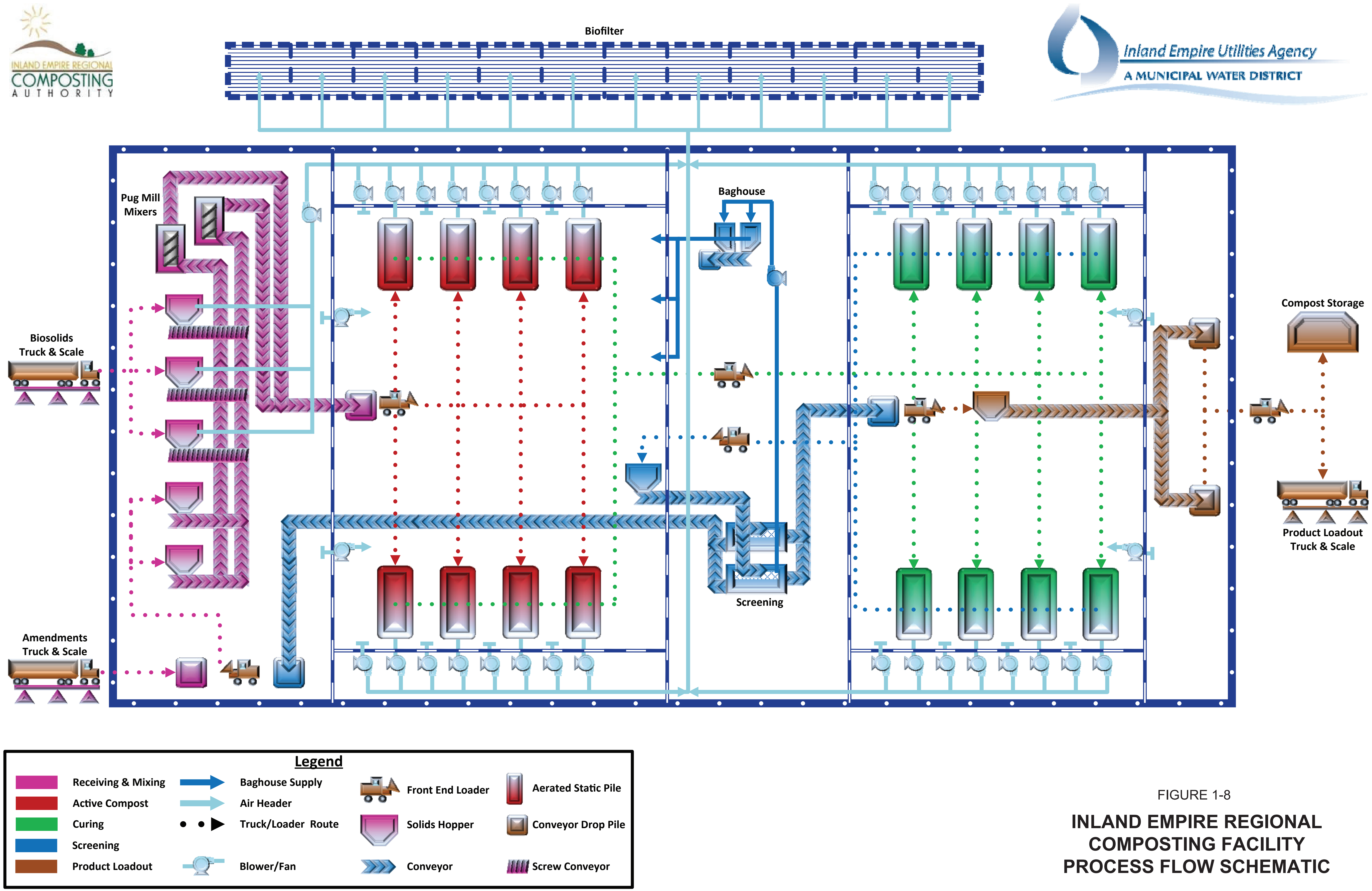


FIGURE 1-8

**INLAND EMPIRE REGIONAL COMPOSTING FACILITY PROCESS FLOW SCHEMATIC**

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TABLE 1-29
**IERCF System**

| Parameter | Units | Value |
|---|---|---|
| **Hoppers** | | |
| Biosolids | | |
| Number | - | 3 |
| Capacity | cubic yards | 55 |
| Amendment | | |
| Number | - | 2 |
| Capacity | cubic yards | 200 |
| **Pug Mill Mixers** | | |
| Number | - | 2 |
| Capacity | tons per hour (tph) | 225 |
| **Conveyors** | | |
| Receiving and Mixing | | |
| Capacity | tph | 225 |
| Screening | | |
| Capacity | tph | 110 - 190 |
| Product Loadout | | |
| Capacity | tph | 145 |
| **Active Composting** | | |
| Time | days | 21 |
| **Curing** | | |
| Time | days | 30 |
| **Foul Air** | | |
| Biofilter | | |
| Capacity | cubic feet per minute | 813,200 |
| **Screen** | | |
| Type | - | Trommel |
| Number | - | 2 |
| Opening | inches | 3/8 |
| Capacity | cubic yards per hour | 400 |

Source: IEUA, 2014

# 5.0 Recycled Water System

IEUA currently produces about 60,000 acre-feet (AF) of recycled water annually. In 2013, recycled water use totaled about 32,362 AF. The recycled water used is produced at all five of IEUA's wastewater treatment plants. Recycled water is distributed throughout the IEUA service area using six different pressure zones, which are interconnected to allow the transfer of recycled water from higher pressure zones to lower pressure zones. The individual pressure zones are named for their design elevation and include the 800, 930, 1050, 1158, 1299, 1630 East, and 1630 West pressure zones. A schematic of the Recycled Water System is shown in Figure 1-9.

## 5.1 800 Pressure Zone

The 800 pressure zone serves agricultural customers, the city of Chino, and San Bernardino County to feed to El Prado Lake. The pressure zone is fed by the RP-5 800 pump station. Major pipelines in the 800 zone include the outfall extension pipeline, El Prado pipeline, and the Bickmore pipeline. Additionally, the 800 zone includes the discharge point to El Prado Lake. Excess recycled water is dechlorinated at the Prado Dechlorination Station and discharged to El Prado Lake.

## 5.2 930 Pressure Zone

The 930 pressure zone serves agricultural customers, the city of Chino, and the city of Chino Hills. The pressure zone is fed by two pump stations—the RP-1 930 Pump Station and the CCWRF 930 Pump Station. Major pipelines in the 930 zone include the CCWRF system pipeline, Edison Segments A and B, and the TP-1 Outfall pipeline. The TP-1 Outfall pipeline connects RP-1 to the 930-to-800 Pressure-Reducing Valve. The 930-to-800 Pressure-Reducing Valve is a 16-inch Cla-Val designed to transfer water from the 930 zone to the 800 zone to help maintain pressure in the 800 zone. Additionally, a new 5-MG reservoir, the 930 Reservoir, is being added to the 930 pressure zone.

## 5.3 1050 Pressure Zone

The 1050 pressure zone provides recycled water to the RP-1 Utility Water System, the city of Ontario, and the Ely Basins for groundwater recharge. The pressure zone is fed by the 1050 Pump Station located at RP-1. The Philadelphia Street pipeline supplies water from the pump station to the Ely Basins. The 1050 zone has three turnouts (one at each of the Ely Basins) that meter and control flow to the basins. Additionally, the 1050-to-930 Pressure-Reducing Valve is installed at RP-1 to transfer water from the 1050 zone to the 930 zone, which helps maintain pressure in the 930 zone.

## 5.4 1158 Pressure Zone

The 1158 pressure zone provides recycled water to the cities of Fontana and Ontario, the 1158 Reservoirs, and the 1299 Pump Station. The pressure zone is fed by two pump stations—the RP-1 1158 Pump Station and the RP-4 1158 Pump Station. Major system components include two 4-MG reservoirs (1158 Reservoirs) and three major pipelines—the RP-4 outfall pipeline that connects RP-4 recycled water system to RP-1, the 1158 Reservoir pipeline, and the Wineville pipeline. The 1158 zone includes the 1158-to-1050 Pressure-Reducing Valve to transfer water from the 1158 zone to the 1050 zone, which helps maintain pressure in the 1050 zone. The 1158 zone also includes the RP-4 Energy Displacement Valves that are installed at RP-1. These valves are used to discharge excess recycled water to the RP-1 North Dechlorination Structure when recycled water levels in the 1158 Reservoirs reach their high-level set point. Current projects in the 1158 zone include an extension of the Wineville pipeline to connect the 1158 zone to the RP-3 groundwater recharge basin.

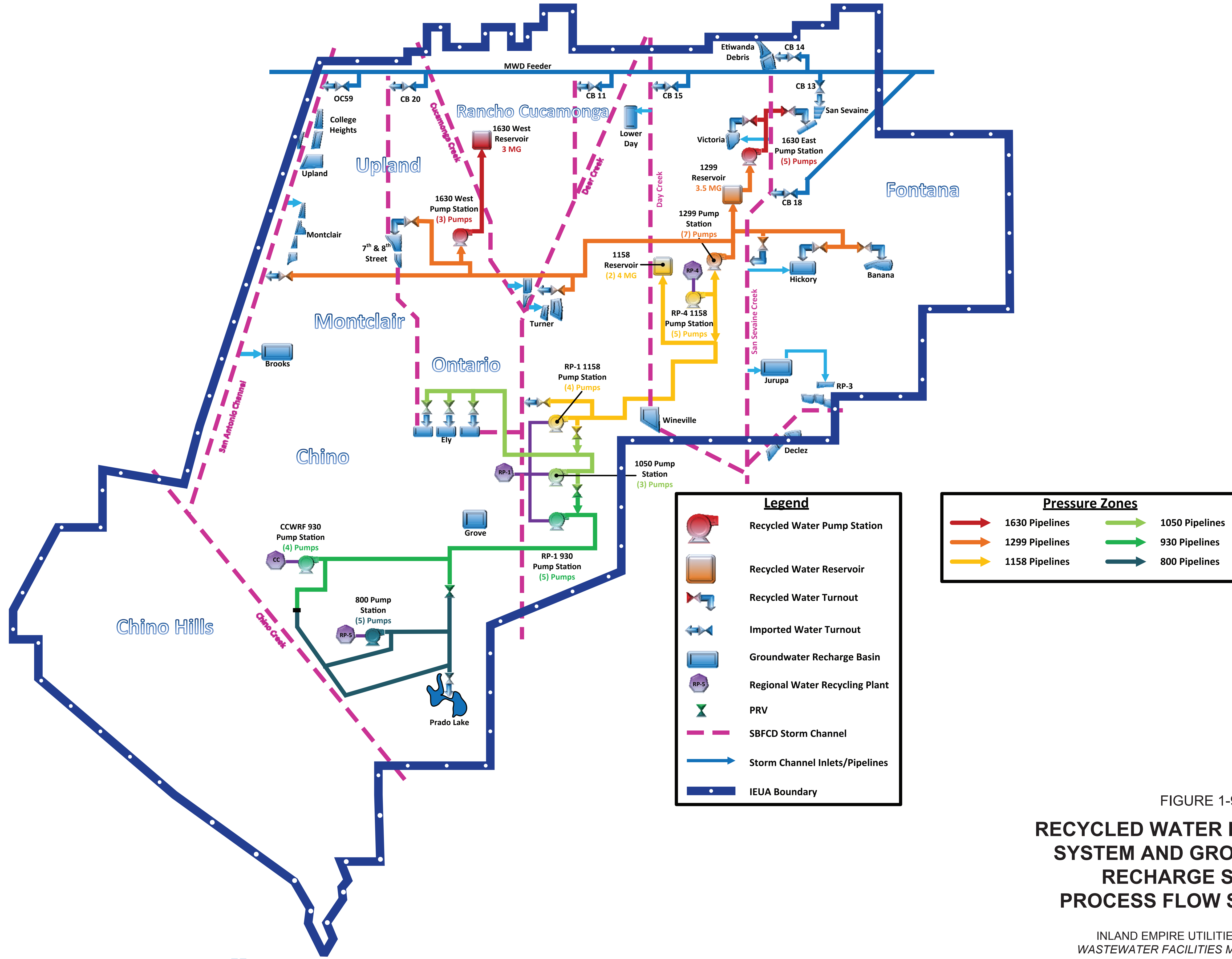


FIGURE 1-9

**RECYCLED WATER DISTRIBUTION SYSTEM AND GROUNDWATER RECHARGE SYSTEM PROCESS FLOW SCHEMATIC**

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## 5.5 1299 Pressure Zone

The 1299 pressure zone provides recycled water to the Cucamonga Valley Water District (CVWD), Monte Vista Water District (MVWD), city of Fontana, city of Ontario, and city of Upland. It also provides recycled water for groundwater recharge at Brooks Basin, 8th Street Basin, Turner Basin, Hickory Basin, Banana Basin, Jurupa Basin, and RP-3 Basin. The pressure zone is fed by the 1299 Pump Station located at RP-4. Major pipelines in the pressure zone include the 1299 Recycled Water pipeline, RP-4 West Extension pipeline, and the San Antonio Channel pipeline. Major system components include a 3.5-MG reservoir, which supplies recycled water to the 1630 East Pump Station, and several turnouts that meter and control flow to the groundwater recharge basins.

## 5.6 1630 East Pressure Zone

The 1630 East pressure zone provides recycled water to CVWD and the city of Fontana, as well as to the Victoria and San Sevaine basins for groundwater recharge. The pressure zone is fed by the 1630 East Pump Station. Major pipelines in the pressure zone include the Segment A pipeline, Baseline pipeline, and the Church Street lateral. Two turnouts meter and control flow to the San Sevaine and Victoria basins. Future projects for this pressure zone include an 8-MG reservoir for recycled water storage.

## 5.7 1630 West Pressure Zone

The 1630 West pressure zone provides recycled water to CVWD and the city of Upland. The pressure zone is fed by the 1630 West Pump Station. The pump station design includes a pressure-reducing valve that allows excess water from the 1630 pressure zone to be discharged to the 1299 pressure zone. Major pipelines within the 1630 West pressure zone included the Segment A, Segment B, and Segment C pipelines. Additionally, the 1630 West pressure zone includes a 3-MG recycled water reservoir to provide additional recycled water storage.

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# TM 2 Hydraulic Modeling and GIS Implementation

# IEUA Wastewater Facilities Master Plan
# TM 2 Hydraulic Modeling and GIS Implementation

PREPARED FOR: Inland Empire Utilities Agency

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REVIEWED BY: CH2M HILL

DATE: April 2015

# Executive Summary

As part of the Wastewater Facilities Master Plan (WFMP), the Inland Empire Utilities Agency (IEUA) is planning facilities for growth and the optimization of wastewater treatment, collection, and recycled water systems. An integral part of that planning effort is the continued development of the IEUA Geographic Information System (GIS) and the collection system hydraulic model.

The WFMP incorporated the wastewater flow projections developed by the Integrated Water Resources Plan (IRP) consultant in conjunction with critical input from IEUA staff on the operations of the wastewater collection and treatment systems to develop a comprehensive facilities and operations plan. This Technical Memorandum (TM) discusses the foundations of those planning efforts.

The WFMP utilized multiple GIS data sources as part of the project, and data accuracy was verified based on the Federal Geographic Data Standards (FGDS) Committee standards. The GIS system used for this project was the Environmental Systems Research Incorporated (ESRI) ArcGIS 10.2.1.

The model for IEUA's wastewater collection system was updated and validated based on the inputs provided by IEUA. The flow projections were allocated into the model, and tributary areas were confirmed for accuracy. The model was calibrated, and the flows were verified at 33 sites, which included a combination of temporary and permanent flow metering sites throughout the IEUA collection system. Based on the results of the model calibration, the model was determined to be suitable for planning-level analysis and evaluations of flow routing alternatives.

As part of the IRP and the WFMP, goals for the utilization of water resources within IEUA were established. It was determined that the northern portions of the IEUA service area would be the targeted area for groundwater recharge. Therefore, the flow diversion alternatives developed as part of the WFMP will focus on routing flows to Regional Water Recycling Plant No. 1 (RP-1) for treatment and distribution to the recycled water system. Based on this goal, four flow diversion alternatives were developed that utilized a combination of existing IEUA and city of Ontario facilities to convey either raw wastewater or treated water to RP-1.

# 1.0 Background and Objectives

The WFMP includes an analysis of the IEUA wastewater treatment and collection systems, as well as an analysis of ways to optimize the conveyance of wastewater to maximize the benefit of wastewater as a source of recycled water. This TM is an integral part of the IEUA WFMP because it provides essential technical details to support the conclusions made in the WFMP regarding the development and analysis of the IEUA wastewater collection system.

This TM covers the aspects that are essential to establish the framework of the WFMP related to the wastewater collection system, including the following:

- Identification of data requirements, availability, and acquisition plan for the preparation and future updates of the WFMP, as well as the description of the GIS data used as part of modeling the collection system
- Sewer modeling software and update of the IEUA wastewater collection system model
- Hydraulic modeling techniques, model calibration, and model calibration results
- Development of collection system diversion and routing alternatives

The results of the analysis of the collection system diversion and routing alternatives are presented in *TM 3 Regional Trunk Sewer Alternatives Analysis*.

# 2.0 Data Requirements

## 2.1 WFMP Data Requirements

To provide the essential information and perform sewer system analysis for the WFMP, the following data requirements were identified:

- IEUA Member Agency sewer service boundaries including city limits and sphere of influence (SOI) boundaries
- IEUA boundaries and sewer service tributary areas
- Street centerlines and right-of-way, freeways, and highways
- Wastewater infrastructure (sewer pipes, pump stations, and connection points)
- Member Agency land use data (existing and ultimate)
- Parcel information
- Census information
- Water reclamation plant flow data

Much of the data listed above were used to develop the wastewater flow projections. The IRP consultant developed wastewater flow projections as part of the IRP effort. These flow projections are included in Appendix 2-A.

## 2.2 Data Availability and Acquisition

A majority of the information acquired for the WFMP is in ESRI native GIS format ("shapefiles"), or can be associated with GIS shapefiles. Shapefiles can be readily integrated with an existing or new GIS project file. The following describes data used for the IEUA model:

- **Flow Monitoring Data**: As part of the IRP project, IEUA contracted with ADS Environmental Services to conduct a temporary flow monitoring program. The flow monitoring data collected as part of the program were used to create diurnal patterns that are applied to the base wastewater flows to simulate the variation of flow measured for each meter area. The flow monitoring data were also used to validate the flows simulated by the hydraulic model. Model diurnal patterns and model validation (or calibrations) are discussed in Section 5 in this TM.
- **Member Agency Shapefiles**: Each agency within the IEUA boundary provided a shapefile of its collection system, which included pipeline sizes and invert elevations, as well as manhole information. These data were used to determine where the flowmeters should be located to gather the flow monitoring data.
- **Shapefiles of Tributary Areas**: The shapefiles of tributary areas were used to determine the loads associated with each area that was later used to allocate the flow projections from the IRP consultant.
- **Wastewater Flow Projections**: This contains necessary information regarding the buildout flows for future scenarios. The loads associated with each tributary area were input into the tributary area shapefile to allocate loads to the appropriate manholes.
- **Record Drawings for Lift Stations and Flow Diversions**: These record drawings were used to verify the lift stations and flow diversions in the model.
- **Lift Station Data**: The lift station data provided information on the lift station, including number of pumps, capacity of each pump, and wet well dimensions.

## 2.3 Data Accuracy and Validation

Data accuracy is arguably the most relevant factor in keeping a GIS useful, efficient, and effective. The standards designed by FGDS Committee keep track of how geospatial data are organized, stored, and distributed. However, the effort taken to fulfill the standards that describe how to maintain accuracy in the creation process remains at the discretion of the creator (provider of the data).

IEUA is aggregating a variety of information from various sources, many with differing philosophies. In the case of geospatial data, every effort has been made to ensure the data are accurate and deemed suitable for incorporation into the IEUA database. Metadata (data about the data) provide a crucial resource in the effort of maintaining the accuracy of data. Metadata reveal many important details about the raw data that may confuse or elude the end-user if no other data descriptions are provided. For example, time of data collection, how the data were collected, who collected the data, any modifications applied to the data, and how the data are organized.

Data validation is only relevant to each particular scenario. There is no particular predetermined method for validating data, and a variety of checks may be required to ascertain the condition of the data. In the case of IEUA, the Local Area Formation Commission (LAFCO) boundaries were used as the basis for land use shapefiles. There were also instances where land use shapefiles of individual member agencies settled discrepancies between conflicting land use issues.

When working with geographic regions as large as IEUA, it is important to validate the accuracy of data received from San Bernardino Association of Governments (SANBAG) and Southern California Association of Governments (SCAG). The best means of checking the county-level data is by comparing the data against member agency-level data. Where available, electronic databases (GIS shapefiles) can be used to modify the SANBAG/SCAG files. If electronic GIS-compatible files are unavailable, hard copies of land uses can be used to check specific regions in question.

As part of the flow projection and model update process for this WFMP, there were several instances where IEUA data on tributary area boundaries were inconsistent with member agency data. As part of the WFMP, the general accuracy of the tributary area boundary information was confirmed relative to the boundaries of member agencies. The updated shapefiles of tributary area boundaries (delivered as part of this WFMP) were adjusted to capture the most recent understanding of the location of the tributary area boundaries.

# 3.0 GIS System Analysis and Update

The GIS software used for this model was ESRI's ArcGIS 10.2.1. The ArcGIS software allows IEUA to organize, maintain, query, analyze, and visualize data. For GIS and mapping tasks, the latest ArcGIS software caters to the needs of GIS experts and end users. Data automation is conducted via a Windows-type browser; Geo-processing and data manipulation are handled via wizards and visual tools for conversion and analysis. The ESRI GIS modules, such as ArcInfo and ArcEditor, integrate seamlessly, creating a solid and dependable GIS engine. ArcView 10.2.1 is the latest release of this popular and widely used ArcGIS module. It is the standard issue for desktop GIS and is suitable for general database queries and mapping needs.

# 4.0 Hydraulic Model Review and Update

A sewer collection system model is a simplified representation of the real sewer system. Sewer system models can assess the conveyance capacity for a collection system, provide the ability to conduct "what-if" scenarios, and help IEUA to plan and manage its collection system. The hydraulic model of the IEUA collection system was constructed using a multi-step process utilizing data from a variety of sources. This section summarizes the development process for the hydraulic model, including a summary of the modeling software, a description of the modeled collection system, the hydraulic model elements, and the model creation process.

## 4.1 Model Review

After gaining an understanding of how the model was created through discussions with IEUA, the model was then reviewed against industry standards to identify discrepancies and to determine which aspects of the model should be updated as part of the WFMP project.

### 4.1.1 Existing Hydraulic Model Software

Parsons built the existing IEUA hydraulic model using the IEUA GIS database as part of the 2002 WFMP. The existing hydraulic model used the InfoSewer hydraulic modeling software package developed by Innovyze (formerly MWH Soft), which is an add-on to the ArcView software package. InfoSewer tracks the movement of wastewater flowing through the network over an extended period of time under varying wastewater loading and operating conditions. The extended-period simulation (EPS) model implemented in InfoSewer is a quasi-dynamic model and is predicated on solving a simplified form of the full 1D Saint-Venant equations neglecting local acceleration. It provides seamless database and GIS interfacing and output features for presentations and reports.

The IEUA existing $H_2$OMAP sewer model is an “all-pipe” model. In other words, the model includes all of the active sewer mains, trunks, interceptors, and lift stations in the IEUA wastewater collection system. The existing hydraulic model includes base wastewater loads (flows); however, these loads were reallocated and revised as part of the model update process.

### 4.1.2 Modeled Interceptor System

The updated model of the wastewater collection system consists of only the IEUA pipelines and facilities. The surrounding city pipelines that flow into the IEUA system were not modeled. Figure 2-1 illustrates the facilities that are included in the updated hydraulic model.

## 4.2 Elements of the Hydraulic Model

The following provides a brief overview of the major elements of the IEUA hydraulic model and the required input parameters associated with each:

- **Loading Manholes**: Sewer manholes, cleanouts, and other locations where pipe sizes change or where pipelines intersect are represented by loading manholes in the hydraulic model. Required inputs for loading manholes include diameter, rim elevation, and wastewater loads (dry and wet weather). Loading manholes are also used to represent locations where flows are split or diverted between two or more downstream pipelines.
- **Chamber Manholes**: Chamber manholes connect pumps and force mains in the hydraulic model. The only required input parameter for a chamber manhole is elevation.
- **Gravity Mains**: Gravity sewers are represented as gravity mains in the hydraulic model. Input parameters for pipes include length, friction factor (i.e., Manning’s *n* for gravity mains, Hazen Williams C for force mains), invert elevations, diameter, and a flow split type and percentage/curve (if the pipeline is directly downstream of an overflow/flow diversion).
- **Force Mains**: Force mains represent pressure sewers in the model. Required input parameters are diameter, invert elevations, length, and friction factor (i.e., Hazen Williams C).

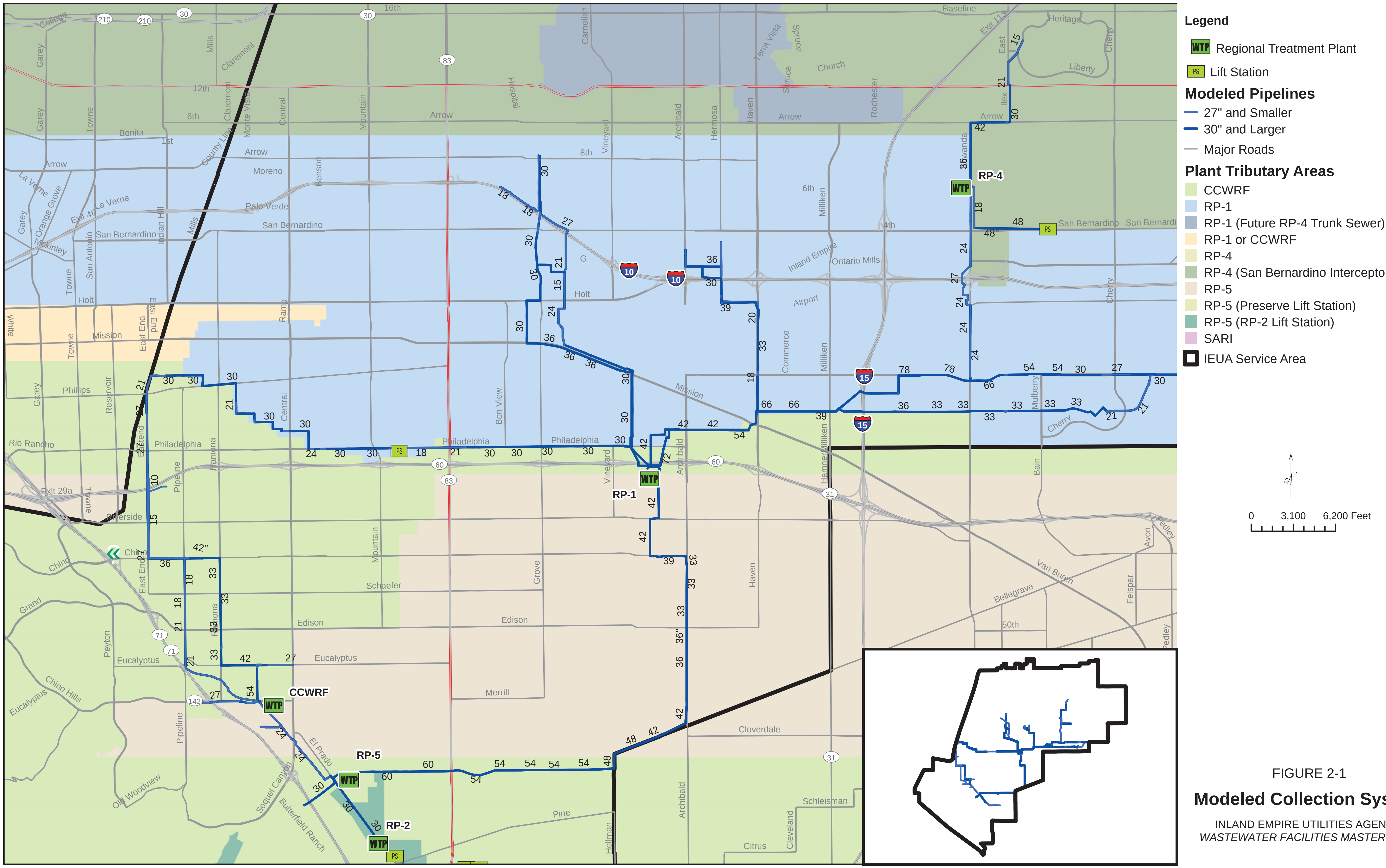


FIGURE 2-1

## Modeled Collection System

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- **Pumps**: Pumps are included in the hydraulic model as links. Input parameters for pumps include type (fixed capacity, design point, or exponential 3-point curve), pump curves, pump capacity/head information, and operational controls (on/off set points).
- **Wet Wells**: Required input parameters for wet wells include invert elevation, wet well depth, type of cross section (e.g., circular or variable area), and wet well cross section (e.g., diameter).
- **Outlets**: Outlets represent areas where flow leaves the system. For sewer system modeling, an outfall typically represents the connection to the influent pump station at a wastewater treatment plant, or a connection to a regional interceptor operated by a neighboring agency.
- **Curves**: Curves represent a number of items in the hydraulic model, including rainfall hyetographs, flow split curves, and other miscellaneous items.
- **Flows**: The following wastewater flow source can be injected into individual model junctions:
  - **Loads.** Loads simulate base sanitary wastewater flows and represent the average flow. The base flows are multiplied by a pattern that varies the flow temporally. The base flow diurnal patterns are adjusted during the dry weather calibration process.

The IEUA collection system model includes all of the elements listed above. Much of the collection system facilities for the model were created as part of the 2002 WFMP completed by Parsons. Several elements of the hydraulic model were updated as part of the WFMP, as described in the next section of this TM.

## 4.3 Hydraulic Model Update

The existing IEUA hydraulic model contained only one scenario (the “BASE” scenario). As part of any master planning project, multiple scenarios are used to simulate different flow conditions, for both current flow conditions and future flow conditions. As part of the model update process, additional model scenarios were added. There are three model calibration scenarios, which usually are not modified by the end user after model calibration is complete. In addition, there are two “evaluation” scenarios: (1) the average dry weather flow (ADWF) condition, and (2) the peak day flow (PDF) condition for each planning year in the WFMP. These scenarios are used to identify system deficiencies and to develop capacity improvement projects and can be used by IEUA in the future to run several “what if” scenarios, such as the impact of new developments or land use changes.

Several other additions and modifications were made to the hydraulic model as part of the model update process, including the following:

- Information fields were created in the model to identify the group of collection system facilities associated with each flow-monitoring sub-basin (e.g., M01, M02). Database queries were created for each flow monitoring basin so that facilities within the collection system tributary to each flowmeter can easily be identified and edited as part of this project and in the future.
- Custom diurnal patterns for each flow monitoring basin and water reclamation plant tributary area were created based not only on the flow data collected from the temporary flow monitoring program as part of the IRP project, but also on data collected from IEUA’s permanent flow monitoring stations.
- The model developed as part of the 2002 WFMP did not include pump stations (e.g., the Montclair Pump Station). The physical attributes of the pump stations were digitized, such as wet well size, number of pumps, and force main configuration. Data associated with each pump were input into the model to simulate the operation of the pump stations.
- When flow is split between two downstream pipelines, the InfoSewer model needs to have a diversion curve to specify the flow rate attributed to each downstream pipeline. Diversion curves were developed for the bypasses at Regional Water Recycling Plant No. 4 (RP-4) and Carbon Canyon Water Recycling

Facility (CCWRF). The diversion curves were based on the flow patterns measured in the flow monitoring data. These values were adjusted until the model-simulated flows matched the measured flows. Based on discussions with IEUA and confirmation with the flow monitoring data, the curve for the RP-4 bypass was developed so that only flow above 9.5 million gallons per day (mgd) would bypass the plant. The curve for CCWRF was developed so that only flow above 8.5 mgd would bypass the plant.

In addition to the changes noted above, there were several GIS shapefiles that were used to update the model, which include:

- **Connection Points**: The connection points shapefile contained the locations where the member agencies connect to the IEUA sewer system. This information was used to determine the flow monitoring locations.
- **Flowmeter Locations**: The flowmeter locations shapefile gives the location of the meters used in the temporary flow monitoring study. This also allowed queries to be created in the model for the facilities that were upstream of each temporary or permanent flowmeter. The queries are called selection sets in the model, and they are crucial in allowing easy modification of flows and diurnal patterns associated with each connection to IEUA's collection system from member agencies.
- **Street**: The street shapefile was used for reference to the streets in the IEUA area.
- **Parcel**: The parcel shapefile was used for reference to the parcels in the IEUA area.
- **Contours**: The contours shapefile provided elevation data for the IEUA area. These data will be used when determining the pipeline paths for the alternatives that will be analyzed as part of TM 3.
- **Member Agency Boundaries**: The member agency boundaries shapefiles were used to divide the model flows into member area tributaries.
- **Tributary Areas**: The tributary area shapefile was the main shapefile used when updating the IEUA model. This shapefile contained the model manhole Identification Designation (ID), which identified where the flow attributed to that tributary area was to be allocated to the modeled collection system. Before the loads could be allocated, the manhole IDs needed to be verified. There were several manhole IDs that did not match a model junction ID. Carollo reviewed each manhole and compared it with the IEUA GIS system to determine the correct model ID number to be used for the allocation of the loads. Once all manhole IDs were corrected, the tributary areas also had to be verified.

  The IRP consultant provided an Excel table with the existing and projected wastewater load that was associated with the tributary area shapefile. IEUA reviewed the projected wastewater loading for use in the WFMP.

## 4.4 Wastewater Load Allocation

As stated previously, the IRP consultant calculated the existing and projected wastewater loads. The report produced by the IRP consultant that discusses the flow projection methodologies can be found in Appendix 2-A.

As part of the wastewater flow projection task, the IRP consultant developed a database with loads for current and buildout conditions. The database used the tributary areas shapefile as the basis for developing the wastewater flow projections.

The flow projection database was formatted to conform to the requirements of the InfoSewer software. The loads were allocated to their specific model junction ID using the allocation manager in InfoSewer. The InfoSewer database is formatted with up to 10 wastewater loading fields, titled "Load 1" through "Load 10." The wastewater flows for the existing system scenario were allocated into Load 1, with the total flow for each tributary area. For each subsequent planning year, another load would be added to the subsequent load field with the incremental wastewater flow increase. For example, the 2020 flow scenario would have two loads. The 2013 flows would be allocated to Load 1, and the incremental increase in flows between 2013 and 2020 would be allocated to Load 2. The model was allocated for all the planning years in a similar way.

# 5.0 Model Calibration

Hydraulic models are built using the best available information regarding the physical attributes and operational conditions of the collection system, most of which are known to a reasonable level of confidence. Even so, a number of parameters are not directly known and cannot be directly measured. For this reason, these parameters must be assumed initially based on typical values and engineering judgment. Every collection system is unique. For this reason, industry standard of care dictates that a model be validated to ensure that the assumptions built into the model are accurate. This validation process is commonly referred to as *calibration*.

The calibration process must be undertaken in any modeling effort. Having an appropriately calibrated model is necessary to provide confidence for all project team members and stakeholders that the results produced by the model are within the accuracy needed for the WFMP.

A model cannot be considered calibrated unless it accurately represents flow conditions that have actually occurred, preferably in the very recent past. This dictates that the model include an “existing” model scenario, which represents the configuration and flow conditions that are currently experienced. Only after the model has been shown to accurately simulate these flow conditions can it be used to simulate hypothetical conditions, such as future peak flow conditions.

The intended purpose of the model will dictate how the model is constructed and should be calibrated. For the WFMP, the model was calibrated for dry weather conditions. The model was calibrated at 33 sites. The sites included the temporary flow monitoring locations and the influent metering locations at the water reclamation plants. Other permanent metering sites were used as well, such as flow measurements from the San Bernardino and Montclair pump stations, and the Regional Water Recycling Plant No. 5 (RP-5) Bypass. Figure 2-2 illustrates the system points used for model calibration.

The calibration process consisted of comparing the model-generated flows to the measured flows for the period of October 25 to November 8, 2013, a period of 14 days that corresponds to the temporary flow monitoring period. The process is as outlined below:

- **Divide the system into tributary areas.** The first step in the calibration process was to divide the IEUA service area into tributary areas. As previously described, the IRP consultant performed this task. The information was reviewed for accuracy as part of the WFMP effort.
- **Define flow volumes within each area.** The next step was to define the flow volumes within each area, which was accomplished in the flow allocation step.
- **Create diurnal patterns to match the temporal distribution of flow.** Once the load allocation was completed, the data from the flow monitoring program was used to develop customized diurnal patterns for each flow monitoring and treatment plant tributary area. The diurnal patterns are factors that are applied to the wastewater flows at each manhole to simulate the hourly variations in flows that normally occur in collection systems throughout the day. Two diurnal curves were developed for each flow monitoring tributary area, one representing weekday flow and one representing weekend flow. The diurnal patterns were initially developed based on the flow monitoring data and adjusted as part of the calibration process until the model simulated flows closely matched the field-measured flows. Figure 2-3 illustrates an example of a typical diurnal pattern. The remaining diurnal patterns are provided in Appendix 2-B.

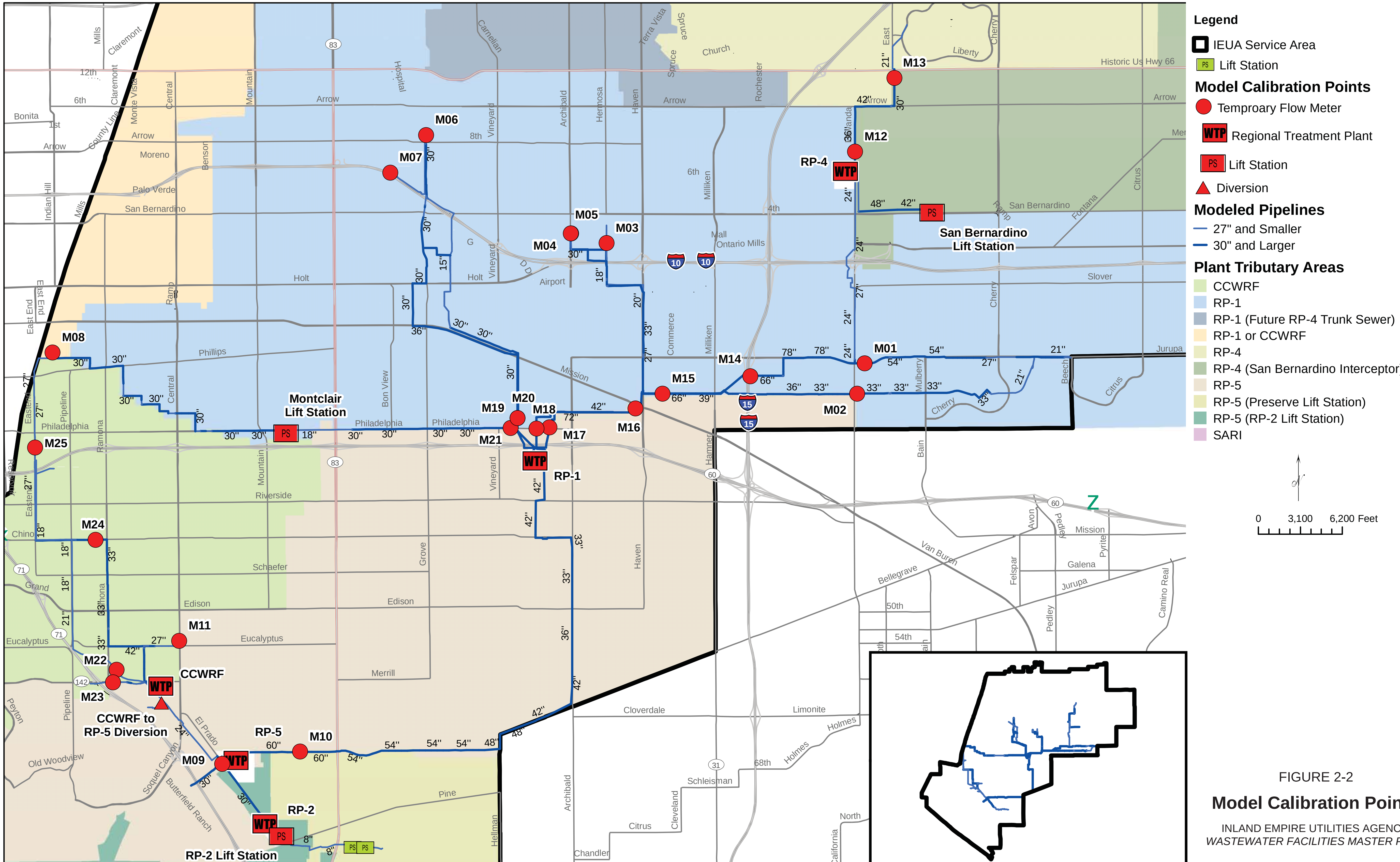


FIGURE 2-2

**Model Calibration Points**

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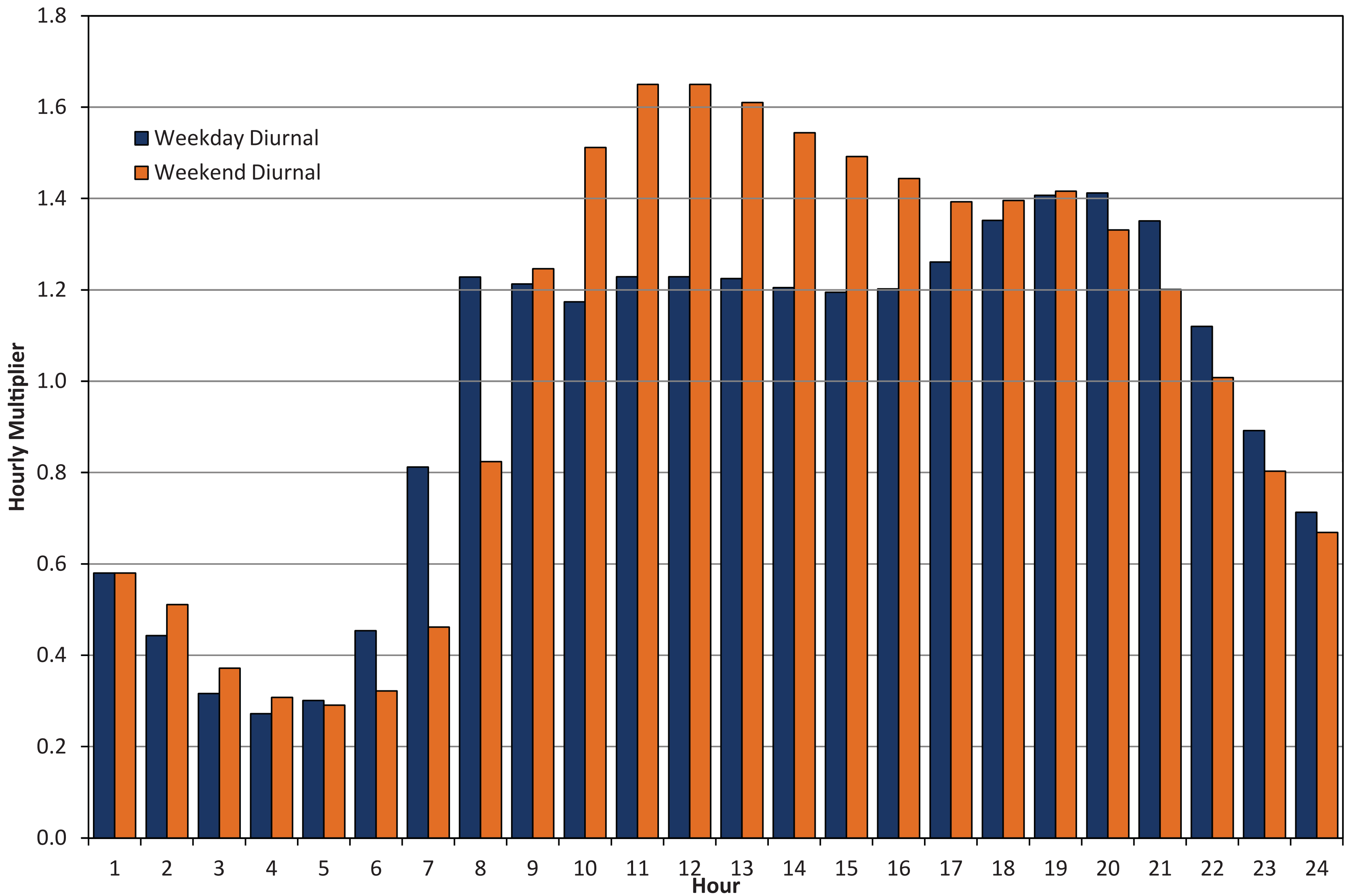


FIGURE 2-3

**Typical Diurnal Patterns**

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Figure 2-4 shows an example calibration plot for Flowmeter 8. The remaining calibration plots are provided in Appendix 2-C. In general, the model showed good correlation with the measured flows for the 2-week flow monitoring period and can be used for master planning or conceptual planning purposes. Some notable items related to the model calibration are discussed below:

- **Flowmeter 6:** Flowmeter 6 was intended to capture flow from an 18-inch-diameter pipe in the city of Upland. However, the flow monitoring data collected on the metered manhole showed much less flow than would be expected for the area tributary to this meter (0.02 mgd). Such data indicate that either the meter was installed on the incorrect manhole (there is a parallel pipeline in this area) or an unaccounted for flow split upstream of the flowmeter has occurred. For this reason, the flow data from Flowmeter 6 were disregarded for model calibration purposes.
- **Gates Upstream of San Bernardino Pump Station.** IEUA staff indicated to the project team that a leaky gate was discovered upstream of the San Bernardino Pump Station, which would have led to unintentional flow being diverted from the San Bernardino Pump Station to the RP-1 interceptor sewers, upstream of Flowmeters 1 and 2. Although the exact amount of flow that may have been diverted from RP-4 to RP-1 from this leaking gate could not be definitively quantified, it was estimated to be 0.7 mgd, based on an analysis of the results from the hydraulic model. In the model calibration scenario, flows were split manually to account for this condition because the upstream gates are not modeled.

# 6.0 Flow Diversion Alternatives

This section describes the proposed flow diversion alternatives that will be analyzed with the calibrated model. The analysis results will be presented in *TM 3 Regional Trunk Sewer Alternatives Analysis*.

One of the goals of the WFMP is to plan the efficient use of IEUA wastewater treatment plants and optimize the use of recycled water within the IEUA service area. One of the tasks in the project is to develop and evaluate flow diversion alternatives, given an understanding of the constraints and goals of the treatment evaluations and plans for expansion of IEUA Regional Water Recycling Plants (RWRPs).

In general, the overall goal of diverting flow is to keep the wastewater in the RP-1 service area where it will be closer to potential recycled water uses. Depending on how this is implemented, diversions to RP-1 could divert flows away from RP-5 and thus delay the expansion of RP-5. Part of the work conducted for the development of the diversion alternatives is to conduct an analysis of the projected wastewater flows tributary to each of the reclamation plants based on an understanding of the anticipated operational conditions. Currently, IEUA employs a number of bypass and diversion operations at the reclamation plants. Each of these bypass and diversion operations was simulated using the hydraulic model to allow the team to fully understand and evaluate the existing and proposed bypass conditions.

Based on the goals and assumptions above and the flow projections for each tributary area developed by the IRP consultant, plots of the anticipated flows for both RP-1 and RP-5 were developed. As part of the WFMP project, an analysis of the existing and 75 percent capacity of RP-1 and RP-5 was conducted and is included on the plots. The 75 percent capacity is also important because when flows reach that point, the need for potential capacity expansion is triggered. Figures 2-5 and 2-6 illustrate the wastewater flow projections for RP-1 and RP-5, respectively.

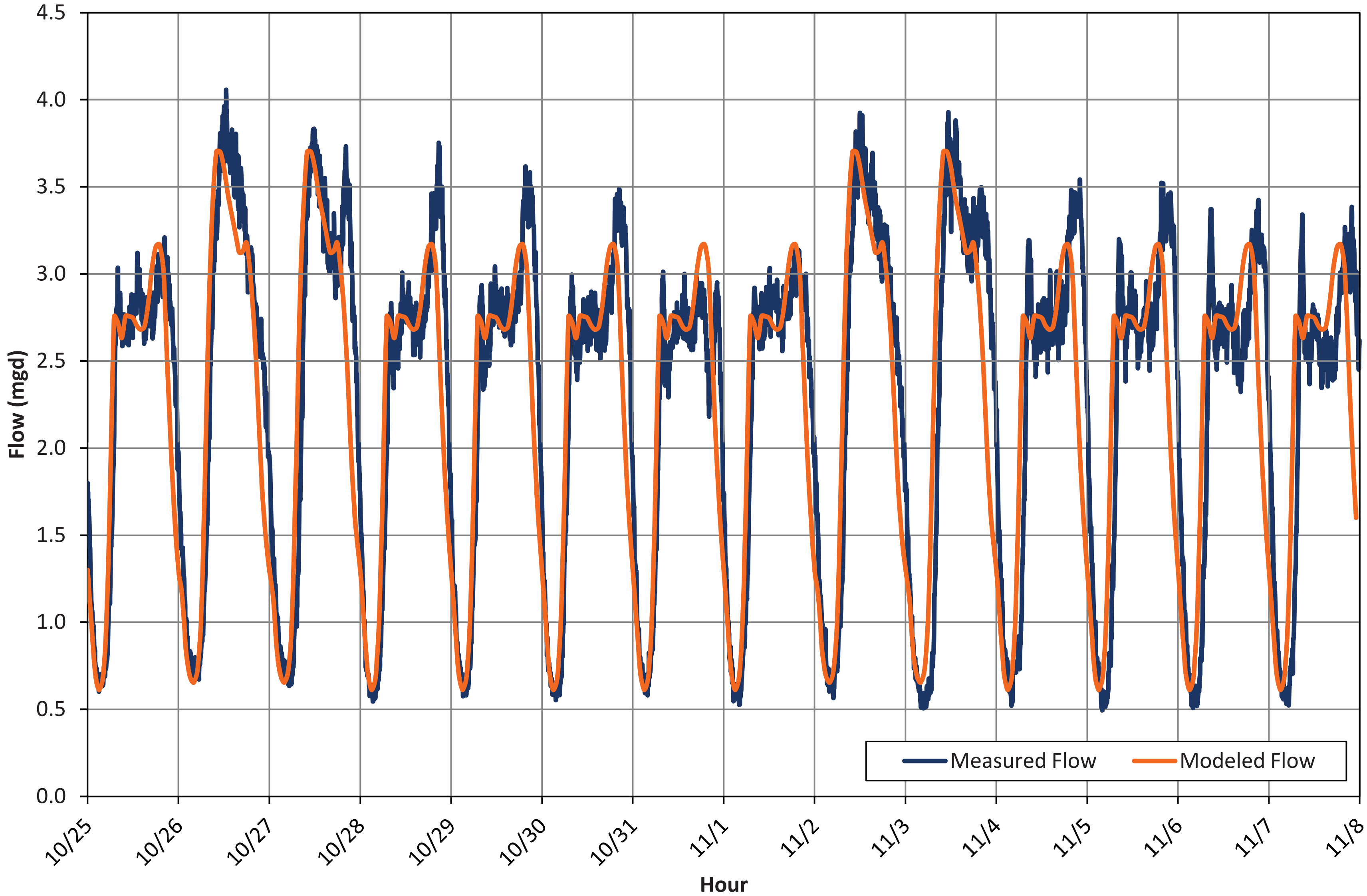


FIGURE 2-4

**Typical Diurnal Patterns**

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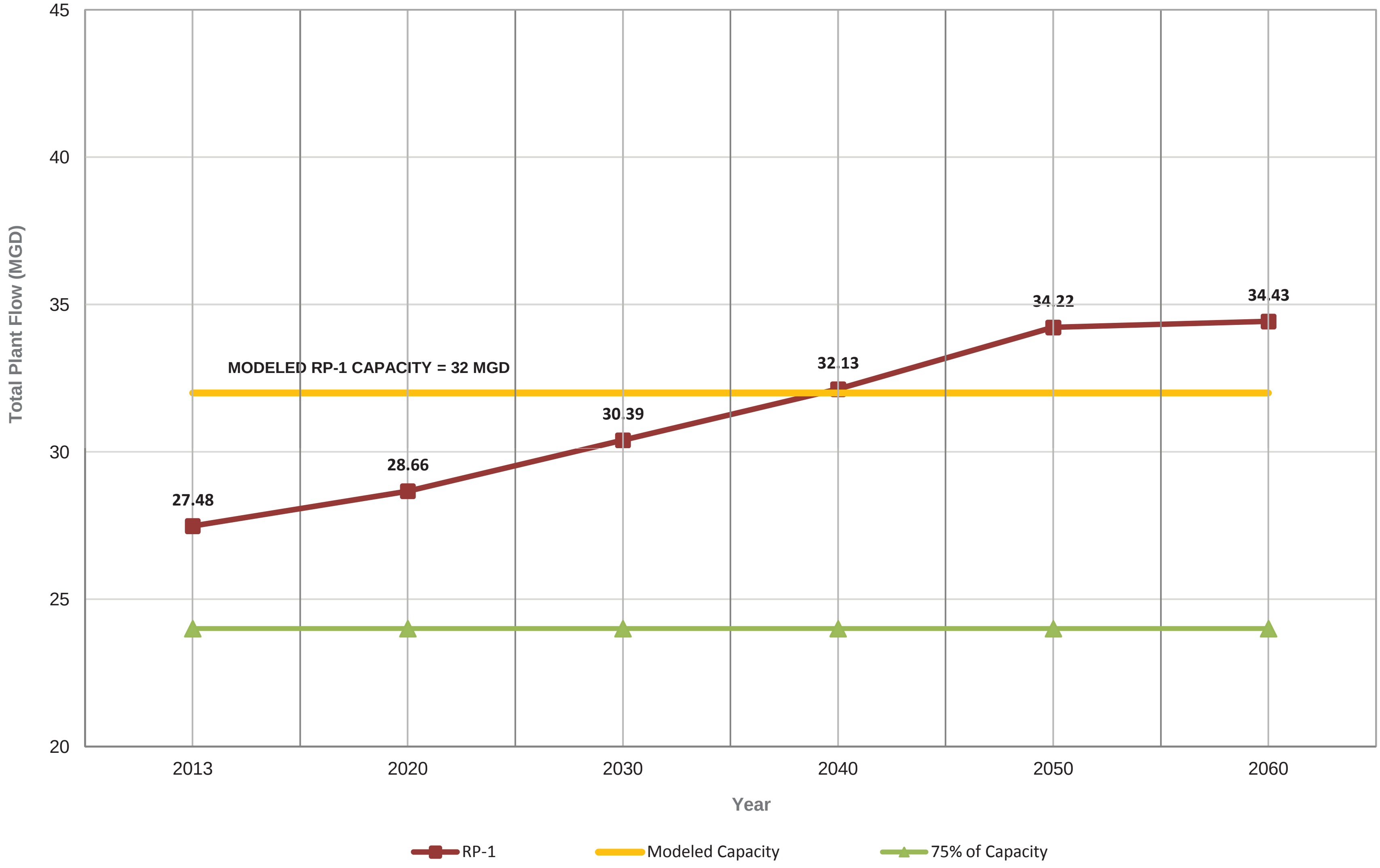


FIGURE 2-5

## Wastewater Flow Projections RP-1

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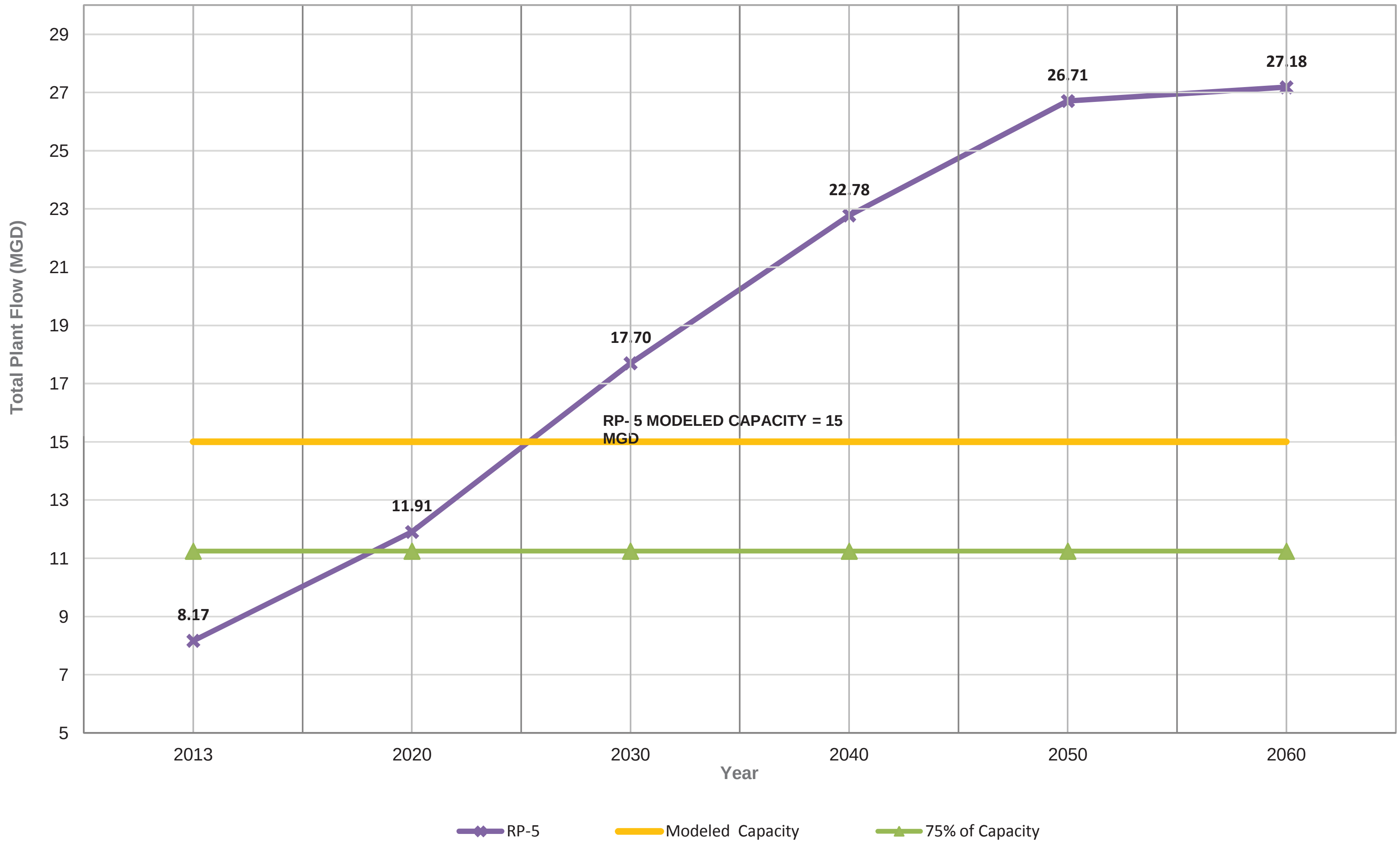


FIGURE 2-6

**Wastewater Flow Projections RP-5**

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As can be seen in the plots, the current modeled capacity of RP-1 is 32 mgd. This capacity is based on all process units in service, with primary flow equalization, for an effluent total inorganic nitrogen (TIN) concentration of 8 milligrams per liter (mg/L), assuming that the mixed-liquor return system is installed and dewatering recycles either go to the Non-Reclaimable Wastewater (NRW) system or are treated separately. A detailed discussion of the RP-1 treatment capacity evaluation is presented in *TM 5 RP-1 Future Plans*. Existing flows under normal bypass conditions reach approximately 28 mgd. Seventy-five percent of the 32 mgd capacity equates to 24 mgd; therefore, current flows exceed the 75 percent capacity criteria. For RP-5, the current capacity is 15 mgd plus 1.3 mgd of pumped flows from RP-2; the 75 percent capacity is 12 mgd, including RP-2 lift station flows. Existing flows to RP-5 are approximately 8 mgd. Based on these numbers, RP-1 needs a capacity upgrade in the near future. Based on discussions with IEUA staff and other members of the WFMP team, it is understood that the most likely upgrade scenario would be to increase the capacity at RP-1 to 44 mgd. The evaluation of water reclamation plant capacity is discussed in more detail as part of subsequent TMs.

As can be seen in Figures 2-5 and 2-6, the projected growth for the areas tributary to RP-1 and RP-5 will experience increases in wastewater flow. Growth within the existing tributary for RP-1 will increase flows from 27.2 mgd to 34.4 mgd, which equates to an approximately 25 percent increase. The increase in flow at RP-5 is much more significant. Wastewater flow rates are anticipated to increase from 8.2 mgd to 27.2 mgd, or approximately 230 percent. Table 2-1 summarizes the existing and projected wastewater flow rates for both RP-1 and RP-5.

TABLE 2-1
**Wastewater Flow Projection Summary (RP-1 and RP-5)**

| Reclamation Plant | Existing Flow (mgd) | 2020 | 2030 | 2040 | 2050 | 2060 | Percent Increase |
|---|---|---|---|---|---|---|---|
| RP-1 | 27.5 | 28.7 | 30.4 | 32.1 | 34.2 | 34.4 | 25 |
| RP-5 | 8.2 | 11.9 | 17.7 | 22.8 | 26.7 | 27.2 | 230 |

As stated above, the goal is to focus the alternatives on diverting flow from the RP-5 tributary area to RP-1 at associated flow rates such that IEUA can maximize the use of RP-1 for production of recycled water for use within the northern service area to optimize groundwater recharge.

The flow diversion alternatives will focus on options to utilize readily available diversion scenarios, such as areas of the system that currently convey flow to RP-5 but were previously pumped to RP-1. These areas include the service areas tributary to the city of Ontario's Haven and Whispering Lakes pump stations. Those areas would provide IEUA with a relatively quick way to divert flows to RP-1, but this would not provide enough flow to account for the additional capacity at RP-1 that would be available after a treatment upgrade. Therefore, diversion alternatives will also focus on diverting wastewater flows generated by new growth within the city of Ontario's New Model Colony area. The New Model Colony area is a large area of land within the city of Ontario's sphere of influence that is currently slated for growth in the near future.

In addition to evaluating the Haven and Whispering Lakes areas, diversion alternatives will evaluate the impacts that the operations of the Montclair diversion structure have on system capacity and availability of flows to RP-1. Currently, approximately 3.3 mgd of flow enters the Montclair diversion structure. Based on discussions with IEUA staff and data from the flow monitoring program, the flow is split approximately 50 percent to RP-1 and 50 percent to the CCWRF. The CCWRF portion of the flow can ultimately end up at RP-5. Diversion alternatives will be analyzed that take the Montclair diversion operations into consideration.

Based on these assumptions, the diversion alternatives summarized below were identified, and the benefits of each alternative will be analyzed and as part of the work conducted for TM 3. All of the alternatives include maximizing use of the Montclair diversions to RP-1.

In addition to the flow diversion alternatives discussed herein, the option of adding satellite treatment facilities where the recycled water would most likely be used was also considered. Although the use of satellite facilities for this purpose may be viable in some cases, it was not deemed to be a viable option for this project and therefore was not evaluated as part of this diversion alternatives analysis. Typically, for a satellite facility to be viable when compared to a regional facility, the capital and operational cost of the satellite facility must be less than the incremental capital and operational cost of the additional distribution system needed to provide recycled water from a regional facility. Since IEUA already has an extensive recycled water distribution system, and because the focus of future growth in reclamation is on groundwater recharge in close proximity to this system, the cost of satellite facilities likely would not be cost-effective.

## 6.1 Diversion Alternatives

### 6.1.1 Alternative 1

Alternative 1 is the “Do Nothing” alternative. This alternative will evaluate the future flows at RP-1 and RP-5, and determine how keeping the existing methodologies for flow routing in place affect IEUA’s ability to meet its goals. The assumption is that all flows from the Whispering Lakes tributary area, as well as the flows from the Haven Pump Station tributary area, will be conveyed by gravity to RP-5.

### 6.1.2 Alternative 2

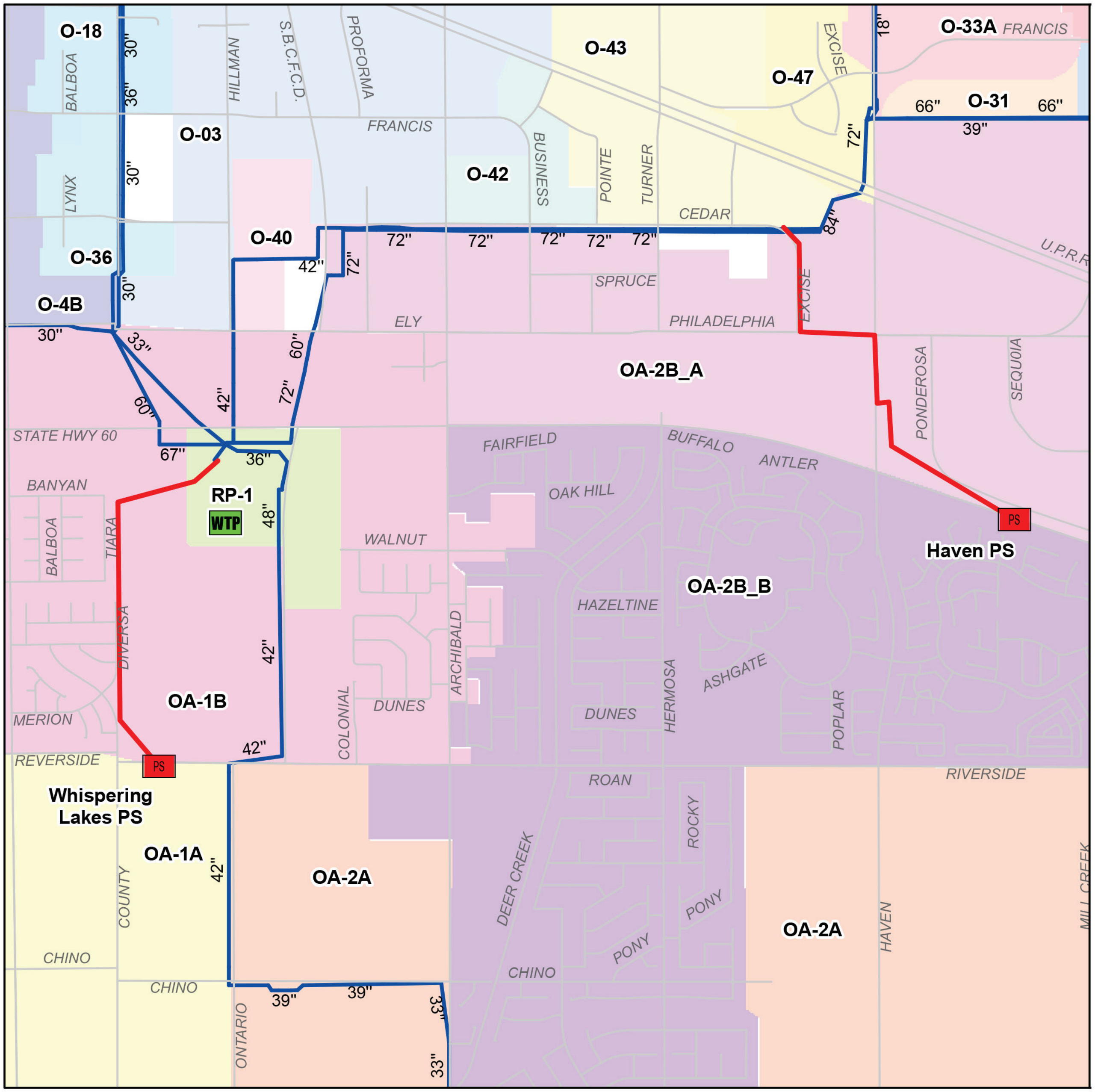
Alternative 2 assumes that the flows from the Whispering Lakes tributary area would be pumped to RP-1 for treatment. Currently, the Haven pump station conveys flow to RP-1, and this alternative would assume that the flows would continue to be conveyed to RP-1 in the future.

As can be seen in Figure 2-7, the Whispering Lakes pump station collects wastewater from agency tributary area OA-1B, while Haven collects from tributary area OA-2B_A. This alternative would provide flexibility where the wastewater is routed because IEUA would still have the option to route the flows to RP-5.

### 6.1.3 Alternative 3

Alternative 3 would install a new pump station south of the Archibald Ranch area to convey flows from the Whispering Lakes, Haven, and Archibald Ranch developments. As shown in Figure 2-8, the areas that could be diverted to RP-1 include tributary areas OA-1B, OA-2B_A, OA-2B_B, OA-1A, and OA-2A. There would be three sub-alternatives of this approach. The sub-alternatives will look at and compare different locations for the new pump station in order to maximize the collection of sewer flows from the New Model Colony in the city of Ontario and to optimize the amount of flow diverted to RP-1. Alternative 3 includes additional diversions of flow from the eastern portions of the New Model Colony. Alternative 2 does not assume that any new flows outside the existing Whispering Lakes and Haven tributary areas would be conveyed to RP-1. Alternative 3 would maximize the amount of flow going to RP-1 by taking flow from new growth. Potential locations to be considered for the new pump station would be (1) south of Edison Avenue to intercept approximately 30 percent of the New Model Colony flows, (2) near the flood control channel and Hellman Avenue to intercept approximately 50 percent of the New Model Colony flows, and (3) near Euclid Avenue and Kimball Avenue to intercept all of the New Model Colony flows. These locations have not been analyzed to determine the percentage of New Model Colony flows that could be captured. The locations would serve as starting points for the analysis and the captured flow percentages will most likely be modified.

Another difference between Alternative 2 and Alternative 3 is that Alternative 3 includes the construction of a single regional pump station instead of utilizing the existing city of Ontario pump stations (Whispering Lakes and Haven). Alternative 3 would eliminate the operation and maintenance of multiple pump stations. There is still some flexibility with this alternative because the flows could be conveyed to either RP-1 or RP-5.




**Legend**

- PS Proposed Lift Station
- Alternative 2 Pipelines
- WTP Regional Treatment Plant
- PS Lift Station

**Modeled Pipelines**

- 12" and Smaller
- 15" and Larger
- Streets
- IEUA Tributary Areas

N

0 900 1,800 Feet

FIGURE 2-7

## Alternative 2

INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

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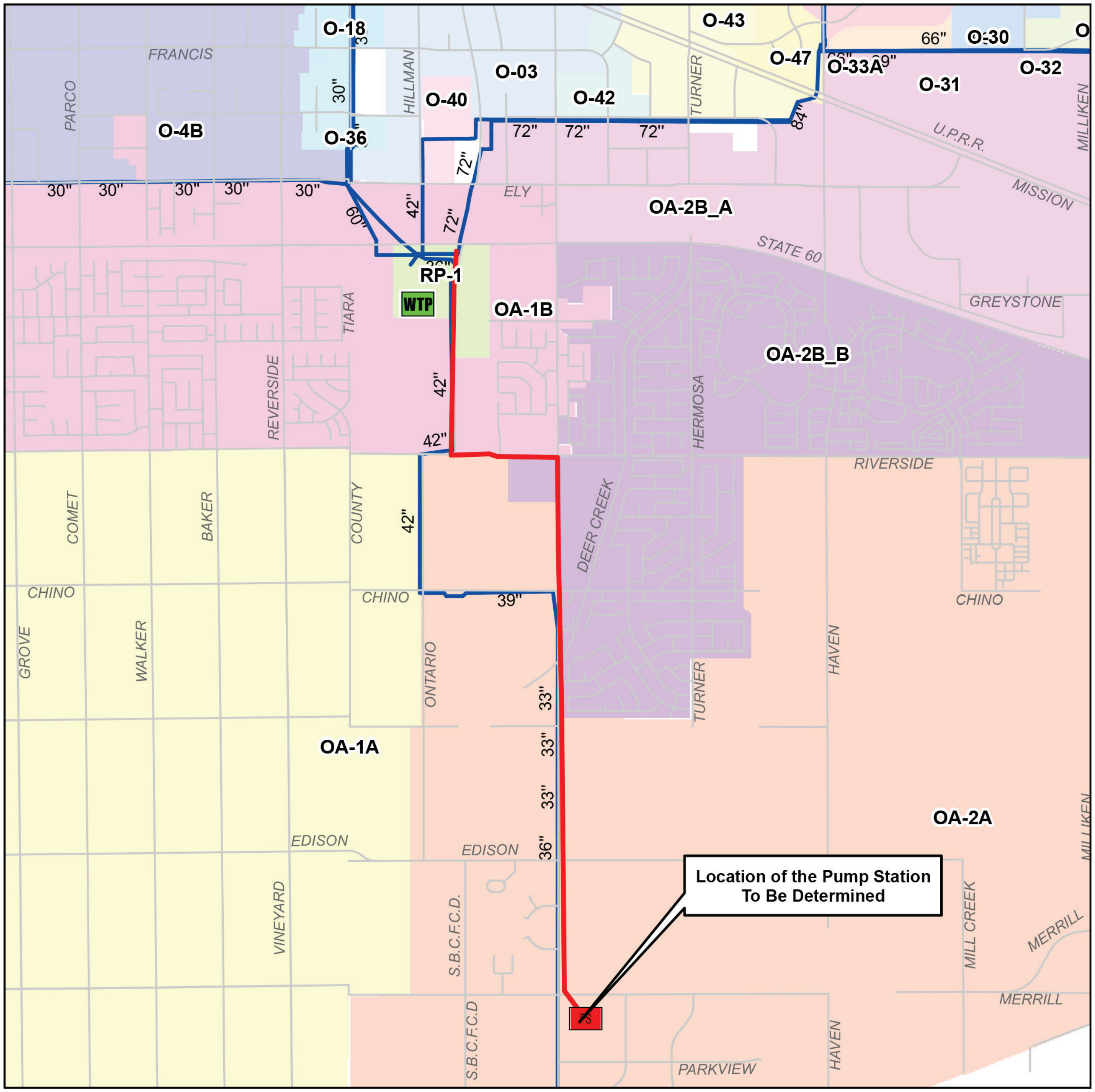


Legend

- PS Proposed Lift Station
- Alternative 3 Pipelines
- WTP Regional Treatment Plant
- PS Lift Station

**Modeled Pipelines**

- 12" and Smaller
- 15" and Larger
- Streets
- IEUA Tributary Areas

0 1,500 3,000 Feet

FIGURE 2-8

## Alternative 3

INLAND EMPIRE UTILITIES AGENCY

*WASTEWATER FACILITIES MASTER PLAN*

WT012215104SCO 480772.03.31.60.03 inland_empire_fig2_8.ai 1/15

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### 6.1.4 Alternatives 4A and 4B

Alternative 4 (Figure 2-9) would assume that instead of diverting flow to RP-1 for treatment, the flows would be treated at RP-5 and pumped to RP-1 to be distributed in the recycled water distribution system in the northern portions of the IEUA service area. It is assumed that a recycled water pump station would be installed at RP-5 to pump the recycled water to the facility at RP-1. This alternative would require an upgrade of RP-5 to handle the increase in flow to the plant. This alternative is the least flexible of the alternatives because it will not be able to divert water away from RP-5 before the treatment plant.

Alternative 4 would have two sub-alternatives. Alternative 4A would assume that all flows at the Montclair Diversion are diverted east to the Montclair pump station and ultimately to RP-1. Alternative 4B would assume that flows at the Montclair Diversion are diverted west to RP-5.

# 7.0 Conclusions

In conclusion, as part of the WFMP project, the wastewater flow projections and GIS data from the IRP consultant, as well as data collected from other agencies, were used to update the GIS and the IEUA hydraulic model. The model was calibrated to a level of accuracy suitable for this planning effort.

Based on goals established as part of the WFMP, four flow diversion alternatives were developed that will optimize the use of wastewater for recycled water purposes. The diversion alternatives will be evaluated for their ability to optimize system operations, and the findings from that evaluation will be critical for the future planning of IEUA’s collection and treatment systems.

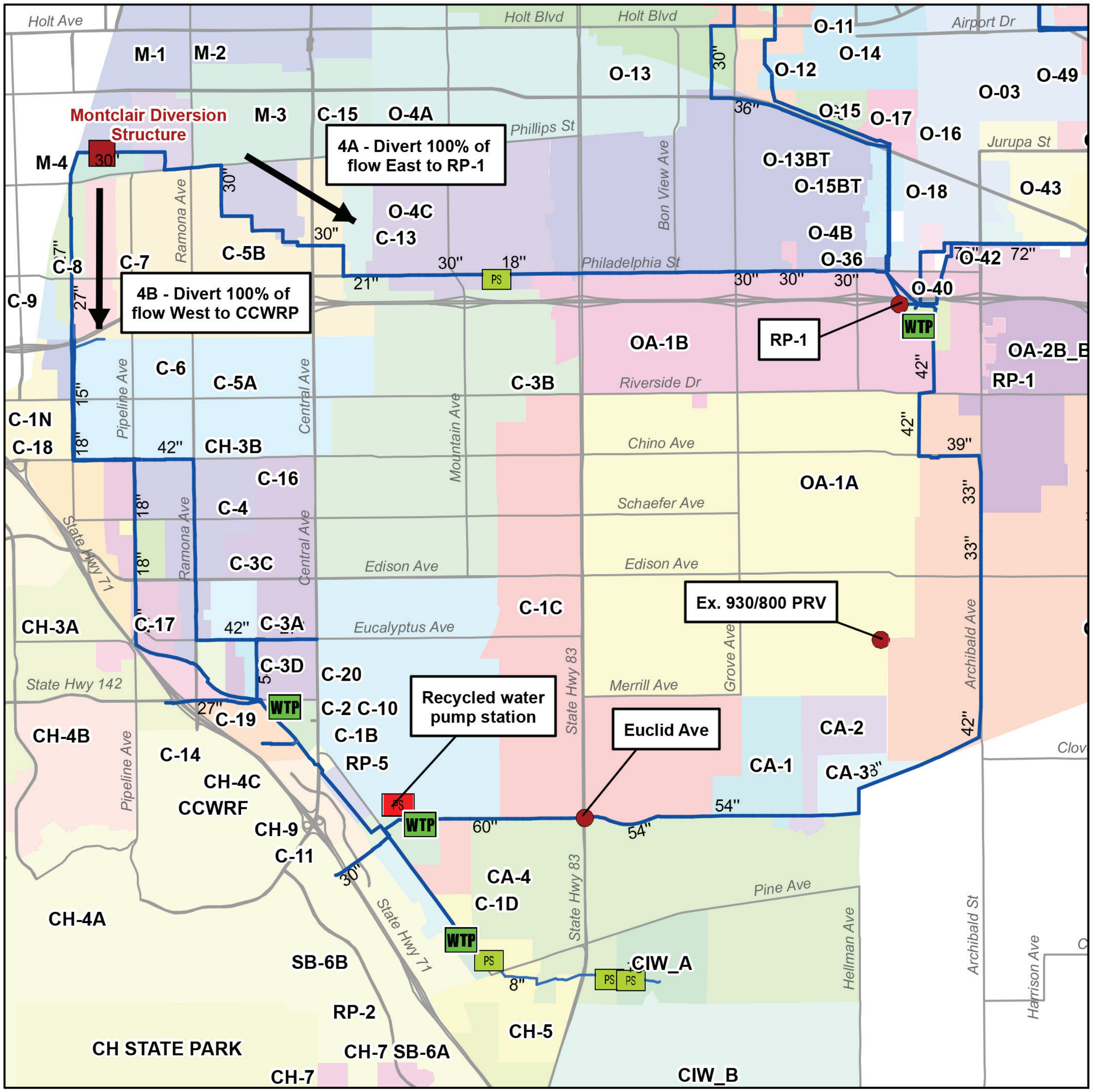


FIGURE 2-9

**Alternative 4A & 4B**

INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

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# Appendix 2-A
# Flow Projections from IRP Consultant

# TM 2 Appendix A

The flow projections developed by the IRP Consultant in December 2013 are presented in this appendix. The following TM prepared by the IRP Consultant also documents the assumptions and methodologies used for estimating existing and future influent wastewater flows tributary to each of the four regional treatment facilities. The existing and future influent wastewater flows were further refined by IEUA to account for “normal” bypassing and diversions between plants to more closely represent flows currently observed at each plant. The resulting existing wastewater flows and flow projections were provided to the Consultant team by IEUA on March 12, 2014, for use in the WFMP. The hydraulic analysis of the IEUA sewer system presented in TMs 2 and 3 of this WFMP is conducted based on the values presented below.

| Calculated Raw Influent Assuming "Normal" Bypassing and Diversions (No Recycle) | | | | | | |
|---|---|---|---|---|---|---|
| | 2013 | 2020 | 2030 | 2040 | 2050 | 2060 |
| CCWRF | 6.7 | 6.9 | 7.1 | 7.4 | 7.7 | 7.9 |
| RP-1 | 27.5 | 28.7 | 30.4 | 32.1 | 34.2 | 34.4 |
| RP-4 | 10.1 | 10.7 | 12.5 | 13.4 | 14.3 | 15.4 |
| RP-5 | 8.2 | 11.9 | 17.7 | 22.8 | 26.7 | 27.2 |
| **Total** | **52.4** | **58.2** | **67.7** | **75.7** | **82.9** | **84.9** |
| Septic | 0 | 1 | 1.5 | 2 | 2.5 | 3 |
| **Total with Septic** | **52.4** | **59.2** | **69.2** | **77.7** | **85.4** | **87.9** |

# Technical Memorandum

**Inland Empire Utilities Agency**
**Integrated Resources Plan**

**Subject:** **Wastewater Flow Projections**

**Prepared For:** Inland Empire Utilities Agency

**Prepared by:** Alison Hill

**Reviewed by:** Scott Goldman

**Date:** December 31, 2013

**Reference:** 0134-015.00

The purpose of this Wastewater Flow Projections TM is to document the assumptions and methodologies used for estimating existing and future wastewater flows in the IEUA service area. The flows will be used for modeling of IEUA's sewer system as part of the Wastewater Facilities Master Plan, a project which is being completed in parallel with the Integrated Resources Plan.

This TM is organized into the following sections:

- Task Overview
- Data Sources Used
- Flow Factor Calibration
- Future Flow Projections

# 1 Task Overview

The main goal of this task was to estimate existing and future wastewater flows that are or will be conveyed to the IEUA sewer system. Existing wastewater flows were estimated using population and employment data that were distributed to each of IEUA's 155 sewer tributary areas. Unit flow factors were calibrated to existing flow data measured at IEUA's plants and lift stations as well as at a number of flow meters which were installed throughout the service area as part of this task. These unit flow factors took into account specific information regarding unsewered areas or significant industrial contributions.

Information about indoor water conservation was extracted from the water demand projections that are being developed by A&N Technical Services, Inc. as part of IEUA's Integrated Resources Plan. This information was used to analyze the potential decrease in future sewer flows due to conservation.

Wastewater flow projections were then developed for 2020, 2030, 2040, 2050 and buildout conditions. Flow projections were based on projected population and employment data and identified land use plans combined with the calibrated unit flow factors.

Results by City, tributary area, and plant designation are provided in the spreadsheet "IEUA_Wastewater_Flow_Projections_12302013.xls".

# 2 Data Sources Used

There are a number of data sources that were used for estimating wastewater flows in the IEUA service area. They are listed below:

- IEUA wastewater tributary areas and connections points (refined by RMC as part of this project). Each tributary area is associated with one of 11 plant basins as well as a member agency.
- Southern California Association of Governments (SCAG) 2012-2035 Regional Transportation Plan projections of population and employment
- Center for Demographic Research (CDR)'s distribution of SCAG population and employment by tributary area
- Temporary flow monitoring data conducted by ADS Environmental Services, October 25 – November 7, 2013
- IEUA plant flow data, October 25 – November 7, 2013
- General plans and master plans by member agency, including:
  - City of Chino General Plan Environmental Impact Report section (January 2010)
  - City of Chino Urban Water Management Plan (2010)
  - City of Chino Hills Urban Water Management Plan (2010)
  - City of Rancho Cucamonga General Plan Update Draft EIR (February 2010)
  - Cucamonga Valley Water District Urban Water Management Plan (2010)
  - City of Fontana General Plan (2003)
  - City of Fontana Development Impact Fee update Study Report (2006)
  - Fontana Water Company Urban Water Management Plan (2010)
  - City of Ontario General Plan Draft Environmental Impact Report (April 2009)
  - City of Ontario Old Model Colony and New Model Colony Sewer Master Plan Update (April 2012)
  - City of Ontario Urban Water Management Plan (2010)
  - City of Montclair General Plan (1999)
  - City of Montclair Housing Element 2006-2014. September (2011)
  - Monte Vista Water District Urban Water Management Plan (2010)
  - City of Upland Urban Water Management Plan (2010)
  - County of San Bernardino 2007 General Plan - Amended July 18, 2013.
  - The Preserve Building Permits Status Map and Preserve Flow Monitoring Data (December 2013)
- Shapefiles of City and IEUA sewer systems
- List of Significant Industrial Users (SIUs)
- Water demand projections for the IEUA service area (2012 – 2050)

# 3 Flow Factor Calibration

A customized spreadsheet was created to streamline the calibration of unit flow factors to the measured flow at the ADS and plant meters. Based on input of unit flow factors in the FLOW FACTOR CALIBRATION tab, flows per meter basin, plant basin, and member agency are automatically updated. An iterative process was used to find the unit flow factors which resulted in the best overall fit at all meters and plants.

SCAG estimates of population and employment were only provided for years 2008, 2010, 2015, 2020, 2025, 2030, and 2035. Existing (2013) population and employment per tributary area was calculated by interpolating between years 2010 and 2015.

It was assumed that the areas in the unincorporated county shown as having no sewers or sewers that are disconnected from the IEUA system are on septic tanks.

Industrial users with > 0.05 mgd average daily production were added to the flow estimates independently of the population and employment data. It is assumed that these flows are not reflected in the employment estimates.

- Coca-Cola (Ontario) = 0.121 mgd
- Parallel Products (Rancho Cucamonga) = 0.076 mgd
- Schlosser Forge Company (Rancho Cucamonga) = 0.207 mgd
- Nestlé Waters North America (Ontario) = 0.15 mgd

The final calibrated unit flow factors for 2013 conditions are:

- Residential population = 55 gpcd
- Group quarter population = 25 gpcd
- Non-residential properties = 25 gpd/employee

It is noted that some effort was made to investigate the use of different flow factors for the various employment categories provided by SCAG. In the end, however, a single rate of 25 gpd/employee appeared to best match the meter data.

The calibrated residential value compares well to those reported by member agencies in a number of documents, including the Ontario Sewer Master Plan Update (2012) which reported a factor of 55 gpcd.

Group quarter populations consist of facilities such as college dorms, prisons and military barracks. In the IEUA service area, the vast majority of the group population is associated with the California Institution for Men and the California Institution for Women. The calibrated group quarter value is based on flow data measured at Meter M10, where approximately one quarter of the flow at this meter (171,000 gpd from the Prison East facility of the California Institution for Men) was associated with group quarter populations.

The calibrated commercial/industrial flow factor of 25 gpd/employee is similar to common industry values used for flow per employee. The Ontario Sewer Master Plan Update recommends a value of 39 gpd/employee based on a limited water consumption data analysis performed in the City of Ontario.

The results of the metered vs. calculated flows show that the match between observed and calculated flows was within 10% for all but one of the ADS or plant meters that had basin areas correlating closely with sewer tributary area boundaries. This is considered to be an excellent calibration for smaller basin sizes, as it is expected that the actual sewage generation will vary somewhat throughout the service area due to household income, commercial user type, and a number of other factors. Additionally, from a systemwide perspective, the accuracy of the flow factors in estimating flow in the system was verified by the fact that the total calculated flow from the service area was within 1% of the total estimated sewage entering the five regional plants.

Meter M06, which was intended to capture flow from Upland, was disregarded from the analysis due to its apparent location downstream of a major diversion which conveyed flow away from the metering site.

# 4 Future Flow Projections

The calibrated flow factors were applied to the population and employment projections to calculate future wastewater flows. Flows were calculated for the following years: 2020, 2030, 2040, 2050, and buildout.

2040, 2050, and buildout flows were calculated by extrapolating the trendline from years 2030 to 2035 for each tributary area.

Buildout flows correspond to the total buildout population and employment stated in each member agency's general plan or most recent master planning document.

The resulting flows corresponded well with IEUA's Ten-Year Forecast for 2020. The flow estimate based on the systemwide flow factors for 2020 is 57.2 mgd compared to the 59.7 mgd reported in the Ten-Year Forecast.

Conversion of septic areas to sewer. Currently, there are negotiations being conducted to annex the California Speedway, California Steel Industries (CSI) and Prologis to the IEUA sewer system. It was assumed that this would occur in 2020. The remaining flows attributed to the unincorporated county were assumed to connect to the IEUA system at buildout.

In the future, it is believed that water conservation will result in a future decrease in sewer unit flow factors. Based on annual estimates of indoor water conservation used to develop the water demand projections as part of the Integrated Resources Plan, there is the potential for residential unit flow factors to drop to 50 gpcd for existing development and 37 gpcd for new development. This drop is associated with a 2014 update to the plumbing code that will reduce toilet flush volumes as well as assumptions about the installation of other water-saving devices. While the data suggests that a unit flow factor of 37 gpcd is possible, it may be prudent to use a more conservative value for sewer planning purposes.

Water conservation was not considered for future commercial/industrial development; rather a higher value of 39 gpd/employee was analyzed. This higher value was reported in the City of Ontario Sewer Master Plan and is a more conservative planning-level value that accounts for the high variability of commercial/industrial flows from one customer to the next.

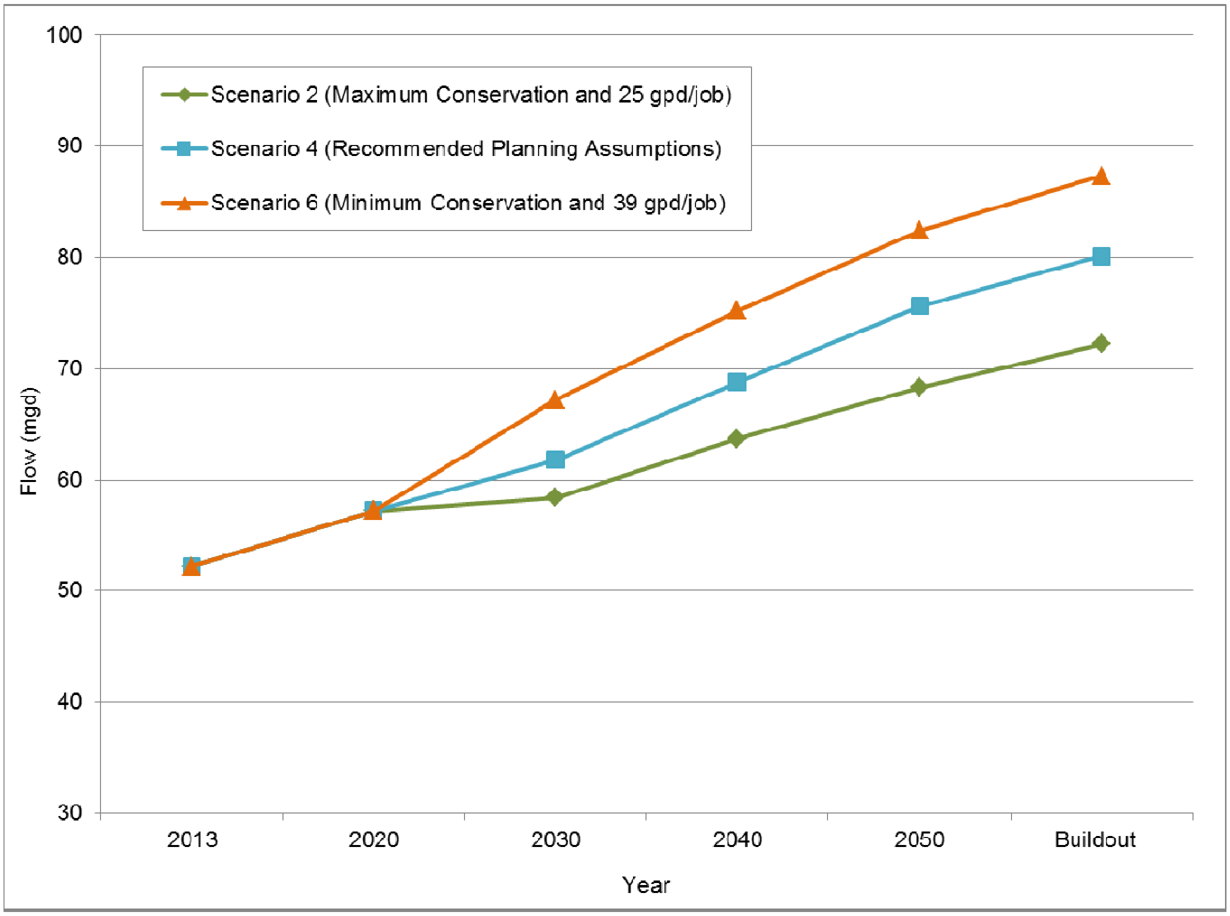
Based on different assumptions for unit flow factors, IEUA system flows were calculated for all the scenarios. The total systemwide flows based on these assumptions is shown in Table 1. The impact of other unit flow factor scenarios can be analyzed by changing the unit flow factors in the FLOW FACTOR CALIBRATION tab and then refreshing the pivot tables in the “Flows By City” and “Flows by Plant” tabs. The spreadsheet will always use the calibrated flow factors shown in the first 19 rows of the Calibrated Flow Factors table to calculate 2013 flows. It will use the last three rows to calculate flows for existing and new development in future years (starting in 2030) only.

**Table 1. Systemwide Flows (mgd) Assuming Different Flow Factors in the Future**

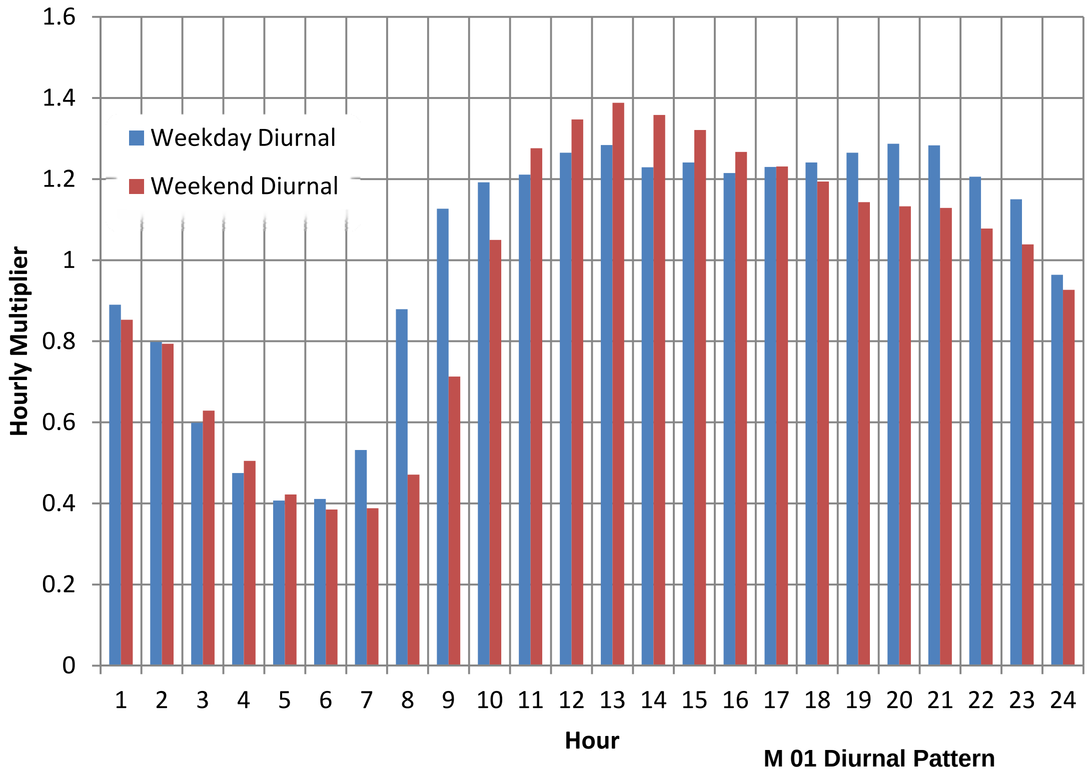
| Scenario | Existing Residential Development (factor used starting in 2020) | New Residential Development | New Commercial/ Industrial Development | 2013 | 2020 | 2030 | 2040 | 2050 | Buildout Flow (mgd) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 55 gpcd | 55 gpcd | 25 gpd/job | 52.2 | 57.2 | 65.3 | 72.5 | 78.0 | 82.6 |
| 2 | 50 gpcd | 37 gpcd | 25 gpd/job | 52.2 | 57.2 | 58.4 | 63.7 | 68.3 | 72.2 |
| 3 | 50 gpcd | 46 gpcd | 25 gpd/job | 52.2 | 57.2 | 59.9 | 66.2 | 71.2 | 75.5 |
| 4 | 55 gpcd | 55 gpcd | 39 gpd/job | 52.2 | 57.2 | 67.2 | 75.2 | 82.4 | 87.3 |
| 5 | 50 gpcd | 37 gpcd | 39 gpd/job | 52.2 | 57.2 | 60.3 | 66.4 | 72.7 | 76.9 |
| 6 | 50 gpcd | 46 gpcd | 39 gpd/job | 52.2 | 57.2 | 61.8 | 68.8 | 75.6 | 80.1 |

Figure 1 illustrates the systemwide flows for three of the six scenarios shown in Table 1. Scenario 2 represents the flows that would result from maximum water conservation and a less conservative flow factor for future commercial/industrial development. Scenario 2 represents the flows that would result from minimum water conservation (same as today) and a more conservative flow factor for future commercial/industrial development. Scenario 4 represents the recommended assumptions for planning purposes – an average level of water conservation and a more conservative flow factor for commercial/industrial development. This higher commercial/industrial flow factor leaves room for potentially significant commercial/industrial development that exceeds today’s average sewage generation per employee. In other words, while residential sewage generation is largely predictable, commercial/industrial sewage generation is highly variable and should be given more flexibility for future planning.

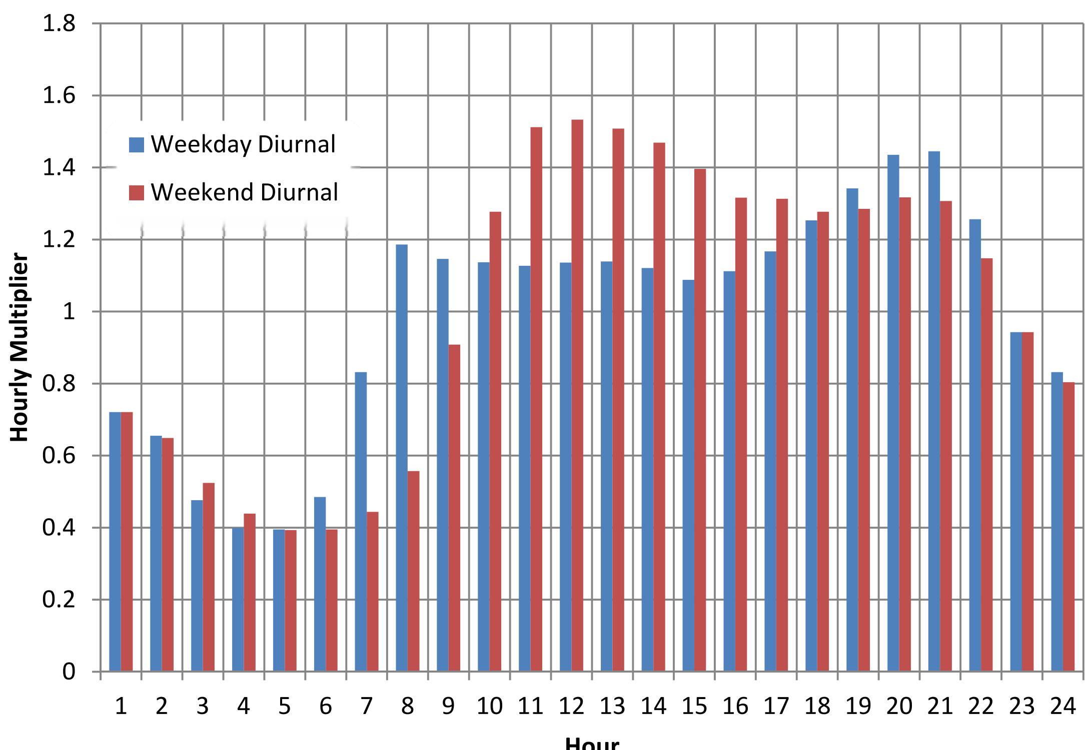
**Figure 1. Systemwide Flows (mgd) for Selected Scenarios Assuming Different Flow Factors in the Future**



# Appendix 2-B
# Tributary Area Diurnal Curves




**M 01 Diurnal Pattern**
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**




**M 02 Diurnal Pattern**
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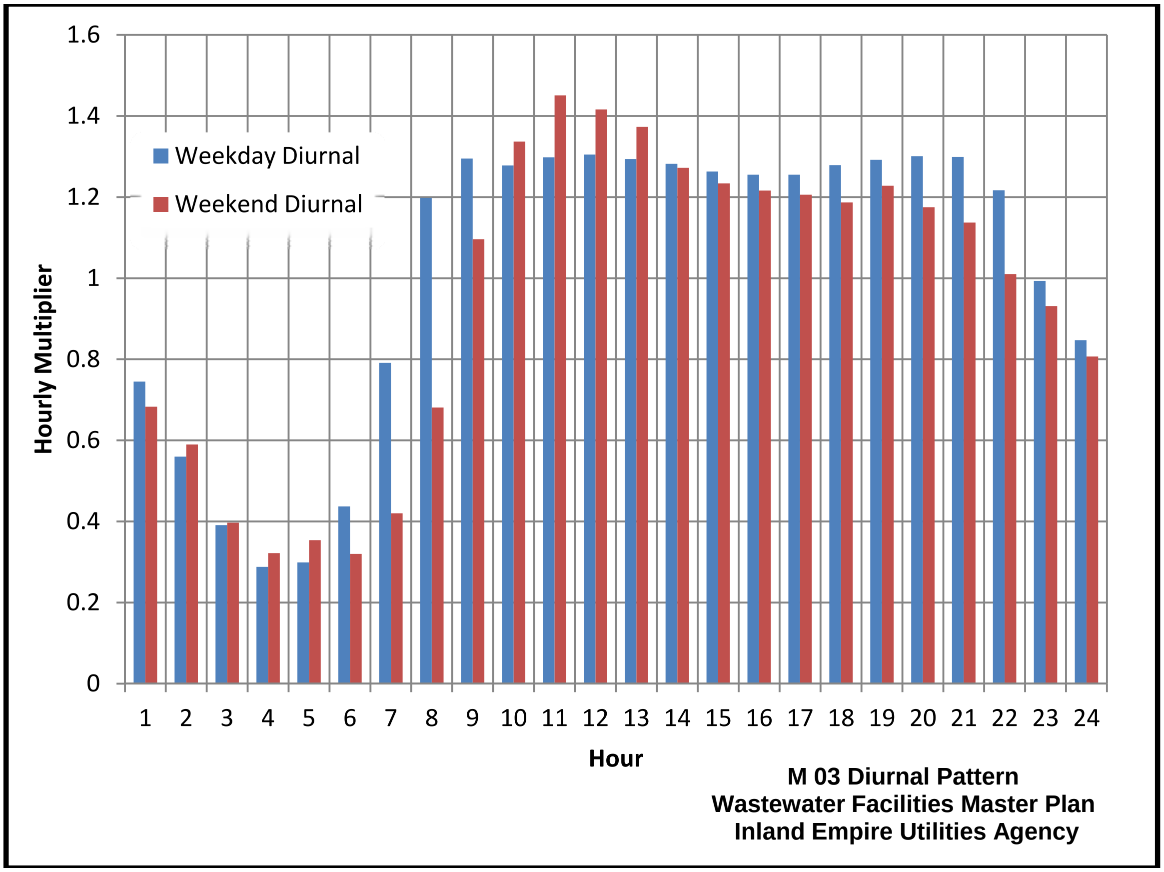
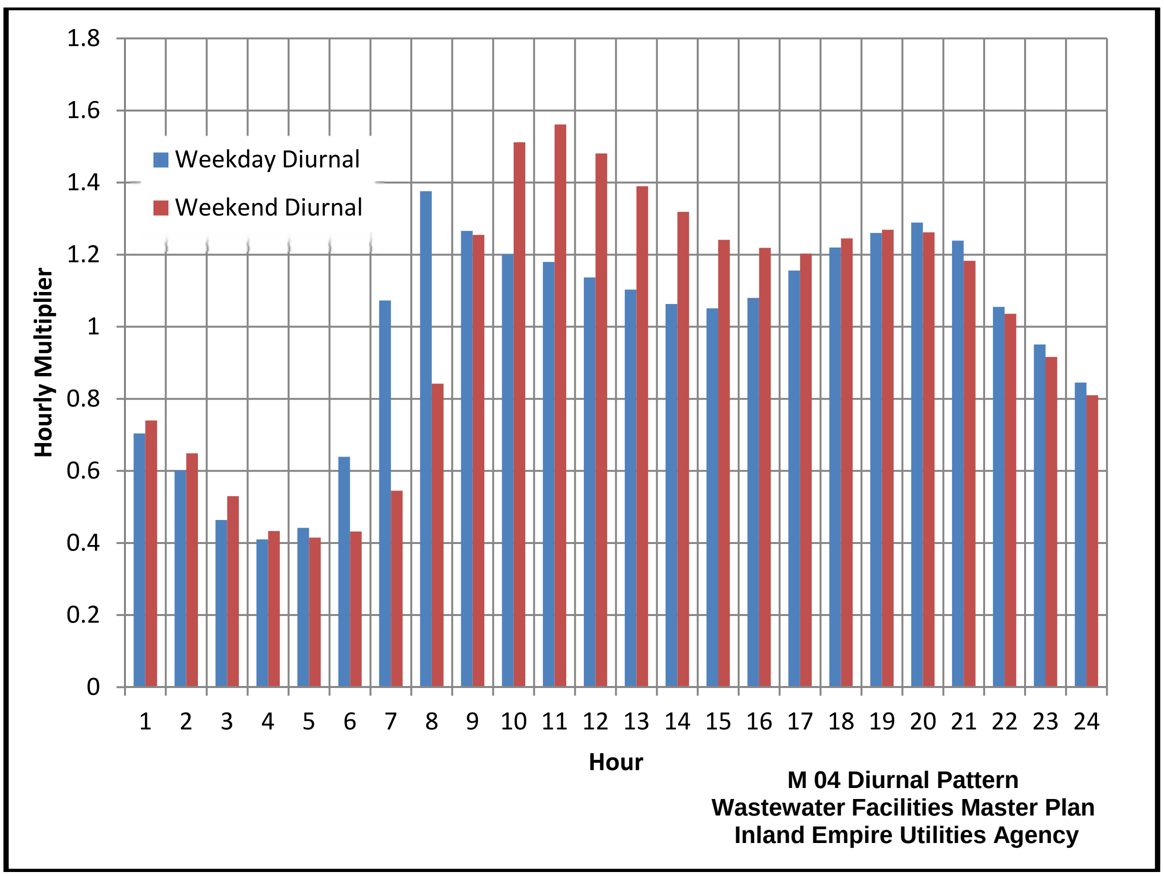
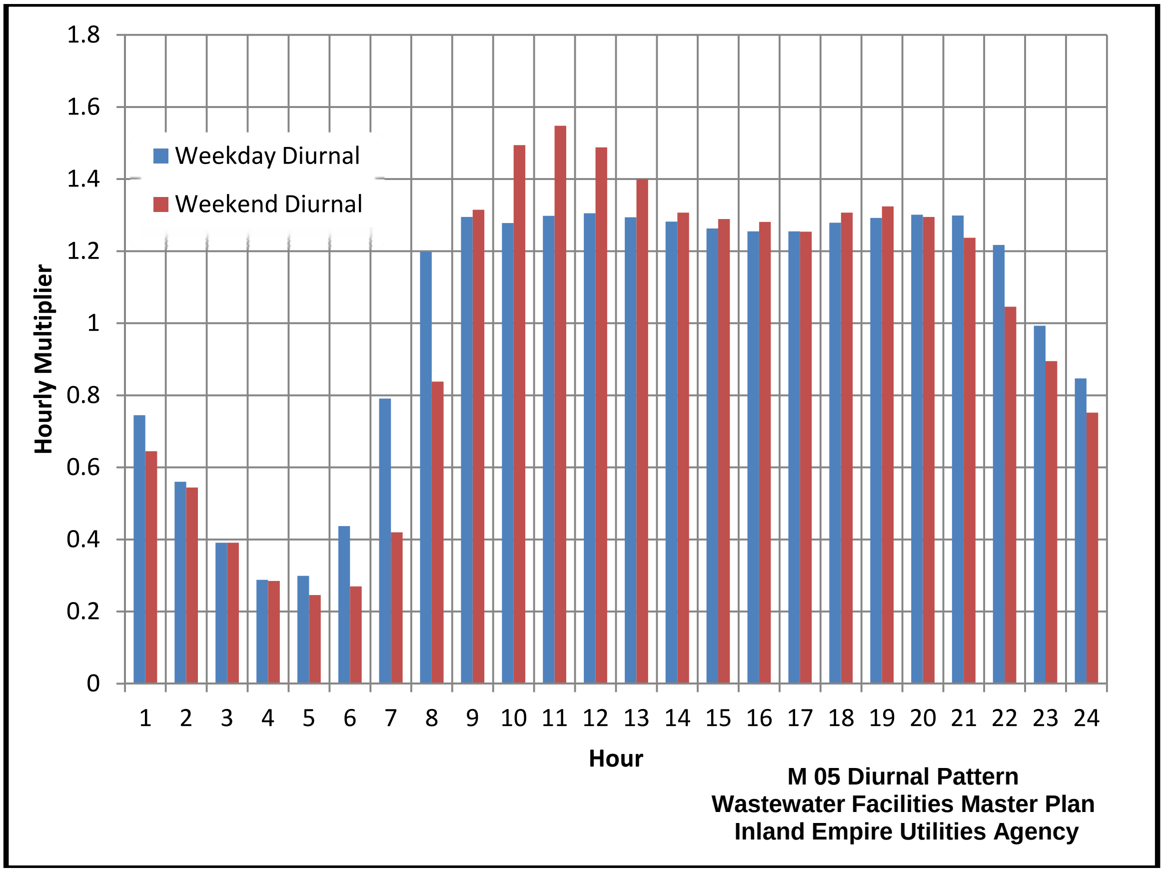


Weekday Diurnal
Weekend Diurnal
Hourly Multiplier
Hour
M 03 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency

Weekday Diurnal
Weekend Diurnal
Hourly Multiplier
Hour
M 04 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency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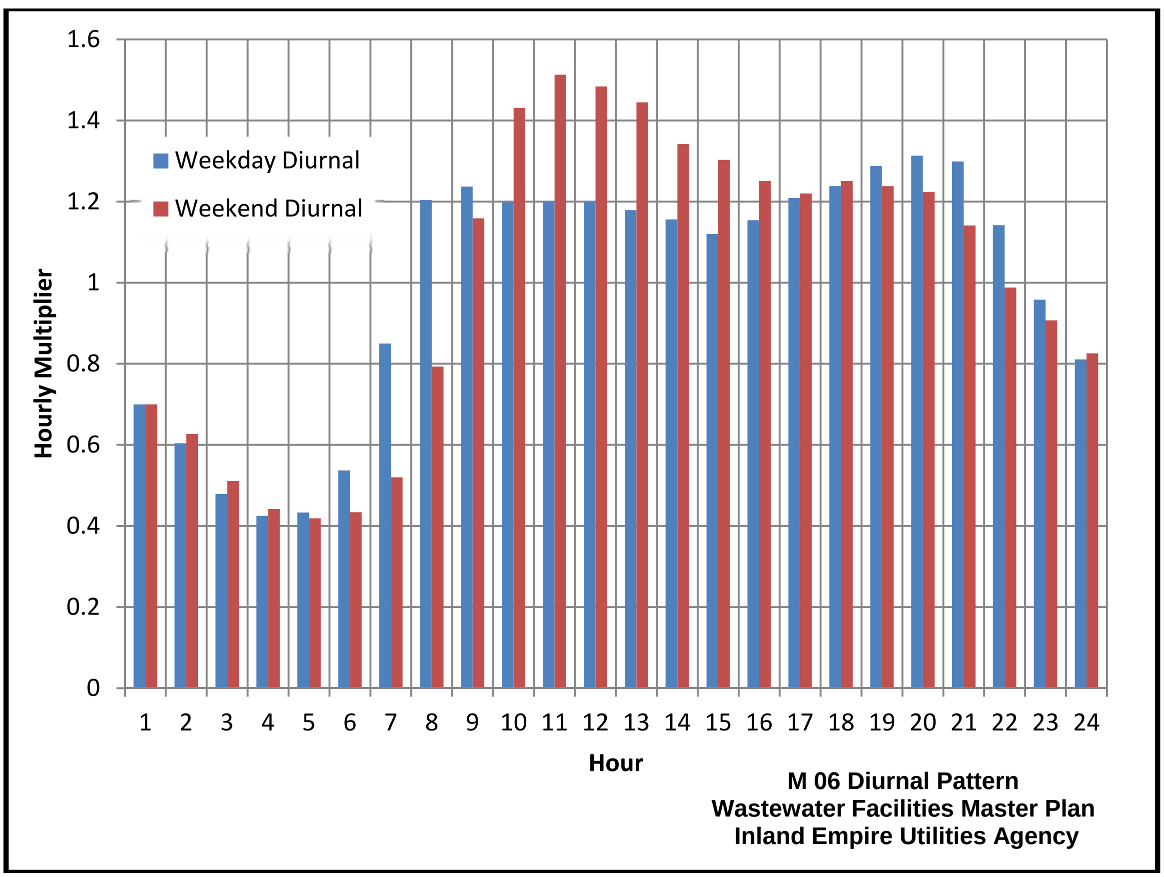
M 05 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency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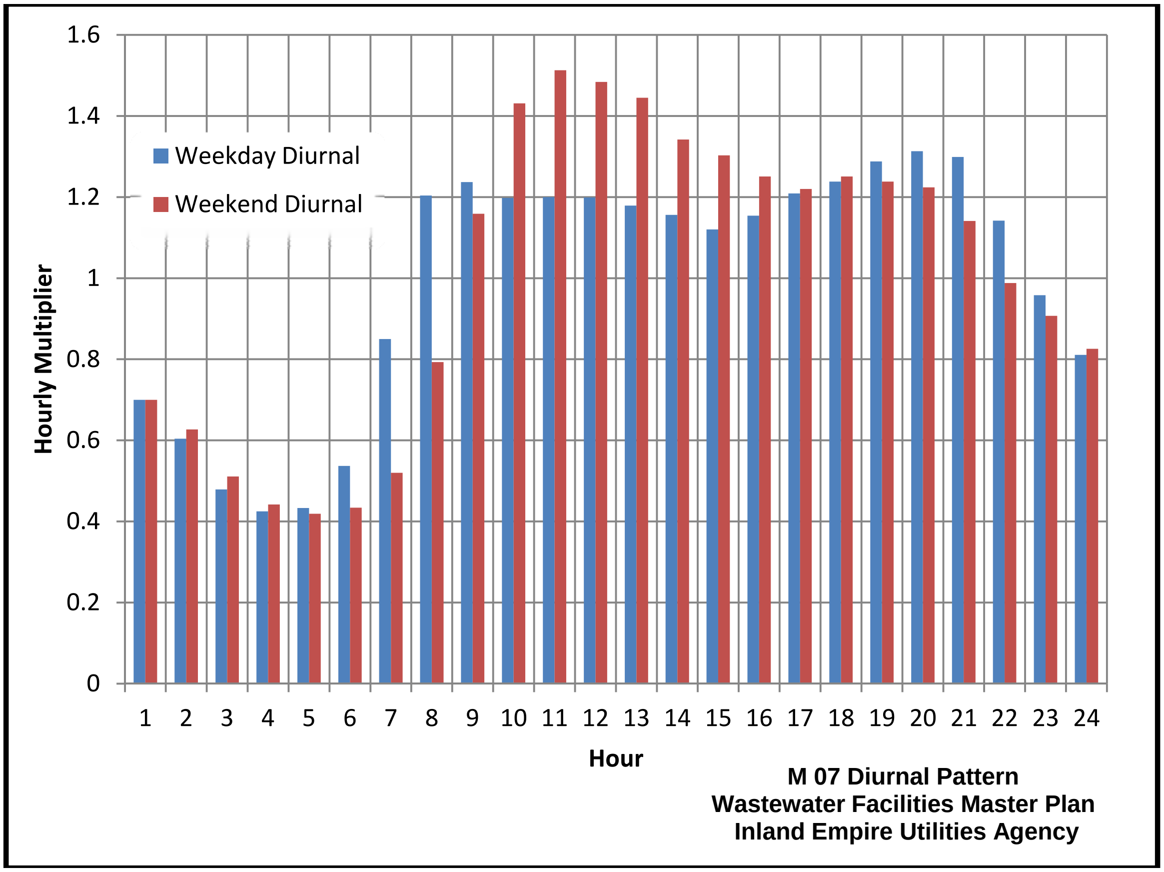
Wastewater Facilities Master Plan
Inland Empire Utilities Agency



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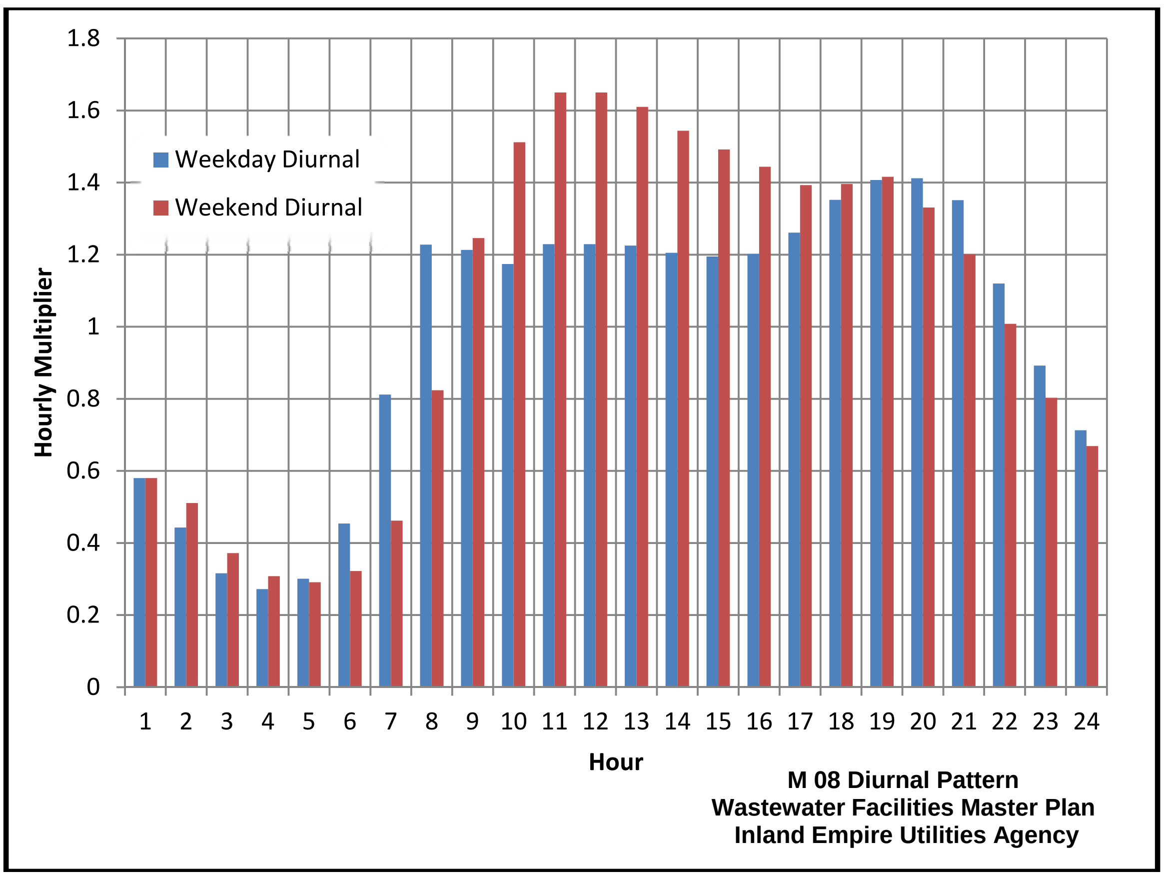
M 07 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency

Weekday Diurnal
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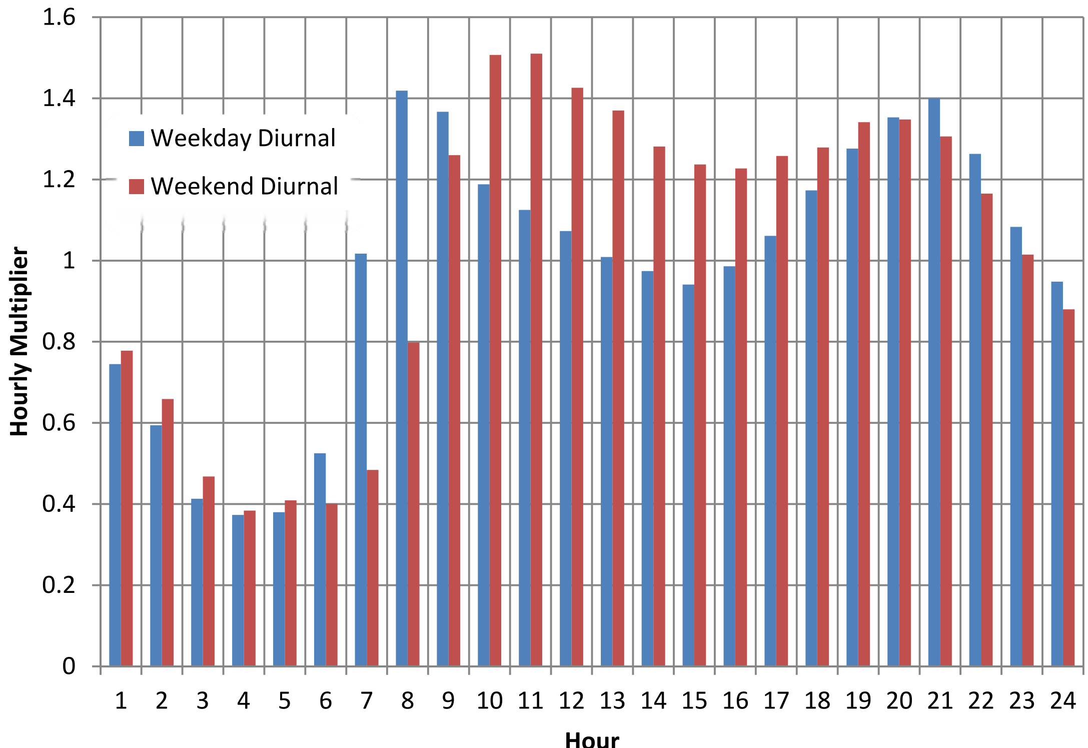
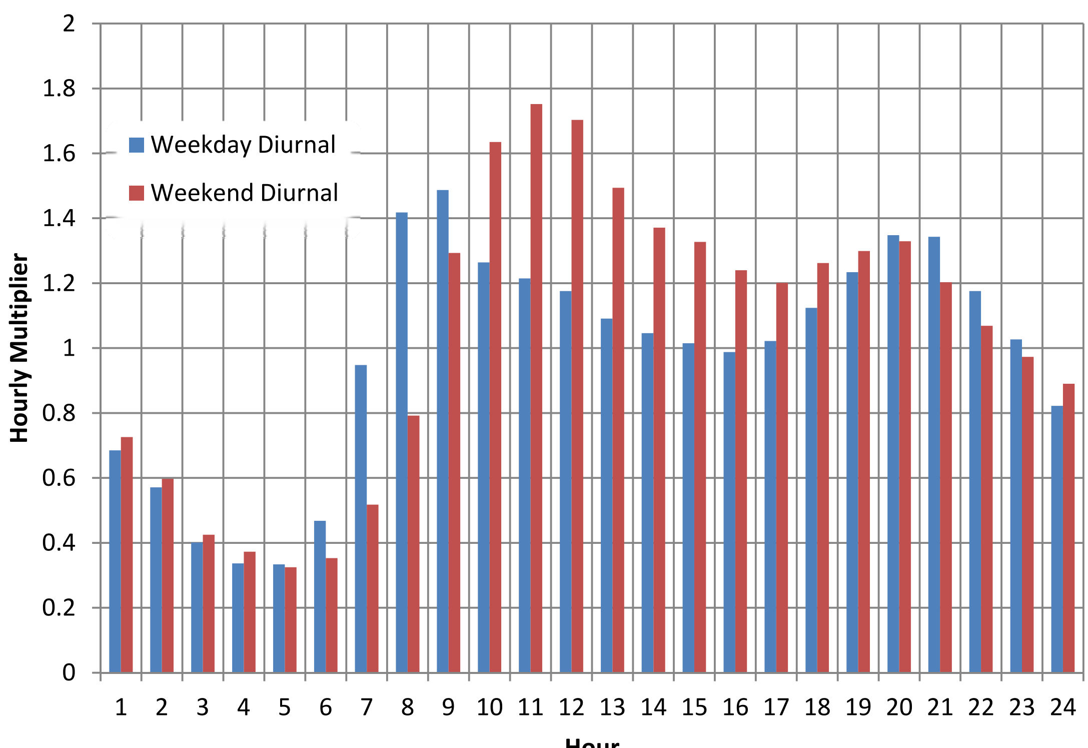
Wastewater Facilities Master Plan
Inland Empire Utilities Agency




**M 09 Diurnal Pattern**
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**




**M 10 Diurnal Pattern**
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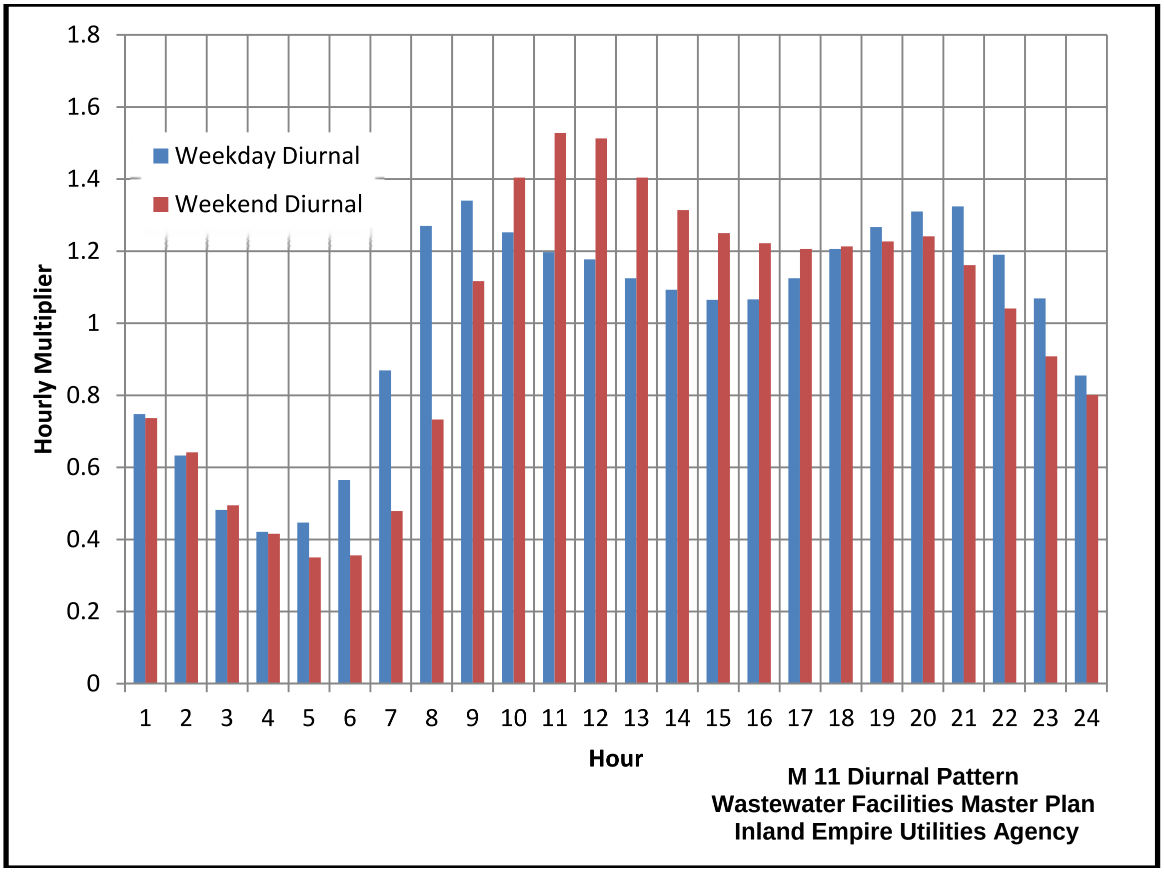
**Inland Empire Utilities Agency**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Hourly Multiplier
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Weekend Diurnal
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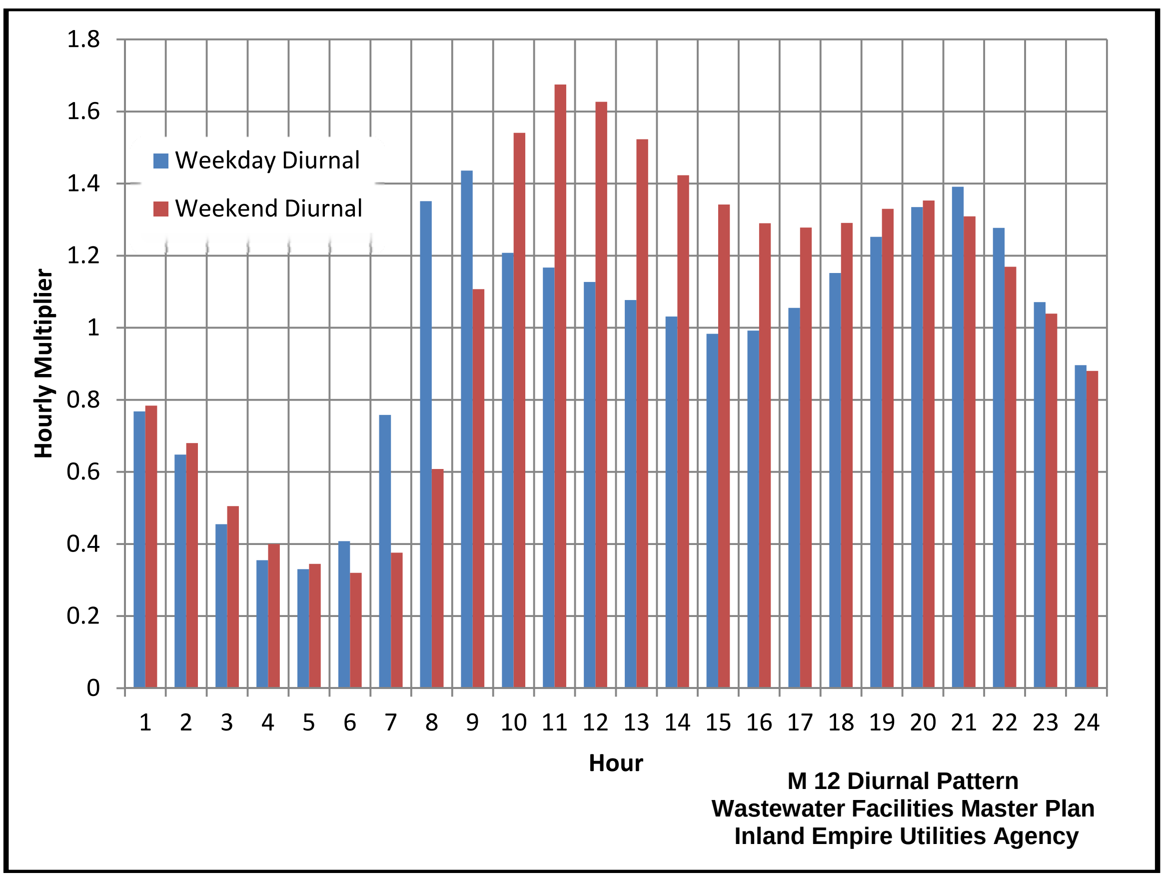
Hour
M 11 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency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Weekend Diurnal
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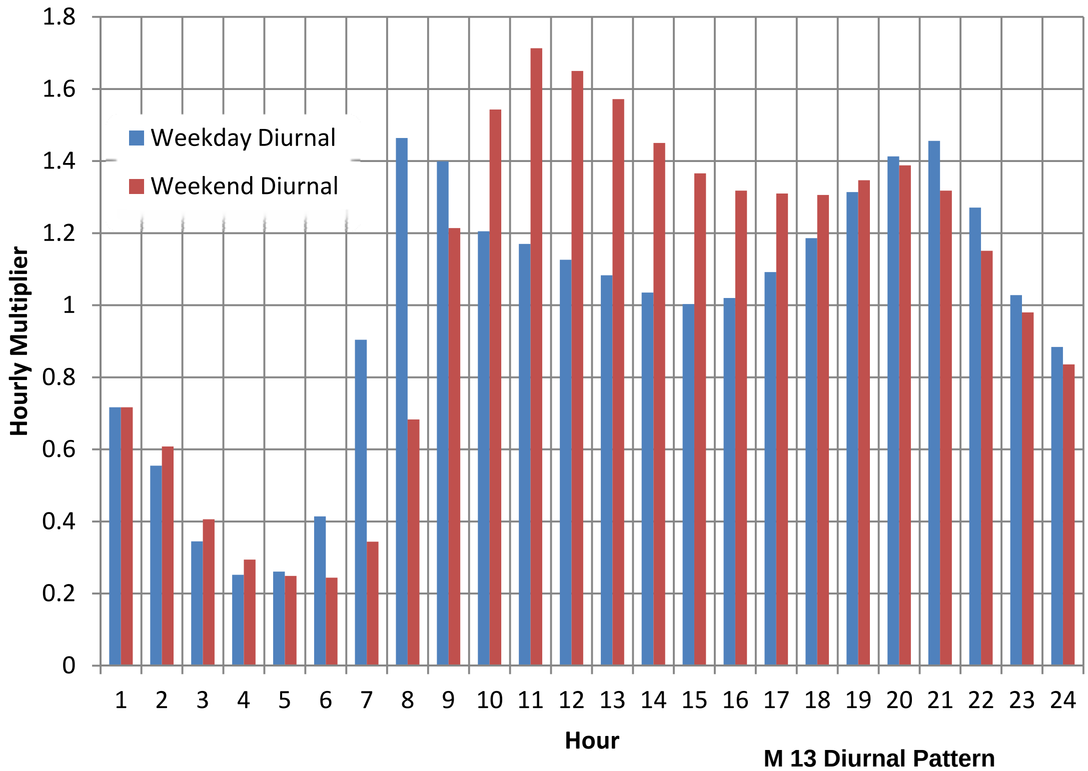
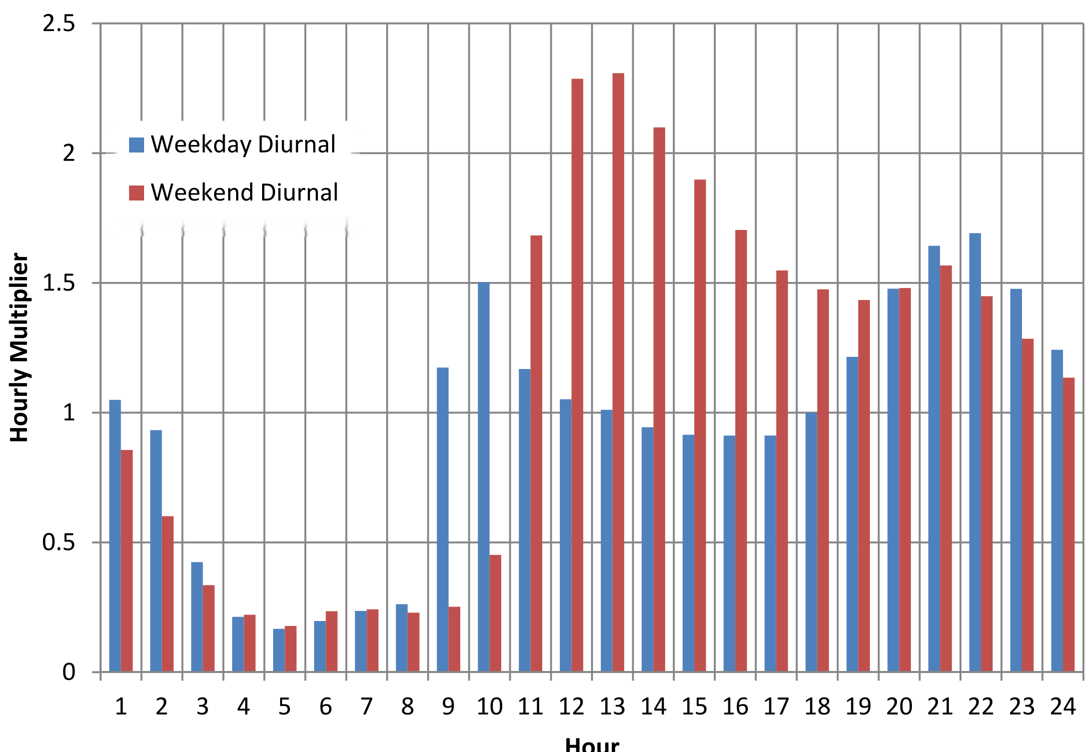
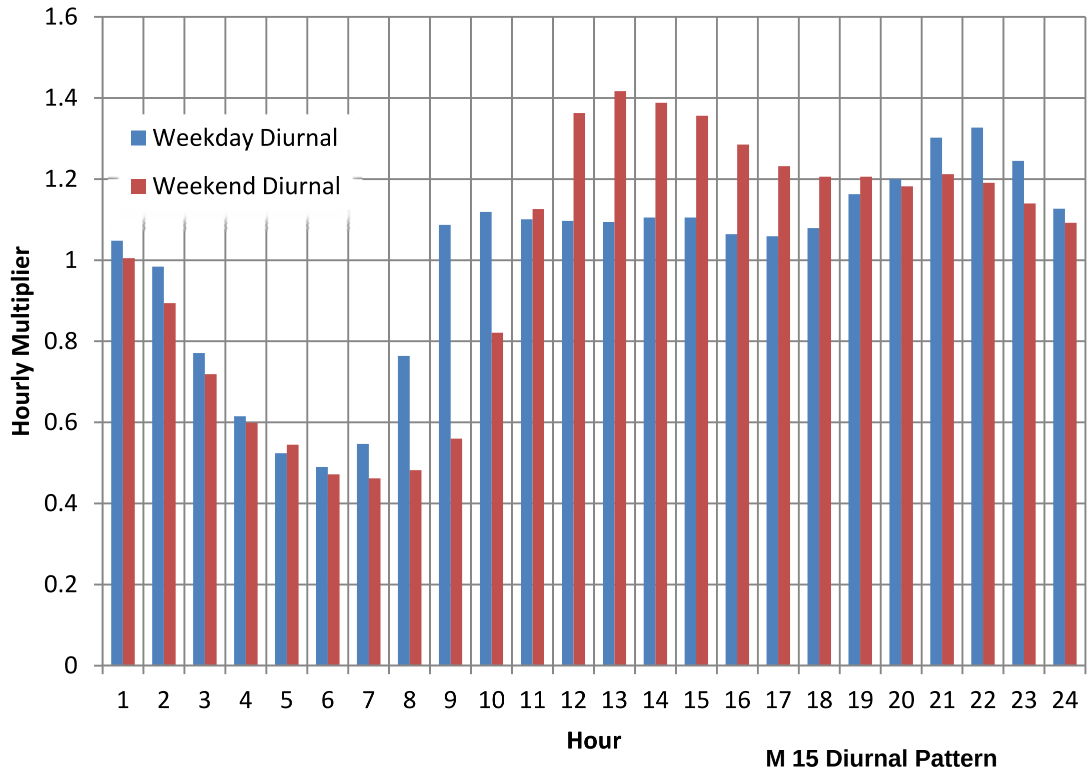
Hour
M 12 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency




**M 13 Diurnal Pattern**
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**




**M 14 Diurnal Pattern**
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**

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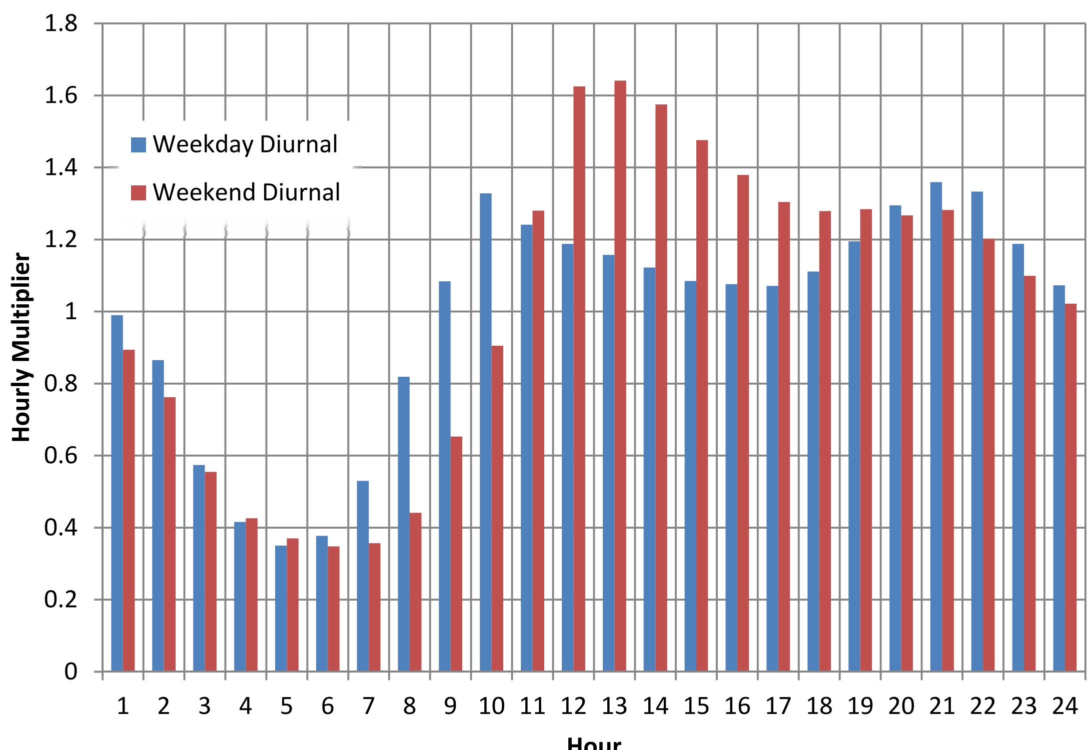
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**

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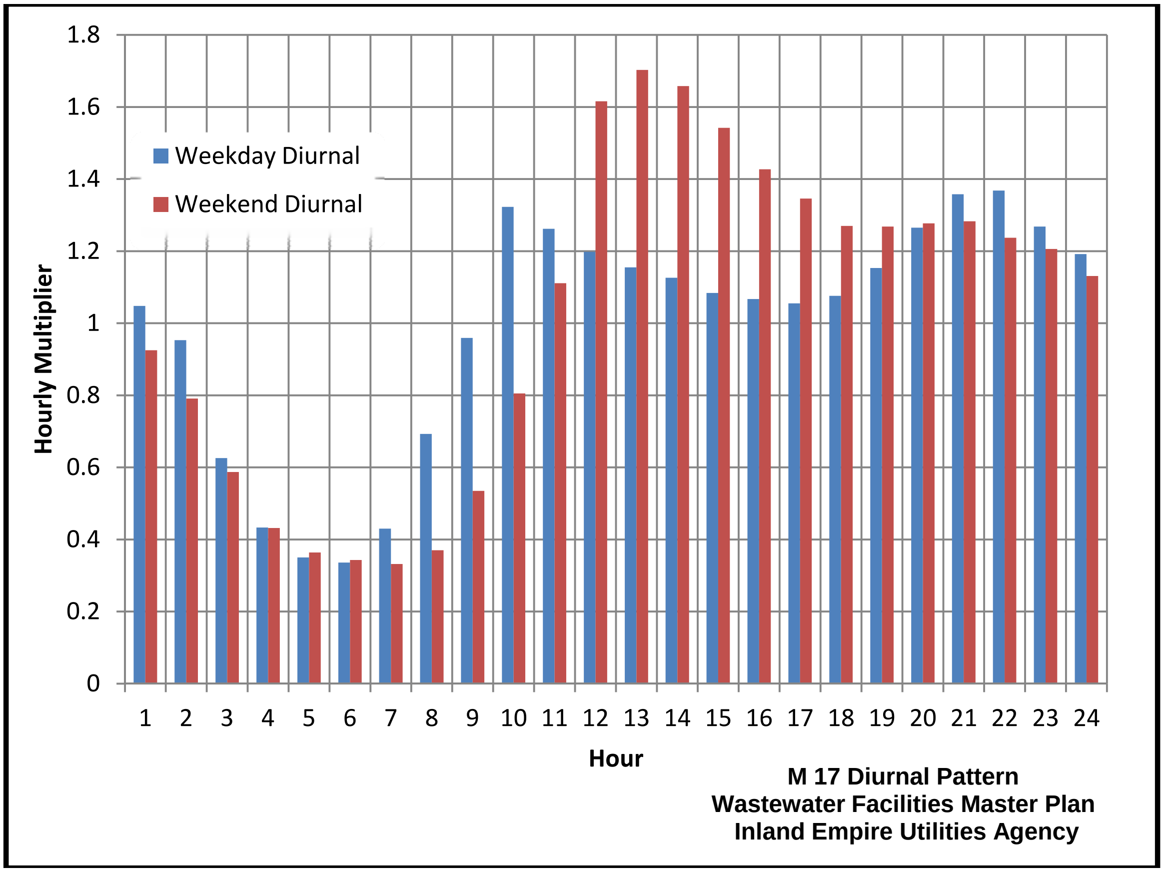
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**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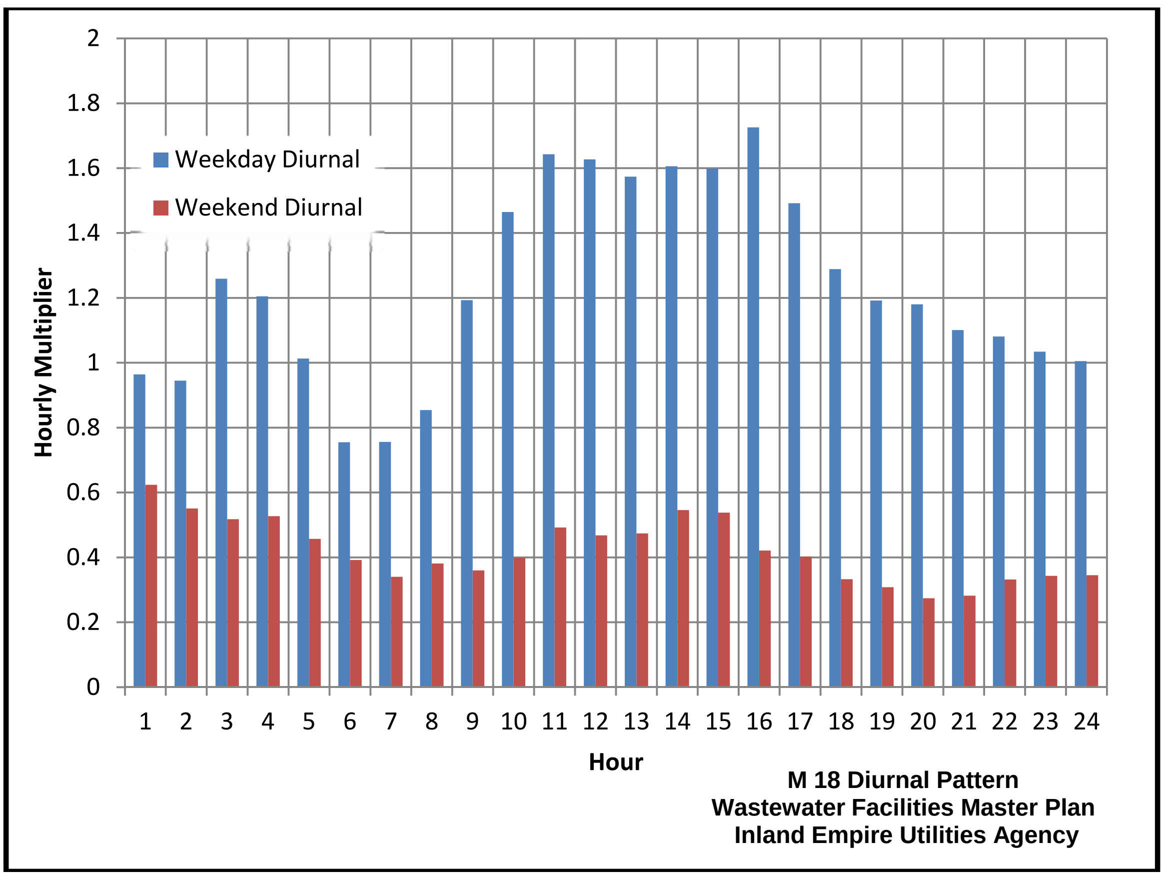
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Hourly Multiplier
Weekday Diurnal
Weekend Diurnal
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour
M 17 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency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0.8
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0.4
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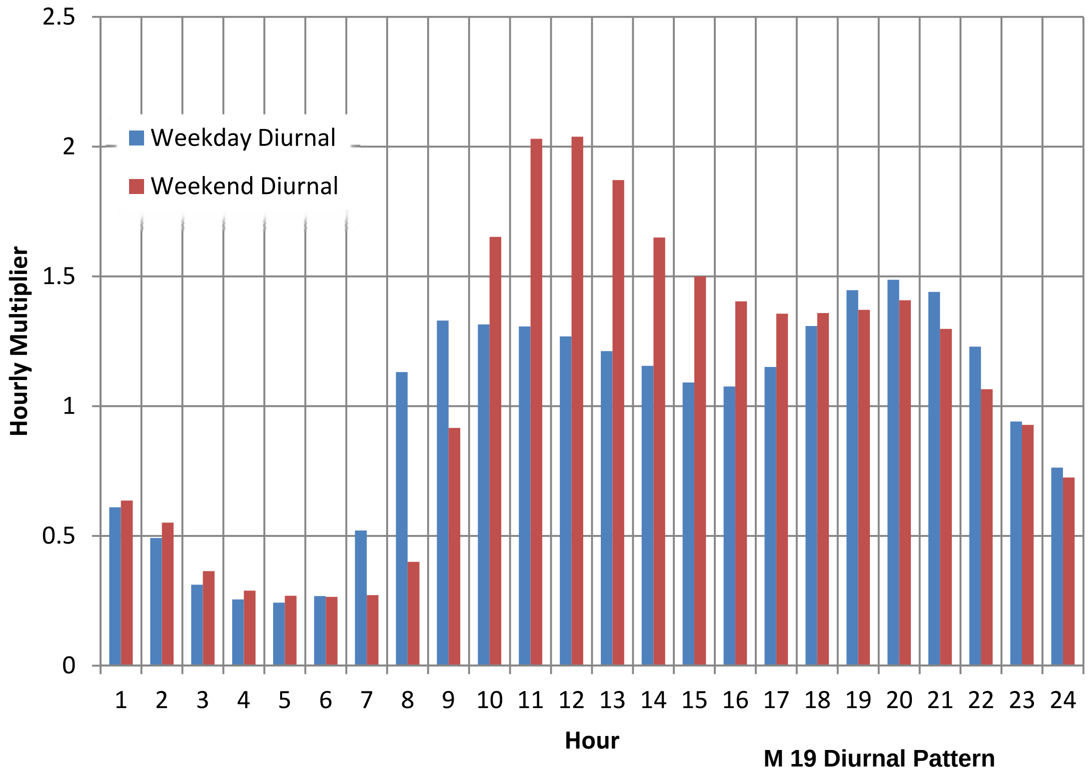
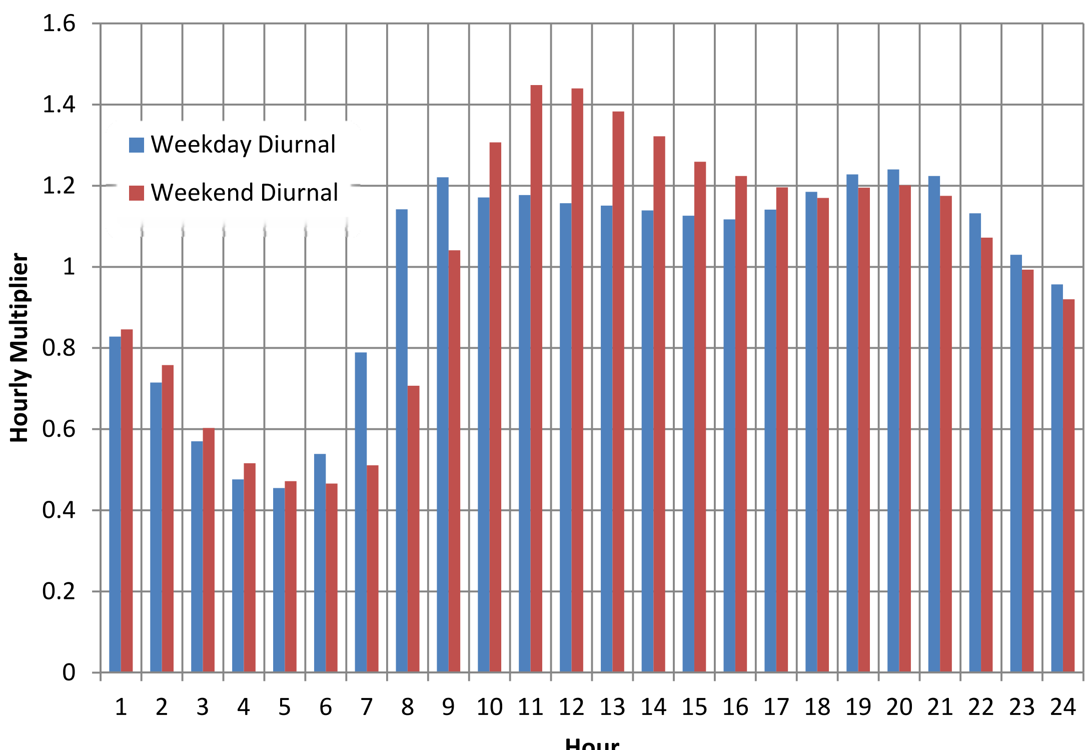
0
Hourly Multiplier
Weekday Diurnal
Weekend Diurnal
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour
M 18 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency




**M 19 Diurnal Pattern**
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**

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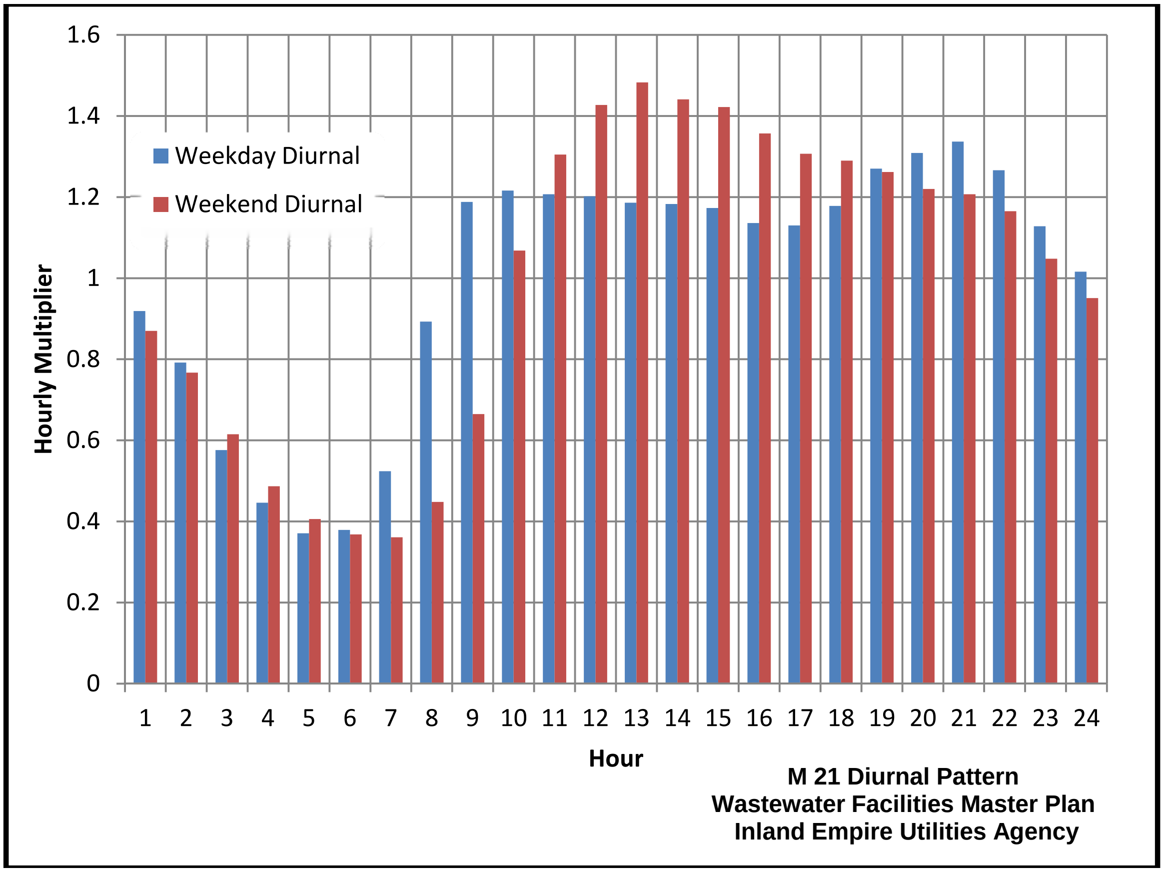
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**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0.6
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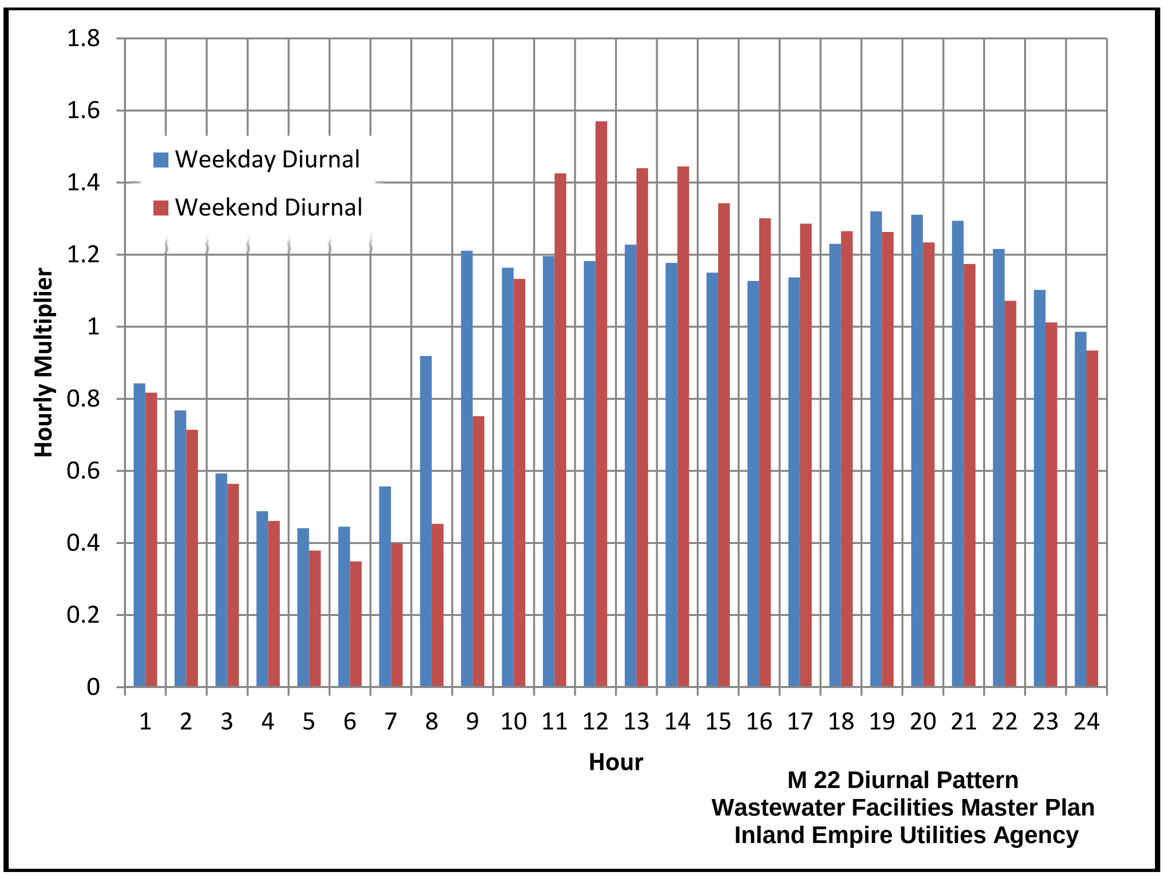
Weekday Diurnal
Weekend Diurnal
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour
M 21 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency


Hourly Multiplier
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1.6
1.4
1.2
1
0.8
0.6
0.4
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0
Weekday Diurnal
Weekend Diurnal
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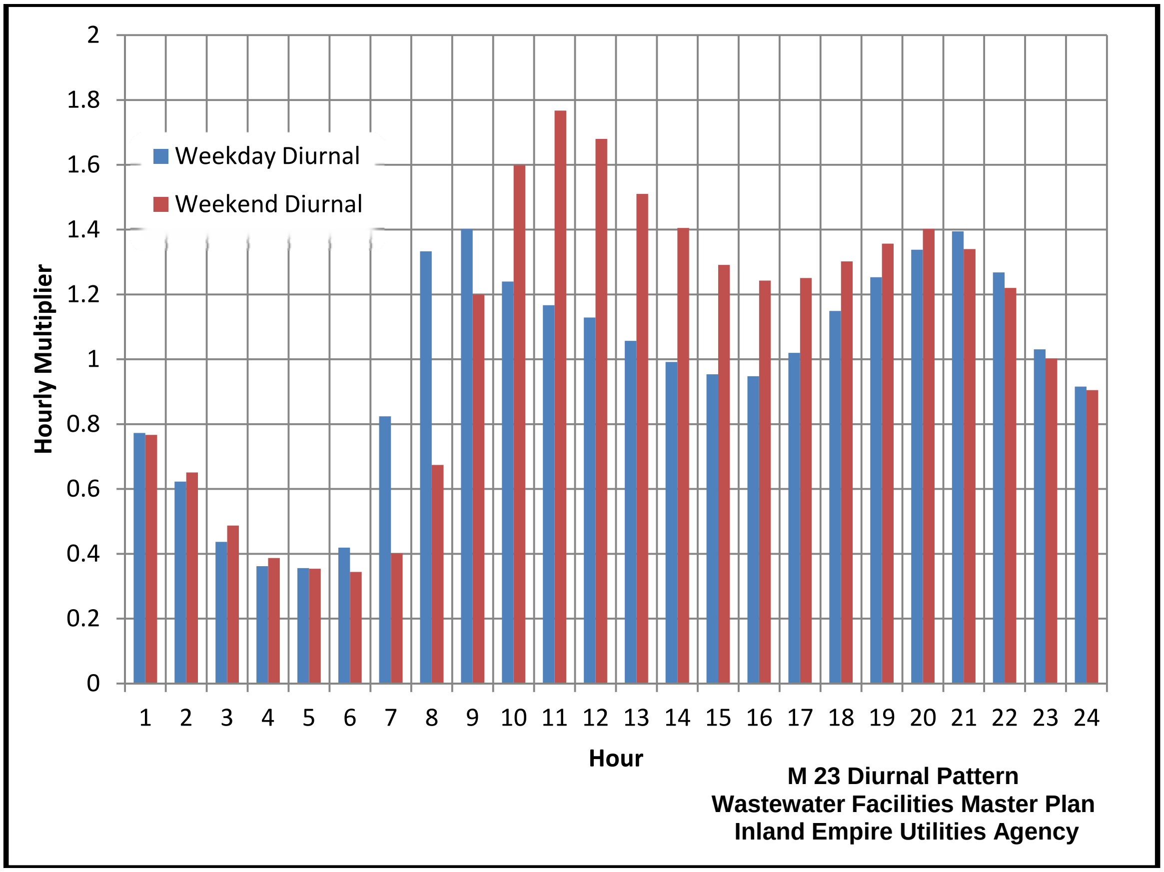
Hour
M 22 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency



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1
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Hourly Multiplier
Weekday Diurnal
Weekend Diurnal
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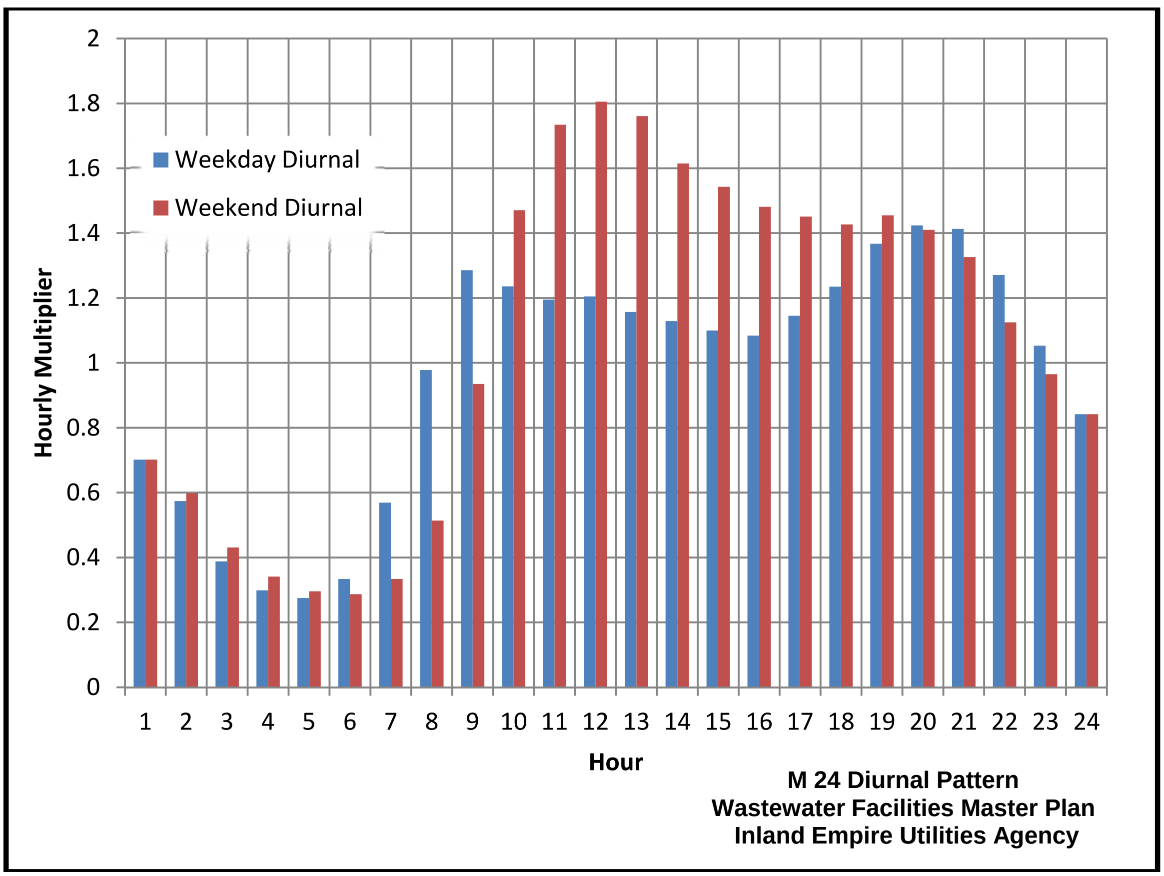
Hour
M 23 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency

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Hourly Multiplier
Weekday Diurnal
Weekend Diurnal
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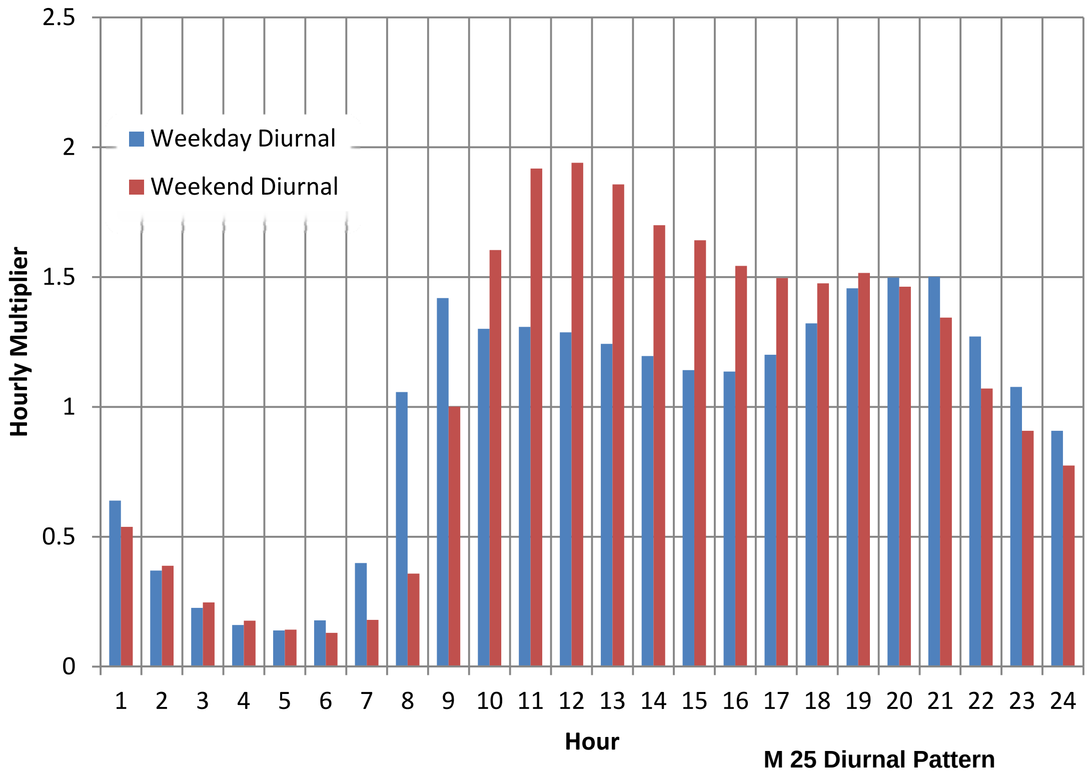
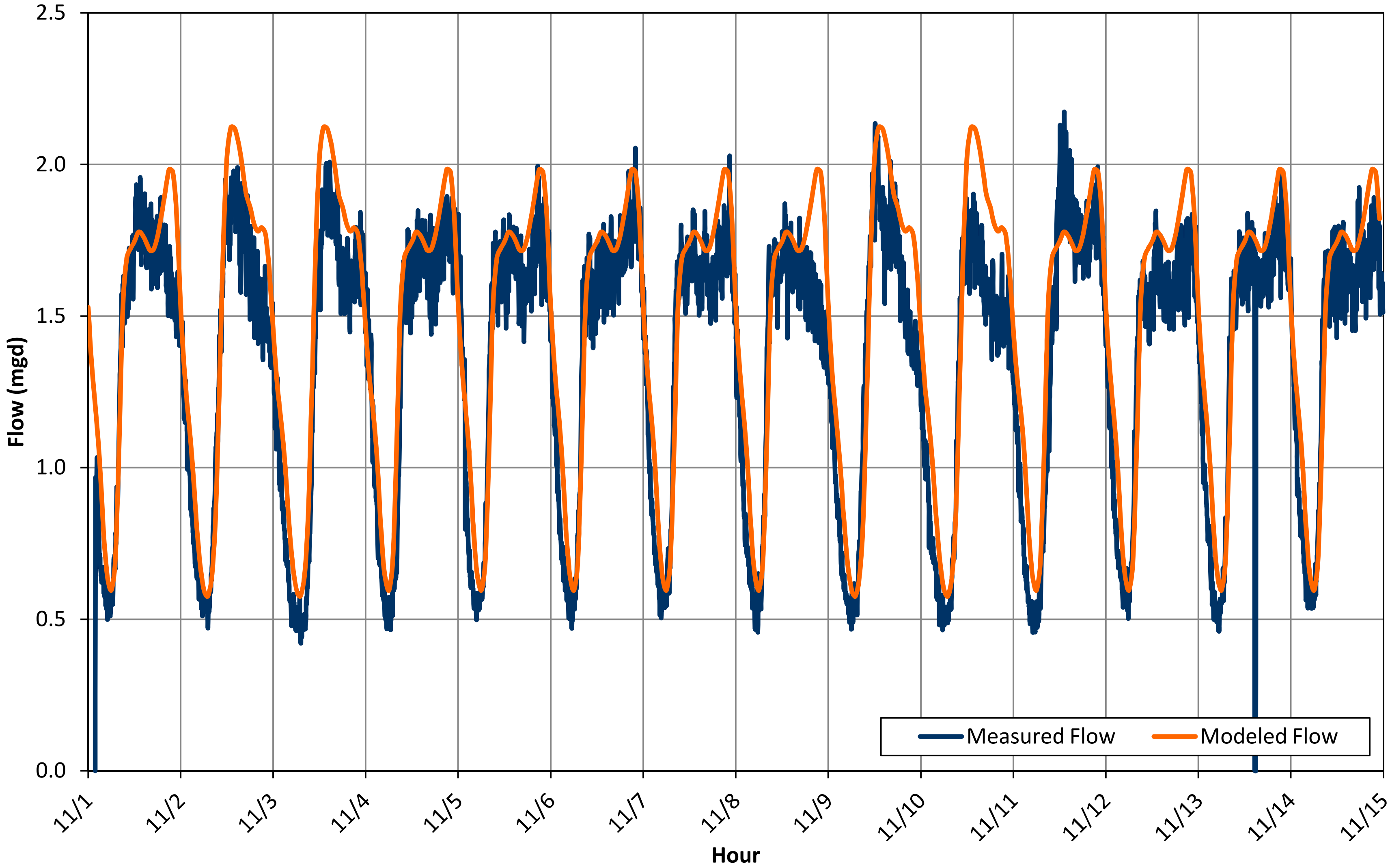
Hour
M 24 Diurnal Pattern
Wastewater Facilities Master Plan
Inland Empire Utilities Agency



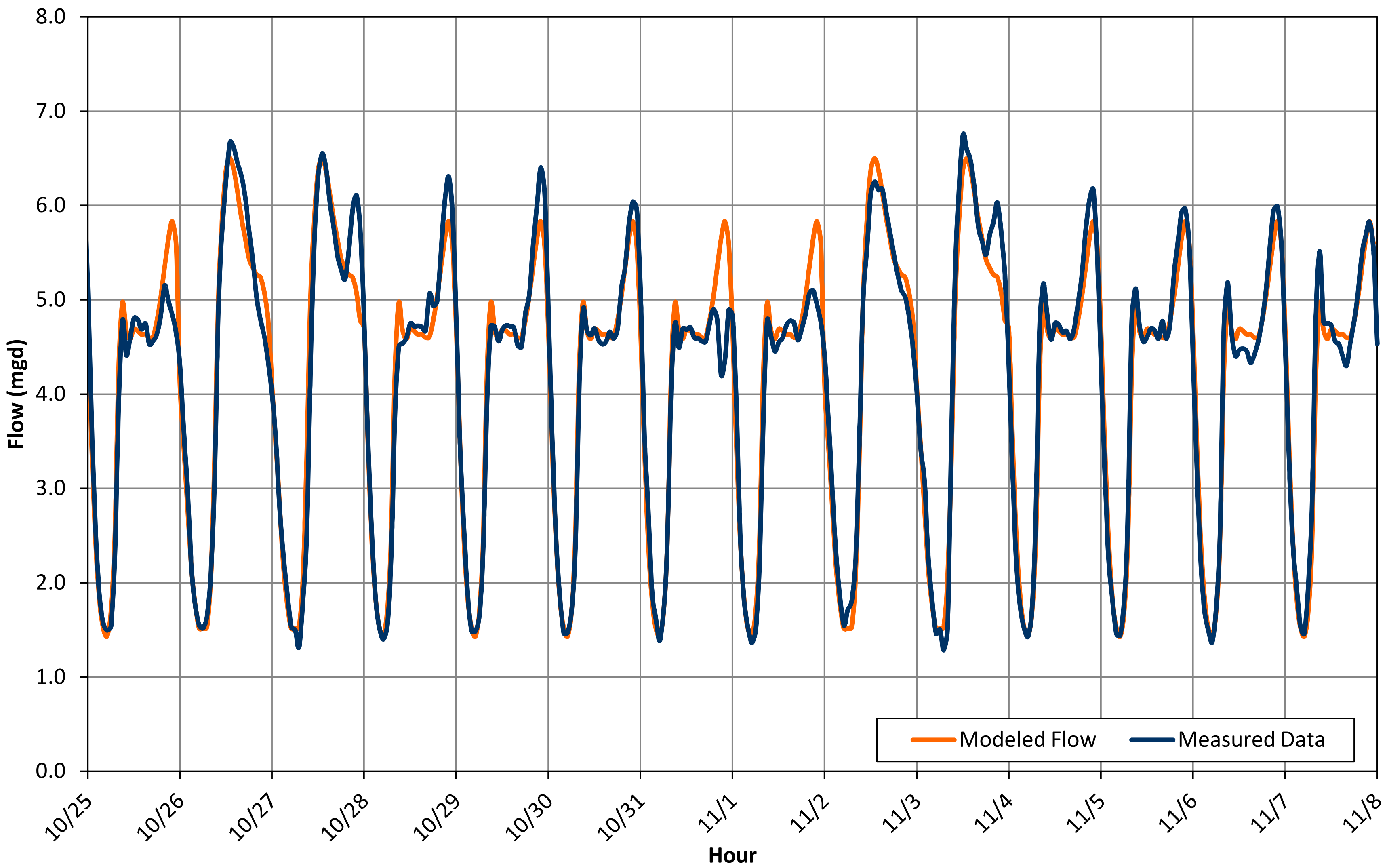

**M 25 Diurnal Pattern**
**Wastewater Facilities Master Plan**
**Inland Empire Utilities Agency**

# Appendix 2-C
# Model Calibration Plots

**Inland Empire Utilities Agency**
**Wastewater Facilities Master Plan**
**FLOW MONITORING SITE M01 FLOW VALIDATION (11/01/2013-11/14/2013)**



Inland Empire Utilities Agency
Wastewater Facilities Master Plan
SBLS FLOW VALIDATION (10/25/2013-11/07/2013)



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**Wastewater Facilities Master Plan**
**RP-5 INFLUENT FLOW VALIDATION (10/25/2013-11/07/2013)**

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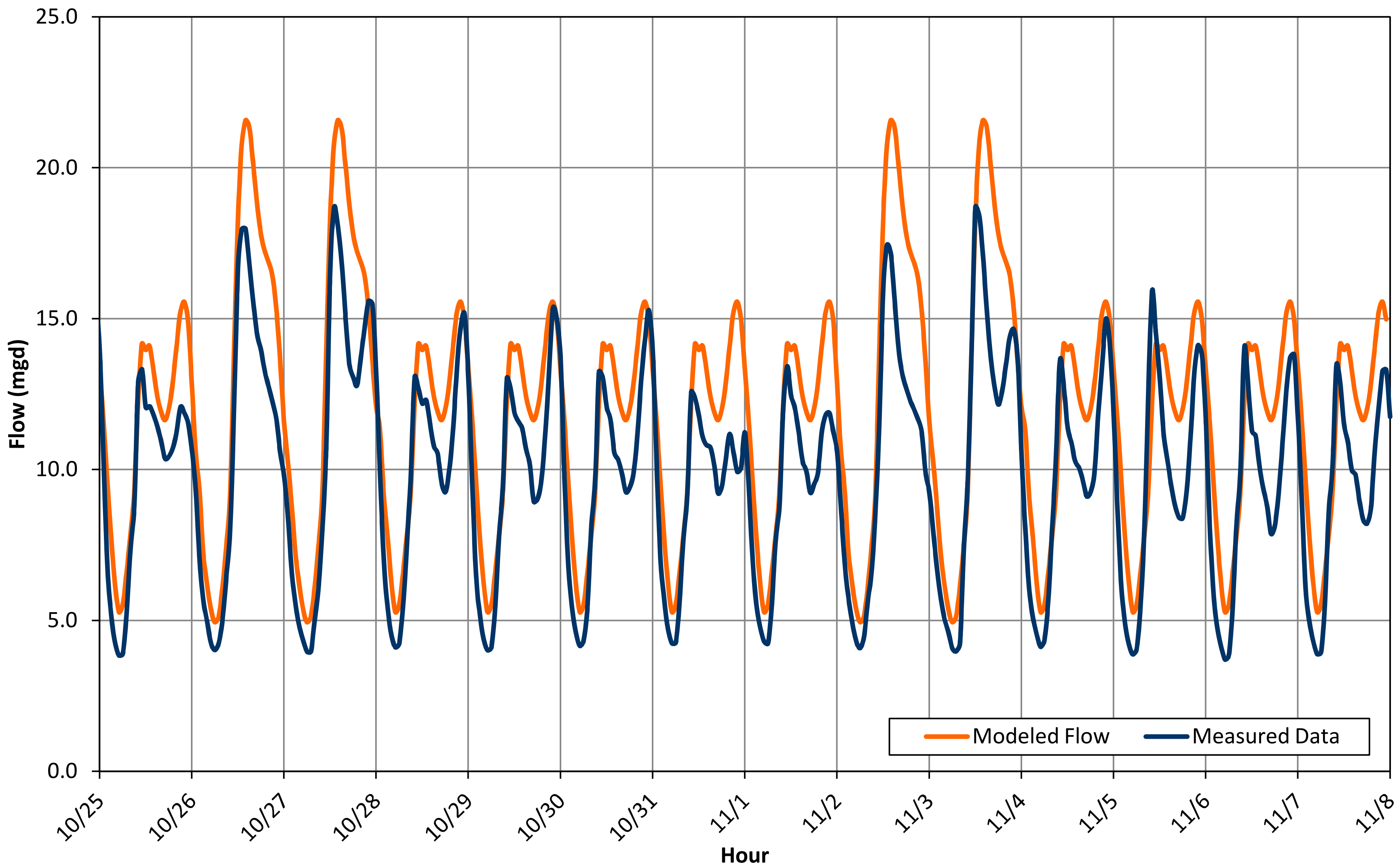

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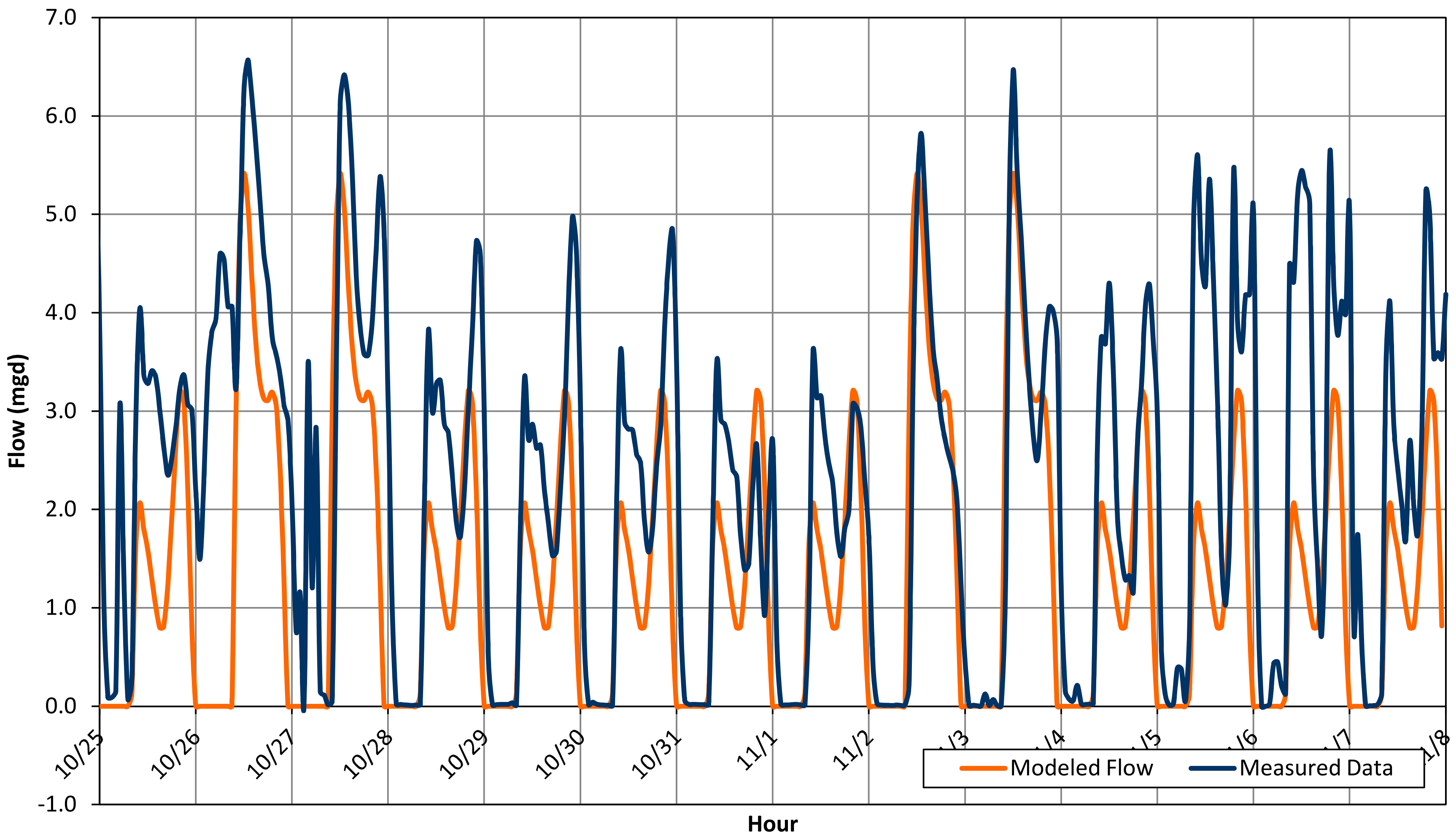
Wastewater Facilities Master Plan

FLOW MONITORING SITE RP-5 BYPASS FLOW VALIDATION (10/25/2013-11/07/2013)



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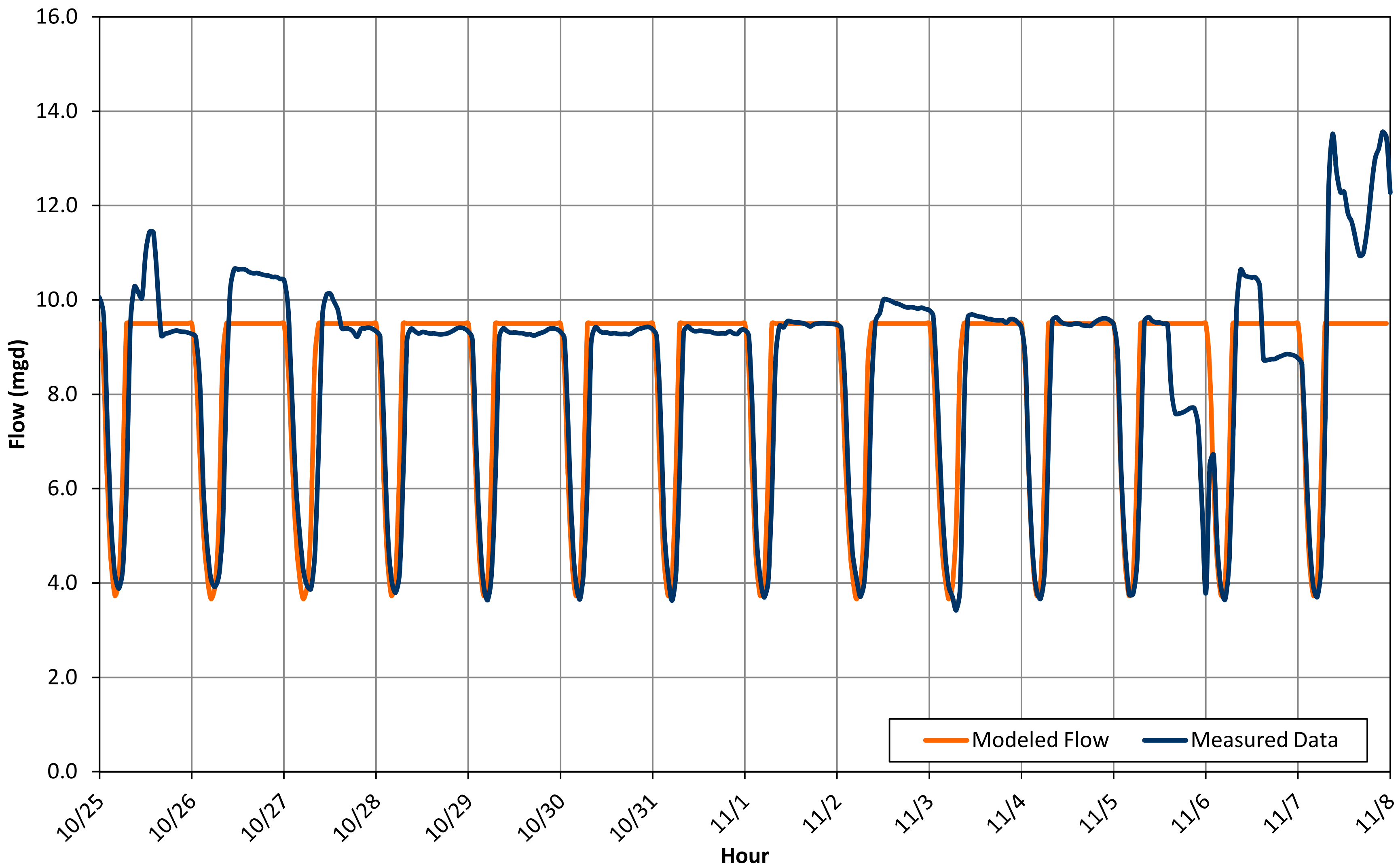
Wastewater Facilities Master Plan

RP-4 INFLUENT FLOW VALIDATION (10/25/2013-11/07/2013)



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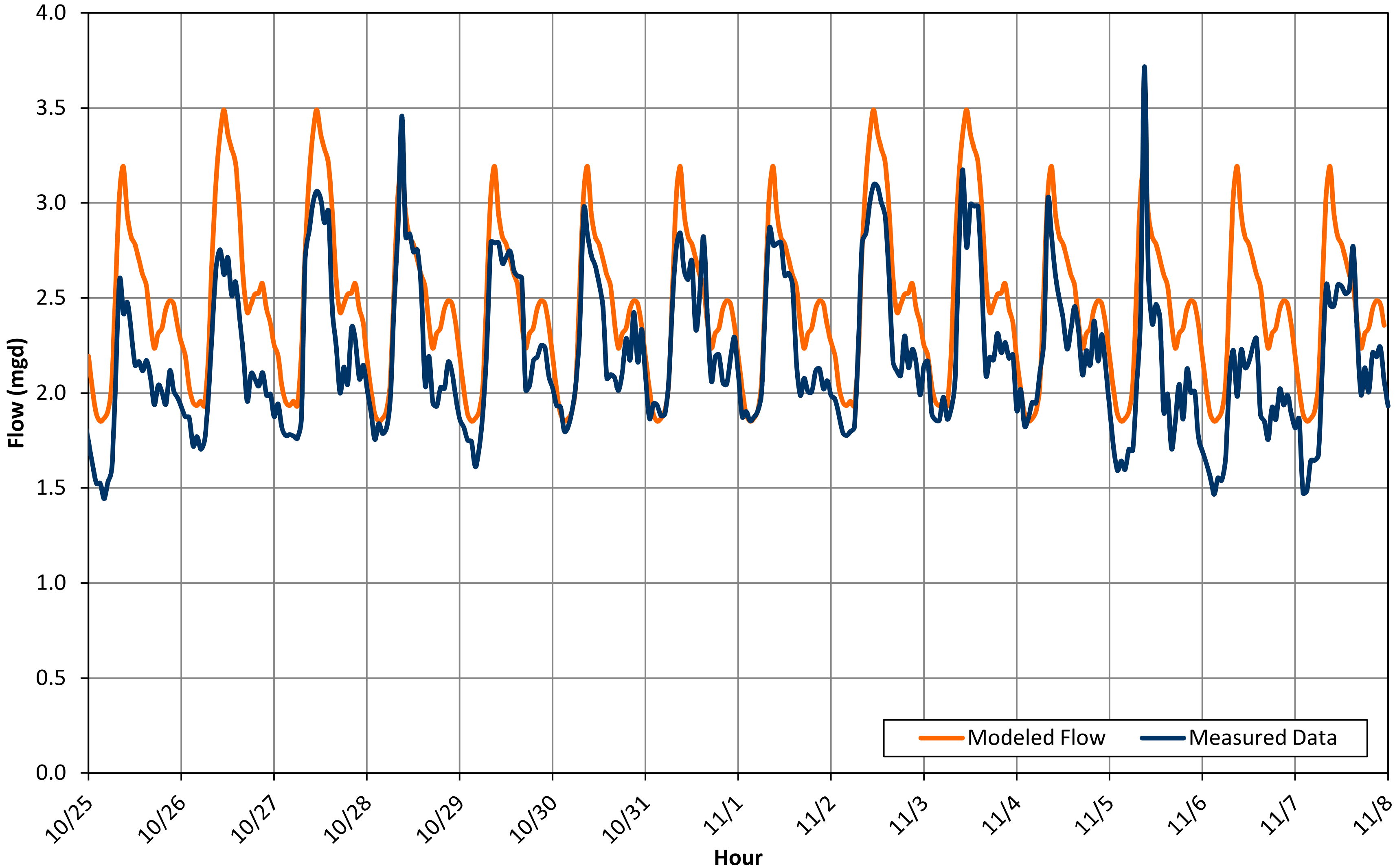
**Wastewater Facilities Master Plan**

**RP-2 LIFT STATION FLOW VALIDATION (10/25/2013-11/07/2013)**



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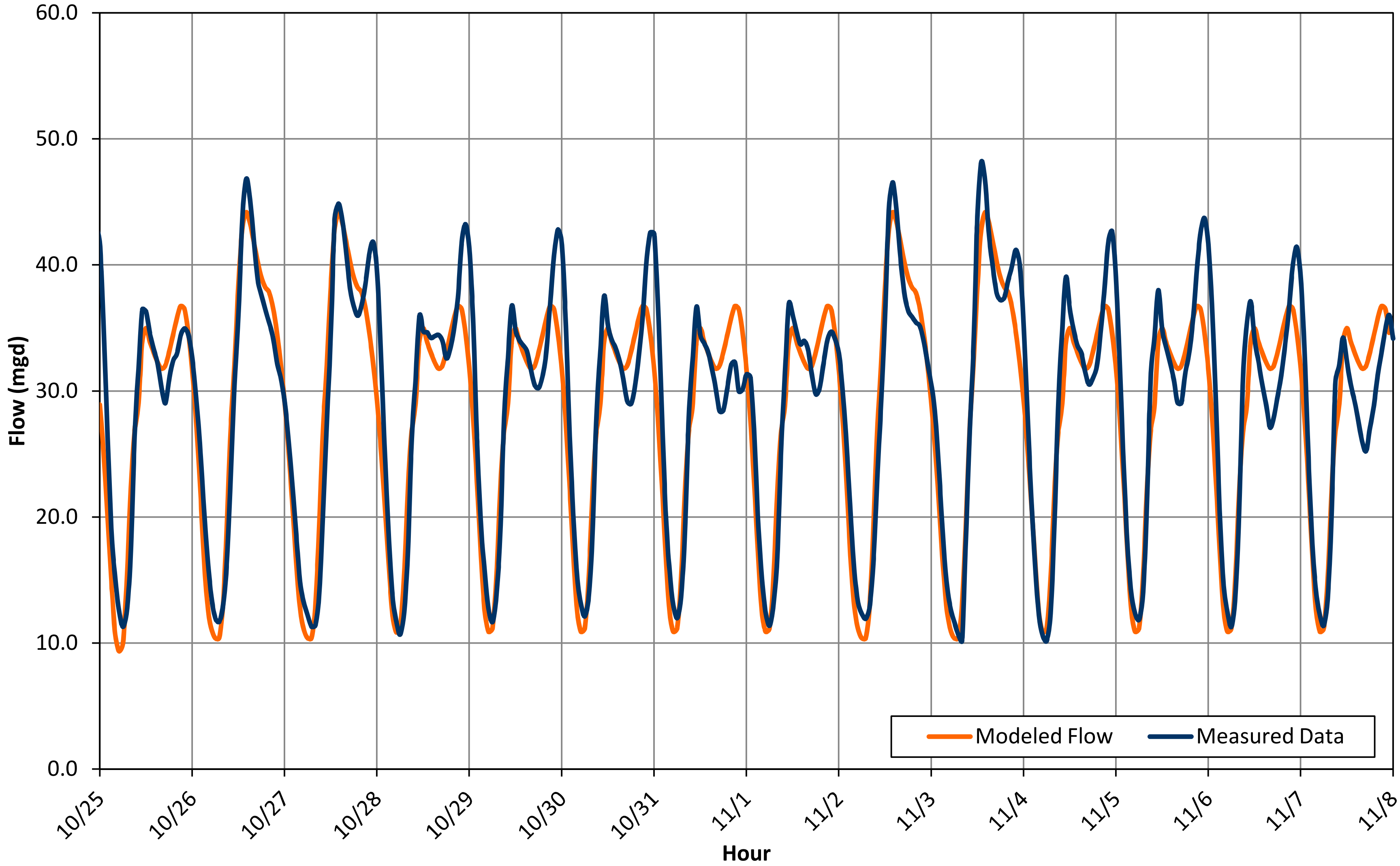
**Wastewater Facilities Master Plan**

**RP-1 INFLUENT FLOW VALIDATION (10/25/2013-11/07/2013)**



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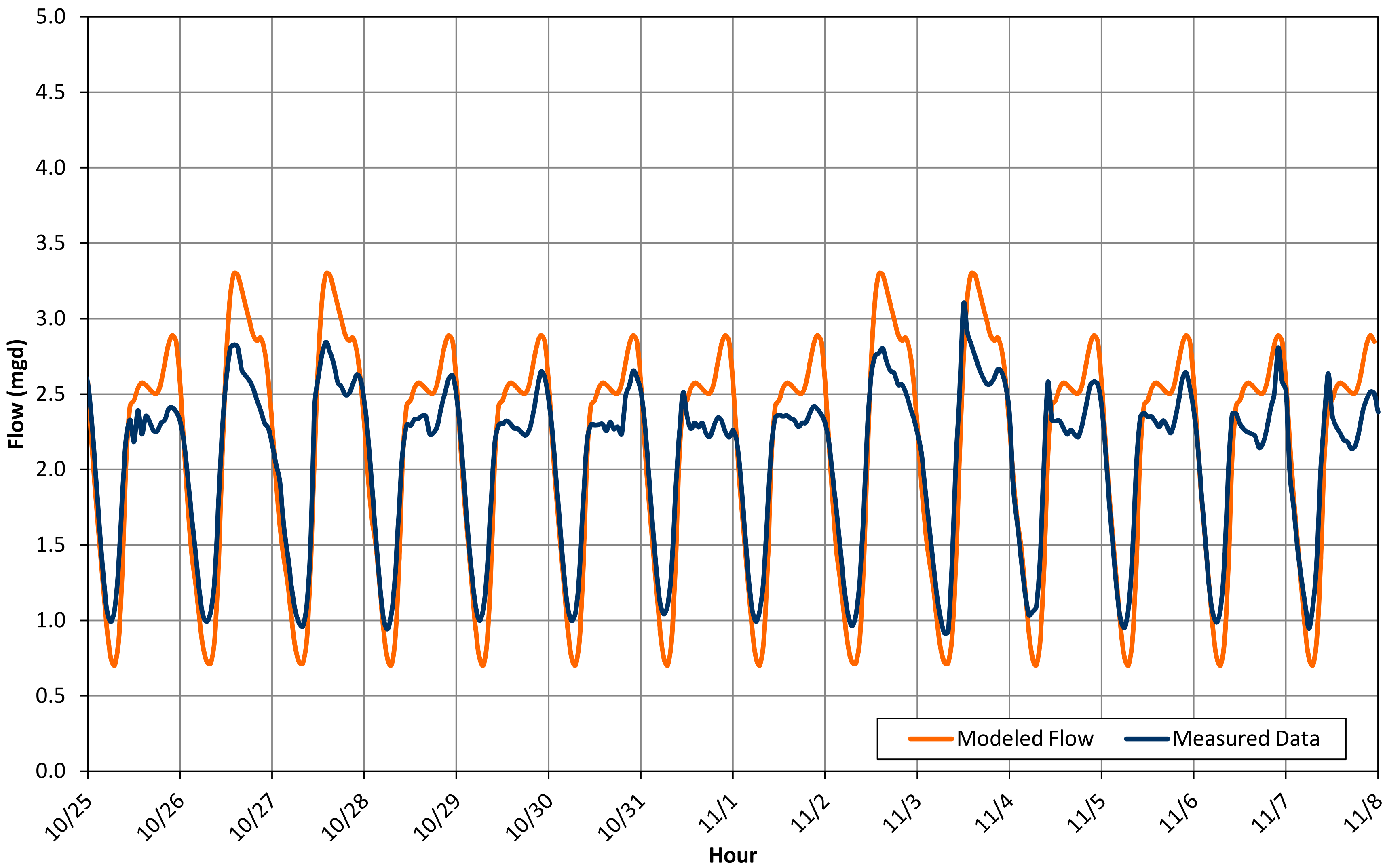
Wastewater Facilities Master Plan
**MONTCLAIR LS FLOW VALIDATION (10/25/2013-11/07/2013)**



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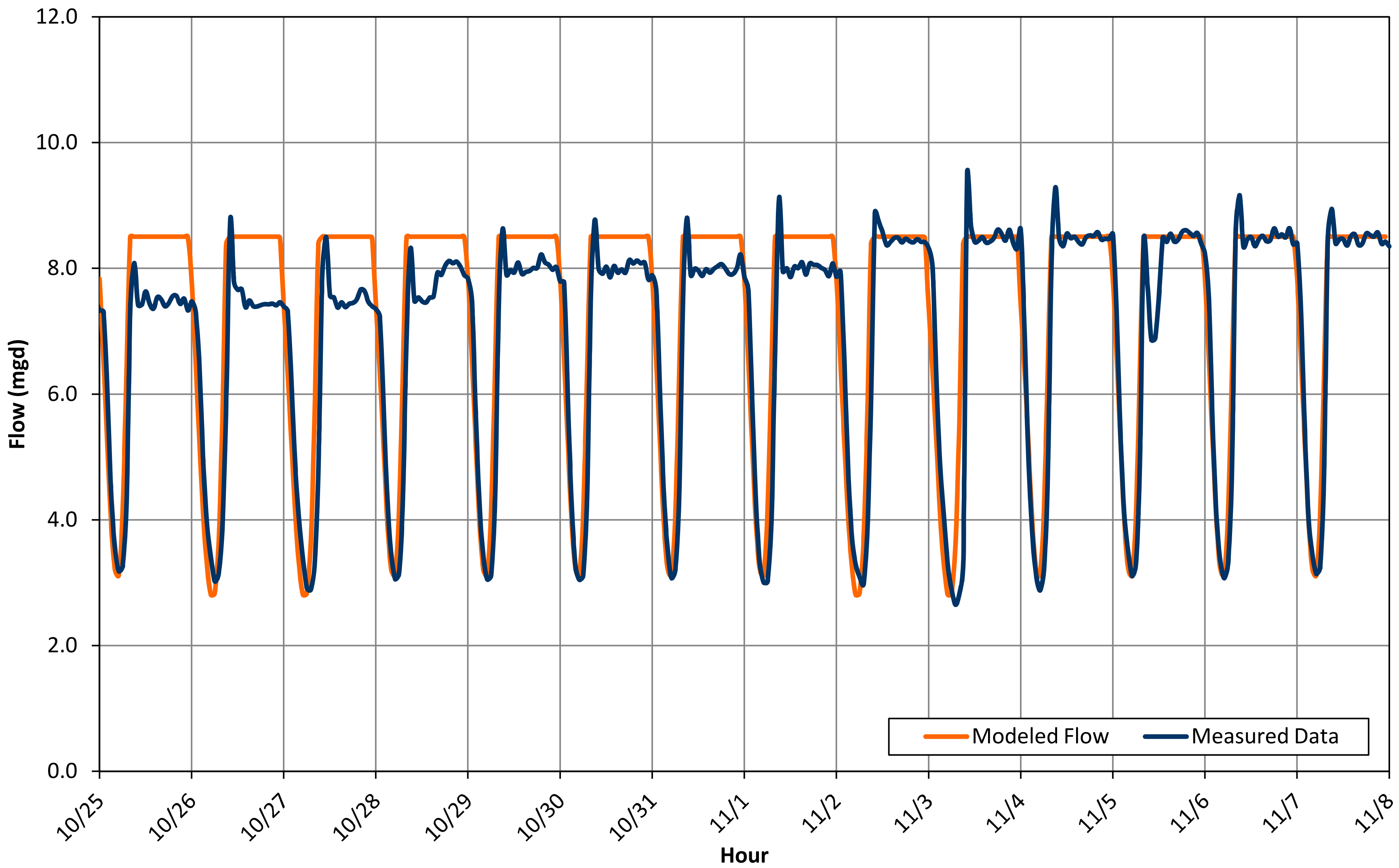
Wastewater Facilities Master Plan

CCWRF INFLUENT FLOW VALIDATION (10/25/2013-11/07/2013)



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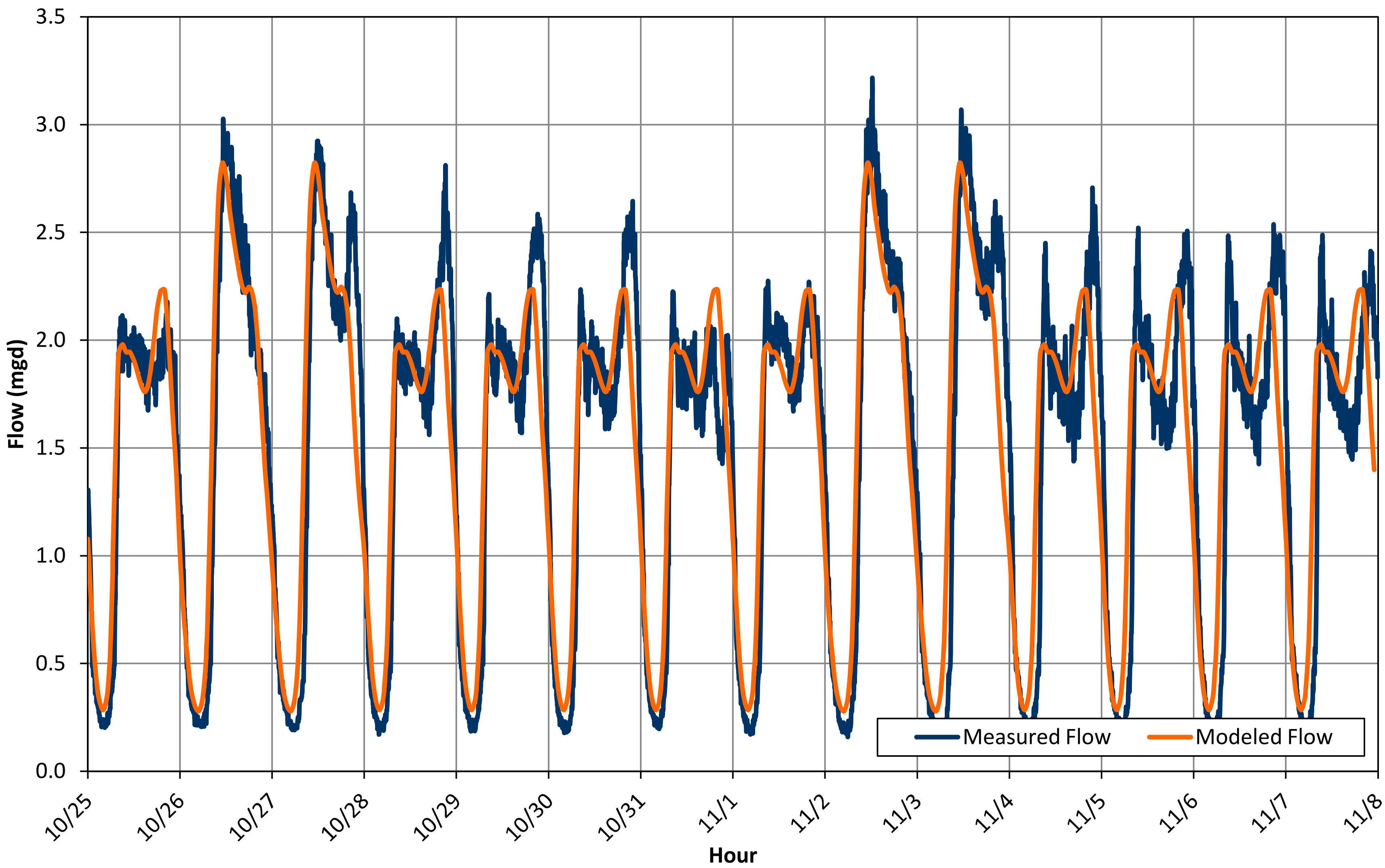
Wastewater Facilities Master Plan

**FLOW MONITORING SITE M25 FLOW VALIDATION (10/25/2013-11/07/2013)**



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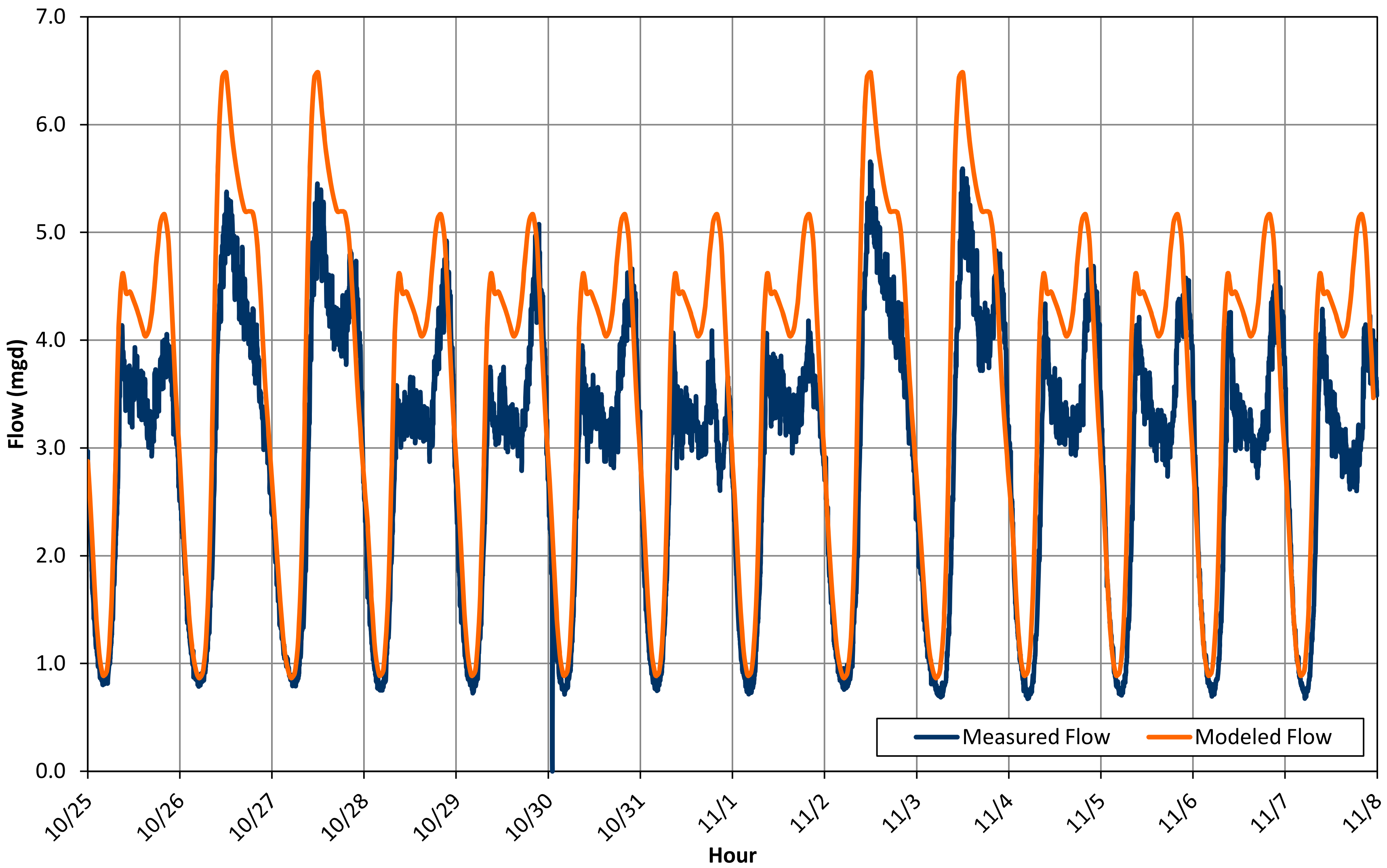
Wastewater Facilities Master Plan
FLOW MONITORING SITE M24 FLOW VALIDATION (10/25/2013-11/07/2013)



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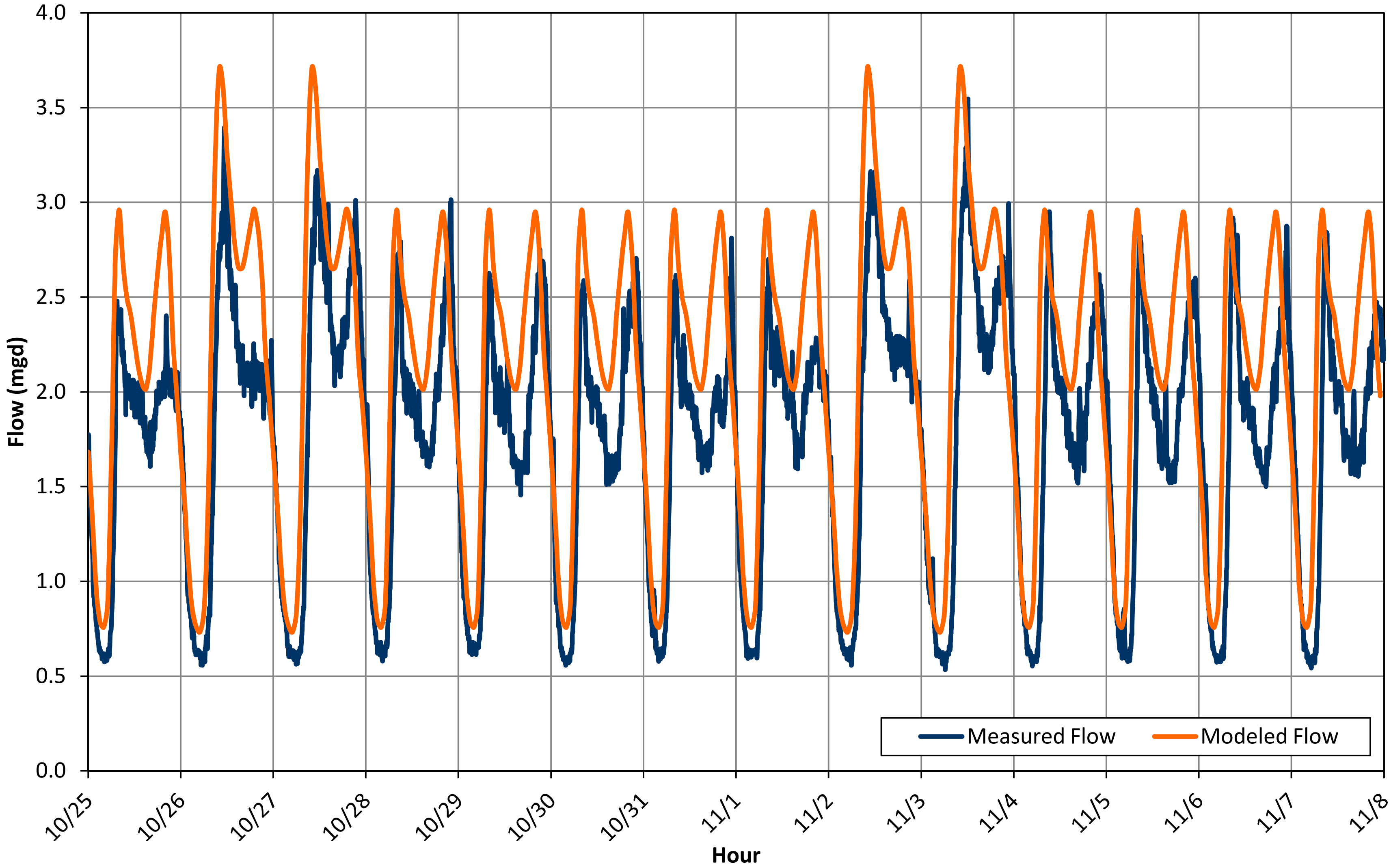
**Wastewater Facilities Master Plan**

**FLOW MONITORING SITE M23 FLOW VALIDATION (10/25/2013-11/07/2013)**



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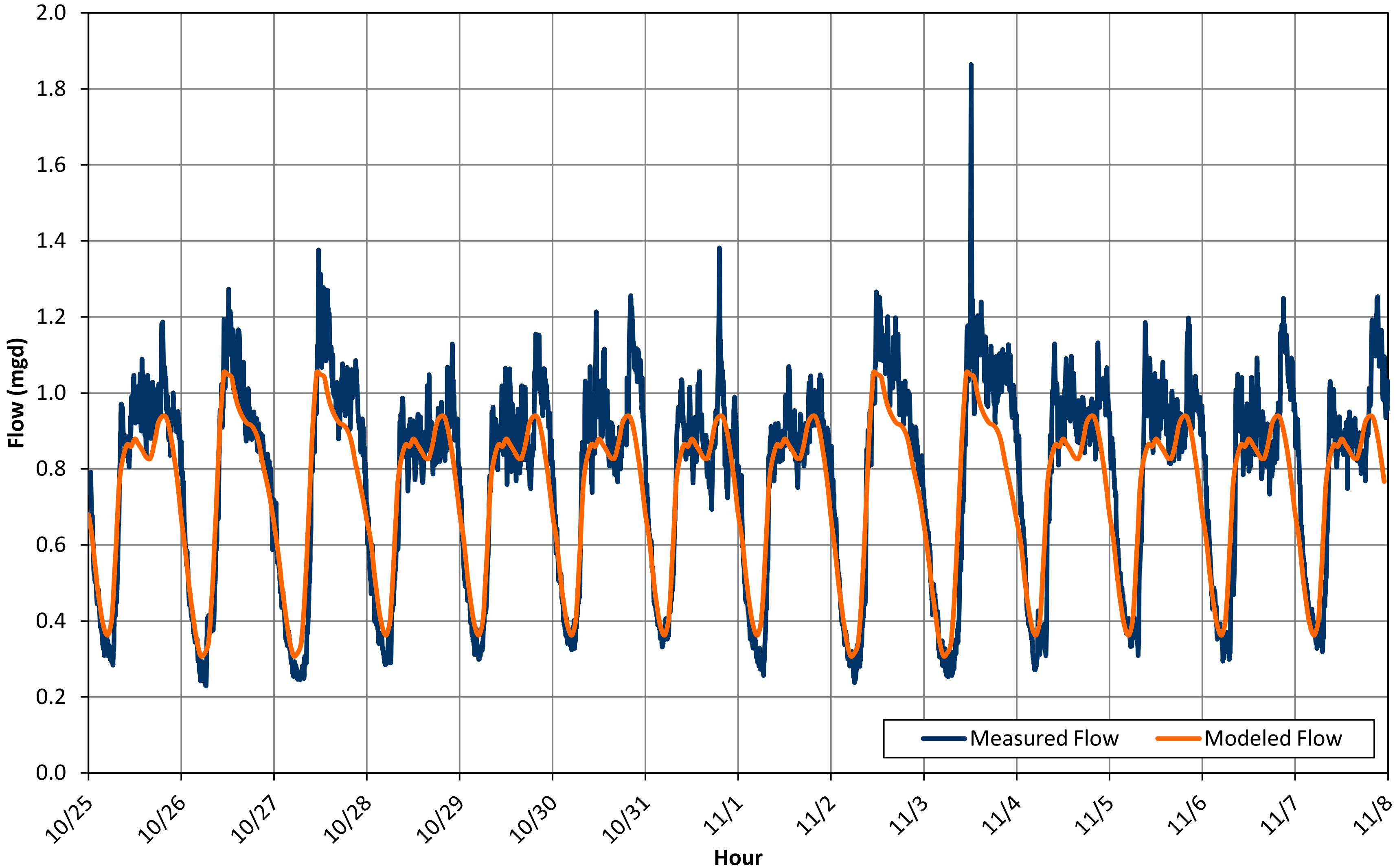
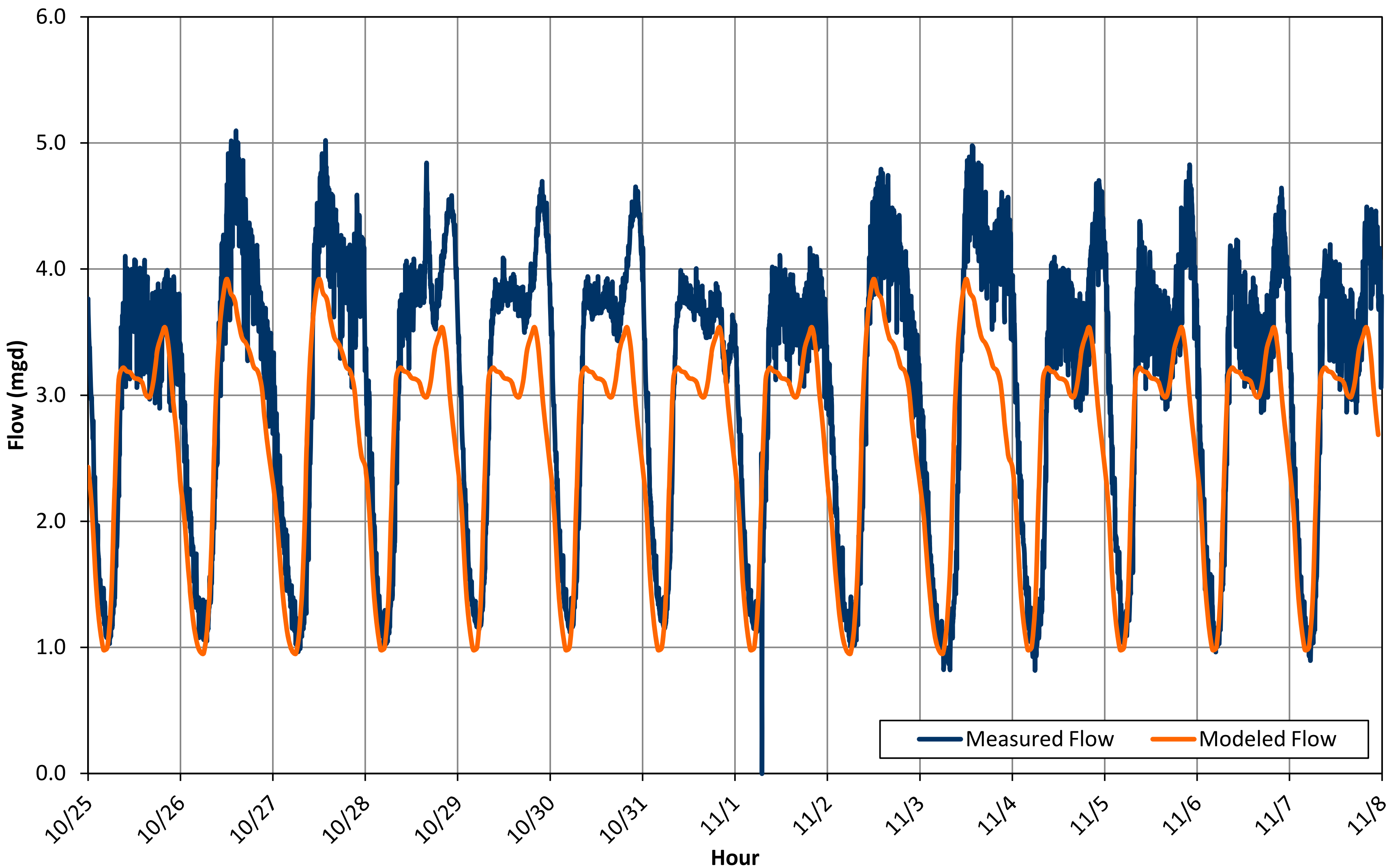
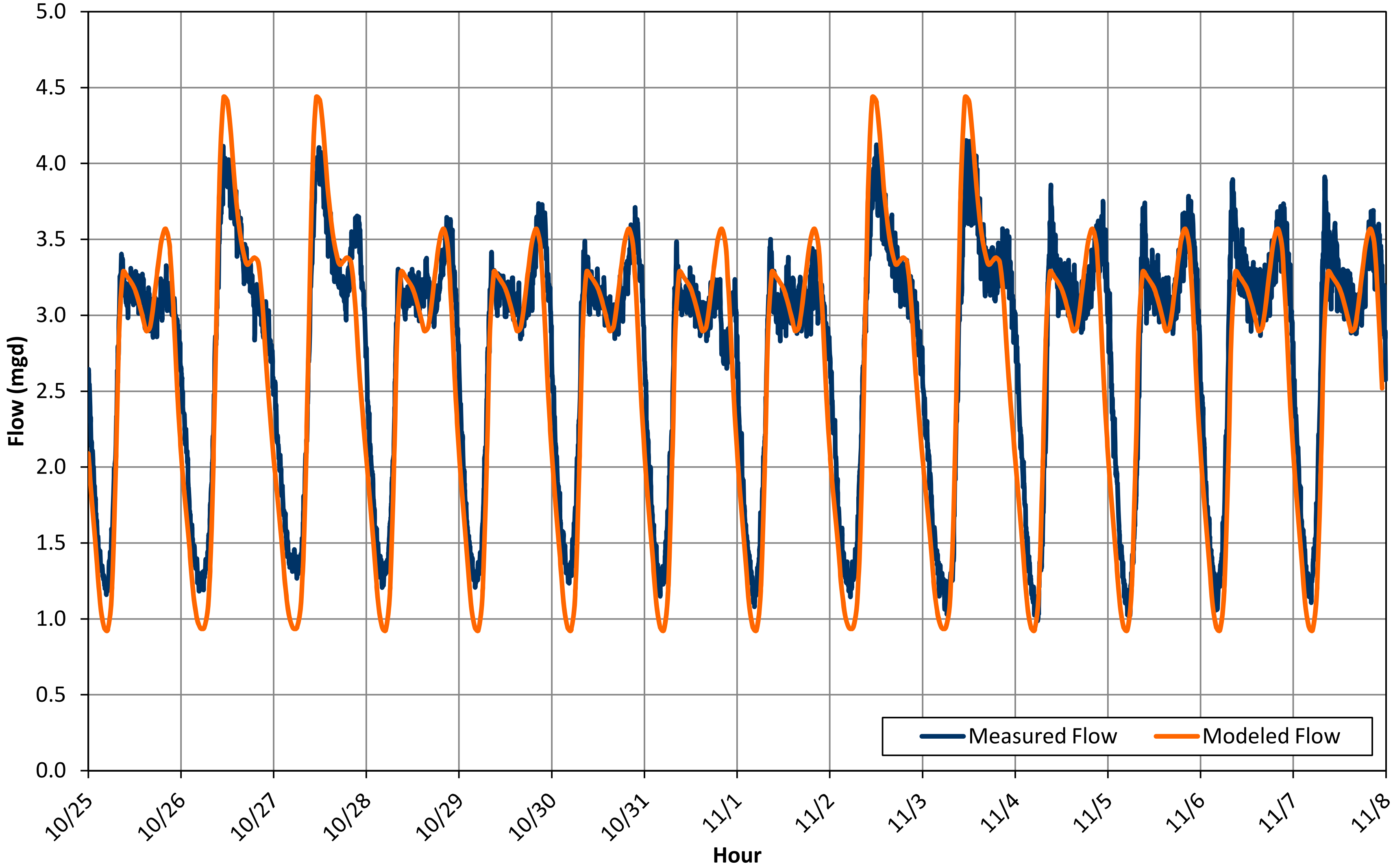
Wastewater Facilities Master Plan
FLOW MONITORING SITE M22 FLOW VALIDATION (10/25/2013-11/07/2013)



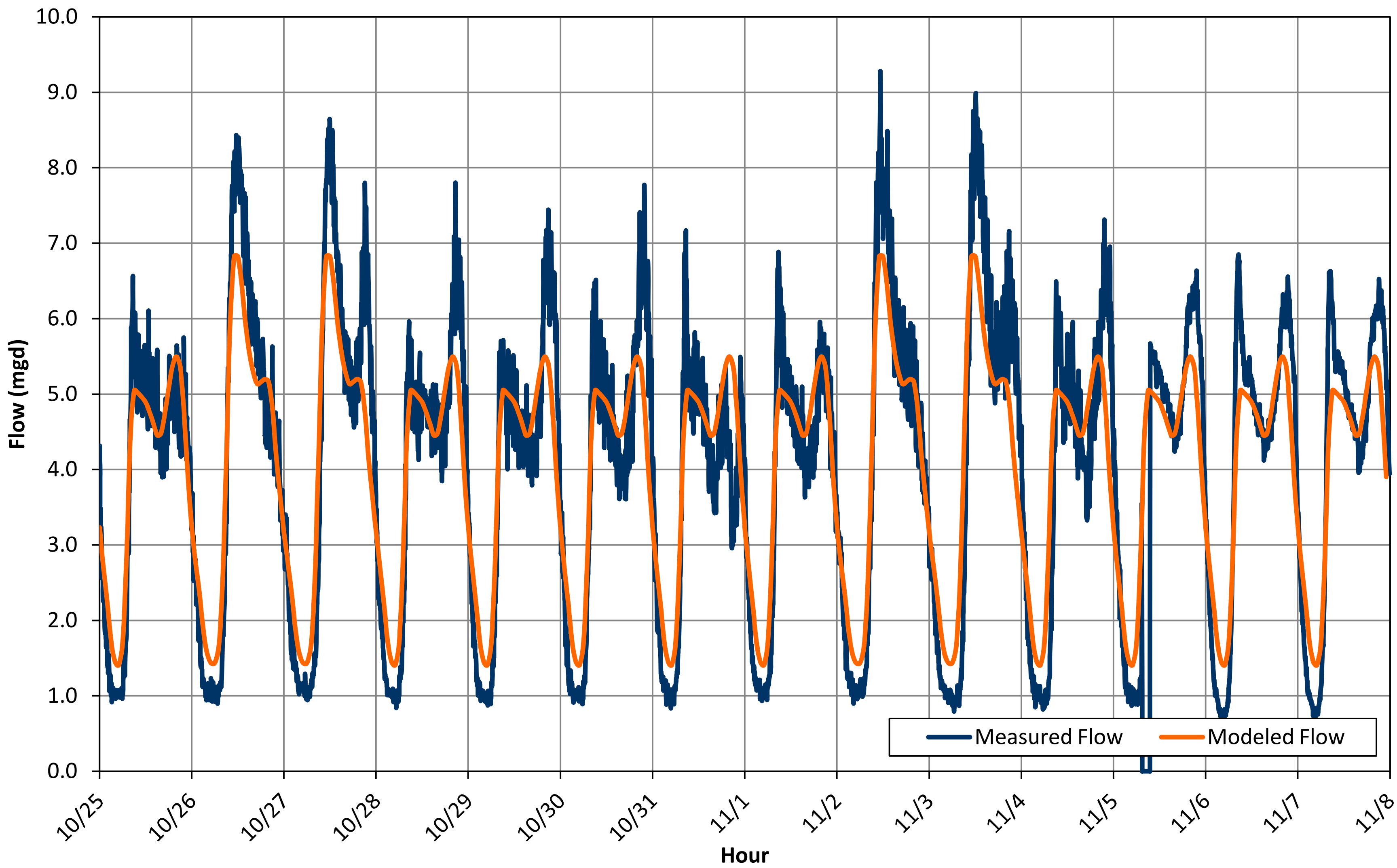
Inland Empire Utilities Agency
Wastewater Facilities Master Plan
FLOW MONITORING SITE M21 FLOW VALIDATION (10/25/2013-11/07/2013)



Inland Empire Utilities Agency
Wastewater Facilities Master Plan
FLOW MONITORING SITE M20 FLOW VALIDATION (10/25/2013-11/07/2013)



Inland Empire Utilities Agency
Wastewater Facilities Master Plan
FLOW MONITORING SITE M19 FLOW VALIDATION (10/25/2013-11/07/2013)



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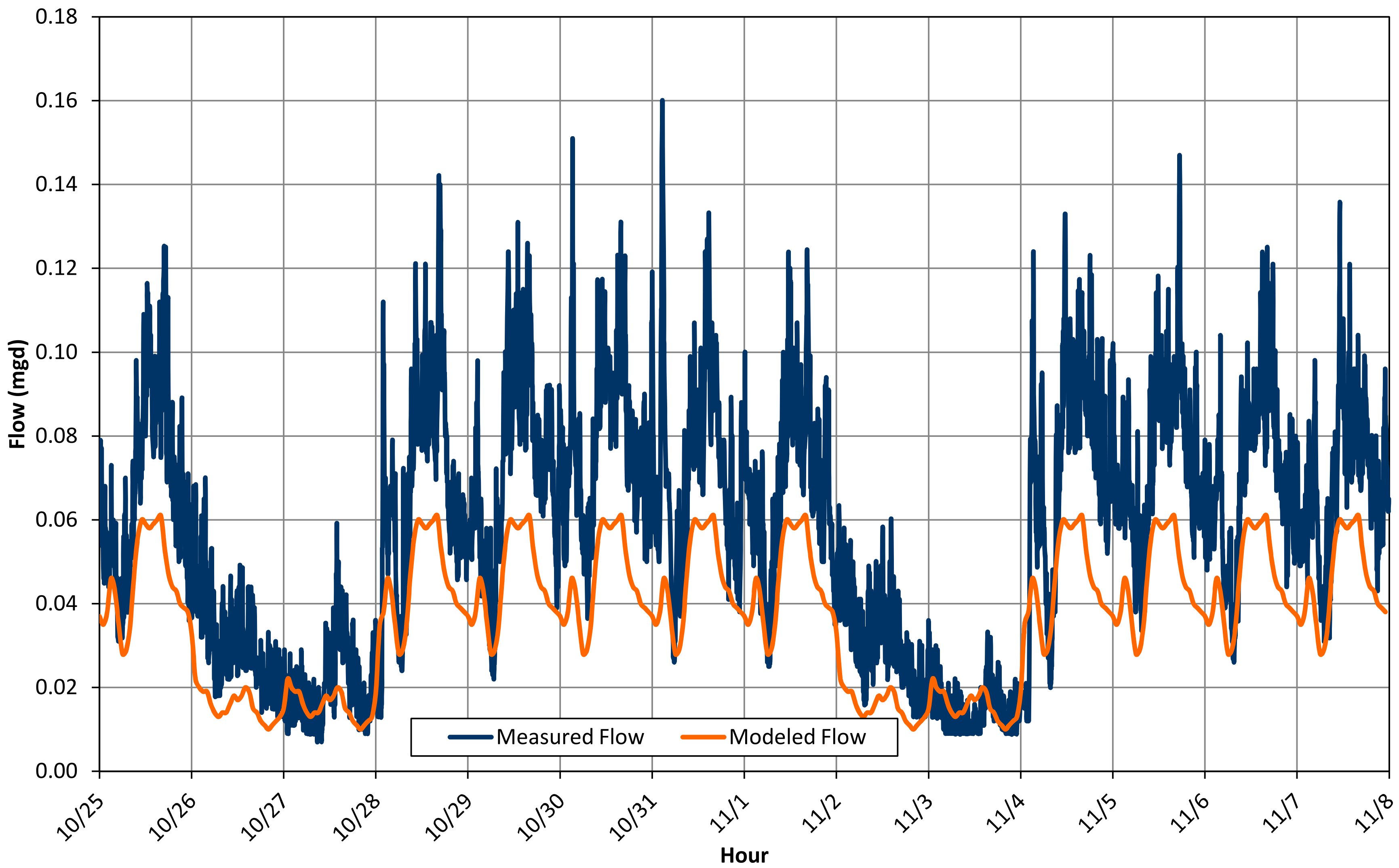
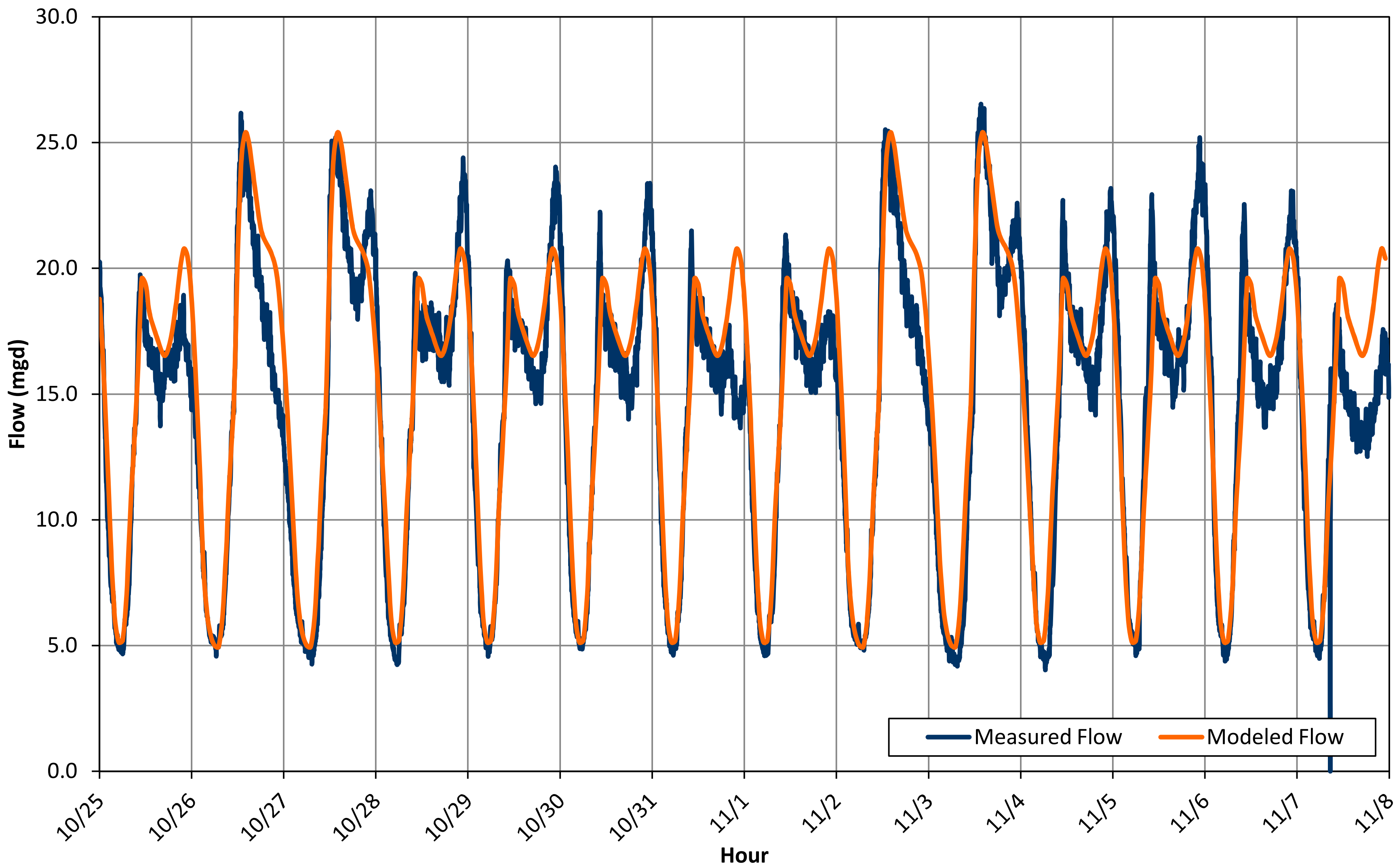
**Wastewater Facilities Master Plan**

**FLOW MONITORING SITE M18 FLOW VALIDATION (10/25/2013-11/07/2013)**



Inland Empire Utilities Agency
Wastewater Facilities Master Plan
FLOW MONITORING SITE M17 FLOW VALIDATION (10/25/2013-11/07/2013)



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**Wastewater Facilities Master Plan**
**FLOW MONITORING SITE M16 FLOW VALIDATION (10/25/2013-11/07/2013)**

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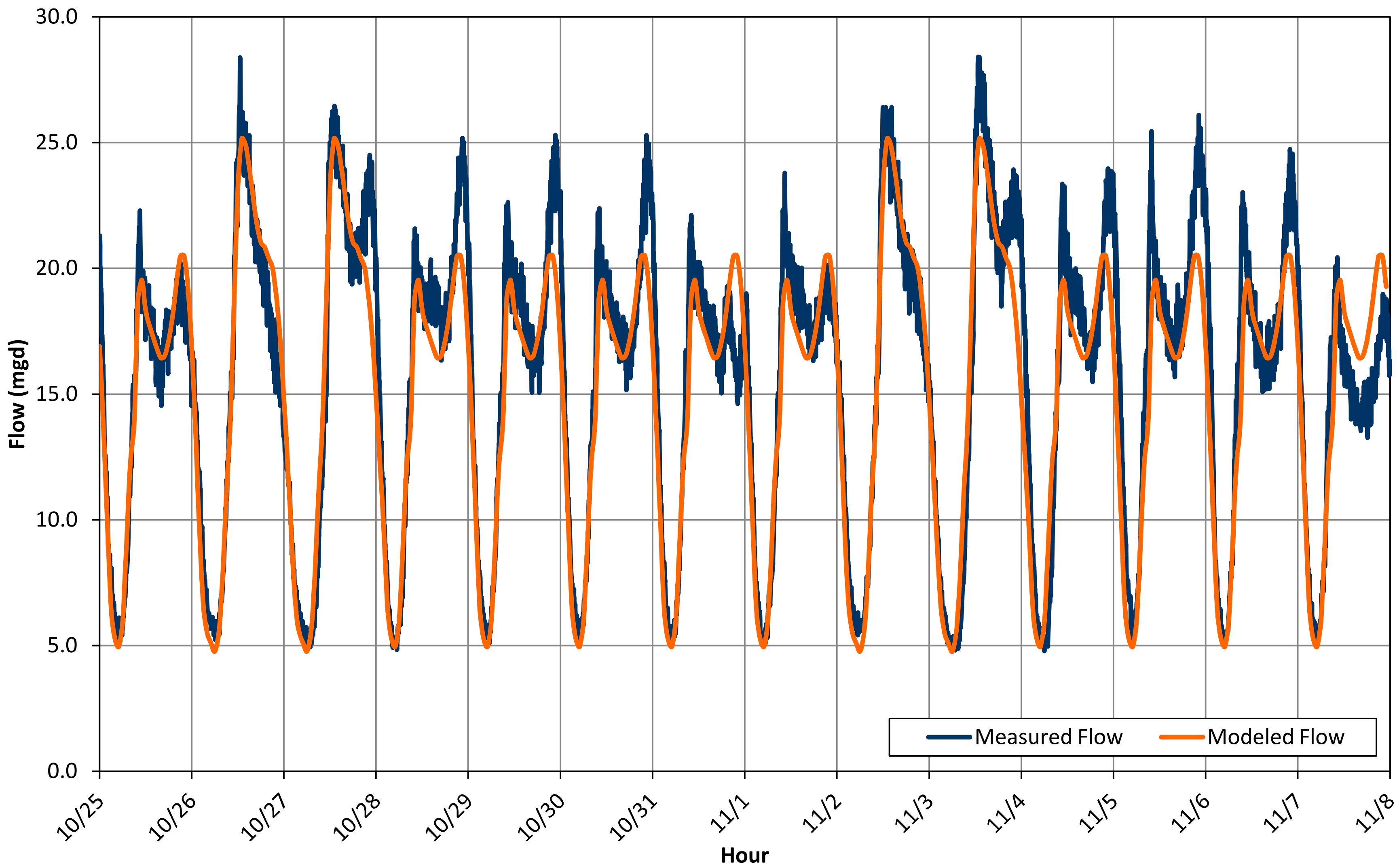

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Wastewater Facilities Master Plan
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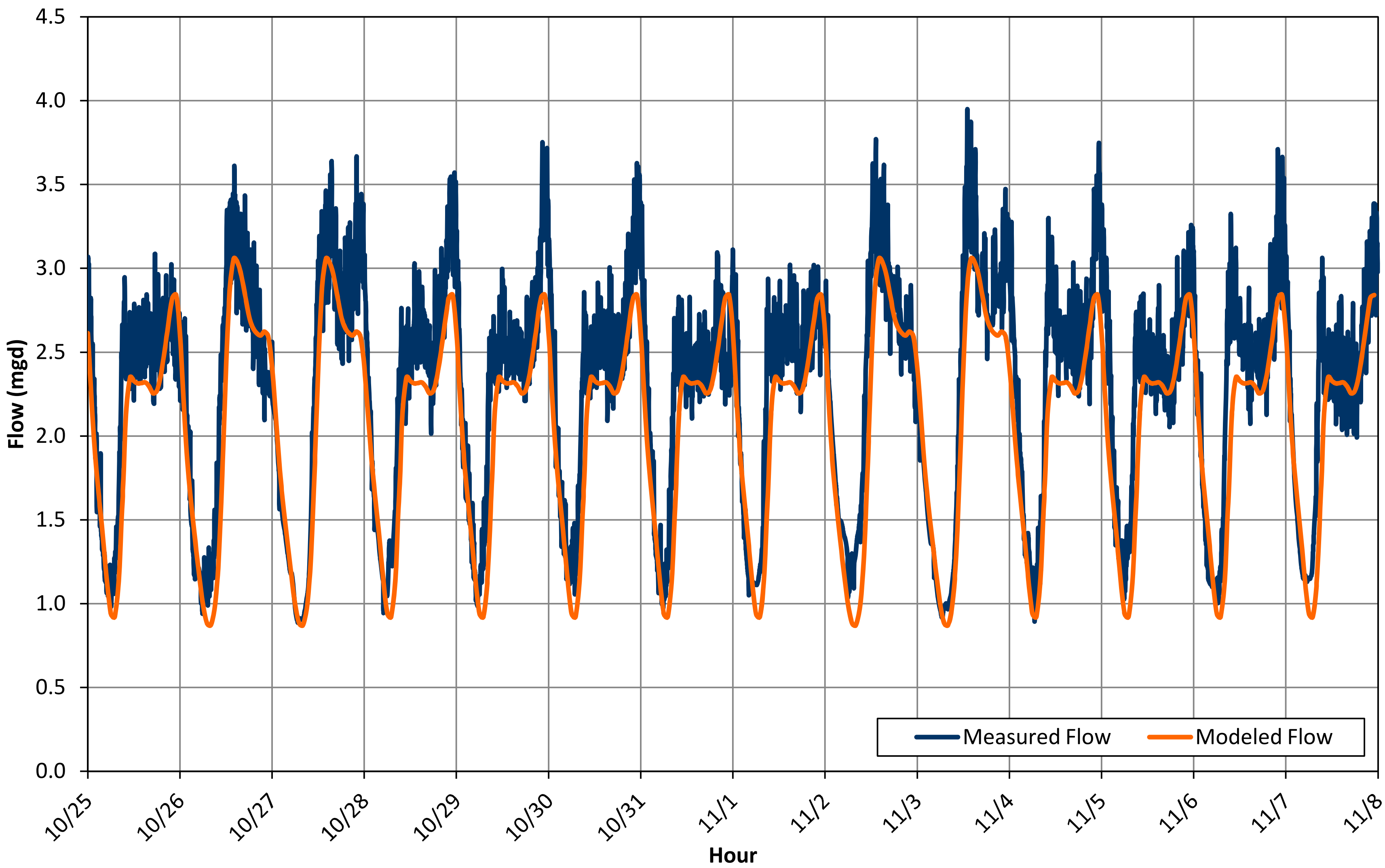

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**Wastewater Facilities Master Plan**
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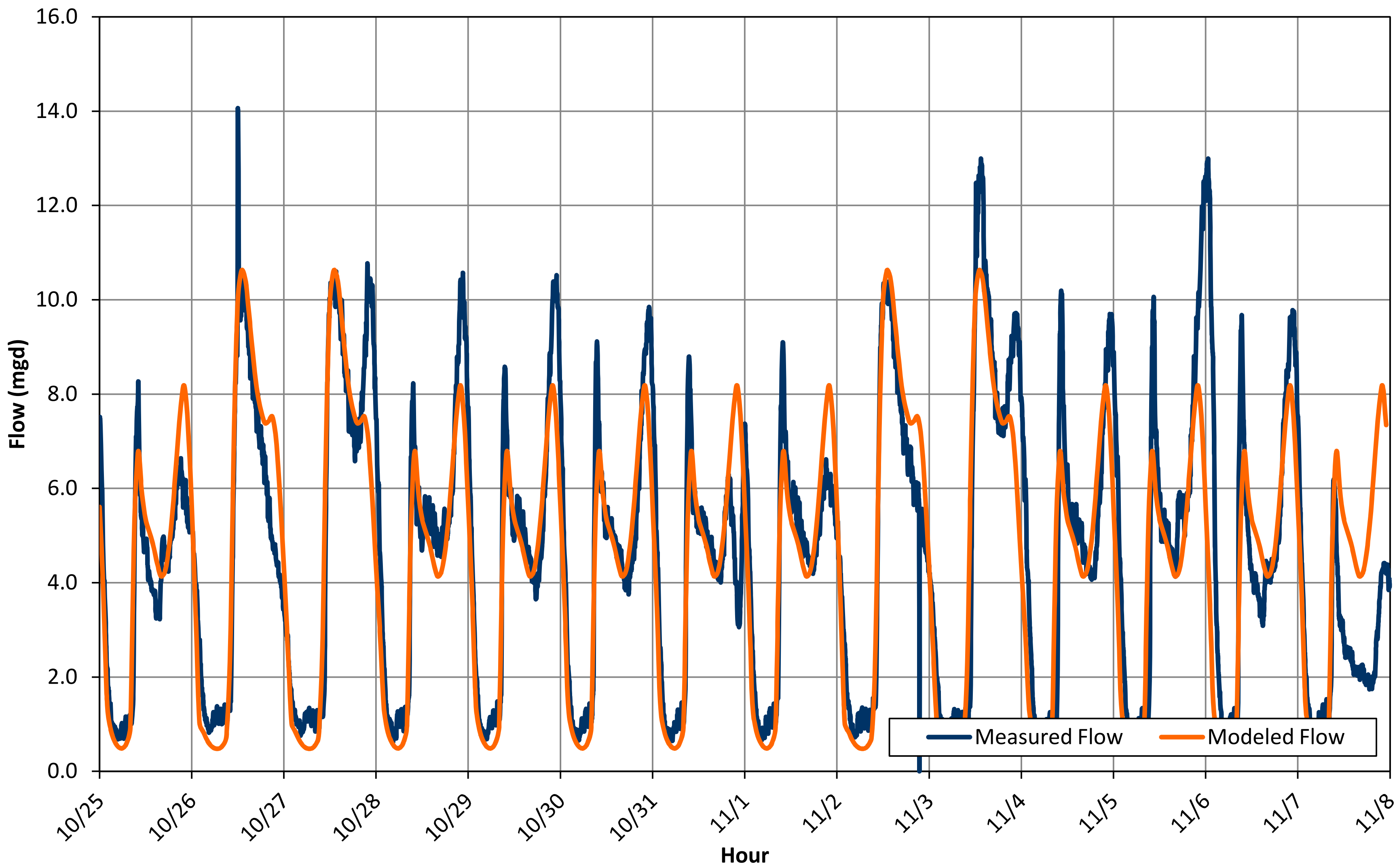

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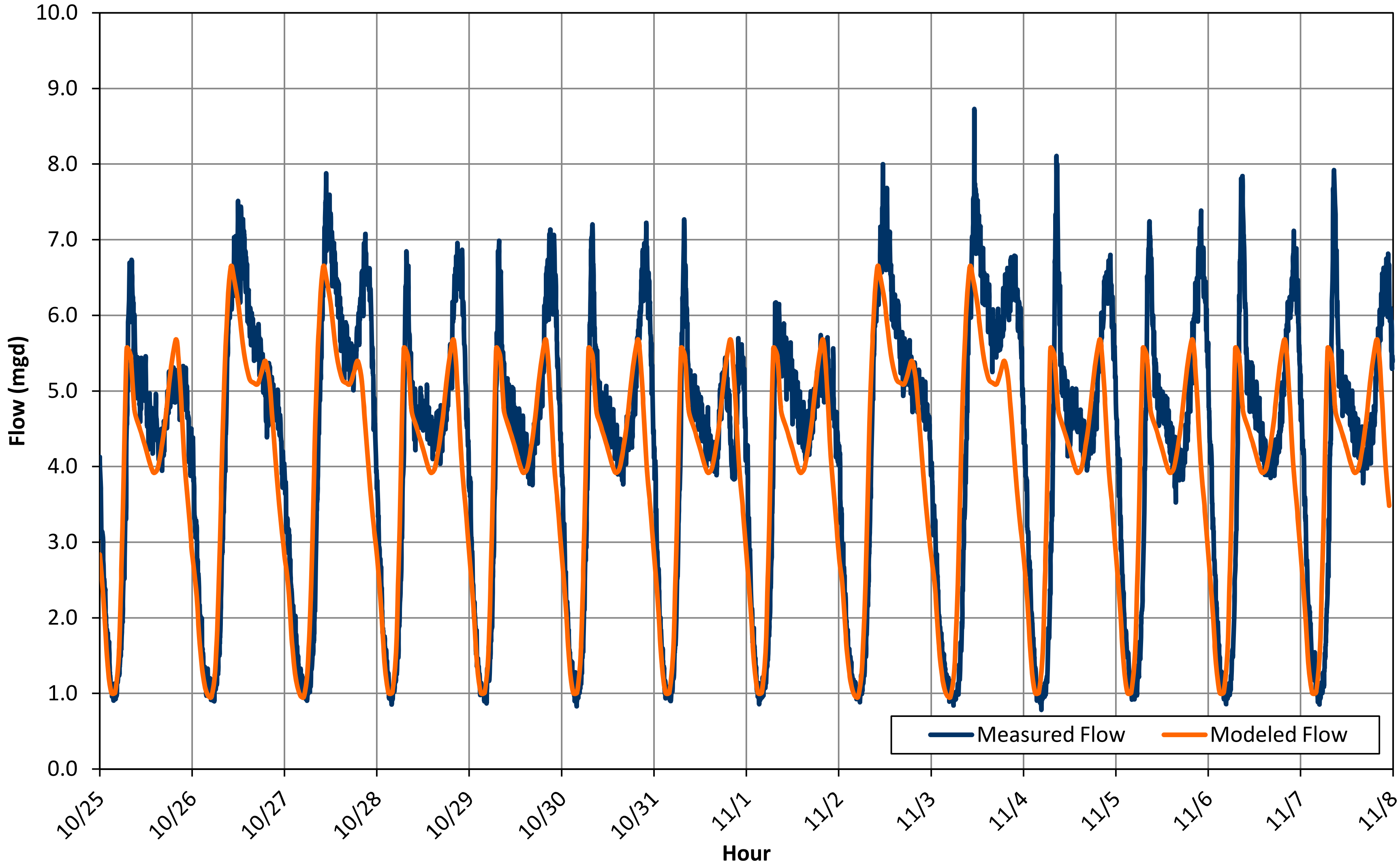
FLOW MONITORING SITE M13 FLOW VALIDATION (10/25/2013-11/07/2013)



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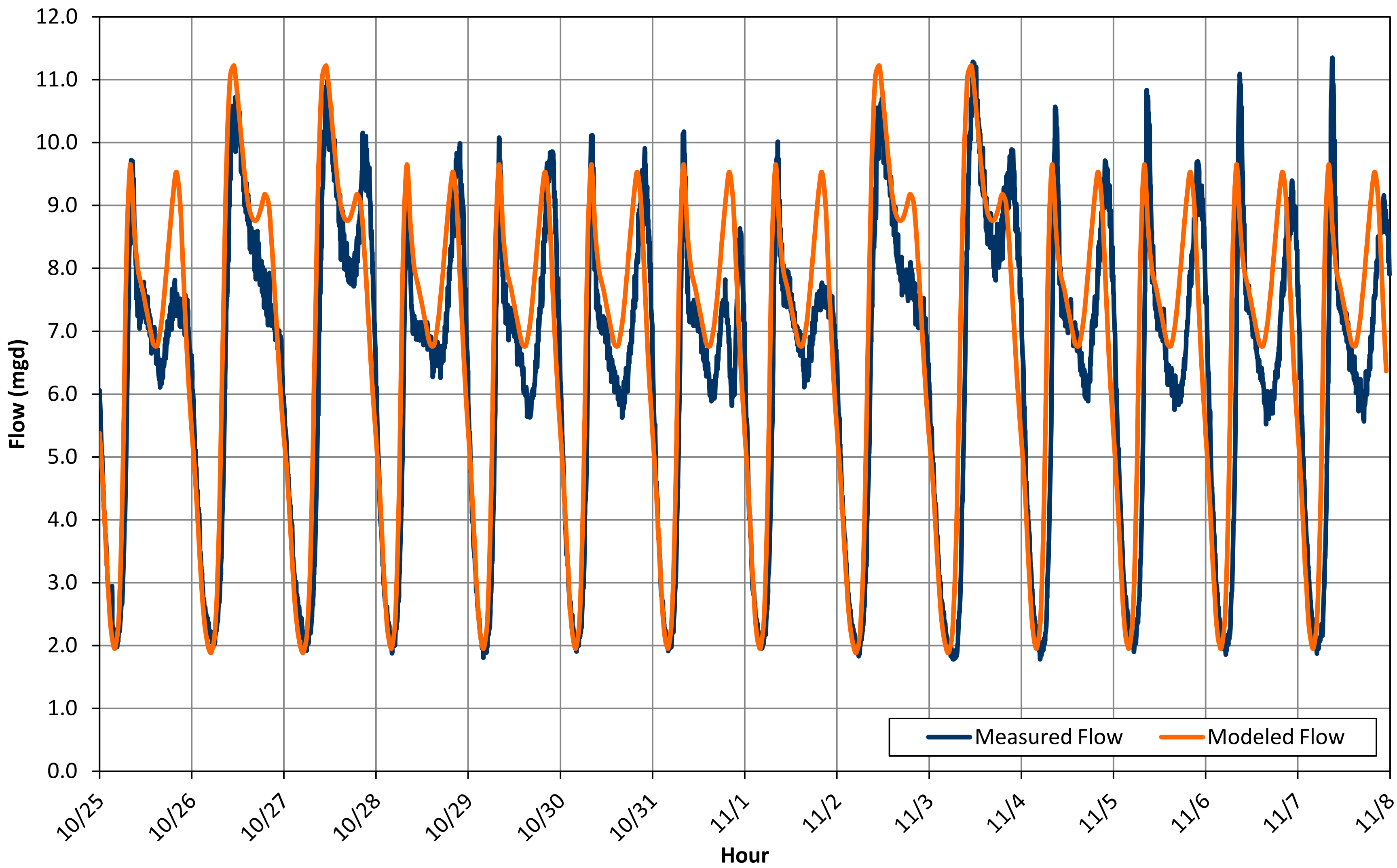
Wastewater Facilities Master Plan
FLOW MONITORING SITE M12 FLOW VALIDATION (10/25/2013-11/07/2013)



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Wastewater Facilities Master Plan
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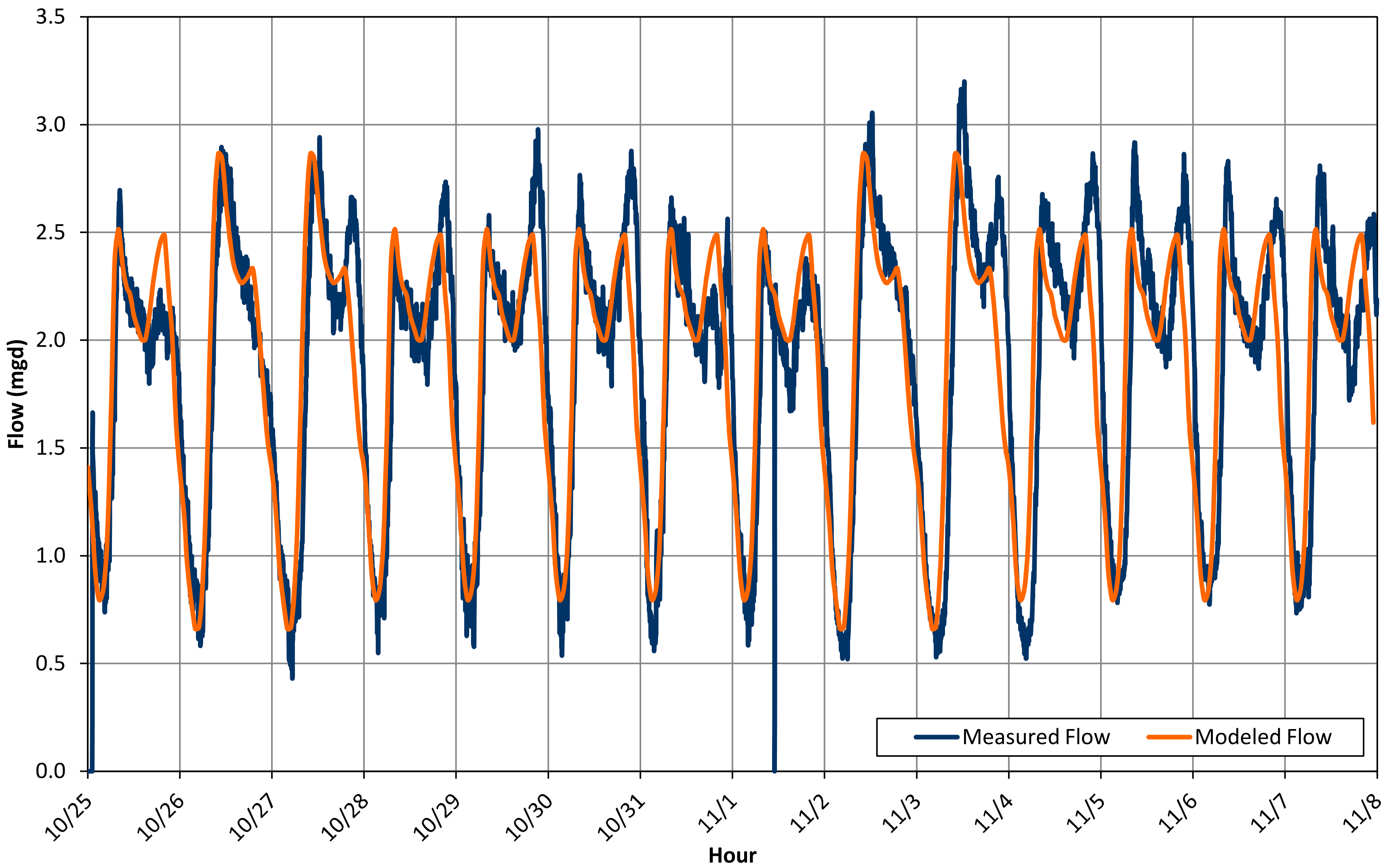

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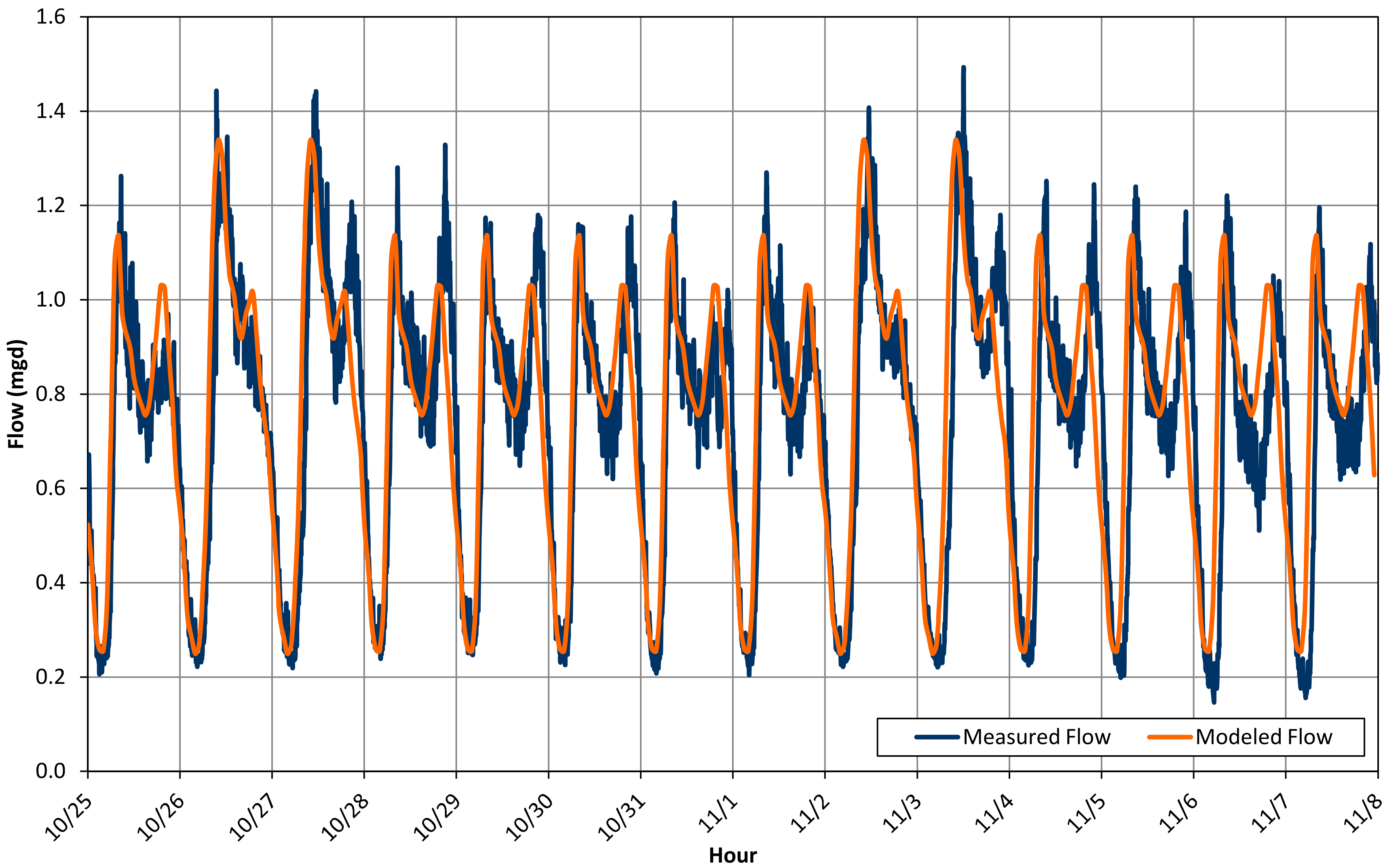
**Wastewater Facilities Master Plan**

**FLOW MONITORING SITE M10 FLOW VALIDATION (10/25/2013-11/07/2013)**



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Wastewater Facilities Master Plan
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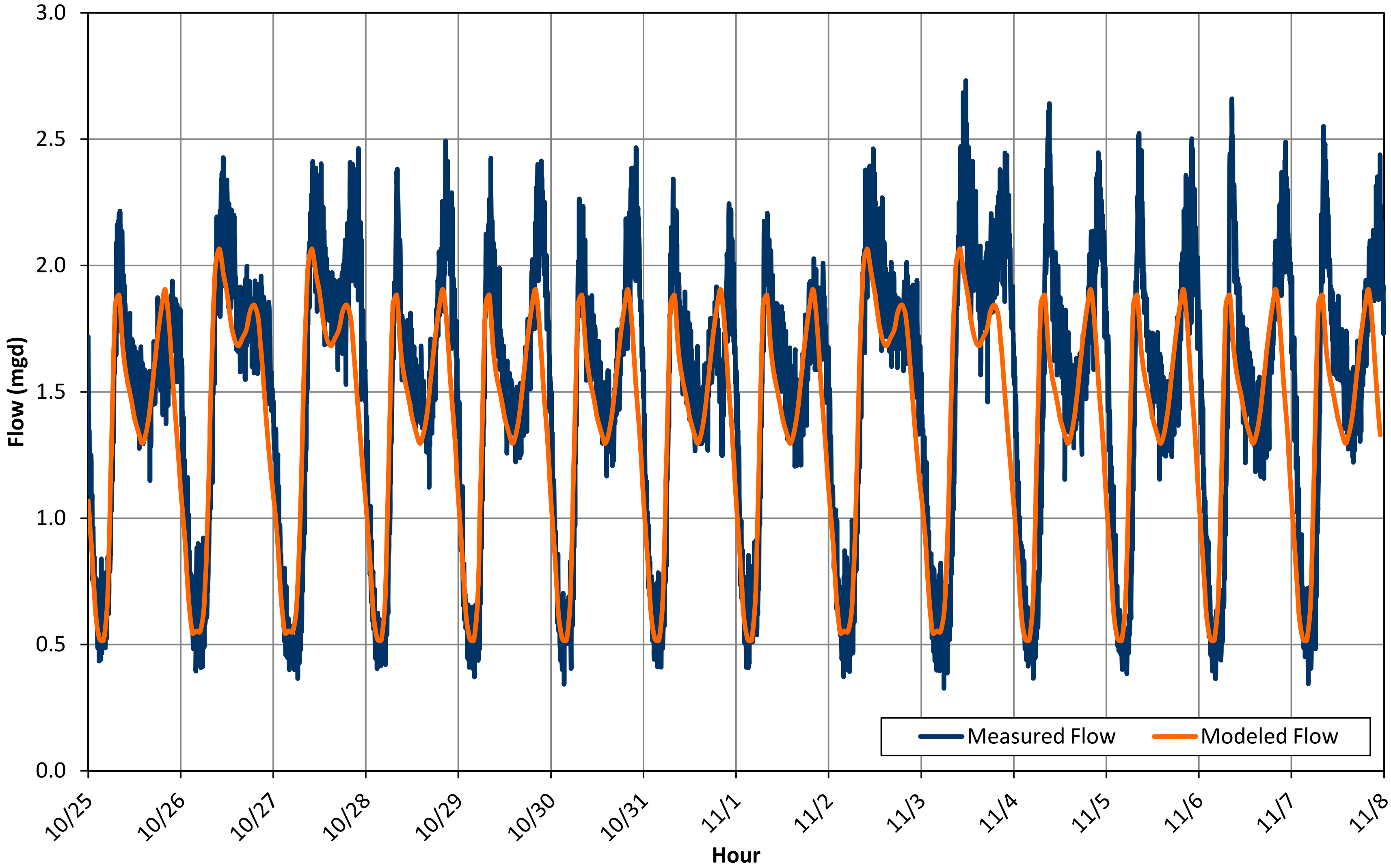

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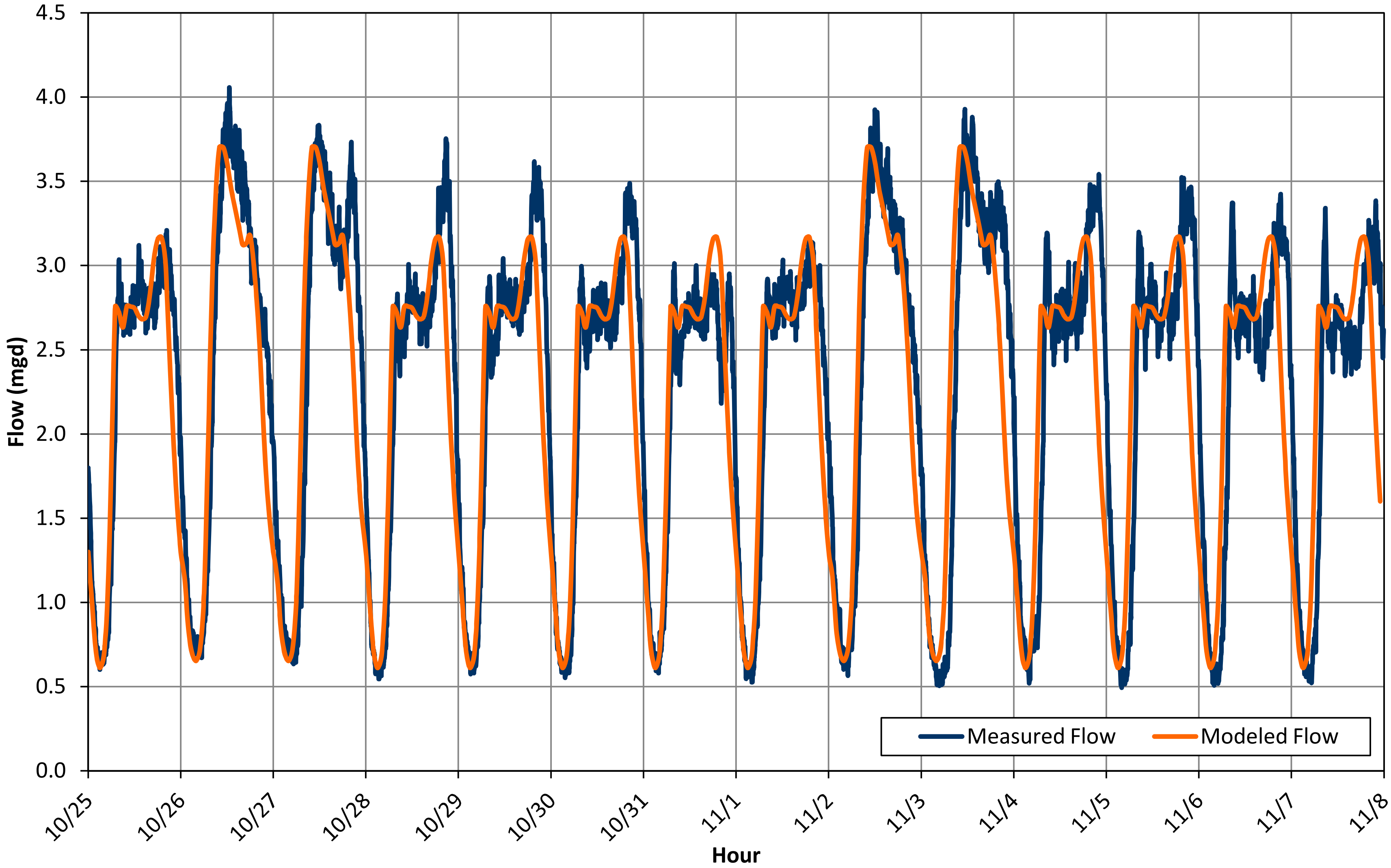
**Wastewater Facilities Master Plan**

**FLOW MONITORING SITE M08 FLOW VALIDATION (10/25/2013-11/07/2013)**



Inland Empire Utilities Agency
Wastewater Facilities Master Plan
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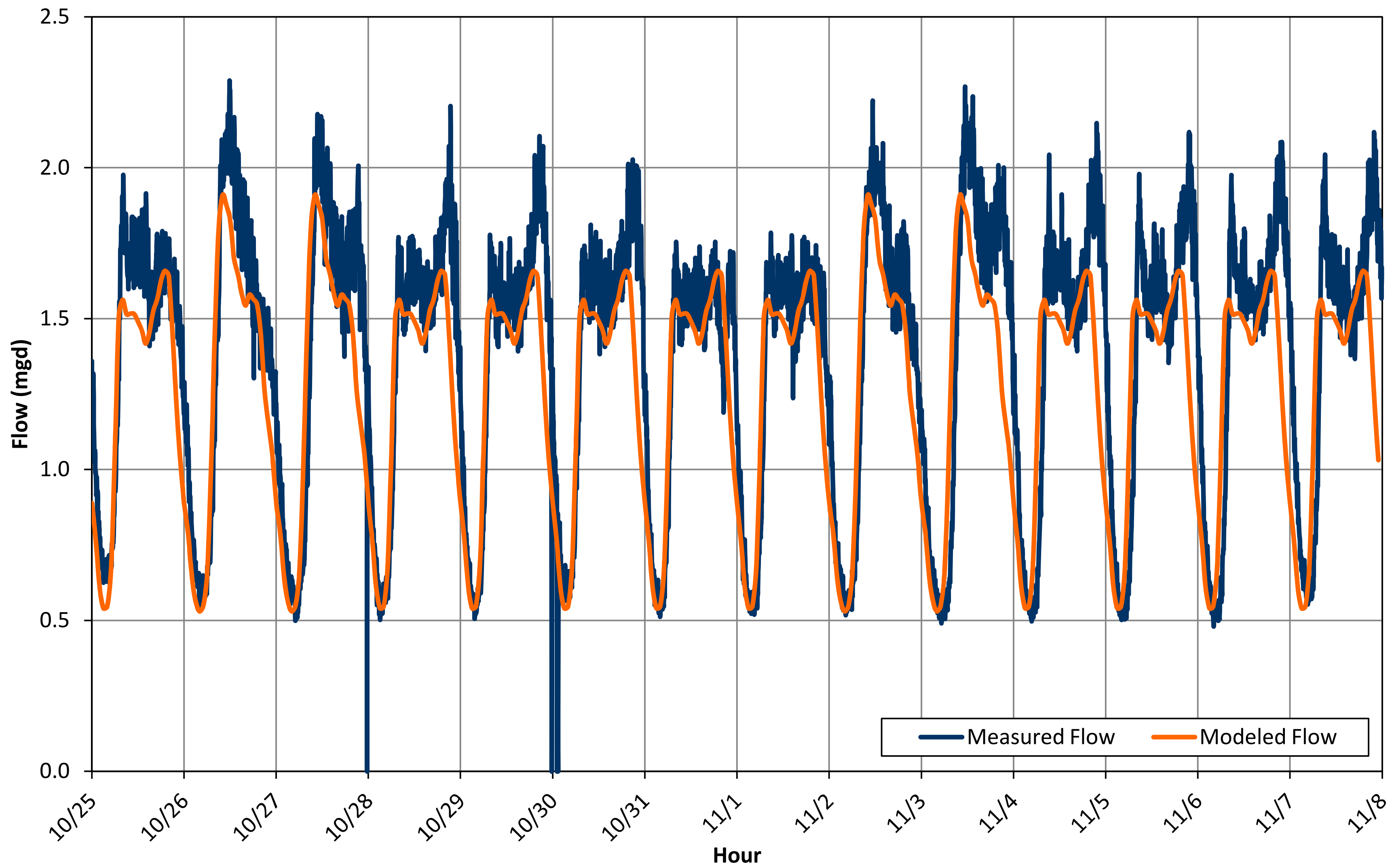
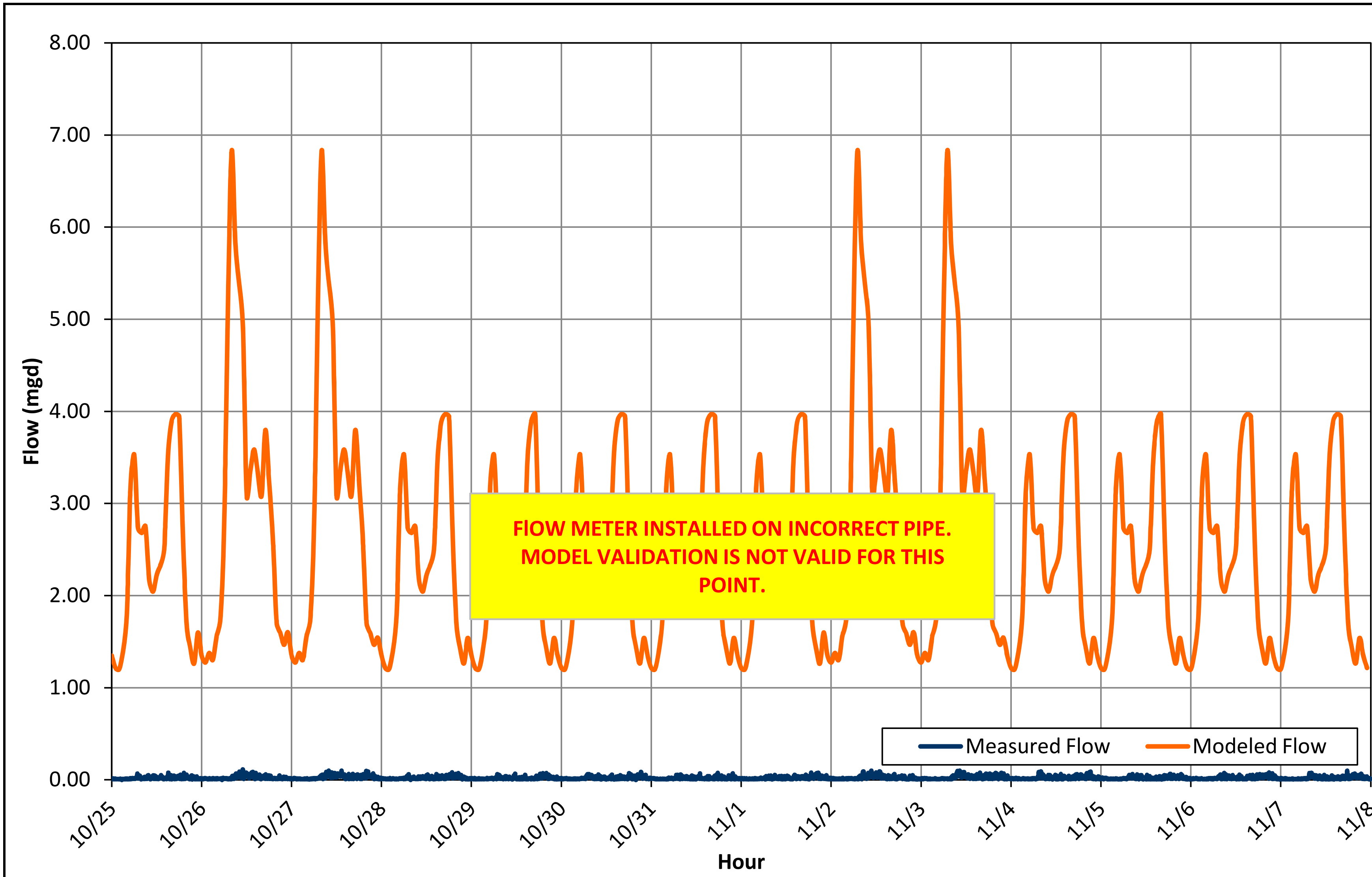


Inland Empire Utilities Agency
Wastewater Facilities Master Plan
FLOW MONITORING SITE M06 FLOW VALIDATION (10/25/2013-11/07/2013)



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**Wastewater Facilities Master Plan**
**FLOW MONITORING SITE M05 FLOW VALIDATION (10/25/2013-11/07/2013)**

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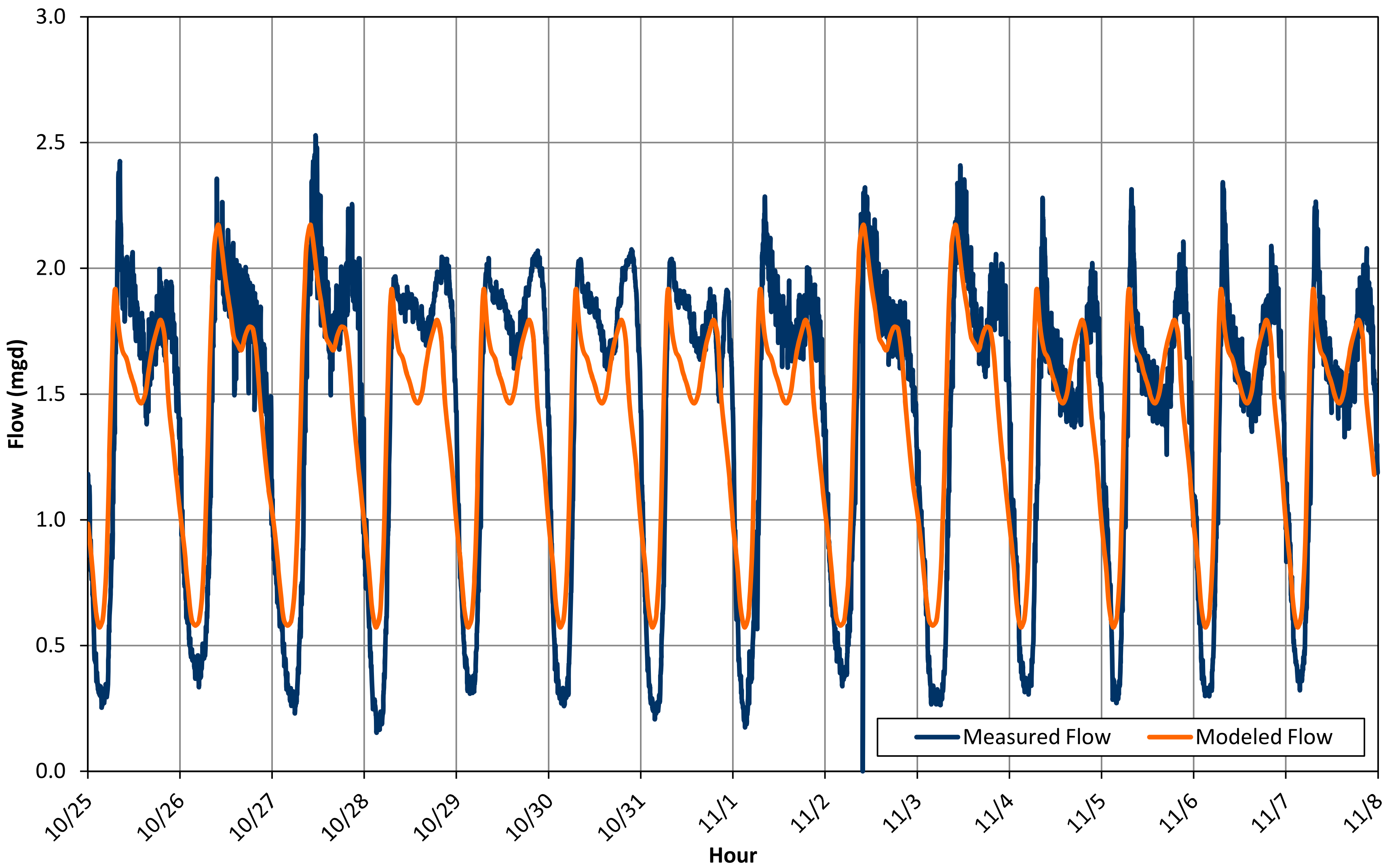

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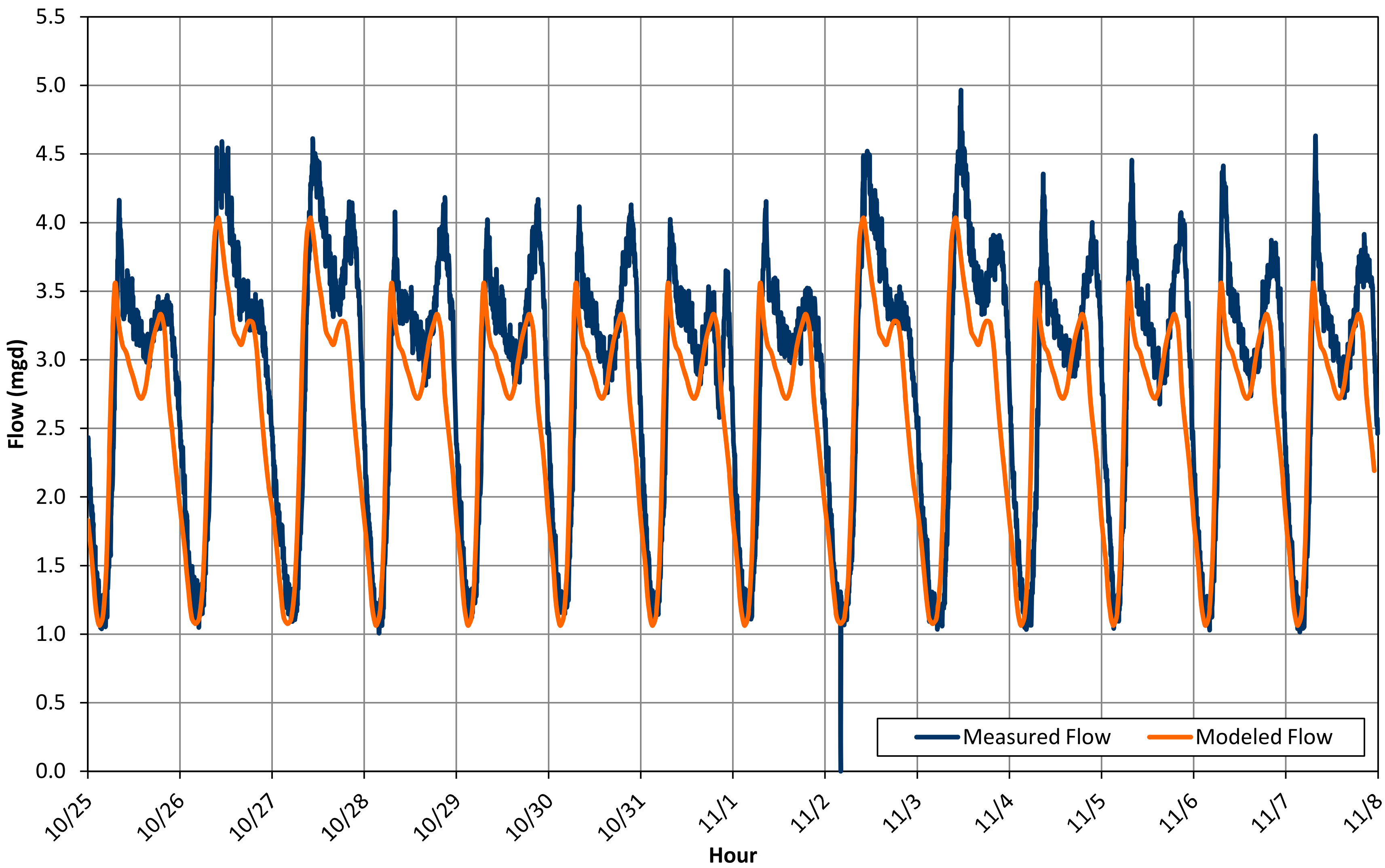
Wastewater Facilities Master Plan
FLOW MONITORING SITE M04 FLOW VALIDATION (10/25/2013-11/07/2013)



Inland Empire Utilities Agency
Wastewater Facilities Master Plan
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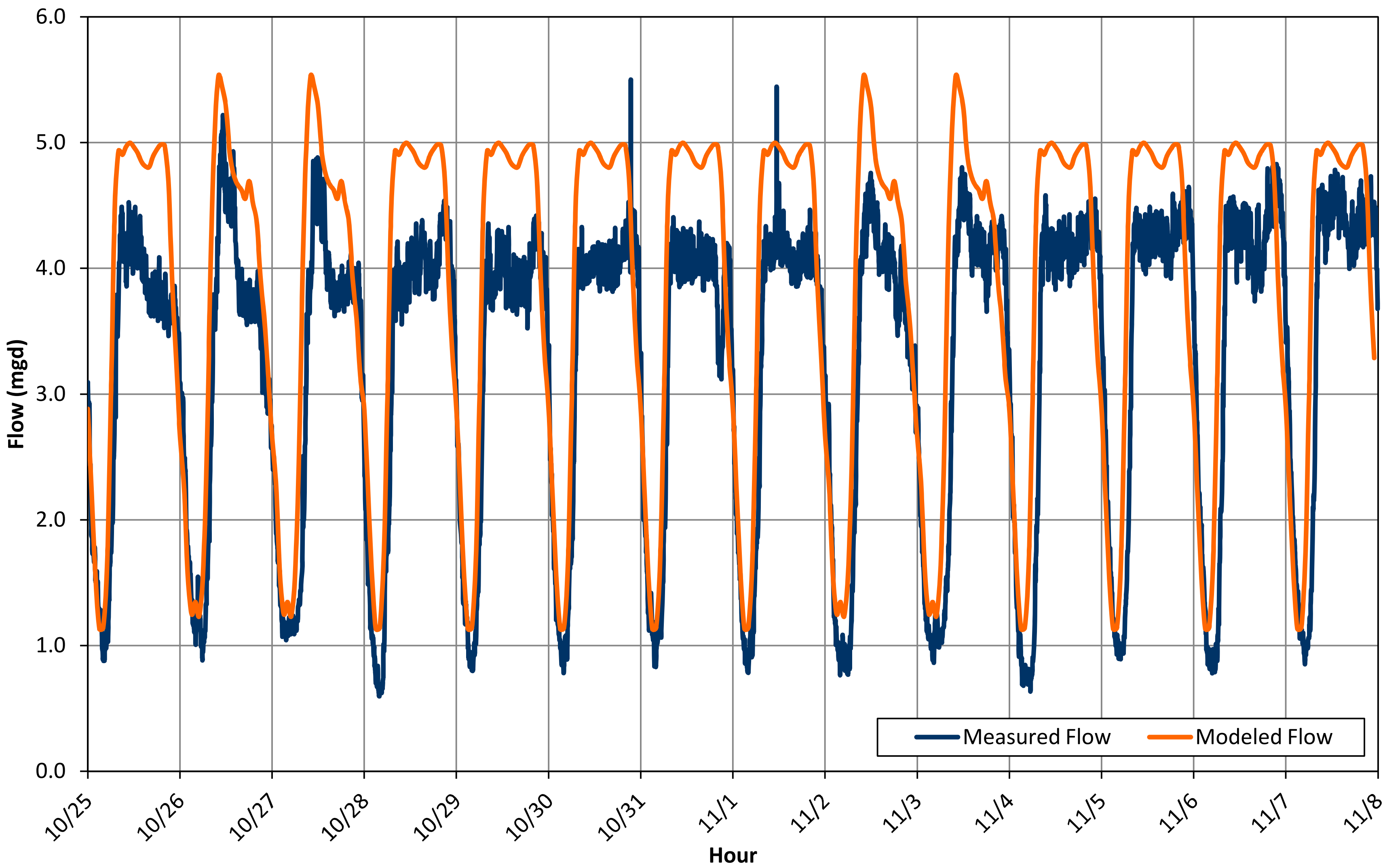

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**Wastewater Facilities Master Plan**
**FLOW MONITORING SITE M02 FLOW VALIDATION (10/25/2013-11/07/2013)**

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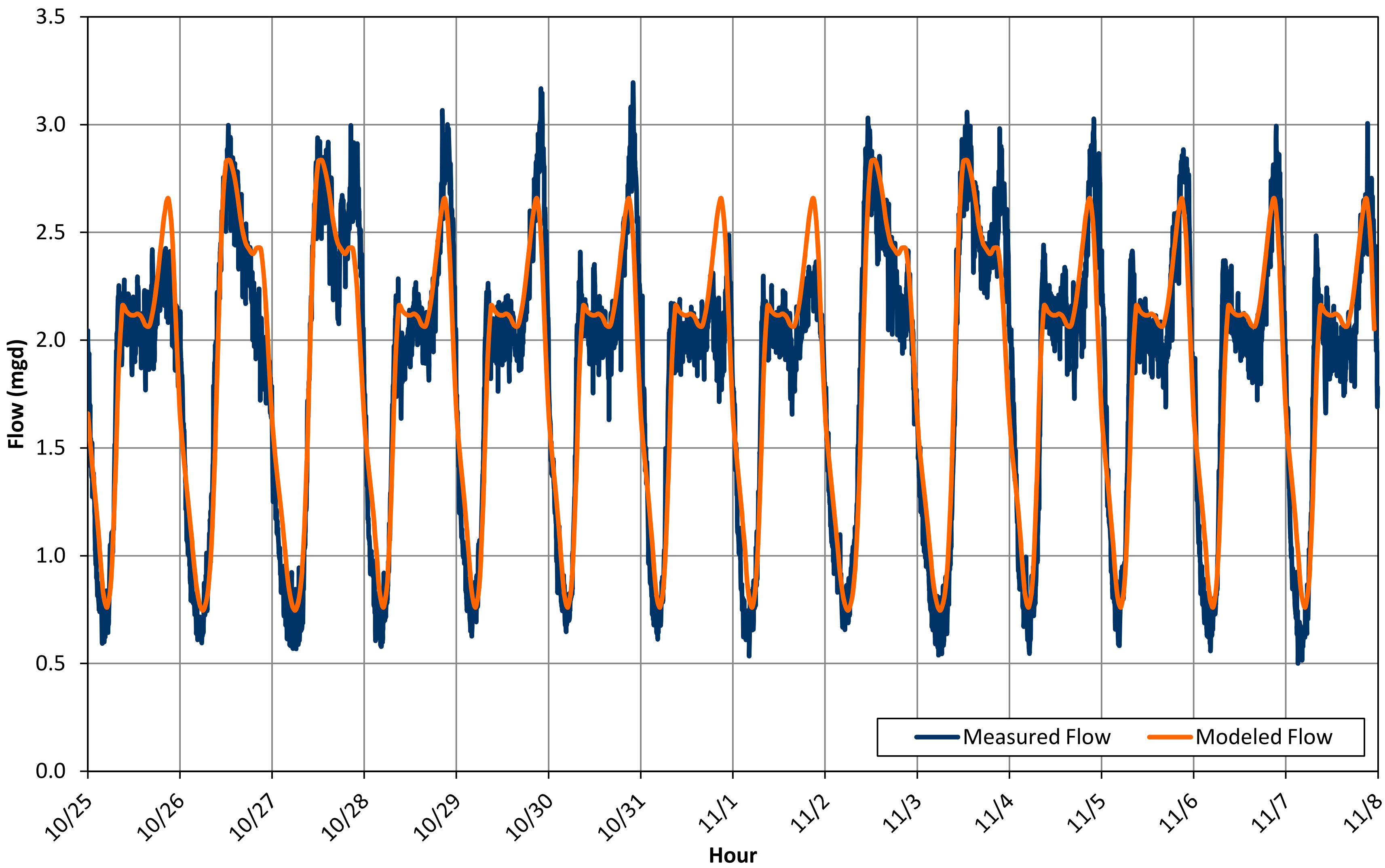


# TM 3 Regional Trunk Sewer Alternatives Analysis

# IEUA Wastewater Facilities Master Plan
# TM 3 Regional Trunk Sewer Alternatives Analysis

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: Carollo Engineers, Inc.

REVIEWED BY: CH2M HILL

DATE: April 2015

# Executive Summary

In accordance with the goals of the master planning effort, the capacity of the Inland Empire Utilities Agency (IEUA) collection system was evaluated and flow diversion alternatives were developed to optimize the use of recycled water in the service area for groundwater recharge. To achieve this goal as part of the Wastewater Facilities Master Plan (WFMP), four flow diversion alternatives were developed that would allow IEUA to optimize recharge groundwater opportunities in its northern service area.

As part of this analysis, the IEUA collection system hydraulic model was updated. This updated model was used to conduct an evaluation of the regional trunk sewer system under both existing and projected future flow conditions. Results of the analysis indicate that IEUA's collection system generally maintains adequate capacity to convey existing and future (buildout) peak dry weather flows. However, capacity limitations were identified in the Montclair pipeline reach that conveys flow from the Montclair pump station to Regional Water Recycling Plant No. 1 (RP-1).

Flow diversion alternatives were evaluated using both monetary and non-monetary evaluation criteria, as well as a benefit-cost analysis to identify the most suitable alternative for meeting IEUA objectives. IEUA identified Alternative 2, which utilizes the existing Whispering Lakes and Haven pump stations to divert flows from Regional Water Recycling Plant No. 5 (RP-5) to RP-1, as the preferred flow diversion alternative. Alternative 2 has a lower capital cost, is easier to implement, and provides a relatively high benefit related to diverting additional flows to RP-1 for groundwater recharge. Alternative 2 also provides flexibility because flows could still be conveyed to RP-5 by gravity should the need arise.

# 1.0 Background and Objectives

The objective of the WFMP is to plan improvements for IEUA's wastewater treatment and conveyance facilities, and develop a capital program. The capital program will guide IEUA in the development of major improvements to its treatment and conveyance facilities.

As part of the WFMP effort, a series of alternatives for flow diversion were developed in coordination with IEUA. The alternatives were developed as a way to convey wastewater to RP-1, which would maximize groundwater recharge opportunities in the northern portions of the IEUA service area. The flow diversion alternatives are described in *TM 2 Hydraulic Modeling and GIS Implementation*. In conjunction with the analysis of the diversion alternatives, IEUA's existing conveyance system was evaluated to determine its ability to convey current and projected flows based on specified evaluation criteria. The purpose of this technical memorandum (TM) is to summarize the analysis of IEUA's conveyance system and the results of the evaluation of the alternatives presented in TM 2.

# 2.0 Evaluation and Planning Criteria

Evaluation criteria were established to provide a framework for the analysis of the collection system using the hydraulic model, the conveyance system, and the flow diversion alternatives. The evaluation of the flow diversion alternatives used a qualitative non-monetary approach called the Simple Multi-Attribute Rating Technique (SMART). The conveyance system criteria and the SMART system are summarized herein.

## 2.1 Collection System Evaluation Criteria

### 2.1.1 Gravity Conveyance System

Gravity sewer pipe capacities are dependent on many factors, including roughness of the pipe, the chosen maximum allowable depth of flow downstream, and limiting velocity and slope. The following sections describe the factors that account for the determination of existing and future pipeline capacities in the IEUA collection system.

#### 2.1.1.1 Manning Coefficient (n)

The Manning coefficient (n) is a friction coefficient that varies with respect to pipe material, size of pipe, depth of flow, smoothness of joints, root intrusion, and other factors. For sewer pipes, the Manning coefficient typically ranges between 0.011 and 0.017, with 0.013 being a representative value used for system planning purposes. For this study, a Manning n factor of 0.013 was assigned to all existing sewer lines in the hydraulic model, and then refined as necessary during model verification to accurately simulate field-measured levels and velocities.

#### 2.1.1.2 Peak Flow Criteria

The primary criteria used to identify capacity-deficient sewers or to size new sewer improvements is the ratio of maximum flow depth to pipe diameter (d/D). The d/D value is defined as the depth of flow (d) in a pipe during peak design-flow conditions divided by the diameter of the pipe (D). Based on engineering experience, IEUA staff input, and industry standards, the following criteria were used and are summarized in Table 3-1 for existing and new sewers:

- **Flow Depth for Existing Sewers.** Peak flow criteria for existing sanitary sewers are established based on a number of factors, among which are the acceptable risk tolerance of the utility, and local standards and codes. Using a conservative criterion for evaluating existing sewers could lead to unnecessary replacement of existing pipelines. Conversely, a lenient criterion could increase the risk of sanitary sewer overflows (SSOs). Ultimately, the maximum allowable peak flow criterion should be established to be as cost-effective as possible while at the same time reducing the risk of SSOs to the greatest extent possible.

  The maximum flow rate that a gravity pipeline can carry occurs at a d/D ratio of 0.92. Setting flow criteria in existing pipelines at this level allows IEUA to recognize all of the available capacity in an existing sewer when considering improvement needs. Therefore, a maximum d/D ratio of 0.92 was used to identify capacity-deficient sewers for IEUA.

- **Flow Depth for New Sewers.** When designing sewer pipelines, it is common practice to adopt variable flow depth criteria for various pipe sizes. Design d/D ratios typically range from 0.5 to 0.92, with the lower values used for the smaller pipes that might experience flow peaks greater than design flow or blockages from debris. Since IEUA collects wastewater flow from multiple agencies, the IEUA collection system primarily consists of larger-diameter interceptors (i.e., greater than 18 inches in diameter). Therefore, new sewer interceptor projects will be sized to a d/D of 0.75.

TABLE 3-1
**Maximum Flow Depth Criteria**

| Pipeline | Maximum d/D |
|---|---|
| Existing Sewers | 0.92 |
| New Sewers | 0.75[a] |

[a] For pipe diameters larger than 18 inches

### 2.1.2 Pump Stations and Force Mains

Industry standard practice is to require that sewage lift stations have sufficient capacity to pump the peak flow with the largest pump out of service (firm capacity).

Force main piping should be sized to provide a minimum velocity of 3 feet per second (ft/s) at the design flow rate of the lift station and no more than 8 ft/s. For the determination of head loss, the Hazen Williams Equation is used with a C-factor of 110. These factors are typical for sewer system master planning purposes.

## 2.2 Flow Diversion Evaluation Criteria

The SMART method was used to evaluate alternatives. This approach includes development of a benefit score for each alternative based on non-monetary criteria and their assigned weighting factors. Once the benefit score was established for each alternative, a monetary evaluation was conducted to estimate life-cycle costs for each alternative. A benefit to cost (B/C) ratio was then determined for each alternative to establish the recommended alternative.

For the non-monetary evaluation, a multi-attribute analysis methodology was employed to develop clear and defensible benefit scores for identified alternatives. With multi-attribute analysis, a set of criteria was first developed for use in ranking the appropriateness of each alternative in satisfying the project objectives. Secondly, each criterion was assigned a weighting factor that reflects its relative importance. The weighting factors range from 1 (least important relative to other criteria) to 10 (most important relative to other criteria), allowing calculation of a weighted criterion score based on how important the criterion is for the project in the overall decision-making process.

The non-monetary evaluation criteria, definitions, and weighting factors for evaluating the flow diversion alternatives are presented in Table 3-2.

TABLE 3-2
**Non-Monetary Evaluation Criteria, Definitions, and Assigned Weighting Factors**

| Criterion | Description | Weighting Factor |
|---|---|---|
| Optimize Groundwater Recharge | Evaluate each alternative relative to the volume of water available for recharge. | 10 |
| Operational Flexibility | Ability to divert flow to either RP-5 or RP-1. | 10 |
| Operational Risk and Reliability | Operational implications on system reliability and redundancy, and on the associated risk involved in the operation of the lift station(s) and other major facilities. | 10 |
| Ability to maximize use of existing assets | Ability to use existing infrastructure, lift stations, and other facilities. | 8 |
| Ease of operation and maintenance | Relative degree of ease and extent of time required to operate and maintain the facilities. Ability to operate one regional lift station versus operating multiple lift stations. | 8 |
| Recycled water pumping needs | Implications on pumping and conveying recycled water. | 6 |
| Impacts on liquid treatment facilities | Impacts on the required level of treatment at RP-5 or RP-1 (i.e., to achieve the corresponding total nitrogen [TN] limits for groundwater recharge). | 6 |
| Environmental considerations | Environmental considerations, impacts, permitting, and documentation required for project implementation. | 6 |
| Construction impacts | Construction impacts on factors such as traffic, commuter schedules, and ecosystems. | 5 |
| Institutional feasibility | Extent of coordination required for rights-of-way and easement procurement, as well as major crossings for freeways, channels, and other needs. | 5 |
| Carbon footprint and sustainability | Potential impacts on the carbon footprint of each plant or conveyance system as a result of construction and operation of the facilities. | 4 |
| Footprint and space constraints | Overall footprint requirements and space constraints. | 3 |

# 3.0 Evaluation of Existing Collection System

The hydraulic model developed for the WFMP was used to conduct an analysis of the capacity of IEUA's existing conveyance system. The analysis was conducted under the peak dry weather flow scenario for both existing and future (buildout) conditions.

In general, IEUA's collection system has adequate capacity to convey peak wastewater flows, with one exception. The facility that is currently lacking adequate capacity for existing flows is the 30-inch pipeline downstream of the Montclair pump station. The sections of pipeline that are currently deficient are illustrated in Figure 3-1.

Table 3-3 summarizes the peak dry weather flow, velocity, and maximum d/D values for the deficient reaches of the Montclair pipeline for existing and future flow conditions. As shown, the existing and future flows exceed the capacity of the pipeline by 0.6 million gallons per day (mgd) and 2.0 mgd, respectively.

TABLE 3-3
**Montclair Pipeline Flow and Capacity**

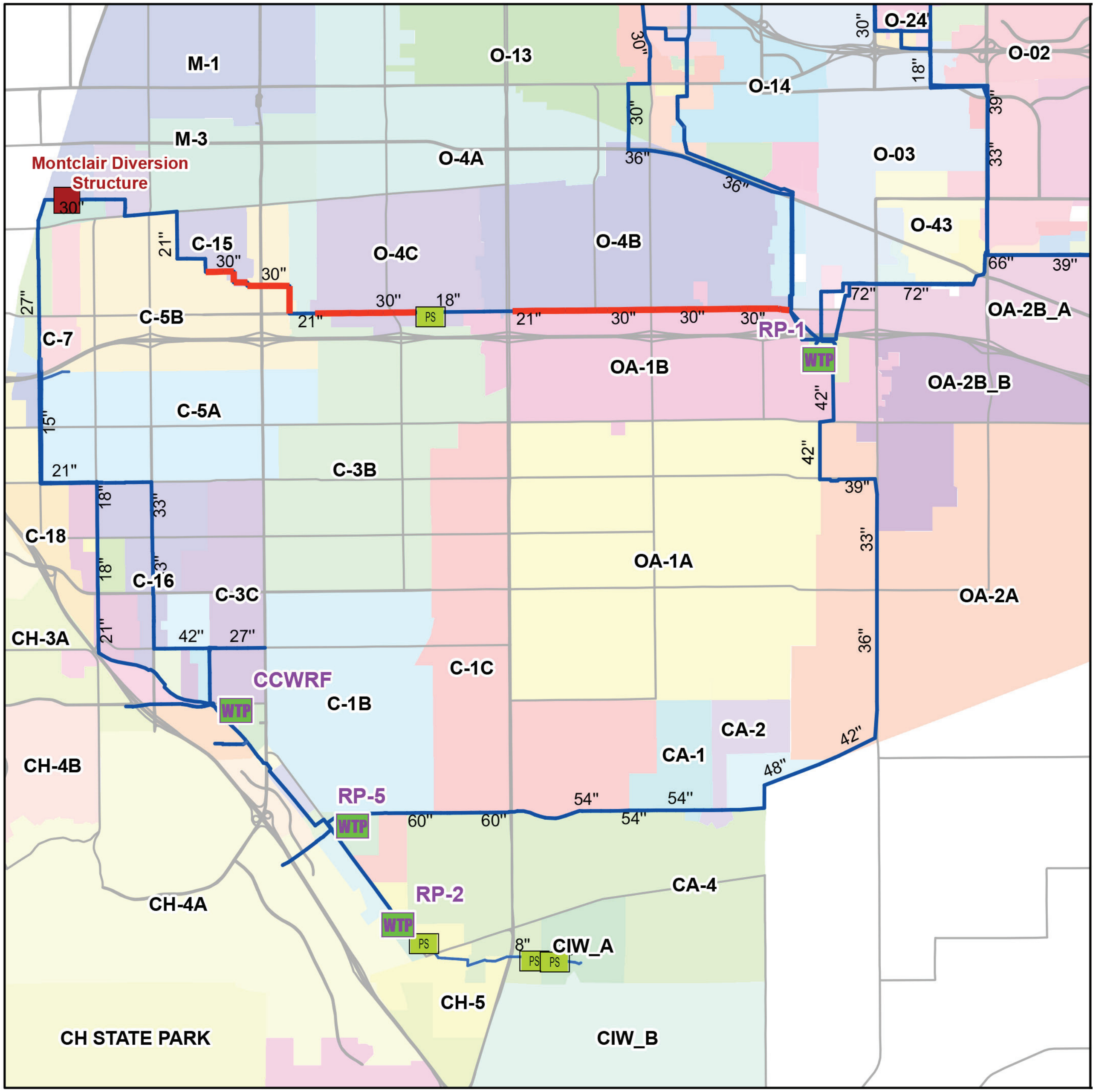
| Flow Condition | Maximum d/D | Peak Dry Weather Flow (mgd) | Maximum Capacity (mgd) | Flow Over Pipe Capacity (mgd) | Velocity (ft/s) |
|---|---|---|---|---|---|
| Existing | 1.0 | 7.4 | 6.6 | 0.6 | 2.3 |
| Future | 1.0 | 8.7 | 6.6 | 2.0 | 2.7 |

The deficient reach of the Montclair pipeline includes approximately 24,000 linear feet of 30-inch-diameter sewer. The hydraulic model was run under future system conditions as part of the analysis of the diversion alternatives discussed in the following sections of this TM. It was determined that to mitigate the capacity deficiencies, the pipeline would need to be upgraded to a 36-inch-diameter line to convey peak buildout flows at a d/D value less than 0.75 (criterion for sizing new pipelines).

It is recommended that IEUA staff conduct further flow monitoring of this reach of pipeline to determine the extent of the deficiency. IEUA staff should conduct a focused flow monitoring effort on this reach to develop a clear picture of the flow conditions during peak flow periods to verify the modeling results and help size the pipeline during preliminary and final design of mitigation alternatives. Although upgrading the pipeline is a viable alternative, other options exist such as constructing parallel reaches of conveyance trunk lines.

# 4.0 Evaluation of Flow Diversion Alternatives

One of the goals of the WFMP is to plan the efficient use of IEUA's wastewater treatment plants and optimize the use of recycled water within the IEUA service area for groundwater recharge. One of the tasks in the project is to develop and evaluate flow diversion alternatives given an understanding of the constraints and goals of the treatment evaluations and plans for Regional Water Recycling Plant (RWRP) expansion. For instance, consideration of treatment plant expansions at RP-1 and RP-5 took into account nitrogen concentration limits at the groundwater recharge basin and the treatment plants.




Legend

- Montclair Diversion Structure
- Montclair Capacity Deficiency
- WTP Regional Treatment Plant
- PS Lift Station

**Modeled Pipelines**

- 12" and Smaller
- 15" and Larger
- Major Roads
- IEUA Tributary Areas

0 3,600 7,200 Feet

FIGURE 3-1

## Montclair Interceptor Deficiencies

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Per the Waste Discharge Order No. R8-2009-0021 (National Pollutant Discharge Elimination System [NPDES] No. CA8000409) and Water Recycling Order No. R8-2007-0039 (and subsequent amendments), the concentration of total inorganic nitrogen (TIN) in the 12-month flow-weighted average of plant effluent shall not exceed 8 milligrams per liter (mg/L). This limitation may be met on an agency-wide basis using flow-weighted averages of discharges from RP-1, RP-4, RP-5, and Carbon Canyon Water Recycling Facility (CCWRF). Per the California Department of Public Health (CDPH) regulations for groundwater recharge and in accordance with Water Recycling Order No. R8-2007-0039, total nitrogen (TN) concentration of the recycled water used for recharge prior to reaching the regional groundwater table must not exceed 5 mg/L. The organic nitrogen content in plant effluent is typically in the range of 1.5 to 2.0 mg/L. Therefore, a plant effluent TIN of 8 mg/L corresponds to a TN of about 9.5 to 10 mg/L at the basins. In comparison, a plant effluent TIN of 5 mg/L corresponds to a TN of about 6.5 to 7 mg/L at the basins.

The plant capacity analyses in TM 5 through TM 8 are based on an effluent concentration of 8 mg/L TIN in accordance with discharge permit requirements. However, in this TM, expansion needs are based on a plant effluent concentration of 5 mg/L TIN for those alternatives where treated effluent may be used for groundwater recharge. Targeting a plant effluent concentration of 5 mg/L TIN reduces process capacity and requires plant expansions to occur sooner, thus representing a more conservative approach to identifying expansion needs in this evaluation of alternatives. This approach applies to RP-1 under all alternatives, and to RP-5 under both Alternatives 4A and 4B where flow from RP-5 is pumped north for groundwater recharge.

This section provides a summary of the proposed flow diversion alternatives, and details the results of the non-monetary evaluation of the alternatives. The alternatives are described in detail in TM 2 and are summarized below. The analysis is based on a planning horizon of 20 years (2035), which is then used to establish the infrastructure needs for each alternative. The flows diverted under each alternative are summarized in Table 3-4.

## 4.1 Summary of Flow Diversion Alternatives

## 4.2 Alternative 1

Alternative 1 is the “Do Nothing” alternative. This alternative makes use of the future flow projections for RP-1 and RP-5 and determines how keeping the existing methodologies for flow routing in place affects IEUA’s ability to meet its goals. The assumption is that all flows from the Whispering Lakes tributary area, as well as the flows from the Haven pump station tributary area, are conveyed by gravity to RP-5.

## 4.3 Alternative 2

Alternative 2 assumes that the flows from the Whispering Lakes tributary area are pumped to RP-1 for treatment. Currently, the Haven pump station conveys flow to RP-1, and Alternative 2 assumes that the flows would continue to be conveyed to RP-1 in the future.

The Whispering Lakes pump station collects wastewater from agency tributary area OA-1B, while Haven pump station collects from tributary area OA-2B_A. Alternative 2 provides flexibility where the wastewater is routed because IEUA would still have the option to send the flows to RP-5 either through the Eastern Trunk Sewer or the RP-1 Bypass.

## 4.4 Alternatives 3A, 3B, and 3C

Alternative 3 assumes a new pump station would be installed south of the Archibald Ranch area to convey flows from the Whispering Lakes, Haven, and Archibald Ranch developments. The areas diverted to RP-1 include tributary areas OA-1B, OA-2B_A, OA-2B_B, OA-1A, and OA-2A. There would be three sub-alternatives of Alternative 3. The sub-alternatives compare different locations for the new pump station to maximize the collection of sewer flows from the New Model Colony in the city of Ontario and to optimize the amount of flow diverted to RP-1.

Alternative 3 includes additional flow diversions from the eastern portions of the New Model Colony. In comparison, Alternative 2 assumes that no new flows outside the existing Whispering Lakes and Haven tributary areas would be conveyed to RP-1. Alternative 3 maximizes the amount of flow going to RP-1 by taking flow from new growth. Potential locations for the new pump station are (a) south of Edison Avenue to intercept approximately 30 percent of the New Model Colony flows, (b) near the flood control channel and Hellman Avenue to intercept approximately 50 percent of the New Model Colony flows, and (c) near Euclid Avenue and Kimball Avenue to intercept all of the New Model Colony flows. Each location represents a corresponding sub-alternative (3A, 3B, and 3C).

TABLE 3-4
**Projected Sewer Flows for Diversion Alternatives**

| | Facility | 2013 Flow (mgd) | 2020 Flow (mgd) | 2030 Flow (mgd) | 2035 Flow[c] (mgd) | 2040 Flow (mgd) | 2050 Flow (mgd) | 2060 Flow (mgd) |
|---|---|---|---|---|---|---|---|---|
| Do Nothing | | | | | | | | |
| | RP-1 | 27.5 | 28.7 | 30.4 | **31.3** | 32.1 | 34.2 | 34.4 |
| | RP-5 | 8.2 | 11.9 | 17.7 | **20.3** | 22.8 | 26.7 | 27.2 |
| Alternative 2 | | | | | | | | |
| | RP-1 | 29.2 | 30.4 | 32.2 | **33.1** | 34.0 | 36.1 | 36.3 |
| | RP-5 | 6.4 | 10.2 | 15.9 | **18.4** | 20.9 | 24.8 | 25.3 |
| Alternative 3[a] | | | | | | | | |
| 3A | | | | | | | | |
| | RP-1 | 28.4 | 30.3 | 33.4 | **34.9** | 36.3 | 39.3 | 39.5 |
| | RP-5 | 7.3 | 10.3 | 14.8 | **16.7** | 18.6 | 21.6 | 22.1 |
| 3B | | | | | | | | |
| | RP-1 | 29.0 | 31.4 | 35.3 | **37.2** | 39.1 | 42.7 | 42.9 |
| | RP-5 | 6.7 | 9.2 | 12.8 | **14.3** | 15.8 | 18.2 | 18.7 |
| 3C | | | | | | | | |
| | RP-1 | 30.4 | 34.1 | 40.2 | **43.2** | 46.1 | 51.1 | 51.3 |
| | RP-5 | 5.3 | 6.5 | 7.9 | **8.4** | 8.9 | 9.8 | 10.3 |
| Alternative 4[b] | | | | | | | | |
| 4A | | | | | | | | |
| | RP-1 | 28.6 | 29.9 | 31.7 | **32.6** | 33.4 | 35.5 | 35.7 |
| | RP-5 | 7.1 | 10.7 | 16.4 | **19.0** | 21.5 | 25.4 | 25.9 |
| 4B | | | | | | | | |
| | RP-1 | 26.4 | 27.5 | 29.1 | **30.0** | 30.8 | 32.9 | 33.1 |
| | RP-5 | 9.3 | 13.1 | 19.0 | **21.6** | 24.1 | 28.0 | 28.5 |

[a] Includes construction of a new regional lift station to convey flows to RP-1. Three sub-alternatives were developed to evaluate diverting differing percentages of flows from the city of Ontario's New Model Colony growth area. Alternative 3A diverted 30 percent of New Model Colony flow, Alternative 3B diverted 50 percent of New Model Colony flow, and Alternative 3C diverted 100 percent of New Model Colony flow.

[b] Alternative 4A evaluated the flows if 100 percent of flow at the Montclair diversion structure was diverted to RP-1. Alternative 4B assumes 100 percent of the flows at the Montclair diversion were conveyed to CCWRF.

The analysis is based on a 20-year planning horizon.

These locations have not been analyzed to determine the percentage of New Model Colony flows that could be captured. Rather, these locations are intended to serve as starting points for the analysis, and the captured flow percentages most likely will be modified.

Another difference between Alternative 2 and Alternative 3 is that Alternative 3 includes the construction of a single regional pump station instead of utilizing the existing city of Ontario pump stations (Whispering Lakes and Haven). This alternative eliminates the operation and maintenance of multiple pump stations. Some flexibility exists with Alternative 3 because the flows could be diverted to either RP-1 or RP-5.

## 4.5 Alternatives 4A and 4B

Alternative 4 assumes that instead of diverting flows to RP-1 for treatment, the flows are treated at RP-5 and pumped to RP-1 to be distributed in the distribution system for recycled water in the northern portions of the IEUA service area. It is assumed that the existing recycled water pump station currently installed at RP-5 would need to be expanded to pump the increased recycled water flow to the recycled water facility at RP-1. Alternative 4 requires an expansion of RP-5 to handle the increase in flow to the plant. This is the least flexible of the alternatives because flows to RP-5 could not be diverted.

Alternative 4 has two sub-alternatives. Alternative 4A assumes that all flows at the Montclair Diversion would be diverted to the Montclair pump station and ultimately to RP-1. Alternative 4B assumes that flows at the Montclair Diversion would be diverted to RP-5.

## 4.6 Infrastructure Implications

Once the flow diversion alternatives were established, the facilities needed to operate under the specifics of each alternative were defined. The requirements of each facility were established using the hydraulic model discussed in TM 2 and an understanding of the treatment requirements for RP-1 and RP-5. For the expansions of the RWRPs, it was assumed that additional capacity would be added in modules based on the current configuration of the unit processes.

As discussed, expansion needs in this TM are based on a plant effluent concentration of 5 mg/L TIN for those alternatives where treated effluent may be used for groundwater recharge. Targeting a plant effluent concentration of 5 mg/L TIN reduces process capacity and requires plant expansions to occur sooner, thus representing a more conservative approach to identifying expansion needs in this alternatives evaluation. This approach applies to RP-1 under all alternatives and to RP-5 under both Alternatives 4A and 4B where flow from RP-5 is pumped north for groundwater recharge. This results in 5-mgd and 6.5-mgd expansion modules at RP-1 and RP-5, respectively, for Alternatives 4A and 4B. For all other alternatives, RP-5 could be expanded in 7.5-mgd modules at a plant effluent concentration of 8 mg/L TIN.

The infrastructure implications for each alternative are listed in Table 3-5. As stated, a planning horizon of 20 years (2035) was used to establish the infrastructure needs for each alternative.

**Alternative 1** – Facilities required under Alternative 1 include the expansions of RP-1 and RP-5 to accommodate the projected increases in wastewater flows. Currently, RP-1 is rated at 29 mgd (5 mg/L TIN) and would need to be expanded to 34 mgd to accommodate the projected increase in flow. RP-5 is currently rated for 15 mgd (8 mg/L TIN) and would need to be expanded to 22.5 mgd. Alternative 1 would also require an upgrade of the Montclair pipeline downstream of the Montclair pump station from a 30-inch line to a 36-inch pipeline. The added facilities are shown in Figure 3-2.

**Alternative 2** – Alternative 2 proposes to utilize the Whispering Lakes pump station to convey wastewater to RP-1. This alternative would require the expansion of the Whispering Lakes pump station by approximately 2.2 mgd to 4.7 mgd. Similar to Alternative 1, RP-1 and RP-5 would require expansions of 5 mgd and 7.5 mgd, respectively. The added facilities are shown in Figure 3-3.

**Alternative 3A** – The infrastructure required for Alternative 3A includes a 17-mgd pump station located south of Edison Avenue and a 24-inch-diameter force main to convey wastewater to RP-1. RP-1 and RP-5 would require expansions of 10 mgd and 7.5 mgd, respectively. RP-1 would expand from 29 mgd to 39 mgd, and RP-5 would expand from 15 mgd to 22.5 mgd. This alternative would also require upgrading the Montclair pipeline downstream of the Montclair pump station from the existing 30-inch line to a 36-inch pipeline. The added facilities are shown in Figure 3-4.

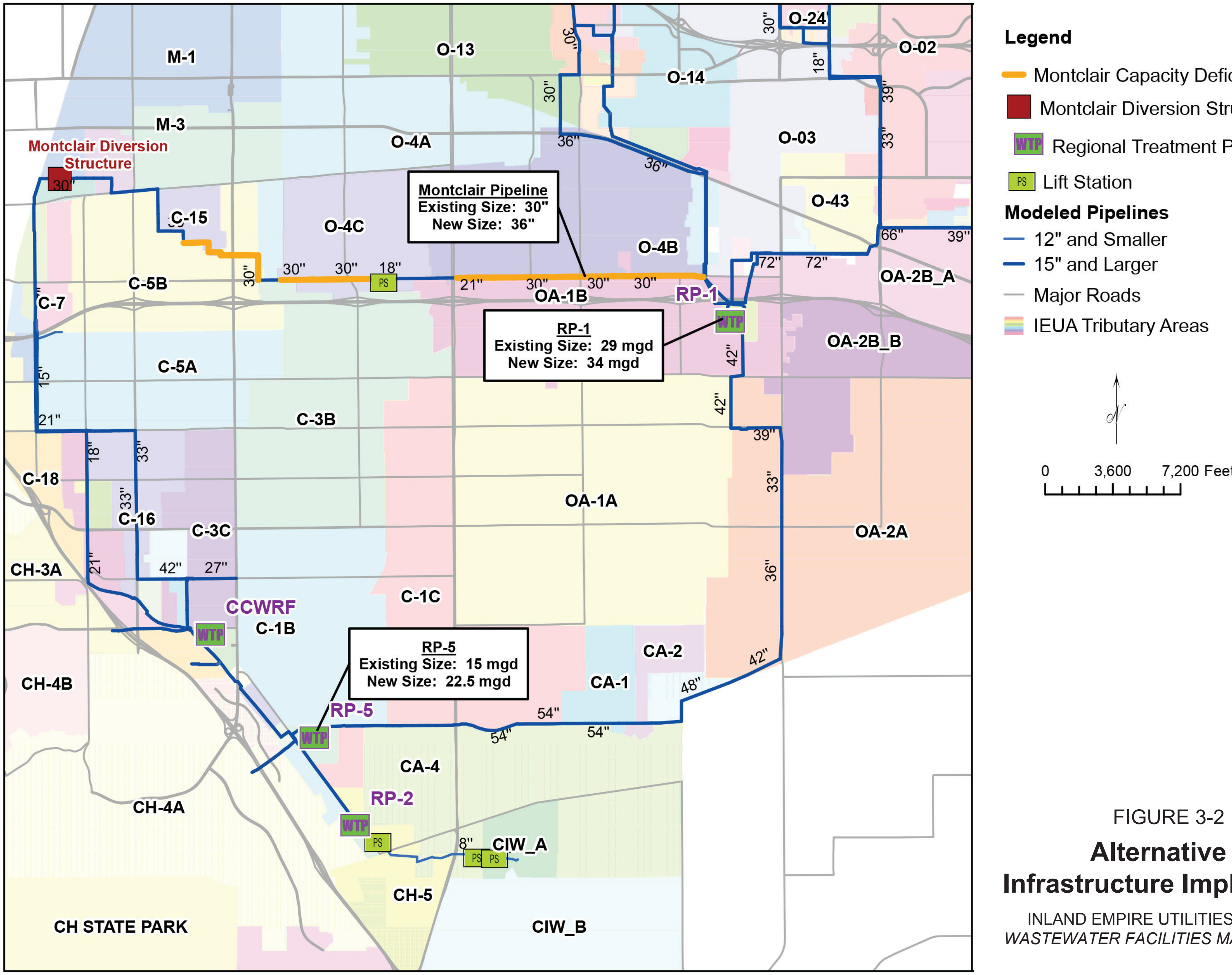




FIGURE 3-2

**Alternative 1**
**Infrastructure Implications**

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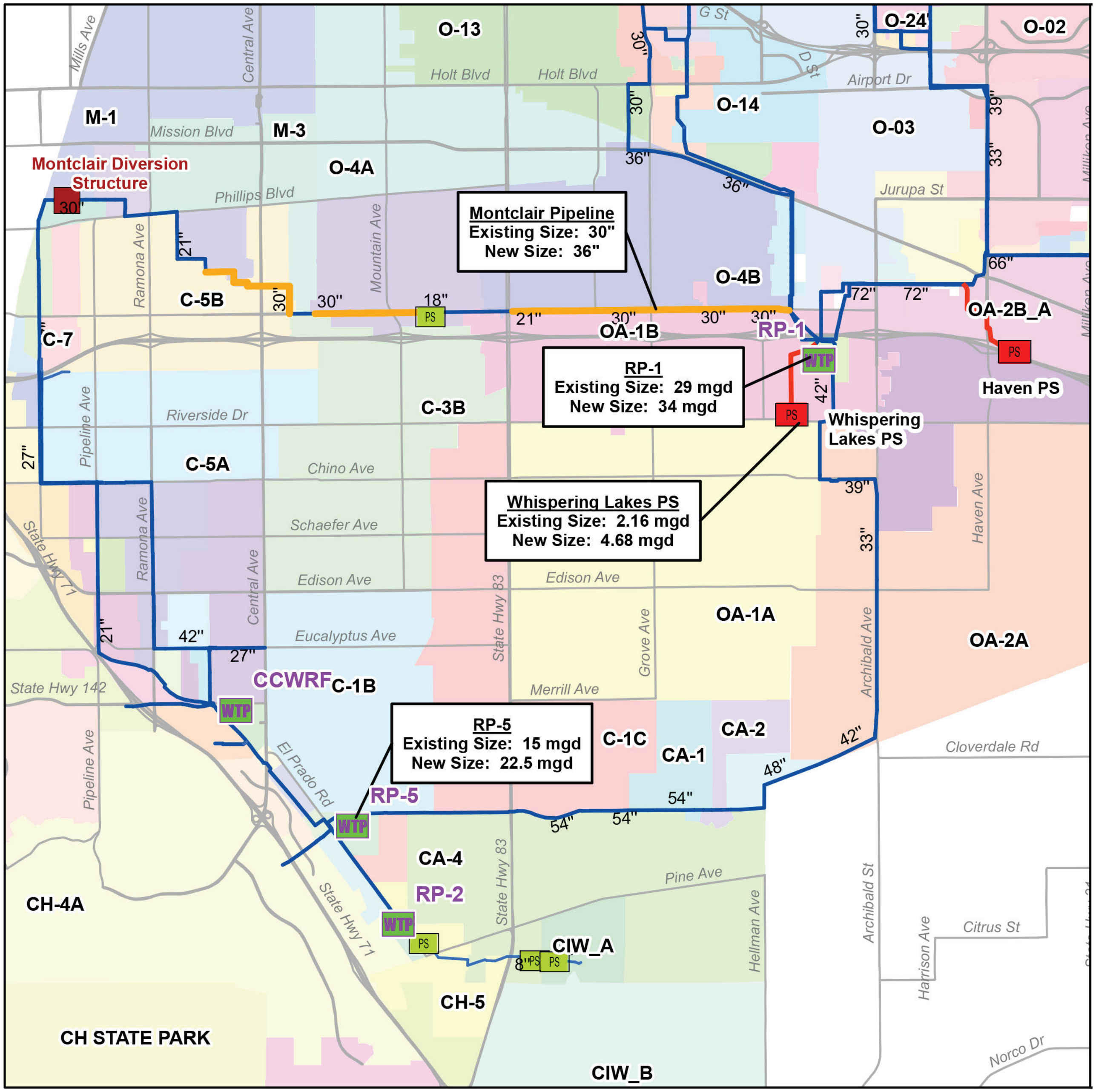


FIGURE 3-3

**Alternative 2**
**Infrastructure Implications**

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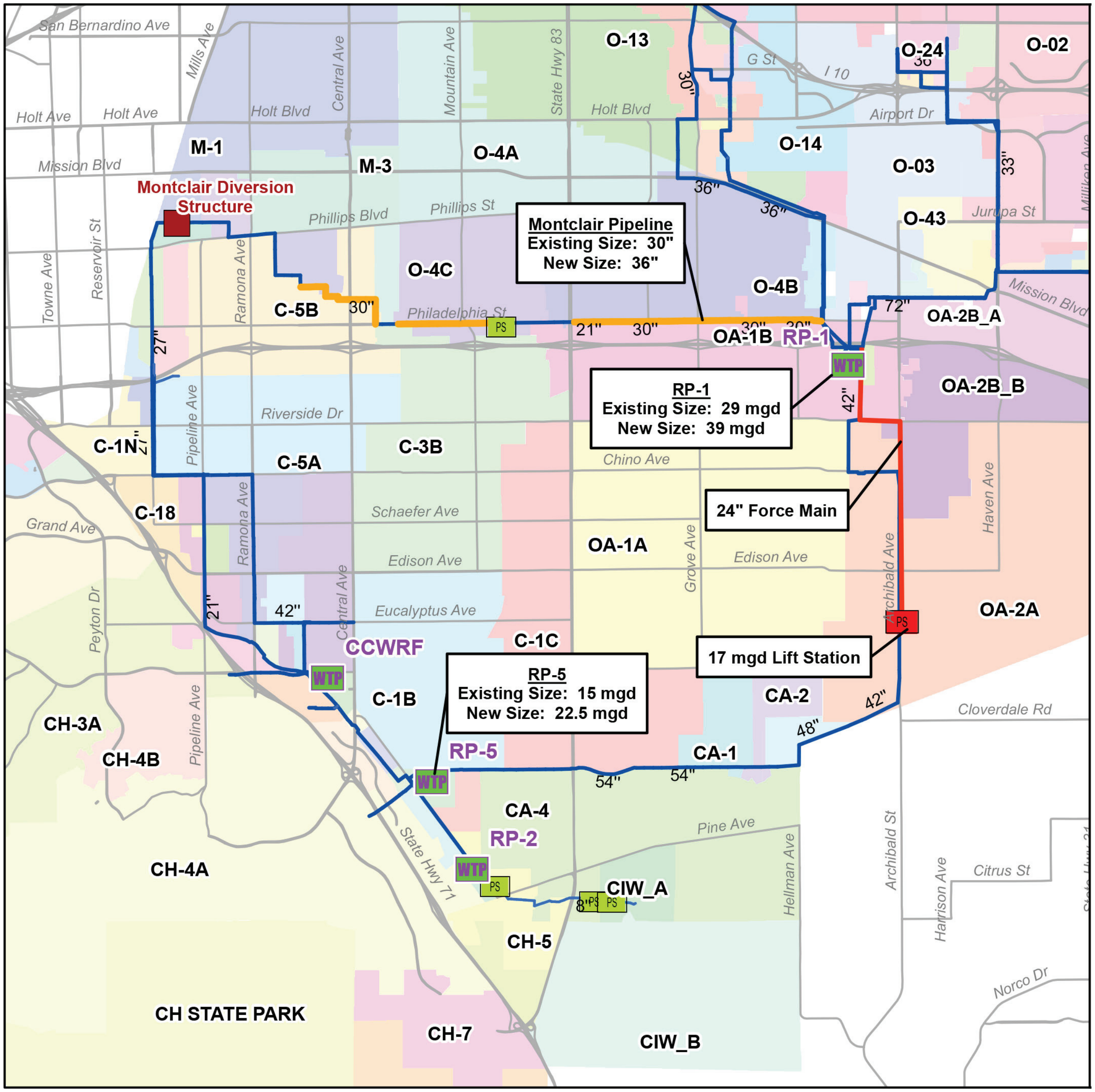


Legend

- Proposed Lift Station
- Alternative 3A Pipeline
- Montclair Capacity Deficiency
- Montclair Diversion Structure
- Regional Treatment Plant
- Lift Station

Modeled Pipelines

- 12" and Smaller
- 15" and Larger
- Major Roads
- IEUA Tributary Areas

0 3,000 6,000 Feet

FIGURE 3-4

## Alternative 3A Infrastructure Implications

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TABLE 3-5
**Alternative Infrastructure Implications**

| Facility | Type of Improvement | Existing Size/ Diameter | New Size/ Diameter |
|---|---|---|---|
| **Alternative 1** | | | |
| RP-1 | Expand 5 mgd | 29 mgd | 34 mgd |
| RP-5 | Expand 7.5 mgd | 15 mgd | 22.5 mgd |
| Montclair Pipeline | Upgrade | 30 inches | 36 inches |
| **Alternative 2** | | | |
| Whispering Lakes | Pump Station | 2.16 mgd | 4.68 mgd |
| RP-1 | Expand 5 mgd | 29 mgd | 34 mgd |
| RP-5 | Expand 7.5 mgd | 15 mgd | 22.5 mgd |
| Montclair Pipeline | Upgrade | 30 inches | 36 inches |
| **Alternative 3A** | | | |
| Proposed | Pump Station | - | 17 mgd |
| | Force Main | - | 24 inches |
| RP-1 | Expand 10 mgd | 29 mgd | 39 mgd |
| RP-5 | Expand 7.5 mgd | 15 mgd | 22.5 mgd |
| Montclair Pipeline | Upgrade | 30 inches | 36 inches |
| **Alternative 3B** | | | |
| Proposed | Pump Station | - | 29 mgd |
| | Force Main | - | 30 inches |
| RP-1 | Expand 10 mgd | 29 mgd | 39 mgd |
| Montclair Pipeline | Upgrade | 30 inches | 36 inches |
| **Alternative 3C** | | | |
| Proposed | Pump Station | - | 45.8 mgd |
| | Force Main | - | 42 in |
| RP-1 | Expand 15 mgd | 29 mgd | 44 mgd |
| Montclair Pipeline | Upgrade | 30 inches | 36 in |
| **Alternative 4A**[a] | | | |
| Proposed | Pump Station | - | 22 mgd |
| | Storage Tank | - | 6 MG |
| | Recycled Water Pipeline | - | 24 inches |
| RP-1 | Expand 5 mgd | 29 mgd | 34 mgd |
| RP-5 | Expand 6.5 mgd | 13 mgd | 19.5 mgd |
| Montclair Pipeline | Upgrade | 30 inches | 36 inches |
| **Alternative 4B**[a] | | | |
| Proposed | Pump Station | - | 22 mgd |
| | Storage Tank | - | 6 MG |
| | Recycled Water Pipeline | - | 24 inches |
| RP-1 | Expand 5 mgd | 29 mgd | 34 mgd |
| RP-5 | Expand 13 mgd | 13 mgd | 26 mgd |

[a] The RP-5 capacity and expansion needs for Alternatives 4A and 4B are based on a concentration of 5 mg/L TIN. For all other alternatives, the RP-5 capacity and expansion needs are based on a concentration of 8 mg/L TIN.

MG = million gallons

**Alternative 3B** – Alternative 3B is similar to Alternative 3A in terms of the treatment plant expansions for RP-1 and the upgrade of the Montclair pipeline. However, this alternative would require a 29-mgd pump station located near the flood control channel and Hellman Avenue, and a 30-inch-diameter force main to convey flows to RP-1. Alternative 3B would not require an expansion of RP-5. Alternative 3B would also include the upgrade of the Montclair pipeline downstream of the Montclair pump station from a 30-inch line to a 36-inch-diameter pipeline. The added facilities are shown in Figure 3-5.

**Alternative 3C** – Alternative 3C would require an expansion of RP-1 by 15 mgd from its existing 29-mgd capacity to 44 mgd, as well as installation of a 46-mgd wastewater pump station and 42-inch-diameter force main. Alternative 3C would also include an upgrade of the Montclair pipeline downstream of the Montclair pump station, from the existing 30-inch line to a 36-inch-diameter pipeline. The added facilities are shown in Figure 3-6.

**Alternative 4A** – Alternative 4A assumes that 22 mgd of wastewater would be treated for groundwater recharge and pumped to RP-1 in a 24-inch-diameter recycled water pipeline. In addition, a recycled water storage tank would be required at RP-5. RP-1 would be expanded by 5 mgd from its existing 29-mgd capacity to 34 mgd, and RP-5 would be expanded by 6.5 mgd from its existing 13-mgd capacity to 19.5 mgd. The difference in the expansion for RP-5 in this alternative is the lower TIN limit of 5 mg/L for RP-5 discussed in Section 2 (Evaluation and Planning Criteria). Alternative 4A would also include an upgrade of the Montclair pipeline downstream of the Montclair pump station, from a 30-inch sewer to a 36-inch pipeline. The added facilities are shown in Figure 3-7.

**Alternative 4B** – Similar to Alternative 4A, the infrastructure required for this alternative includes a 22-mgd recycled water pump station, a 24-inch-diameter recycled water pipeline, and a recycled water storage tank. RP-1 would be expanded by 5 mgd from the existing 29-mgd capacity to 34 mgd, and RP-5 would increase by 13 mgd from the existing 13-mgd capacity to 26 mgd. This is the only alternative that does not require the expansion of the Montclair pipeline. The added facilities are shown in Figure 3-7.

## 4.7 Evaluation of Proposed Flow Diversion Alternatives

The SMART evaluation approach described above was used to conduct a non-monetary evaluation of the flow diversion alternatives. The non-monetary and monetary evaluations are summarized in this section. The non-monetary and monetary evaluations are ultimately combined as a means to develop a cost-benefit analysis of the alternatives.

### 4.7.1 Non-monetary Evaluation

Each alternative was evaluated relative to the others using the SMART criteria described previously in this TM. Each evaluation criterion for each alternative was given a performance score between 1 and 5. The performance score was multiplied by the weighting factor for each criterion to develop a weighted score for that criterion. The total weighted performance for each alternative was then determined by adding together the weighted scores for each alternative. The results of the evaluations are summarized in Table 3-6.

As shown in Table 3-6, the scores ranged from a low of 217 for Alternative 1 to a high of 279 for Alternative 3B. Figure 3-8 charts a summary of the relative weighted score of each criterion for each alternative. The columns show the contribution of each weighted score toward the total score for each alternative. As shown in the chart, Operational Flexibility, Optimizing Groundwater Recharge, and Ease of Operation and Maintenance had the biggest impacts on the total performance scores for each alternative.

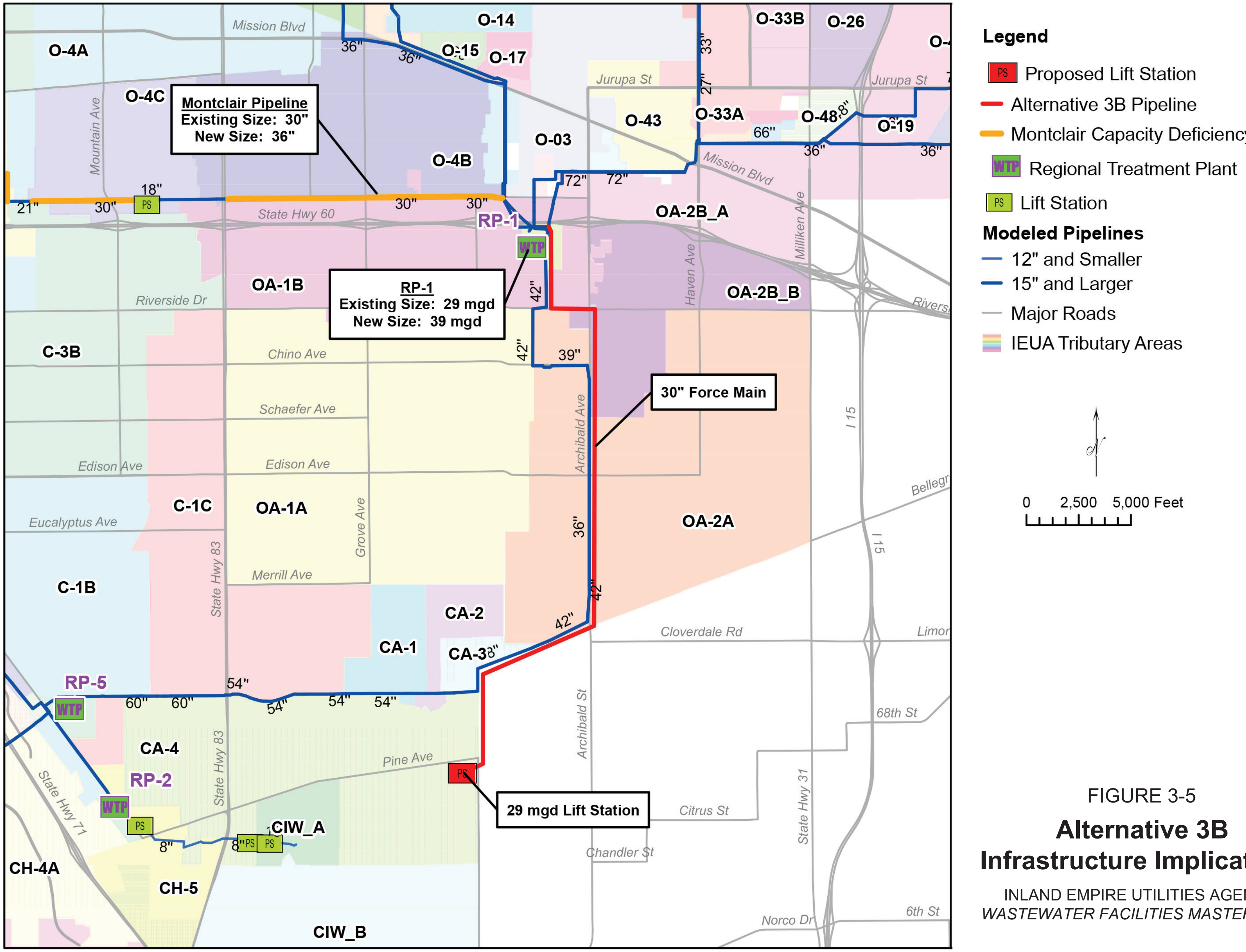


FIGURE 3-5

## Alternative 3B Infrastructure Implications

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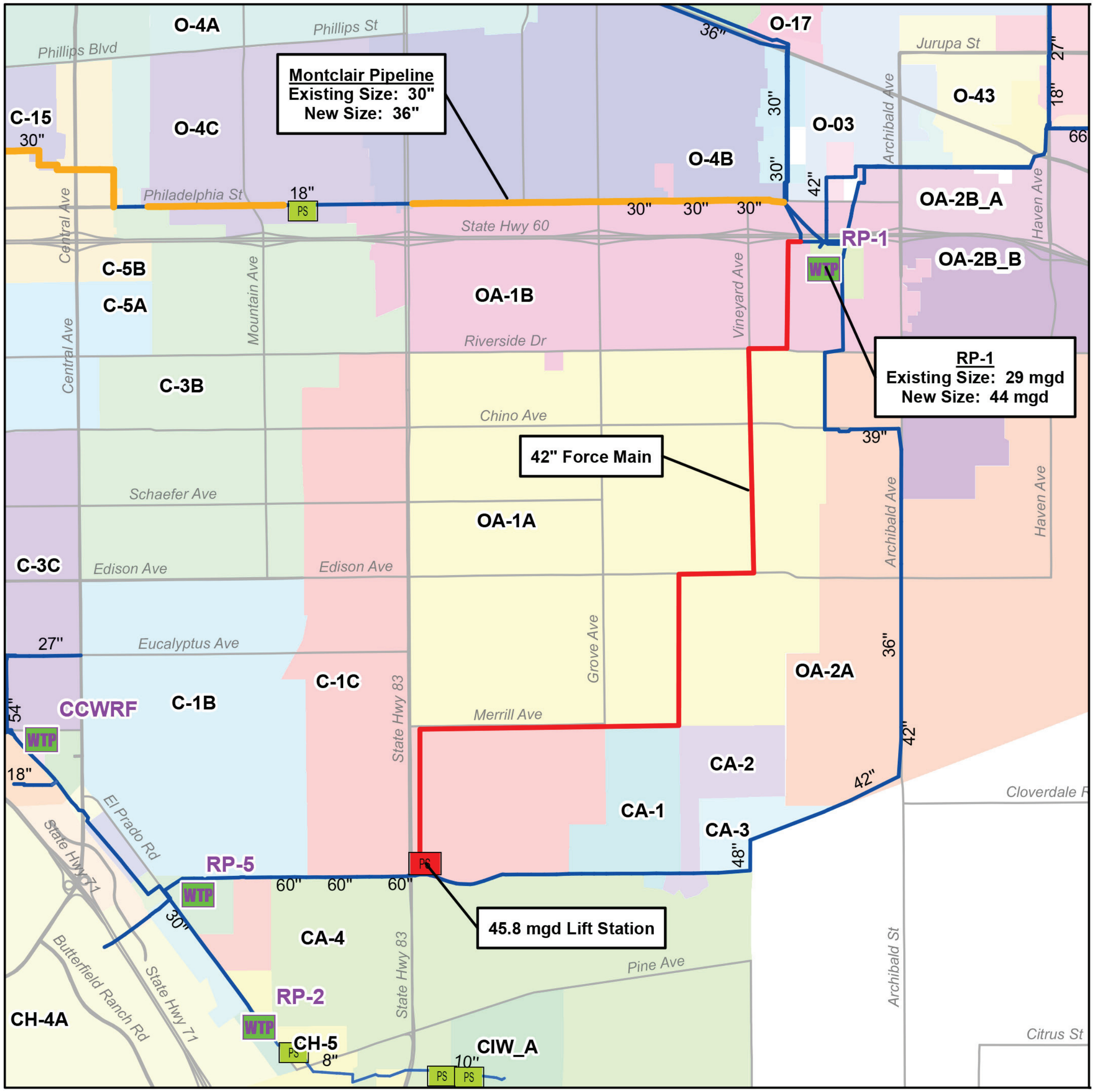


FIGURE 3-6
## Alternative 3C Infrastructure Implications
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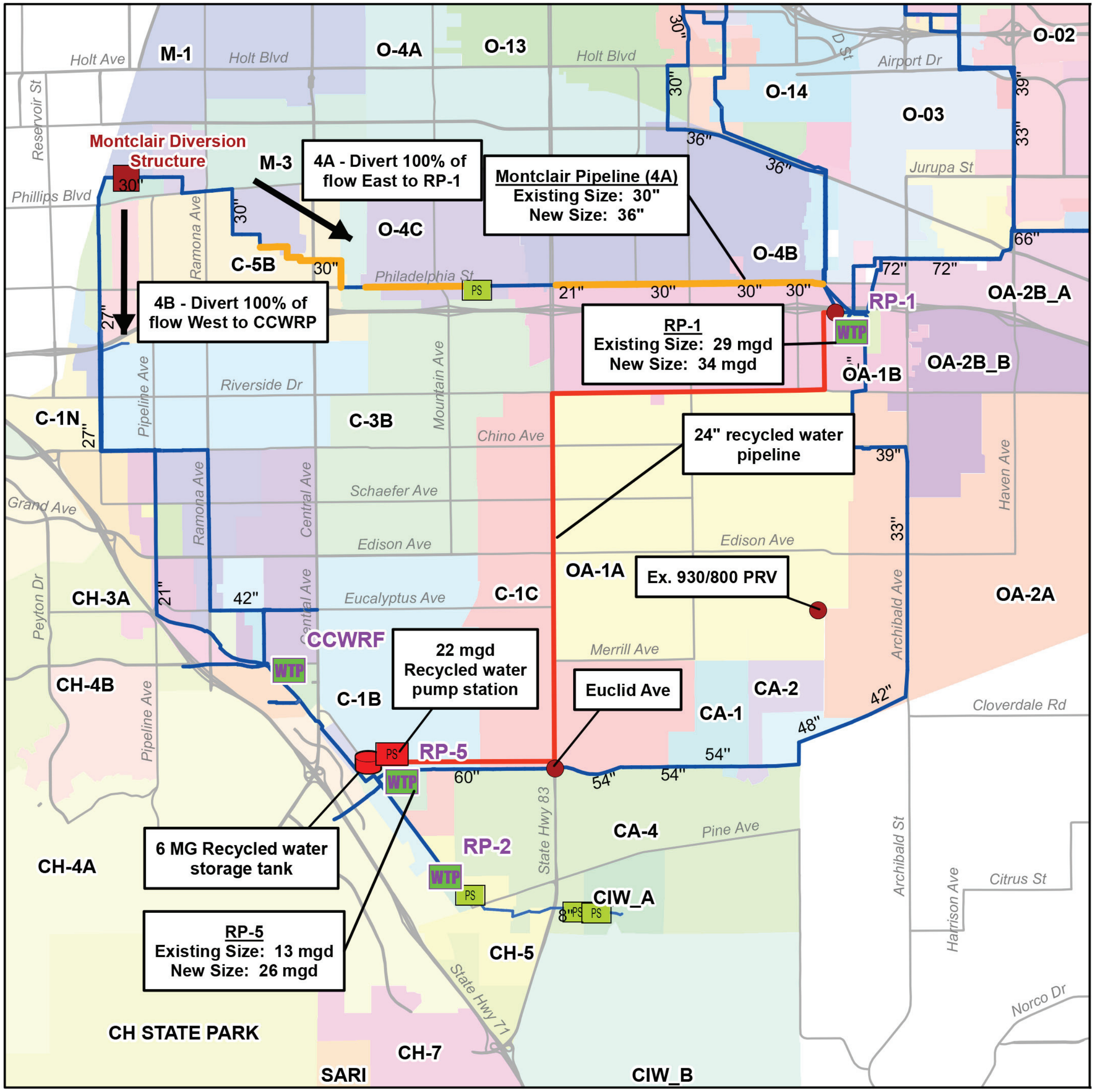


FIGURE 3-7

## Alternative 4A and 4B Infrastructure Implications

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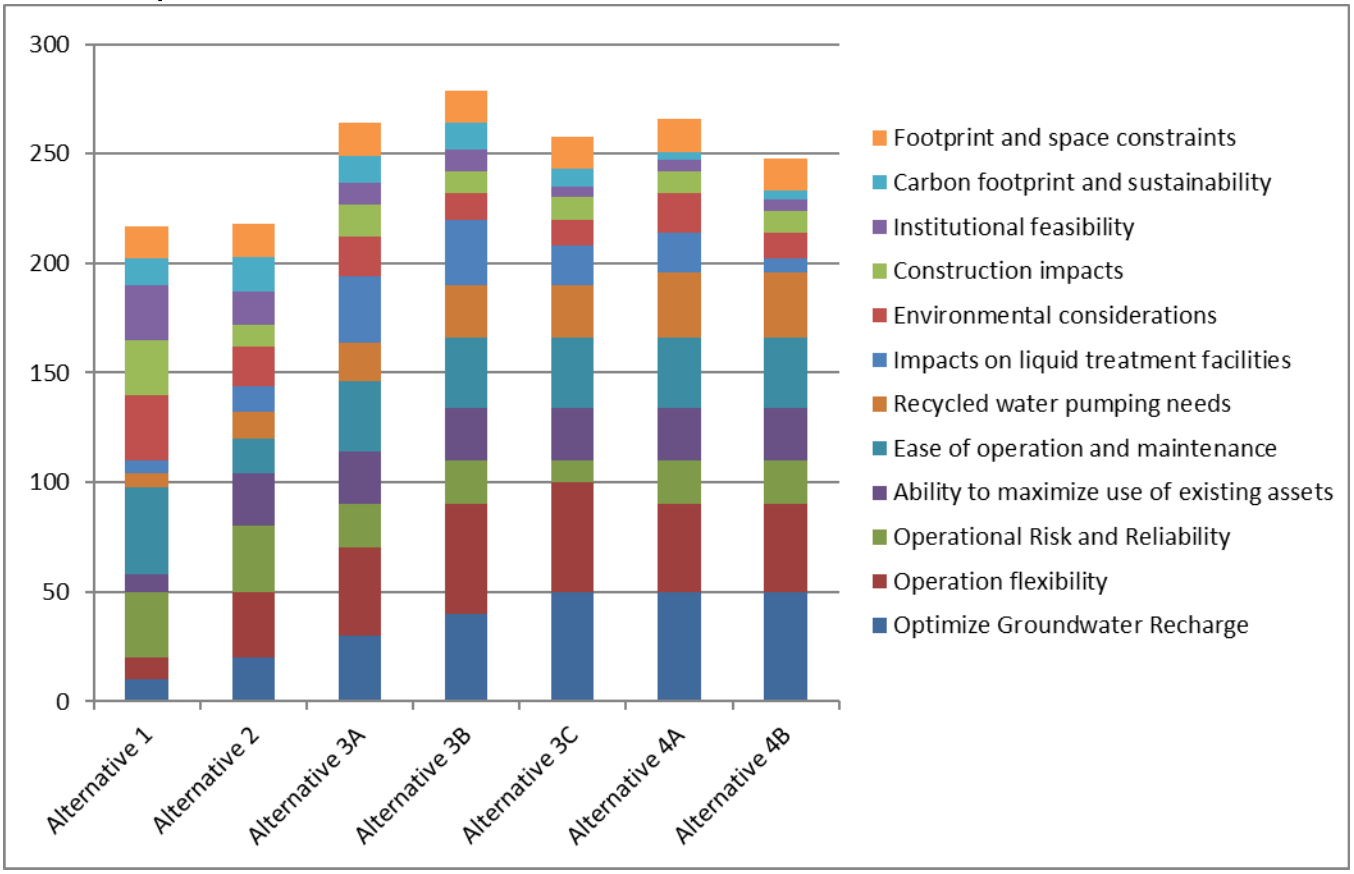
TABLE 3-6
**Non-Monetary Evaluation Results**

| Criterion | Weighting Factor | Alternative 1 | | Alternative 2 | | Alternative 3A | | Alternative 3B | | Alternative 3C | | Alternative 4A | | Alternative 4B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Performance Score | Weighted Score | Performance Score | Weighted Score | Performance Score | Weighted Score | Performance Score | Weighted Score | Performance Score | Weighted Score | Performance Score | Weighted Score | Performance Score | Weighted Score |
| Optimize Groundwater Recharge | 10 | 1 | 10 | 2 | 20 | 3 | 30 | 4 | 40 | 5 | 50 | 5 | 50 | 5 | 50 |
| Operational Flexibility | 10 | 1 | 10 | 3 | 30 | 4 | 40 | 5 | 50 | 5 | 50 | 4 | 40 | 4 | 40 |
| Operational Risk and Reliability | 10 | 3 | 30 | 3 | 30 | 2 | 20 | 2 | 20 | 1 | 10 | 2 | 20 | 2 | 20 |
| Ability to maximize use of existing assets | 8 | 1 | 8 | 3 | 24 | 3 | 24 | 3 | 24 | 3 | 24 | 3 | 24 | 3 | 24 |
| Ease of operation and maintenance | 8 | 5 | 40 | 2 | 16 | 4 | 32 | 4 | 32 | 4 | 32 | 4 | 32 | 4 | 32 |
| Recycled water pumping needs | 6 | 1 | 6 | 2 | 12 | 3 | 18 | 4 | 24 | 4 | 24 | 5 | 30 | 5 | 30 |
| Impacts on liquid treatment facilities | 6 | 1 | 6 | 2 | 12 | 5 | 30 | 5 | 30 | 3 | 18 | 3 | 18 | 1 | 6 |
| Environmental considerations | 6 | 5 | 30 | 3 | 18 | 3 | 18 | 2 | 12 | 2 | 12 | 3 | 18 | 2 | 12 |
| Construction impacts | 5 | 5 | 25 | 3 | 15 | 3 | 15 | 2 | 10 | 2 | 10 | 2 | 10 | 2 | 10 |
| Institutional feasibility | 5 | 5 | 25 | 3 | 15 | 2 | 10 | 2 | 10 | 1 | 5 | 1 | 5 | 1 | 5 |
| Carbon footprint and sustainability | 4 | 3 | 12 | 4 | 16 | 3 | 12 | 3 | 12 | 2 | 8 | 1 | 4 | 1 | 4 |
| Footprint and space constraints | 3 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 |
| **Total Weighted Performance** | | | **217** | | **223** | | **264** | | **279** | | **258** | | **266** | | **248** |

FIGURE 3-8
**Non-Monetary Evaluation Results**




### 4.7.2 Monetary Evaluation

The monetary evaluation included several assumptions that had an impact on the cost estimates. The assumptions included the following:

- WFMP assumed a 20-year planning period
- 3 percent inflation rate
- 6 percent bond (interest) rate
- $10 per gallon for liquid treatment capacity costs
- Pump station costs were based on a cost curve established from historical pump station projects
- Pipeline costs were developed based on the costs per linear foot for varying diameters
- Labor and power costs were provided based on IEUA cost factors
- 30 percent contingency for unknown conditions
- 30 percent contingency for Engineering, Construction Management, Environmental, and Legal costs

Based on the flow curves for each alternative, the year in which each treatment plant expansion will be required was determined. For each alternative, the costs for expansion were escalated to the mid-point of construction using the inflation rate, and were brought back to present worth with the bond interest rate. Both operation and maintenance costs and power costs were annualized and brought to a net present value in the same manner.

With this method, the total life-cycle cost for each alternative was developed. The estimated cost for each alternative is summarized in Table 3-7. These cost estimates range from a high of $341 million for Alternative 3C to a low of $172 million for Alternative 1. Alternative 2 was the second lowest cost at $178 million. The unit costs and the detailed cost breakdown are provided in Appendix 3-A of this TM. B/C ratios are explained in the next subsection.

TABLE 3-7
**Summary of Life-Cycle Costs and Benefit/Cost Ratios**

| Alternative | Life-Cycle Cost ($ Millions) | Benefit/Cost Ratio |
|---|---|---|
| 1 | $172 | 1.26 |
| 2 | $178 | 1.25 |
| 3A | $261 | 1.01 |
| 3B | $219 | 1.28 |
| 3C | $341 | 0.76 |
| 4A | $265 | 1.00 |
| 4B | $335 | 0.74 |

### 4.7.3 Benefit/Cost Ratio

The non-monetary scores and monetary cost estimates were used to develop a B/C ratio as a means to determine the alternative with the highest overall benefit for IEUA. For each alternative, the weighted performance score was divided by the estimated life-cycle cost to determine the B/C ratio. The calculated B/C ratios for all alternatives are summarized in Table 3-7.

The alternative with the highest B/C ratio is Alternative 3B with a score of 1.28. Both Alternatives 1 and 2 also scored high with scores of 1.26 and 1.25 respectively.

# 5.0 Conclusions

The results of the alternatives evaluation and the B/C ratio analysis were presented to IEUA staff at the WFMP Workshop No. 2 on June 11, 2014. The B/C ratio analysis scores for Alternatives 1, 2, and 3B are similar, varying by only 0.03 points. IEUA discussed the alternatives and ultimately selected Alternative 2 as its preferred alternative. Alternative 2 provides IEUA with near-term benefits in diverting flow from both the Whispering Lakes and Haven pump stations, while prolonging the treatment expansions of RP-1 and RP-5. Alternative 2 also offers a lower capital cost than Alternative 3B.

The preferred Alternative 2 includes the following improvements during the planning horizon:

- Expand RP-1 by 5.0 mgd
- Expand RP-5 by 7.5 mgd
- Upgrade the Whispering Lakes pump station to a firm capacity of 4.7 mgd
- Construct improvements to mitigate the deficiencies in the Montclair pipeline

To provide greater system reliability and redundancy, IEUA also requested that RP-5 facilities planning and expansion needs be evaluated under the assumption that both the Whispering Lakes and Haven pump stations are offline, with flows conveyed by gravity to RP-5 rather than to RP-1. This flow condition is reflected in *TM 4 Wastewater Flow and Loading Forecast* and forms the basis for establishing RP-5 facilities planning and expansion.

# Appendix 3-A
# Cost Estimates

| | Type of Improv. | Description / Limits | Ex. Size/ Diam. | New Size/ Diam. | Replace/ New | Length (ft) | 2014 Cost | Potential Flows for GW Recharge AF |
|---|---|---|---|---|---|---|---|---|
| **Proposed Alternatives** | | | | | | | | |
| **Alternative 1** | | | | | | | | |
| | Expand | Expand RP-1 by 5 mgd | 29 mgd | 34.0 mgd | Rehab | - | $ 70,834,000.00 | |
| | Expand | Expand RP-5 by 6.5 mgd | 15 mgd | 21.5 mgd | Rehab | - | $ 84,485,000.00 | |
| | Upsize | Montclair Improvements | 30 in | 36 in | Replace | 24,000 | $ 17,130,000 | |
| **Alternative 1 Total** | | | | | | | **$ 172,449,000** | **None** |
| **Alternative 2** | | | | | | | | |
| | Pump Station | Upgrade to 4.5mgd Firm Capacity | 2.16 mgd | 4.68 mgd | Rehab | - | $ 4,923,000 | |
| | Maintanence | Pump Station Maintanence | - | - | - | - | $ 760,000 | |
| | Pump Station | Energy Consumption | - | - | - | - | $ 582,000 | |
| | Expand | Expand RP-1 by 5 mgd | 29 mgd | 34.0 mgd | Rehab | - | $ 75,020,000 | |
| | Expand | Expand RP-5 by 6.5 mgd | 15 mgd | 21.5 mgd | Rehab | - | $ 79,771,000 | |
| | Upsize | Montclair Improvements | 30 in | 36 in | Replace | 24,000 | $ 17,130,000 | |
| **Alternative 2 Total** | | | | | | | **$ 178,186,000** | **42,559** |
| **Alternative 3A** | | | | | | | | |
| | Force Main | South of Edision to RP-1 | - | 24 in | New | 16,700 | $ 10,118,000 | |
| | Pump Station | 13.8 mgd Firm Capacity | - | 17.3 mgd | New | - | $ 7,258,000 | |
| | Pump Station | Energy Consumption | - | - | - | - | $ 3,981,000 | |
| | Maintanence | Pump Station Maintanence | - | - | - | - | $ 1,120,000 | |
| | Expand | Expand RP-1 by 10 mgd | 29 mgd | 39.0 mgd | Rehab | - | $ 150,041,000 | |
| | Expand | Expand RP-5 by 6.5 mgd | 15 mgd | 21.5 mgd | Rehab | - | $ 71,116,000 | |
| | Upsize | Montclair Improvements | 30 in | 36 in | Replace | 24,000 | $ 17,130,000 | |
| **Alternative 3A Total** | | | | | | | **$ 260,764,000** | **114,245** |
| **Alternative 3B** | | | | | | | | |
| | Force Main | South of Pine Ave and Hellman Ave to RP-1 | - | 30 in | New | 31,000 | $ 28,069,000 | |
| | Pump Station | 22.9 mgd Firm Capacity | - | 29 mgd | New | - | $ 12,033,000 | |
| | Pump Station | Energy Consumption | - | - | - | - | $ 9,622,208 | |
| | Maintanence | Pump Station Maintanence | | | | - | $ 1,857,000 | |
| | Expand | Expand RP-1 by 10 mgd | 29 mgd | 39 mgd | Rehab | - | $ 150,040,758 | |
| | Upsize | Montclair Improvements | 30 in | 36 in | Replace | 24,000 | $ 17,130,000 | |
| **Alternative 3B Total** | | | | | | | **$ 218,752,000** | **190,457** |
| **Alternative 3C** | | | | | | | | |
| | Force main | Forcemain | - | 42 | New | 35,000 | $ 49,186,000 | |
| | Pump Station | 45.8 mgd Firm Capacity | - | 57 mgd | New | - | $ 24,088,000 | |
| | Pump Station | Energy Consumption | - | - | - | - | $ 21,327,000 | |
| | Maintanence | Pump Station Maintanence | - | - | - | - | $ 3,718,000 | |
| | Expand | Expand RP-1 by 15 mgd | 29 mgd | 44 mgd | - | - | $ 225,061,000 | |
| | Upsize | Montclair Improvements | 30 in | 36 in | Replace | 24,000 | $ 17,130,000 | |
| **Alternative 3C Total** | | | | | | | **$ 340,510,000** | **378,578** |
| **Alternative 4A** | | | | | | | | |
| | Pump Station | 24 mgd Recycled Water PS | - | 22 mgd | New | - | $ 9,257,000 | |
| | Eg. Basin | 6 mgd Recycled Water Eq. basin | - | 6 mgd | - | - | $ 10,100,000 | |
| | Maintanence | Pump Station Maintanence | - | - | - | - | $ 1,429,000 | |
| | Pump Station | Energy Consumption | - | - | - | - | $ 23,316,000 | |
| | Force main | Recycled Water Pipeline | - | 30 in | New | 43,500 | $ 39,387,000 | |
| | Expand | Expand RP-1 by 5 mgd | 29 mgd | 34.0 mgd | Rehab | - | $ 75,020,000 | |
| | Expand | Expand RP-5 by 6.5 mgd | 13 | 19.5 mgd | Rehab | - | $ 89,478,000 | |
| | Upsize | Montclair Improvements | 30 in | 36 in | Replace | 24,000 | $ 17,130,000 | |
| **Alternative 4A Total** | | | | | | | **$ 265,117,000** | **492,823** |
| **Alternative 4B** | | | | | | | | |
| | Pump Station | 24 mgd Recycled Water PS | - | 22 mgd | New | - | $ 9,256,500 | |
| | Eg. Basin | 6 mgd Recycled Water Eq. basin | - | 6 mgd | - | - | $ 10,100,000 | |
| | Maintanence | Pump Station Maintanence | - | - | - | - | $ 1,429,000 | |
| | Pump Station | Energy Consumption | - | - | - | - | $ 23,316,000 | |
| | Expand | Expand RP-1 by 5 mgd | 29 mgd | 34.0 mgd | Rehab | - | $ 56,298,000 | |
| | Expand | Expand RP-5 by 13 mgd | 13 mgd | 26.0 mgd | Rehab | - | $ 195,053,000 | |
| | Force main | Recycled Water Pipeline | | 30 in | New | 43,500 | $ 39,387,000 | |
| **Alternative 4B Total** | | | | | | | **$ 334,840,000** | **492,823** |

# TM 4 Wastewater Flow and Loading Forecast

# IEUA Wastewater Facilities Master Plan
# TM 4 Wastewater Flow and Loading Forecast

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: CH2M HILL

DATE: April 2015

# Executive Summary

Analysis of the influent wastewater flow and quality data for each of the four treatment plants was conducted to establish average values and peaking factors. Results of the influent wastewater analysis presented in this Technical Memorandum (TM), as well as the results of the flow diversion alternatives analysis presented in *TM 3 Regional Trunk Sewer Analysis*, formed the basis of the treatment plant influent wastewater flow and loading forecast analysis presented herein. As discussed in TM 3, the Wastewater Facilities Master Plan (WFMP) planning effort will be based on the Inland Empire Utilities Agency (IEUA) preferred flow diversion Alternative 2, optimizing groundwater recharge by diverting flows from Whispering Lakes and Haven pump stations to Regional Water Recycling Plant (RWRP, or RP) RP-1. The corresponding influent wastewater flow and loading projections under this alternative for the planning year 2035, as well as for the 2060 ultimate buildout year, are presented in this TM and will form the basis of the master planning effort for each of the treatment plants.

The data analysis is based on 2 consecutive years of recent data that IEUA provided for influent flow and key wastewater quality constituents, including biological oxygen demand (BOD), total organic carbon (TOC), total suspended solids (TSS), ammonia as nitrogen (NH3-N), and total Kjeldahl nitrogen (TKN). As discussed in TM 3, influent wastewater flows are projected to increase at the Carbon Canyon Water Recycling Facility (CCWRF) between 2020 and 2060 by about 15 percent, with more significant flow increases expected at RP-1, RP-4, and RP-5. The increase in flows to RP-4 by approximately 60 percent is largely attributable to the gradual incorporation of septic flows into the system beginning in 2020. RP-1 flows are projected to increase by 20 percent, while RP-5 flows are projected to more than double by year 2060 as a result of population growth in Chino and other areas served by RP-5.

# 1.0 Background and Objectives

IEUA owns and operates regional sewer pipelines and receives wastewater from the cities of Upland, Montclair, Ontario, Fontana, Chino, Chino Hills, and Cucamonga Valley Water District servicing the city of Rancho Cucamonga. Wastewater collected within these service areas is treated at one of the four regional water recycling plants. RP-1 and RP-4 serve the northern parts of the service area, while RP-5 and CCWRF serve the southern parts. Both RP-4 and CCWRF are designed to be scalping plants for RP-1 and RP-5, respectively.

The four RWRPs are interconnected in a regional network. IEUA staff routinely use the bypass and diversion facilities, such as the San Bernardino lift station, the Montclair lift station and diversion structure, and the Carbon Canyon bypass to optimize flow and capacity utilization within the system. For instance, RP-5 can receive bypass flows from RP-1 (primary effluent) and CCWRF in addition to receiving recycle flows from RP-2, the solids handling facility, and the RP-2 lift station flows. In general, flows are routed between RWRPs to optimize recycled water deliveries while minimizing overall pumping and treatment costs.

The objective of this TM is to summarize current influent wastewater flow and quality data for each of the four RWRPs, establish peaking factors, and develop flow and loading projections for the WFMP. The analysis is based on 2 consecutive years of recent data that IEUA provided for key wastewater quality constituents including BOD, TOC, TSS, NH3-N, and TKN. Peaking factors are established for maximum month, maximum week, and maximum day conditions. Influent wastewater flow projections were developed by the Integrated Water Resources Plan (IRP) consultant as part of the flow monitoring program. The load projections are calculated based on these flow projections along with analysis of the influent wastewater characteristics.

# 2.0 Overview of IEUA Wastewater System

Each of the four regional reclamation facilities is interconnected through an intricate network of diversion points within the wastewater collection systems of member agencies, which enables plant influent flows to be shifted between the facilities to efficiently treat the wastewater and meet recycled water demands within the IEUA service area. A schematic of this network is depicted in Figure 4-1.

To effectively deliver recycled water to users in the north, IEUA uses both the San Bernardino lift station and the Montclair lift station to route additional wastewater to RP-1 and RP-4, where the groundwater recharge basins are located. A diversion structure located upstream of RP-1 allows IEUA to divert raw wastewater to RP-4 by way of the San Bernardino lift station. The RP-4 influent diversion structure offers flexibility within the system to divert RP-4 influent flows downstream toward RP-1, thus enabling control of the volume of influent flow to RP-4.

The Montclair lift station intercepts raw wastewater from the cities of Montclair, Upland, and Chino and pumps them to RP-1 for treatment. A portion of the flows from Upland and Montclair can also be diverted to CCWRF by way of the Montclair diversion structure. Similar to RP-4, the CCWRF influent diversion structure offers flexibility within the system to divert CCWRF influent flows to RP-5, thus enabling IEUA to control the influent flow to CCWRF. In addition, the Primary Effluent Diversion Structure at RP-1 offers IEUA flexibility to divert primary effluent from RP-1 to RP-5.

With bypassed and diverted flows ultimately reaching RP-5 from each of the upstream facilities, as well as from the RP-2 lift station to the south, RP-5 is a critical treatment facility within the IEUA system. The flow diversion alternatives analysis presented in TM 3 evaluated options for diverting flow between the facilities to achieve greater reliability and redundancy within the system. The results of the flow diversion analysis, as well as the analysis of the current and projected influent wastewater flow and quality presented herein, form the basis of the treatment plant capacity and expansion needs in subsequent TMs. A summary of the influent wastewater flow and quality for each RWRP and for the system as a whole are presented in the next section.

# 3.0 Influent Wastewater Flow and Quality

The most recent 2 years of treatment plant flow and quality data was reviewed to establish influent wastewater characteristics for each RWRP, which will form the basis of the treatment plant capacity evaluation conducted as part of the WFMP effort, as well as the wastewater flow and loading projections presented in the next section. The recent data were analyzed to determine the annual average, maximum month, maximum week, and maximum day flows and corresponding peaking factors for each plant. Peaking factors are ratios of the particular flow or load event to the corresponding average values during the same period. The same was done for the concentrations and loads of key constituents.

Daily plant influent flow data for the period of October 15, 2011, through October 15, 2013, were available for each of the RWRPs. Influent data for key parameters such as TOC, BOD, TSS, NH3-N, and TKN were also available for each plant. Constituent concentrations at each RWRP were measured using 24-hour composite samples collected and analyzed by plant personnel. The frequency at which these key parameters were measured during this period varied from one time per week to three times per week, depending on the plant and the constituent. Where BOD data were limited or unavailable, BOD concentrations were calculated using the measured influent TOC values and the parameter correlation currently employed by IEUA, as provided in Equation 1. Review of the data indicated that this correlation is a good representation of influent BOD; therefore, this approach was used for this WFMP.

$$\text{Influent BOD (mg/L)} = 1.92 \times \text{TOC} - 13.19 \qquad \text{Equation 1}$$

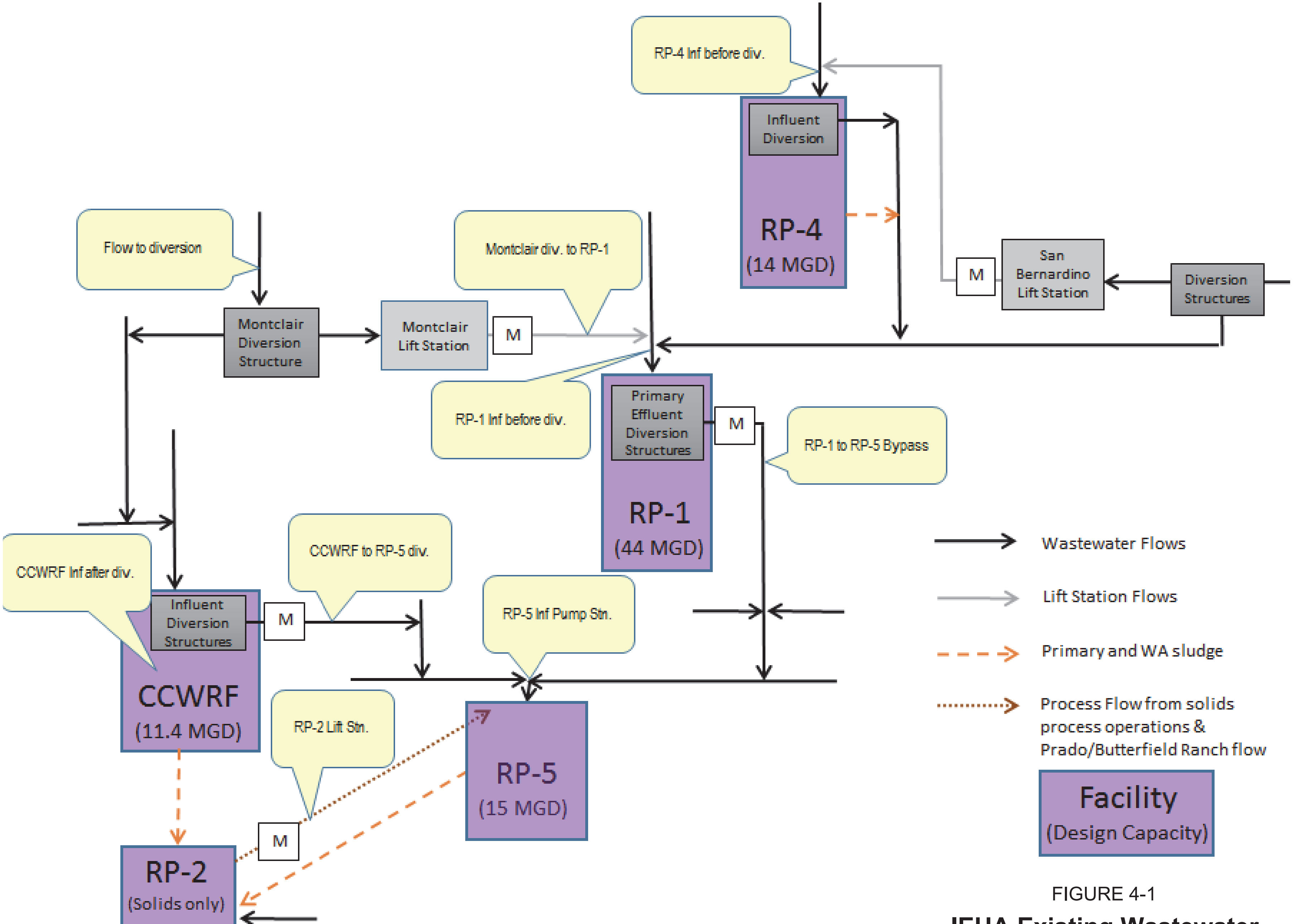



FIGURE 4-1

## IEUA Existing Wastewater System Schematic

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Observations for each plant are discussed in the following sections. In general, plant influent flows and constituent concentrations have remained relatively constant over the 2-year period. A discussion of these observations is presented herein for each RWRP, from the most upstream plant to the most downstream plant. A summary of the influent flows, concentrations, and loads in terms of annual average, maximum month, maximum week, maximum day, and corresponding peaking factors is presented in Tables 4-1, 4-2, and 4-3 for all RWRPs.

TABLE 4-1
**Summary of Current Influent Wastewater Flows[a]**

| | RP-4 | | RP-1 | | CCWRF | | RP-5 | |
|---|---|---|---|---|---|---|---|---|
| | Peaking Factor | Influent Flow (mgd) | Peaking Factor | Influent Flow (mgd) | Peaking Factor | Influent Flow (mgd) | Peaking Factor | Influent Flow (mgd) |
| Annual Average | - | 10.5 | - | 28 | - | 7.2 | - | 10.0 |
| Max Month | 1.10 | 11.6 | 1.04 | 29 | 1.13 | 8.1 | 1.27 | 12.8 |
| Max Week | 1.14 | 11.9 | 1.08 | 30 | 1.25 | 8.9 | 1.43 | 14.3 |
| Max Day | 1.15 | 12.1 | 1.14 | 32 | 1.34 | 9.6 | 1.47 | 14.8 |

[a] Analysis based on plant influent data provided by IEUA for the period between October 15, 2011, and October 15, 2013.

TABLE 4-2
**Summary of Influent Wastewater Concentrations[a,b]**

| | Average Influent Water Quality (mg/L) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | RP-4 | | RP-1 | | CCWRF | | RP-5 | |
| | Current | 2002 | Current | 2002 | Current | 2002 | Current | 2002 |
| BOD | 352 | 245 | 434 | 243 | 455 | 240 | 321 | 240 |
| TSS | 318 | 256 | 472 | 301 | 367 | 300 | 267 | 300 |
| NH3-N | 41 | 28 | 32 | 23 | 34 | 23 | 35 | 23 |
| TKN | 59 | 43 | 55 | 42 | 53 | 42 | 52 | 42 |

[a] Current concentrations based on plant influent data provided by IEUA for the period between October 15, 2011, and October 15, 2013.
[b] 2002 wastewater characteristics as presented in the 2002 WFMP Volume II memoranda. RP-4 concentrations based on plant influent data between August 1999 and July 2001. RP-1 concentrations based on plant influent data between July 1999 and May 2001. CCWRF and RP-5 concentrations established under the assumption that raw wastewater received at most of IEUA's wastewater treatment plants shared the same characteristics.

TABLE 4-3
**Summary of Current Influent Wastewater Loads[a,b]**

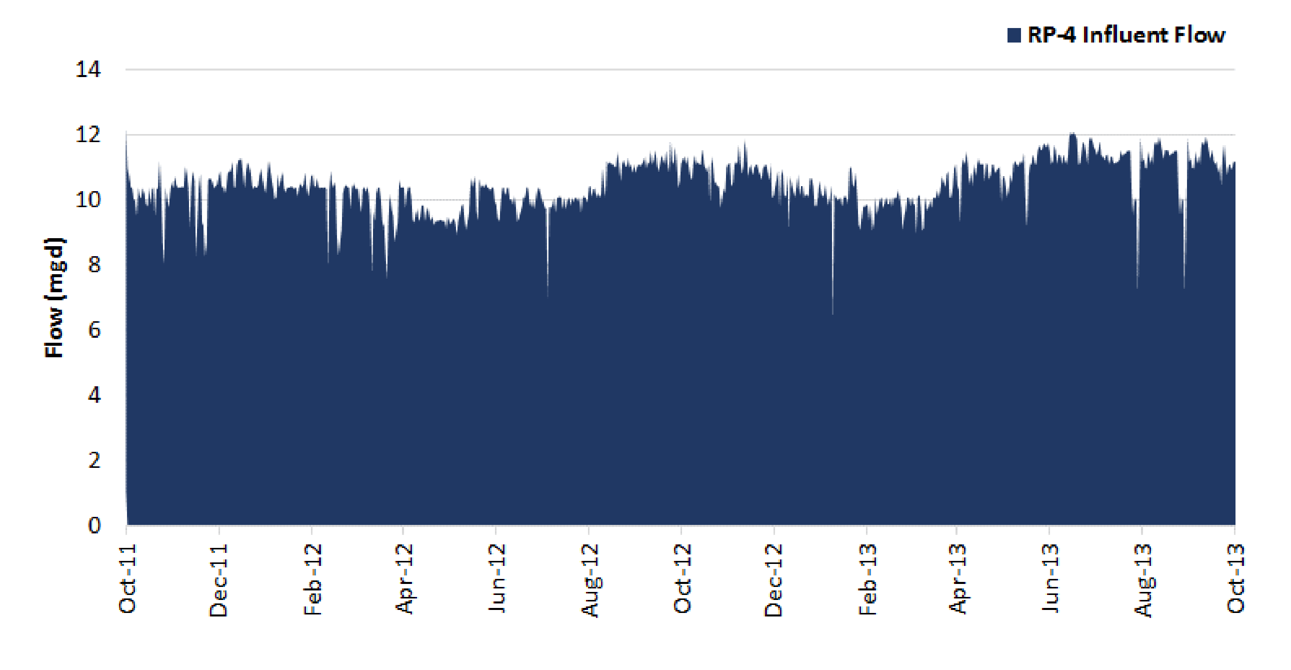
| | RP-4 | | RP-1 | | CCWRF | | RP-5 | |
|---|---|---|---|---|---|---|---|---|
| | **Peaking Factor** | **Load (lb/day)** | **Peaking Factor** | **Load (lb/day)** | **Peaking Factor** | **Load (lb/day)** | **Peaking Factor** | **Load (lb/day)** |
| **BOD** | | | | | | | | |
| Annual Average | - | 30,543 | - | 101,197 | - | 26,839 | - | 27,771 |
| Max Month | 1.85 | 56,393 | 1.53 | 155,195 | 1.58 | 42,479 | 1.79 | 49,636 |
| Max Week | 2.09 | 63,735 | 1.74 | 175,768 | 1.88 | 50,430 | 2.48 | 69,009 |
| Max Day | 2.12 | 64,696 | 1.90 | 191,964 | 1.99 | 53,289 | 2.31 | 64,209 |
| **TSS** | | | | | | | | |
| Annual Average | - | 27,630 | - | 109,880 | - | 21,683 | - | 23,181 |
| Max Month | 1.59 | 43,963 | 1.38 | 151,459 | 1.88 | 40,837 | 2.47 | 57,295 |
| Max Week | 1.98 | 54,717 | 1.71 | 187,551 | 2.45 | 53,219 | 3.22 | 74,660 |
| Max Day | 1.98 | 54,717 | 1.71 | 187,551 | 2.45 | 53,219 | 3.48 | 80,742 |
| **NH3-N** | | | | | | | | |
| Annual Average | - | 3,550 | - | 7,544 | - | 1,993 | - | 3,005 |
| Max Month | 1.24 | 4,393 | 1.20 | 9,045 | 1.21 | 2,413 | 1.35 | 4,043 |
| Max Week | 1.32 | 4,692 | 1.33 | 10,023 | 1.42 | 2,823 | 1.65 | 4,953 |
| Max Day | 1.57 | 5,566 | 1.63 | 12,276 | 1.64 | 3,262 | 1.70 | 5,112 |
| **TKN** | | | | | | | | |
| Annual Average | - | 5,015 | - | 12,975 | - | 3,105 | - | 4,602 |
| Max Month | 1.46 | 7,322 | 1.24 | 16,027 | 1.28 | 3,963 | 1.60 | 7,349 |
| Max Week | 1.59 | 7,963 | 1.53 | 19,912 | 1.40 | 4,338 | 1.92 | 8,854 |
| Max Day | 1.59 | 7,963 | 1.53 | 19,912 | 1.40 | 4,338 | 1.92 | 8,854 |

[a] Analysis based on plant influent data provided by IEUA for the period between October 15, 2011, and October 15, 2013. Loads calculated from flow and concentration data.
[b] Maximum weekly and daily load values are based on limited data with sampling frequencies ranging between one and three times per week.

## 3.1 RP-4 Influent Wastewater Flow and Quality

With the ability to divert northern flows to either RP-1 or RP-4, and to bypass influent RP-4 flows to RP-1, IEUA is able to control the influent flow to RP-4. As shown in Figure 4-2, the daily average influent flow values reported at RP-4 have been stable over the last 2-year period, generally ranging between 8 and 12 million gallons per day (mgd) with an annual average of 10.5 mgd. Because RP-4 serves as a scalping plant for RP-1, routine flow diversions occurred during the analysis period but are not depicted in the figure because RP-4 influent flows are measured after flow diversion has taken place. A summary of the average and maximum influent flows is presented in Table 4-1.

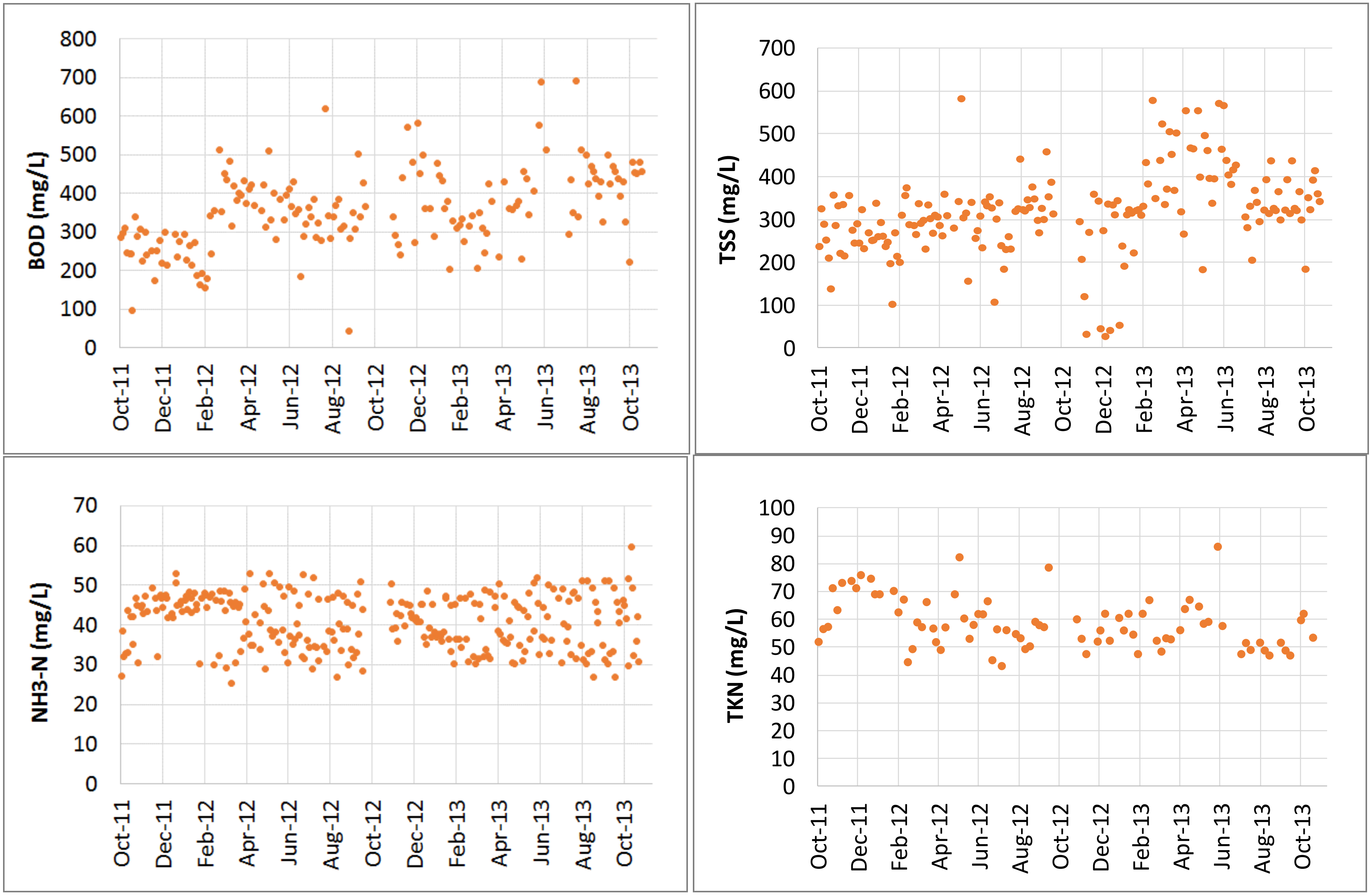
FIGURE 4-2
**RP-4 Influent Wastewater Flows**




The RP-4 influent wastewater qualities for BOD, TSS, NH3-N, and TKN concentrations over the 2-year period are presented in Figure 4-3. Concentrations for TKN, TSS, and NH3-N were reported once, twice, and three times per week, respectively. TOC data were also available twice per week, as well as limited BOD data. For those months where BOD was measured, BOD data were available twice per week. For dates when both TOC and BOD data were available, BOD measurements were used. For dates when only TOC data were available, BOD concentrations were calculated using IEUA's equation derived from the correlation between TOC and BOD.

As shown in the concentration plots, influent BOD, TSS, NH3-N, and TKN concentrations have remained constant during the 2-year period. A summary of the average and maximum concentrations and calculated loads for each of these constituents is presented in Tables 4-2 and 4-3.

FIGURE 4-3
**RP-4 Influent Wastewater Quality**

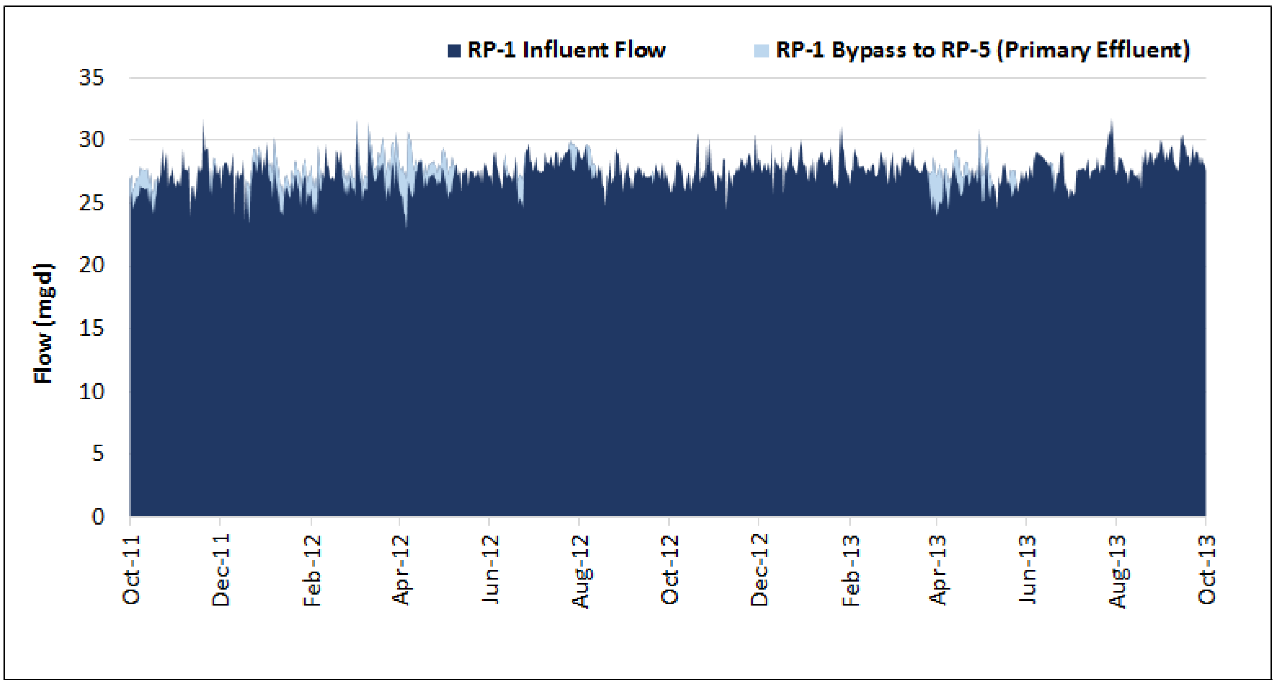


## 3.2 RP-1 Influent Wastewater Flow and Quality

As described, RP-1 has the ability to bypass primary effluent flows to RP-5 to provide relief at RP-1 and/or to perform maintenance activities. Northern flows can also be diverted upstream of RP-1. As shown in Figure 4-4, the daily average flow values reported at RP-1 have been stable over the last 2-year period, generally ranging between 25 and 30 mgd with an average of 28 mgd.

Periodic bypasses of primary effluent from RP-1 to RP-5 were observed during this period, primarily due to maintenance activities at RP-1. In addition, there were two instances during April 2012 and April 2013 when nonroutine bypasses of RP-1 primary effluent flow to RP-5 occurred to allow IEUA to conduct maintenance activities at RP-1. Both of these occurrences were captured in the data and are represented in Figure 4-4. The data was analyzed with and without these occurrences and it was determined that these occurrences did not affect analysis results. Therefore, the analysis presented herein represents the entire 2-year data set, including routine and nonroutine bypasses from RP-1 to RP-5. A summary of the average and maximum influent flows is presented in Table 4-1.

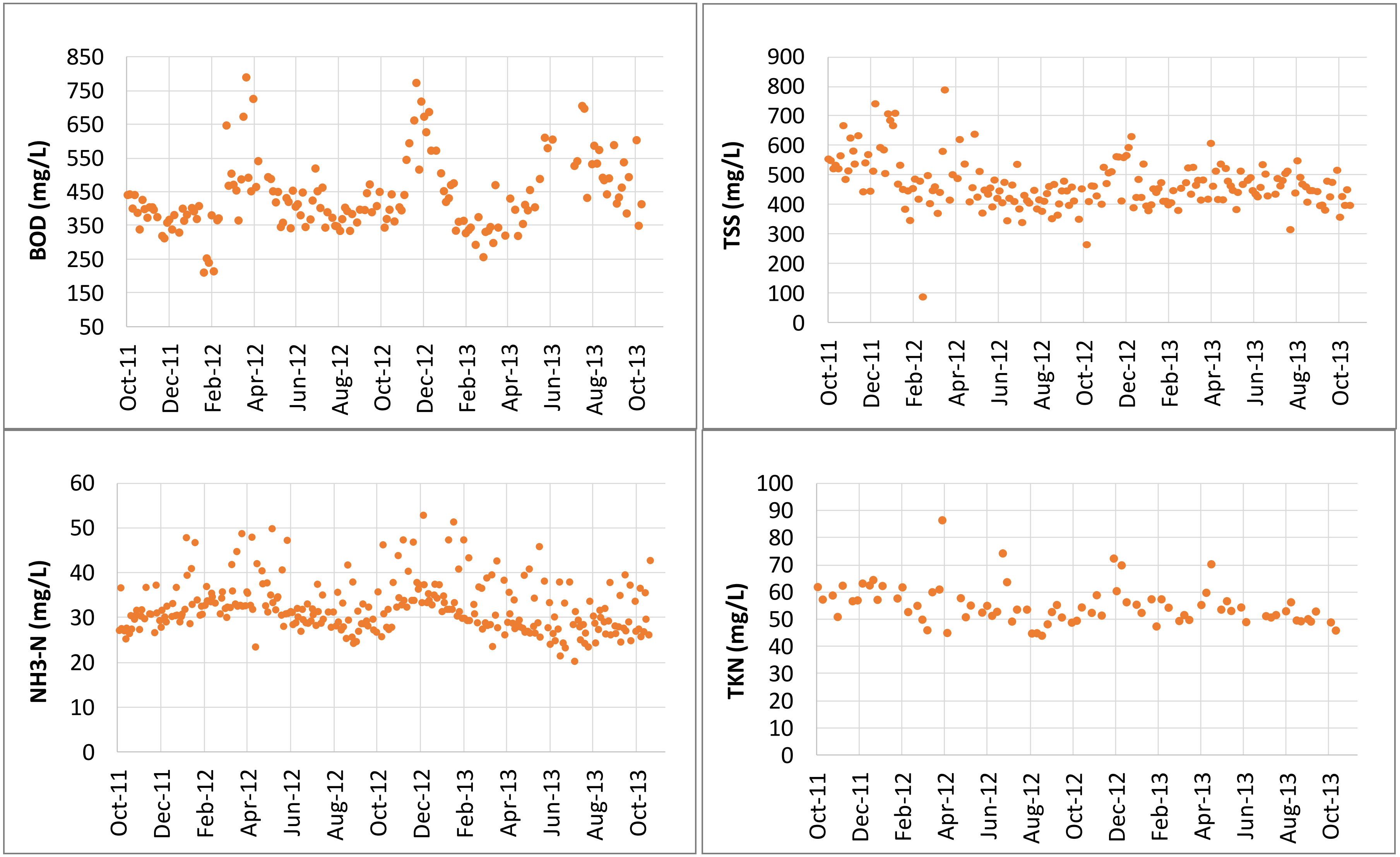
FIGURE 4-4
**RP-1 Influent Wastewater Flows**




The RP-1 influent wastewater qualities for BOD, TSS, NH3-N, and TKN concentrations over the 2-year period are presented in Figure 4-5. Concentrations for TKN, TSS, and NH3-N were reported once, twice, and three times per week, respectively. TOC data were also available twice a week, as well as limited BOD data. For those months where BOD was measured, BOD data were available twice a week. For dates when both TOC and BOD data were available, BOD measurements were used. For dates when only TOC data were available, BOD concentrations were calculated using IEUA's equation derived from the correlation between TOC and BOD.

As shown in the concentration plots, concentrations of BOD, TSS, NH3-N, and TKN have remained constant over the 2-year period, aside from a couple of peak events. A summary of the average and maximum concentrations and calculated loads for each of these constituents is presented in Tables 4-2 and 4-3.

FIGURE 4-5
**RP-1 Influent Wastewater Quality**

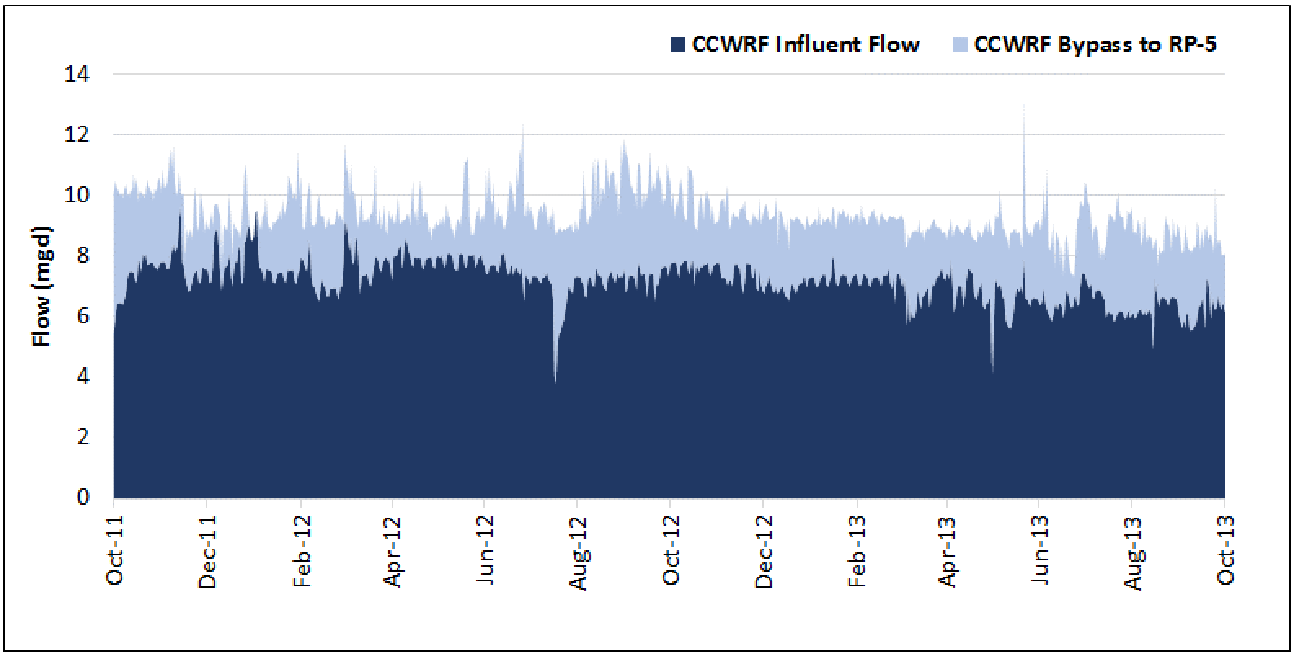


## 3.3 CCWRF Influent Wastewater Flow and Quality

The operational relationship between CCWRF and RP-5 in the south is similar to that between RP-4 and RP-1 in the north, with CCWRF and RP-4 operating as scalping plants for RP-5 and RP-1, respectively. As discussed previously, the Montclair diversion structure upstream of CCWRF allows IEUA to bypass a portion of the northern flows south to CCWRF to provide relief capacity for the Montclair lift station and RP-1. The CCWRF influent diversion structure at CCWRF also allows influent flows to CCWRF to be diverted south to RP-5, allowing IEUA to control the volume of influent flow to CCWRF.

As shown in Figure 4-6, the daily average flow values reported at CCWRF have been stable over the 2-year period, generally ranging between 6 and 8 mgd with an average of 7.2 mgd. Routine bypasses from CCWRF to RP-5 were observed during this 2-year period, averaging about 2.2 mgd. A summary of the average and maximum influent flows is presented in Table 4-1.

FIGURE 4-6
**CCWRF Influent Wastewater Flows**

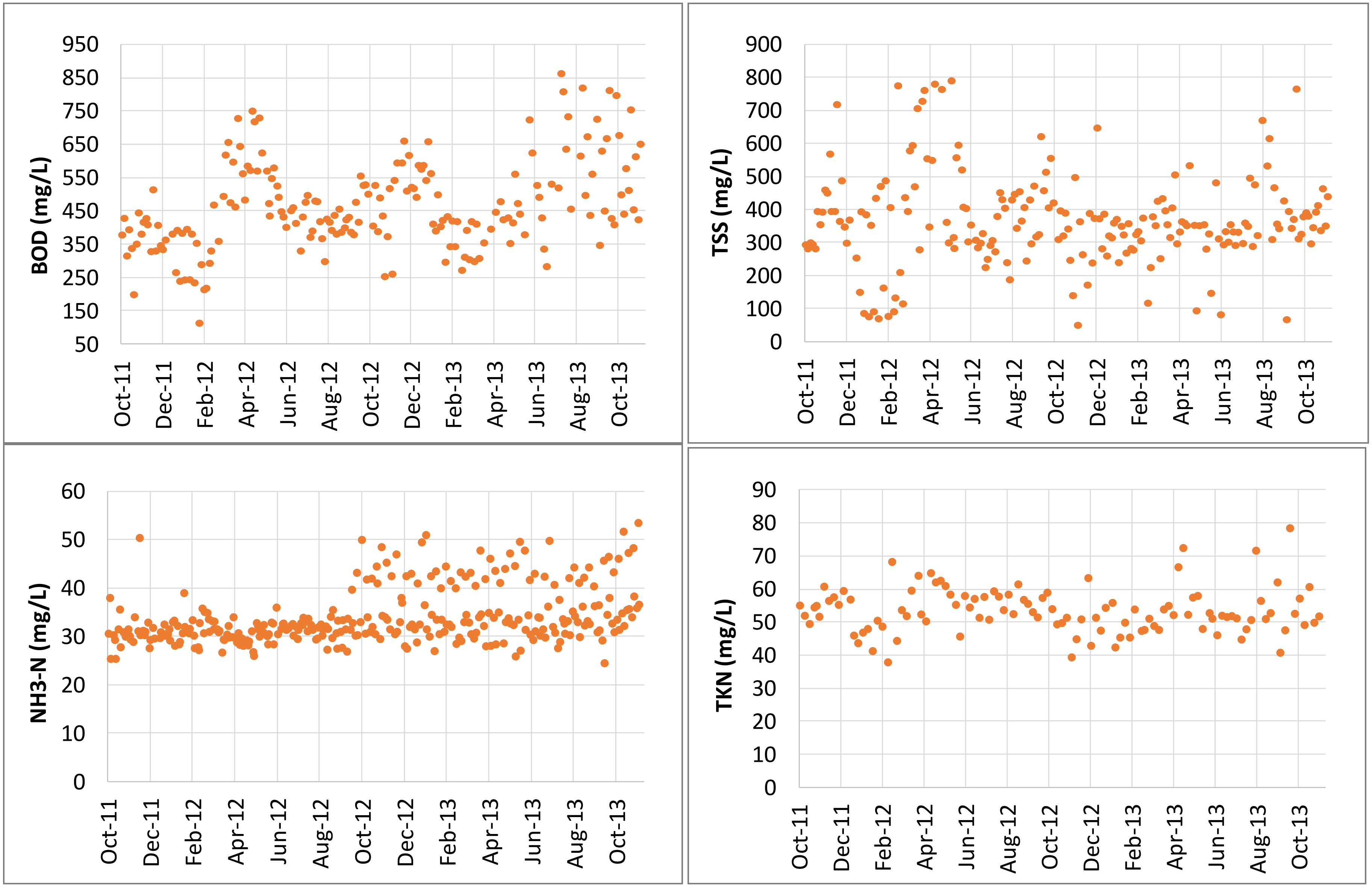



The CCWRF influent wastewater qualities for BOD, TSS, NH3-N, and TKN concentrations over the 2-year period are presented in Figure 4-7. Concentrations for TSS and NH3-N were reported three times per week; TKN was reported once per week. TOC data were also available three times per week, as well as limited BOD data. For those months where BOD was measured, BOD data were available three times per week. For dates when both TOC and BOD data were available, BOD measurements were used. For dates when only TOC data were available, BOD concentrations were calculated using IEUA's equation derived from the correlation between TOC and BOD.

Influent BOD, TSS, NH3-N, and TKN concentrations have remained fairly constant over the 2-year period. The high degree of variability in the CCWRF influent ammonia data is due to the sampling practices employed at the plant during this period. Beginning in October 2012, the reported ammonia concentrations were generally higher on Tuesdays because these represent grab samples rather than composite samples.
A summary of the average and maximum concentrations and calculated loads for each of these constituents is presented in Tables 4-2 and 4-3.

FIGURE 4-7

**CCWRF Influent Wastewater Quality**



## 3.4 RP-5 Influent Wastewater Flow and Quality

With bypassed and diverted flows ultimately reaching RP-5 from each of the upstream facilities and from the RP-2 lift station to the south, RP-5 serves as the system sink with no ability to divert or bypass flows elsewhere within the system. RP-5 receives flows from its surrounding sewershed, as well as bypassed flows from CCWRF, RP-1, and the RP-2 lift station. Each of these sources is captured in the RP-5 data analysis and illustrated in Figure 4-8. The CCWRF bypass flows to RP-5 have been constant over the 2-year period, except during October and November 2011 when greater flows from CCWRF and RP-1 were bypassed to RP-5 for maintenance-related activities. RP-5 influent flows spiked in April 2012 and April 2013 because of increased RP-1 bypass flows. However, the data was analyzed with and without these occurrences and it was determined that these occurrences did not affect analysis results. Therefore, the analysis presented herein represents the entire 2-year data set including routine and nonroutine bypasses to RP-5.

Routine flow diversions from CCWRF and the RP-2 lift station were observed during the 2-year period, with periodic bypasses from RP-1. For conservative planning purposes, the RP-5 influent flows presented in this analysis include raw wastewater contributions from the surrounding sewershed, as well as bypassed flows from CCWRF and RP-1 in addition to RP-2 recycles and other flows from the RP-2 lift station. In general, RP-5 influent flows from all sources, as measured downstream of all diversions and bypasses, ranged between 8 and 12 mgd, with an average influent flow of 10 mgd. A summary of the average and maximum influent flows is presented in Table 4-1.

The RP-5 influent wastewater qualities for BOD, TSS, NH3-N, and TKN concentrations over the 2-year period are presented in Figure 4-9. Concentrations for TKN, TSS, and NH3-N were reported once, twice, and three times per week, respectively. TOC data were also available twice a week, as well as limited BOD data. For those months where BOD was measured, BOD data were available twice a week. For dates when both TOC and BOD data were available, BOD measurements were used. For dates when only TOC data were available, BOD concentrations were calculated using IEUA's equation derived from the correlation between TOC and BOD.

Influent concentrations of BOD, TSS, NH3-N, and TKN have remained constant over the last 2-years. Higher TSS concentrations were observed in October and November of 2011 due to a temporary diversion of RP-1 flows and sludge to RP-5. Although this temporary diversion is not typical of IEUA operations, this 2-month period was included in the analysis for conservatism. A summary of the average and maximum concentrations and calculated loads for each of these constituents is presented in Tables 4-2 and 4-3.

## 3.5 Summary of Current Influent Wastewater Flows and Quality

In summary, each of the RWRPs exhibited constant influent wastewater flows and constituent concentrations during the 2-year analysis period. A summary of the current influent wastewater flows is illustrated in Figure 4-10 for each plant and for the system as a whole. As depicted, the average influent flow for the entire system was about 56 mgd during the 2-year analysis period, with most of the flows being treated at RP-1 and the least of the flows being treated at CCWRF. The average and maximum flows and peaking factors for each of the RWRPs are summarized in Table 4-1. Peaking factors were developed for maximum month, maximum week, and maximum day.

The average concentrations for key constituents, including BOD, TSS, NH3-N, and TKN for each of the RWRPs, are summarized in Table 4-2. For comparison, the concentrations established previously for the 2002 WFMP are also presented in Table 4-2. A comparison of the two analyses demonstrates a substantial increase in wastewater strength since the 2002 WFMP.

For analysis of the current wastewater loads, loads were calculated based on the reported influent flow and constituent concentration for each reporting day. Therefore, the average and maximum loads and peaking factors presented in Table 4-3 represent load characteristics as calculated from flow and concentration data. These load peaking factors formed the basis of the influent wastewater load projections discussed in the next section.

FIGURE 4-8
**RP-5 Influent Wastewater Flows**

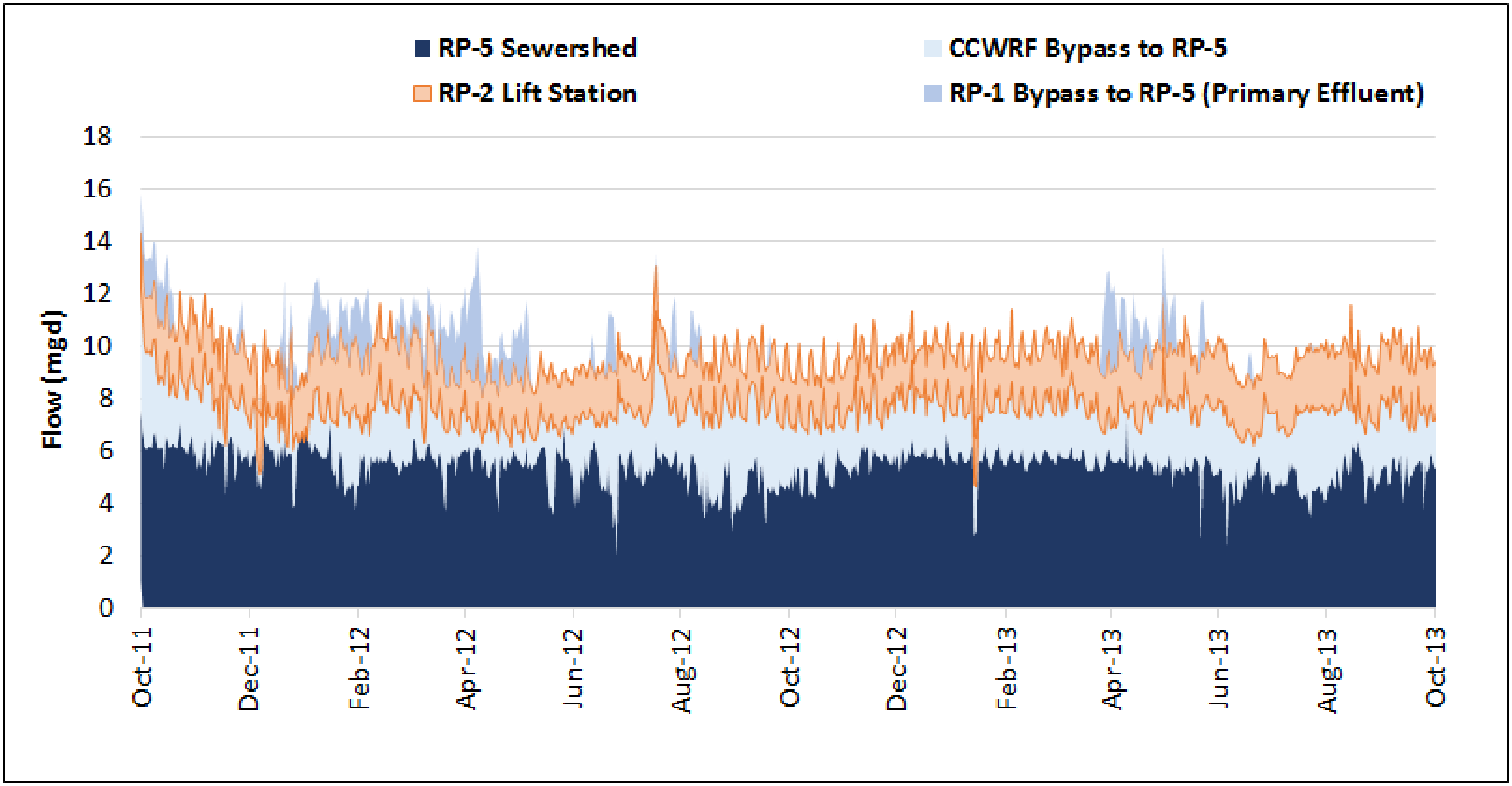


FIGURE 4-9

**RP-5 Influent Wastewater Quality**

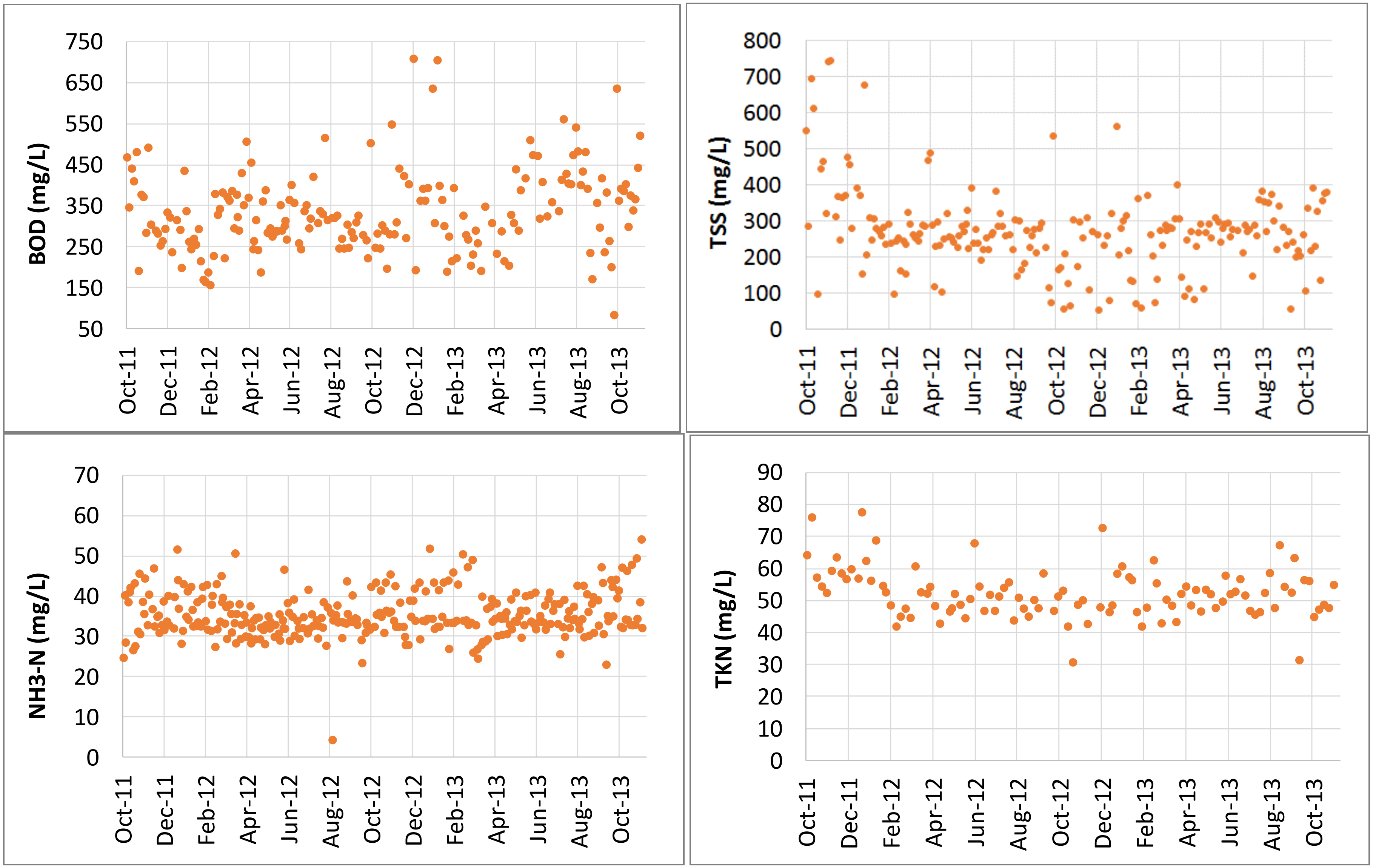
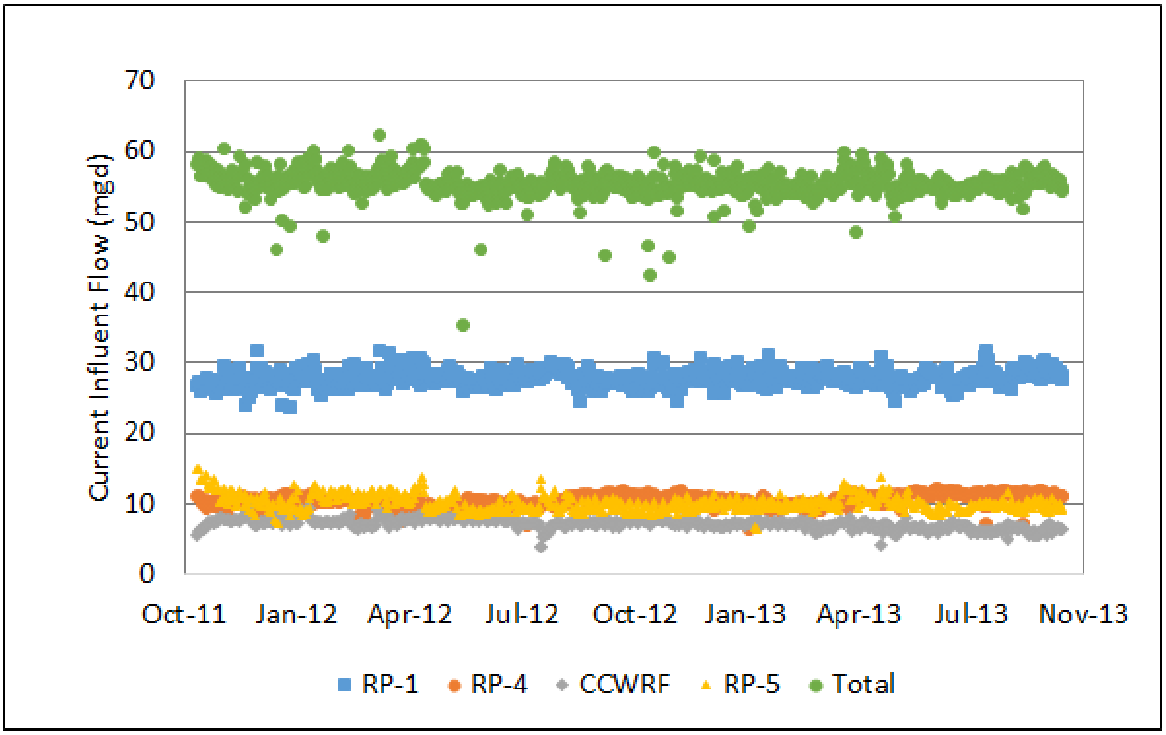


FIGURE 4-10
**IEUA Current Influent Wastewater Flows**




# 4.0 Wastewater Flow and Loading Forecast

Flow and loading projections were developed for each of the RWRPs based on the results of the flow diversion analysis presented in TM 3 and on the influent wastewater analysis presented in the previous section. The results of the flow and loading forecast discussed in this section form the basis of establishing the capacity and expansion needs for each of the four RWRPs as part of this WFMP effort.

Flow projections were developed by the IRP consultant based on the average influent wastewater flows measured during the flow monitoring period in November 2013 and projected through the year 2060 using population, employment, and land use information. The year 2060 represents buildout or ultimate flows. A detailed discussion of the flow monitoring equipment, methodology, and data analysis is presented in the *IEUA IRP Temporary Flow Monitoring Report* (ADS, 2014). A discussion of the development of flow projections is presented in the *IEUA IRP Wastewater Flow Projections Technical Memorandum* (RMC, 2013). These flow projections formed the basis of the flow diversion alternatives analysis presented in *TM 3 Regional Trunk Sewer Analysis* of the WFMP. Accordingly, several flow diversion alternatives were evaluated as part of this WFMP effort, each offering different means to divert flows to either RP-1 or RP-5 to optimize groundwater recharge and serve IEUA customers in each sewershed. As established in TM 3, IEUA's preferred flow diversion alternative is Alternative 2, whereby flows from the existing Whispering Lakes and Haven pump stations will be conveyed to RP-1, while maintaining flexibility in the system to convey flows south to RP-5 if needed.

Under Alternative 2, the CCWRF influent wastewater flows are projected to increase between 2020 and 2060 by about 15 percent, with more significant flow increases expected at RP-1, RP-4, and RP-5. The increase in flows to RP-4 by approximately 60 percent is largely attributable to the gradual incorporation of septic flows into the system beginning in 2020. RP-1 flows are projected to increase by 20 percent, and RP-5 flows are projected to more than double by year 2060 because of population growth in Chino and other areas served by RP-5. The forecasted influent wastewater flows for Alternative 2 are summarized in Table 4-4 for each of the four RWRPs and for the overall system.

TABLE 4-4
**Average Influent Wastewater Flow Projections for Preferred Flow Diversion Alternative 2[a]**

| Year | RP-1[b] (mgd) | RP-4[c] (mgd) | CCWRF (mgd) | RP-5 (mgd) | Total (mgd) |
|---|---|---|---|---|---|
| 2020 | 30.4 | 11.7 | 6.9 | 10.2 | **59.2** |
| 2030 | 32.2 | 14.0 | 7.1 | 15.9 | **69.2** |
| 2035[d] | 33.1 | 14.7 | 7.3 | 18.4 | **73.5** |
| 2040 | 34.0 | 15.4 | 7.4 | 20.9 | **77.7** |
| 2050 | 36.1 | 16.8 | 7.7 | 24.8 | **85.4** |
| 2060[d] | 36.3 | 18.4 | 7.9 | 25.3 | **87.9** |

[a] Analysis performed by the IRP consultant during November 2013 flow monitoring period. IEUA adjusted values to reflect normal bypass and diversion operations between plants.
[b] Assumes Whispering Lakes pump station and Montclair pipeline infrastructure improvements discussed in TM 3 are complete and operational by 2020, with both pump stations online and conveying flow to RP-1.
[c] Includes septic flows tributary to RP-4, introduced in 2020 at 1 mgd and increasing by 0.5 mgd every 10 years through 2060.
[d] WFMP planning effort based on 2035 planning year. For site footprint planning considerations, the ultimate flows (i.e., 2060 flow values) constitute the basis of systems sizing and site space requirements.

At the request of IEUA, the impact on RP-5 flow projections with both Whispering Lakes and Haven pump stations offline was evaluated as a subset of Alternative 2. Under this scenario, the flows from each of these tributary areas would be conveyed to RP-5 rather than to RP-1. To provide greater system reliability and redundancy, RP-5 facilities planning will assume both pump stations are offline. These projected flows form the basis for establishing RP-5 facilities planning and expansion needs in subsequent TMs, which will likely result in the need for RP-5 capacity enhancements to occur sooner. The RP-5 flow projections for the two scenarios (pump stations online and pump stations offline) are presented in Table 4-5.

TABLE 4-5
**RP-5 Average Influent Wastewater Flow Projections for Preferred Flow Diversion Alternative 2**

| Year | RP-5 with Pump Stations Online (mgd) | RP-5 with Pump Stations Offline[a] (mgd) |
|---|---|---|
| 2020 | 10.2 | 11.9 |
| 2030 | 15.9 | 17.7 |
| 2035[b] | 18.4 | 20.2 |
| 2040 | 20.9 | 22.8 |
| 2050 | 24.8 | 26.7 |
| 2060[b] | 25.3 | 27.2 |

[a] Flow projections established for this scenario assumed both Whispering Lakes and Haven pump stations are offline.
[b] WFMP planning effort based on 2035 planning year. For site footprint planning considerations, the ultimate flows (i.e., 2060 flow values) constitute the basis of systems sizing and site space requirements. The projected flow for each lift station in 2035 is 1.6 mgd (Whispering Lakes pump station) and 0.2 mgd (Haven pump station).

The wastewater loading projections were developed for the four key wastewater parameters identified previously for each of the four RWRPs for the 2035 planning year, as well as for the 2060 ultimate buildout year. These projections are based on the flow peaking factors presented in Table 4-1, the average influent wastewater constituent concentrations presented in Table 4-2, the load peaking factors presented in Table 4-3, and average influent wastewater flow projections established in Tables 4-4 and 4-5. The forecasted influent wastewater flow and loading values are summarized in Tables 4-6 through 4-10 for each of the four RWRPs and form the basis of the master planning effort for each of these RWRPs in subsequent TMs. The results are presented below from the most upstream plant to the most downstream plant.

TABLE 4-6
**RP-4 Influent Flow and Loading Projections for Preferred Flow Diversion Alternative 2**

| | Flows | | Loads[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | BOD | | TSS | | NH3-N | | TKN | |
| | PF | mgd | PF | lb/day | PF | lb/day | PF | lb/day | PF | lb/day |
| **Current (Based on 2011-2013 Data)** | | | | | | | | | | |
| Annual Average | - | 10.5 | - | 30,543 | - | 27,630 | - | 3,550 | - | 5,015 |
| Max Month | 1.10 | 11.6 | 1.85 | 56,393 | 1.59 | 43,963 | 1.24 | 4,393 | 1.46 | 7,322 |
| Max Week | 1.14 | 11.9 | 2.09 | 63,735 | 1.98 | 54,717 | 1.32 | 4,692 | 1.59 | 7,963 |
| Max Day | 1.15 | 12.1 | 2.12 | 64,696 | 1.98 | 54,717 | 1.57 | 5,566 | 1.59 | 7,963 |
| **Projections (Planning Year: 2035)[b]** | | | | | | | | | | |
| Annual Average | - | 14.7 | - | 43,207 | - | 38,948 | - | 5,010 | - | 7,186 |
| Max Month | 1.10 | 16.2 | 1.85 | 79,775 | 1.59 | 61,971 | 1.24 | 6,200 | 1.46 | 10,492 |
| Max Week | 1.14 | 16.7 | 2.09 | 90,161 | 1.98 | 77,132 | 1.32 | 6,621 | 1.59 | 11,410 |
| Max Day | 1.15 | 17.0 | 2.12 | 91,521 | 1.98 | 77,132 | 1.57 | 7,856 | 1.59 | 11,410 |
| **Projections (Planning Year: 2060)[c]** | | | | | | | | | | |
| Annual Average | - | 18.4 | - | 54,082 | - | 48,752 | - | 6,271 | - | 8,994 |
| Max Month | 1.10 | 20.3 | 1.85 | 99,854 | 1.59 | 77,570 | 1.24 | 7,761 | 1.46 | 13,132 |
| Max Week | 1.14 | 20.9 | 2.09 | 112,855 | 1.98 | 96,546 | 1.32 | 8,288 | 1.59 | 14,282 |
| Max Day | 1.15 | 21.2 | 2.12 | 114,556 | 1.98 | 96,546 | 1.57 | 9,833 | 1.59 | 14,282 |

[a] Maximum weekly and daily loading values are based on limited data with sampling frequencies ranging between one and three times per week.
[b] Analysis based on average influent wastewater flow projections presented in Table 4-4 and the average concentrations and loading peaking factors established from plant influent data provided by IEUA for the period between October 15, 2011, and October 15, 2013.
[c] Site planning considerations will be based on the projections established for the 2060 ultimate planning year.
PF = peaking factor

TABLE 4-7
**RP-1 Influent Flow and Loading Projections for Preferred Flow Diversion Alternative 2**

| | Flows | | Loads[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | BOD | | TSS | | NH3-N | | TKN | |
| | PF | mgd | PF | lb/day | PF | lb/day | PF | lb/day | PF | lb/day |
| **Current (Based on 2011-2013 Data)** | | | | | | | | | | |
| Annual Average | - | 27.8 | - | 101,197 | - | 109,880 | - | 7,544 | - | 12,975 |
| Max Month | 1.04 | 29.0 | 1.53 | 155,195 | 1.38 | 151,459 | 1.20 | 9,045 | 1.24 | 16,027 |
| Max Week | 1.08 | 30.0 | 1.74 | 175,768 | 1.71 | 187,551 | 1.33 | 10,023 | 1.53 | 19,912 |
| Max Day | 1.14 | 31.8 | 1.90 | 191,964 | 1.71 | 187,551 | 1.63 | 12,276 | 1.53 | 19,912 |
| **Projections (Planning Year: 2035)[b]** | | | | | | | | | | |
| Annual Average | - | 33.1 | - | 119,771 | - | 130,296 | - | 8,937 | - | 15,249 |
| Max Month | 1.04 | 34.4 | 1.53 | 183,680 | 1.38 | 179,602 | 1.20 | 10,716 | 1.24 | 18,835 |
| Max Week | 1.08 | 35.7 | 1.74 | 208,029 | 1.71 | 222,400 | 1.33 | 11,875 | 1.53 | 23,401 |
| Max Day | 1.14 | 37.7 | 1.90 | 227,197 | 1.71 | 222,400 | 1.63 | 14,544 | 1.53 | 23,401 |
| **Projections (Planning Year: 2060)[c]** | | | | | | | | | | |
| Annual Average | - | 36.3 | - | 131,350 | - | 142,893 | - | 9,801 | - | 16,723 |
| Max Month | 1.04 | 37.8 | 1.53 | 201,438 | 1.38 | 196,965 | 1.20 | 11,752 | 1.24 | 20,656 |
| Max Week | 1.08 | 39.1 | 1.74 | 228,141 | 1.71 | 243,900 | 1.33 | 13,023 | 1.53 | 25,663 |
| Max Day | 1.14 | 41.4 | 1.90 | 249,162 | 1.71 | 243,900 | 1.63 | 15,951 | 1.53 | 25,663 |

[a] Maximum weekly and daily loading values are based on limited data with sampling frequencies ranging between one and three times per week.
[b] Analysis based on average influent wastewater flow projections presented in Table 4-4 and the average concentrations and loading peaking factors established from plant influent data provided by IEUA for the period between October 15, 2011, and October 15, 2013.
[c] Site planning considerations will be based on the projections established for the 2060 ultimate planning year.

TABLE 4-8

**CCWRF Influent Flow and Loading Projections for Preferred Flow Diversion Alternative 2**

| | Flows | | Loads[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | BOD | | TSS | | NH3-N | | TKN | |
| | PF | mgd | PF | lb/day | PF | lb/day | PF | lb/day | PF | lb/day |
| **Current (Based on 2011-2013 Data)** | | | | | | | | | | |
| Annual Average | - | 7.2 | - | 26,839 | - | 21,683 | - | 1,993 | - | 3,105 |
| Max Month | 1.13 | 8.1 | 1.58 | 42,479 | 1.88 | 40,837 | 1.21 | 2,413 | 1.28 | 3,963 |
| Max Week | 1.25 | 8.9 | 1.88 | 50,430 | 2.45 | 53,219 | 1.42 | 2,823 | 1.40 | 4,338 |
| Max Day | 1.34 | 9.6 | 1.99 | 53,289 | 2.45 | 53,219 | 1.64 | 3,262 | 1.40 | 4,338 |
| **Projections (Planning Year: 2035)[b]** | | | | | | | | | | |
| Annual Average | - | 7.3 | - | 27,708 | - | 22,353 | - | 2,048 | - | 3,257 |
| Max Month | 1.13 | 8.2 | 1.58 | 43,854 | 1.88 | 42,099 | 1.21 | 2,480 | 1.28 | 4,156 |
| Max Week | 1.25 | 9.1 | 1.88 | 52,063 | 2.45 | 54,863 | 1.42 | 2,901 | 1.40 | 4,550 |
| Max Day | 1.34 | 9.8 | 1.99 | 55,014 | 2.45 | 54,863 | 1.64 | 3,352 | 1.40 | 4,550 |
| **Projections (Planning Year: 2060)[c]** | | | | | | | | | | |
| Annual Average | - | 7.9 | - | 29,985 | - | 24,190 | - | 2,217 | - | 3,524 |
| Max Month | 1.13 | 8.9 | 1.58 | 47,459 | 1.88 | 45,559 | 1.21 | 2,684 | 1.28 | 4,498 |
| Max Week | 1.25 | 9.8 | 1.88 | 56,342 | 2.45 | 59,373 | 1.42 | 3,139 | 1.40 | 4,924 |
| Max Day | 1.34 | 10.6 | 1.99 | 59,535 | 2.45 | 59,373 | 1.64 | 3,628 | 1.40 | 4,924 |

[a] Maximum weekly and daily loading values are based on limited data with sampling frequencies ranging between one and three times per week.
[b] Analysis based on average influent wastewater flow projections presented in Table 4-4 and the average concentrations and loading peaking factors established from plant influent data provided by IEUA for the period between October 15, 2011, and October 15, 2013.
[c] Site planning considerations will be based on the projections established for the 2060 ultimate planning year.

TABLE 4-9
**RP-5 Influent Flow and Loading Projections for Preferred Flow Diversion Alternative 2 with Haven and Whispering Lakes Pump Stations Online**

| | Flows | | Loads[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | BOD | | TSS | | NH3-N | | TKN | |
| | PF | mgd | PF | lb/day | PF | lb/day | PF | lb/day | PF | lb/day |
| **Current (Based on 2011-2013 Data)** | | | | | | | | | | |
| Annual Average | - | 10.0 | - | 27,771 | - | 23,181 | - | 3,005 | - | 4,602 |
| Max Month | 1.27 | 12.8 | 1.79 | 49,636 | 2.47 | 57,295 | 1.35 | 4,043 | 1.60 | 7,349 |
| Max Week | 1.43 | 14.3 | 2.48 | 69,009 | 3.22 | 74,660 | 1.65 | 4,953 | 1.92 | 8,854 |
| Max Day | 1.47 | 14.8 | 2.31 | 64,209 | 3.48 | 80,742 | 1.70 | 5,112 | 1.92 | 8,854 |
| **Projections (Planning Year: 2035)[b]** | | | | | | | | | | |
| Annual Average | - | 18.4 | - | 49,290 | - | 40,964 | - | 5,422 | - | 8,036 |
| Max Month | 1.27 | 23.4 | 1.79 | 88,099 | 2.47 | 101,247 | 1.35 | 7,294 | 1.60 | 12,835 |
| Max Week | 1.43 | 26.3 | 2.48 | 122,483 | 3.22 | 131,932 | 1.65 | 8,937 | 1.92 | 15,463 |
| Max Day | 1.47 | 27.1 | 2.31 | 113,964 | 3.48 | 142,680 | 1.70 | 9,223 | 1.92 | 15,463 |
| **Projections (Planning Year: 2060)[c]** | | | | | | | | | | |
| Annual Average | - | 25.3 | - | 67,774 | - | 56,326 | - | 7,456 | - | 11,050 |
| Max Month | 1.27 | 32.2 | 1.79 | 121,137 | 2.47 | 139,214 | 1.35 | 10,029 | 1.60 | 17,648 |
| Max Week | 1.43 | 36.1 | 2.48 | 168,415 | 3.22 | 181,406 | 1.65 | 12,288 | 1.92 | 21,261 |
| Max Day | 1.47 | 37.3 | 2.31 | 156,700 | 3.48 | 196,185 | 1.70 | 12,682 | 1.92 | 21,261 |

[a] Maximum weekly and daily loading values are based on limited data with sampling frequencies ranging between one and three times per week.
[b] Analysis based on average influent wastewater flow projections presented in Table 4-5 and the average concentrations and loading peaking factors established from plant influent data provided by IEUA for the period between October 15, 2011, and October 15, 2013.
[c] Site planning considerations will be based on the projections established for the 2060 ultimate planning year.

TABLE 4-10
**RP-5 Influent Flow and Loading Projections for Preferred Flow Diversion Alternative 2 with Haven and Whispering Lakes Pump Stations Offline**

| | Flows | | Loads[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | BOD | | TSS | | NH3-N | | TKN | |
| | PF | mgd | PF | lb/day | PF | lb/day | PF | lb/day | PF | lb/day |
| **Current (Based on 2011-2013 Data)** | | | | | | | | | | |
| Annual Average | - | 10.0 | - | 27,771 | - | 23,181 | - | 3,005 | - | 4,602 |
| Max Month | 1.27 | 12.8 | 1.79 | 49,636 | 2.47 | 57,295 | 1.35 | 4,043 | 1.60 | 7,349 |
| Max Week | 1.43 | 14.3 | 2.48 | 69,009 | 3.22 | 74,660 | 1.65 | 4,953 | 1.92 | 8,854 |
| Max Day | 1.47 | 14.8 | 2.31 | 64,209 | 3.48 | 80,742 | 1.70 | 5,112 | 1.92 | 8,854 |
| **Projections (Planning Year: 2035)[b]** | | | | | | | | | | |
| Annual Average | - | 20.2 | - | 54,112 | - | 44,972 | - | 5,953 | - | 8,823 |
| Max Month | 1.27 | 25.7 | 1.79 | 96,718 | 2.47 | 111,151 | 1.35 | 8,007 | 1.60 | 14,090 |
| Max Week | 1.43 | 28.8 | 2.48 | 134,465 | 3.22 | 144,838 | 1.65 | 9,811 | 1.92 | 16,975 |
| Max Day | 1.47 | 29.8 | 2.31 | 125,113 | 3.48 | 156,638 | 1.70 | 10,125 | 1.92 | 16,975 |
| **Projections (Planning Year: 2060)[c]** | | | | | | | | | | |
| Annual Average | - | 27.2 | - | 72,864 | - | 60,556 | - | 8,016 | - | 11,880 |
| Max Month | 1.27 | 34.7 | 1.79 | 130,234 | 2.47 | 149,669 | 1.35 | 10,782 | 1.60 | 18,973 |
| Max Week | 1.43 | 38.8 | 2.48 | 181,062 | 3.22 | 195,030 | 1.65 | 13,211 | 1.92 | 22,858 |
| Max Day | 1.47 | 40.1 | 2.31 | 168,468 | 3.48 | 210,918 | 1.70 | 13,634 | 1.92 | 22,858 |

[a] Maximum weekly and daily loading values are based on limited data with sampling frequencies ranging between one and three times per week.
[b] Analysis based on average influent wastewater flow projections presented in Table 4-5 and the average concentrations and loading peaking factors established from plant influent data provided by IEUA for the period between October 15, 2011, and October 15, 2013.
[c] Site planning considerations will be based on the projections established for the 2060 ultimate planning year.

# 5.0 Conclusions

As discussed in TM 3, the WFMP planning effort is based on IEUA's preferred flow diversion Alternative 2, optimizing groundwater recharge by diverting flows from Whispering Lakes and Haven pump stations to RP-1. The corresponding influent wastewater flow and loading projections under this alternative for the planning year 2035 are presented in this TM and form the basis of the master planning effort for each of the RWRPs in subsequent TMs. Projections are also presented for the 2060 ultimate buildout year, which will be used for site planning considerations. To provide greater system reliability and redundancy, RP-5 facilities planning will assume both the Whispering Lakes and Haven pump stations are offline. These projected flows form the basis for establishing RP-5 facilities planning and expansion needs conducted as part of this WFMP effort.

# 6.0 References

ADS Environmental Services (ADS). 2014. *IEUA IRP Temporary Flow Monitoring Report.* Prepared for Inland Empire Utilities Agency and RMC Water and Environment for the period between October 25, 2013, and November 7, 2013. January.

RMC Water and Environment (RMC). December 2013. *Technical Memorandum: IEUA IRP Wastewater Flow Projections.* Prepared for Inland Empire Utilities Agency.

# TM 5 RP-1 Future Plans

# IEUA Wastewater Facilities Master Plan
# TM 5 RP-1 Future Plans

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: CH2M HILL

DATE: April 2015

# Executive Summary

Regional Water Recycling Plant No. 1 (RP-1) has undergone many expansions since its initial construction in 1948 to serve the needs of the Cities of Ontario, Rancho Cucamonga, Upland, Fontana, Montclair, and Chino. RP-1 includes both liquid treatment and solids handling facilities, receiving and treating wastewater flows from tributary communities and Regional Water Recycling Plant No. 4 (RP-4). RP-1 also includes primary and secondary flow equalization which currently exhibit odor and lagoon maintenance challenges. This technical memorandum (TM) evaluates alternatives for improving RP-1 flow equalization, identifies RP-1 plant expansion projects within the 20-year planning period, and provides preliminary capital cost estimates for the projects. Information from this TM will be incorporated into the updated 20-year Capital Improvement Program (CIP).

The current and future flows and loads for RP-1 were estimated in *TM 4 Wastewater Flow and Loading Forecast*. An analysis of the influent wastewater characteristics at RP-1 was conducted to establish current average and peak influent flows, concentrations, and loads at the plant, and to develop flow and load projections for the 2035 planning year and the 2060 ultimate buildout year. The influent flow and loading projections and the effluent requirements detailed in the Santa Ana Regional Water Quality Control Board (RWQCB) Order No. R8-2009-0021 were used to evaluate the existing capacities of the RP-1 liquid treatment facilities. The estimated capacities were then compared to the projected flow and loads to determine the RP-1 facilities that require expansion within the 20-year planning period, and when those facilities would need to be online.

A nonmonetary evaluation of potential RP-1 flow equalization alternatives identified Alternative 3 (eliminating primary effluent equalization by adding secondary clarifiers, and converting the existing lagoons for other uses) as being the most favorable alternative. This alternative offers a sustainable and cost-effective approach that significantly eliminates plant odors from primary effluent storage and pumping, and frees up the existing lagoons for other flow management needs such as emergency primary effluent storage, secondary effluent equalization, or recycled water storage.

Three plant expansion projects were identified during the 20-year CIP: the RP-1 Primary Effluent Equalization Elimination Project, the RP-1 Liquid Treatment Expansion Project, and the RP-1 Solids Treatment Expansion Project. Together, these projects would include modifications to primary flow equalization piping and pumping systems to be able to use the lagoons for other uses, as well as construction of a new membrane bioreactor (MBR) facility, secondary clarifiers, and anaerobic digesters. The capital costs included in the 20-year CIP for these projects are summarized in Table 5-1.

The evaluation of RP-1 identified three main conclusions:

- The most favorable flow equalization alternative is the elimination of existing primary effluent flow equalization by adding secondary clarifiers and using the existing lagoons for other flow management needs such as emergency primary effluent storage, secondary effluent equalization, or recycled water storage.
- The RP-1 liquid treatment facilities will need to be expanded during the 20-year planning period with the construction of a new MBR facility (Train D).
- The RP-1 solids treatment facilities will need to be expanded during the 20-year planning period with the construction of new anaerobic digesters.

TABLE 5-1
**RP-1 Expansion Projects Capital Cost Estimate Summary**

| Component Description | RP-1 Primary Effluent Equalization Elimination Project | RP-1 Liquid Treatment Expansion Project | RP-1 Solids Treatment Expansion Project |
|---|---|---|---|
| Total Direct Cost[a] | $12,366,000 | $28,890,000 | $9,450,000 |
| Total Estimated Construction Cost[b] | $20,739,000 | $48,450,000 | $15,848,000 |
| Total Estimated Project Costs | $26,961,000 | $62,985,000 | $20,602,000 |

[a] *Engineering-News Record* Construction Cost Index (ENR CCI) for Los Angeles (August 2014 - 10,737).

[b] Cost does not include escalation to midpoint of construction.

*The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. The Consultant Team has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. The Consultant Team cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.*

# 1.0 Background and Objectives

The objective of the Wastewater Facilities Master Plan (WFMP) is to plan Inland Empire Utilities Agency (IEUA)'s wastewater treatment and conveyance improvements and develop a capital program. The capital program will guide IEUA in the development of major improvements to their treatment and conveyance facilities. There are five specific goals for this TM:

- Summarize information from TMs 1 through 4 as it pertains to RP-1.
- Evaluate the current capacities and limitations of the existing facilities.
- Evaluate three alternatives for improving RP-1 flow equalization.
- Determine treatment facilities required to treat projected flows and loads through planning year 2035.
- Estimate timing and preliminary capital costs for plant expansion projects required during the 20-year planning period.

# 2.0 RP-1 Overview

RP-1 was originally constructed in 1948 and has undergone many expansions and improvements over the years to serve the needs of the Cities of Ontario, Rancho Cucamonga, Upland, Fontana, Montclair, and Chino. The treatment plant includes preliminary, primary, secondary, and tertiary liquid treatment facilities, and primary and secondary solids treatment facilities. The liquid facilities are designed to produce an effluent quality meeting Title 22 standards for spray irrigation, nonrestricted recreational and landscape impoundments, and groundwater recharge. The solids handling facilities are operated to achieve Class B biosolids, which are trucked to Inland Empire Regional Composting Facility (IERCF) for further treatment and composting. A schematic of the RP-1 facility process flow diagram is shown in Figure 5-1.

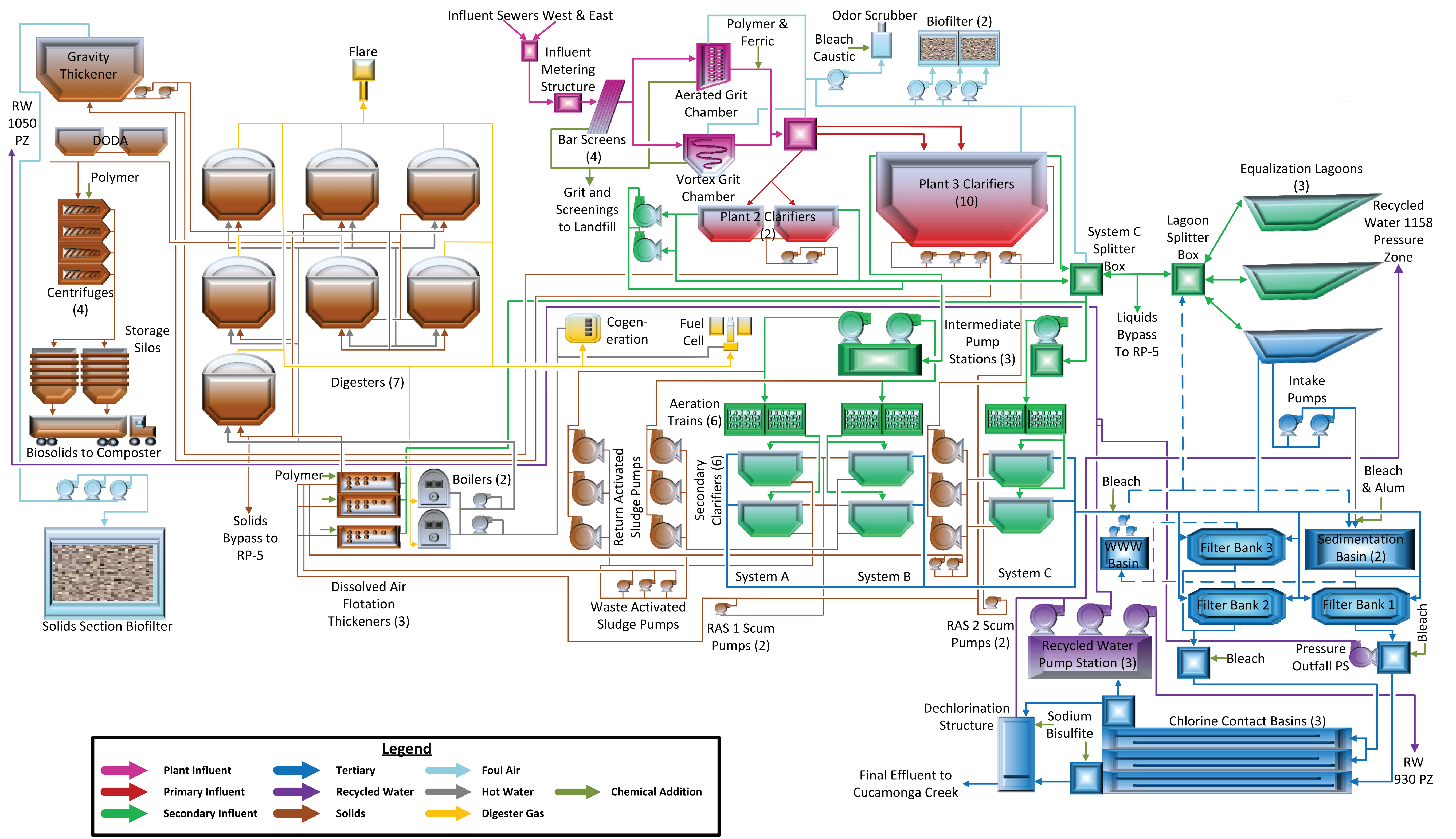



FIGURE 5-1

**REGIONAL WATER RECYCLING PLANT NO. 1**
**PROCESS FLOW SCHEMATIC**

INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

20-IEUA-10-14F5-1-9370A00.AI

## 2.1 Liquid Treatment Facilities

Preliminary treatment at RP-1 involves flow measurement using two Parshall flumes, screening that consists of four mechanical and two manual bar screens, and grit removal consisting of an aerated grit chamber and a vortex-type grit basin. Foul air from the preliminary and primary treatment facilities is sent to a chemical scrubber or biofilter for treatment and discharge. Primary treatment consists of 10 rectangular primary clarifiers and 2 circular primary clarifiers. Ferric chloride and polymer are added upstream of the primary clarifiers to improve settling performance and reduce hydrogen sulfide and odors in digester gas in the solids handling facilities. Primary effluent flow can be equalized using two equalization basins.

The secondary treatment facilities consist of three parallel, suspended growth treatment systems, each made up of two aeration basins and two circular secondary clarifiers. Two are identical, while the third has slightly larger secondary clarifiers. Aeration basins use fine bubble diffused aeration panels supplied by four centrifugal blowers. Tertiary treatment consists of filtration, coagulation, and flocculation/sedimentation of filter backwash, disinfection, and distribution of the tertiary effluent. Filtration is achieved using 26 dual media gravity filters and alum is added in-line upstream. Although flocculation/clarification facilities are available upstream of filtration, the flocculation/clarification process is normally offline. Disinfection is achieved using sodium hypochlorite, and filter effluent is sent to three chlorine contact tanks. The disinfected recycled water can then be discharged directly to Cucamonga Creek or directed to the RP-1 Recycled Water Pump Station. Discharge to Cucamonga Creek or Prado Lake is dechlorinated using sodium bisulfite. Further details of the facilities are summarized in *TM 1 Existing Facilities*.

## 2.2 Solids Handling Facilities

Solids from RP-1 and RP-4 are processed at the RP-1 solids handling facilities. RP-4 solids are discharged into downstream sewers and flow to RP-1; solids are removed from RP-1 primary and secondary treatment processes. RP-1 solids handling facilities consist of thickening, stabilization, and dewatering processes. There are two thickening processes in operation at RP-1: gravity thickening for primary solids, and dissolved air flotation (DAF) thickening for secondary solids. Thickened biosolids from the primary and secondary processes are stabilized in a three-stage anaerobic digestion process. Digesters No. 1 and 2 can be operated as mesophilic-acid digesters. Digesters No. 2 through 7 can be operated as either thermophilic or mesophilic digesters. Methane gas that is produced is sent to the cogeneration facility. Digested biosolids are then dewatered using centrifuges and sent to IERCF for composting. Foul air is diverted to a biofilter for treatment. Further details of the facilities are summarized in *TM 1 Existing Facilities*.

# 3.0 Current and Future Flows and Loads

As presented in *TM 4 Wastewater Flow and Loading Forecast*, an analysis of the influent wastewater characteristics at RP-1 was conducted as part of this WFMP effort in order to establish current average and peak influent flows, concentrations, and loads at the plant, and to develop flow and load projections for the 2035 planning year and 2060 ultimate buildout year. The data analysis is based on 2 consecutive years of recent data provided by IEUA for influent flow and key wastewater quality constituents including biological oxygen demand (BOD), total organic carbon (TOC), total suspended solids (TSS), ammonia as nitrogen (NH3-N), and total Kjeldahl nitrogen (TKN).

Flow projections were developed by the Integrated Water Resources Plan (IRP) Consultant and are based on the average influent wastewater flows measured during the flow monitoring period in November 2013 and projected through the year 2060 using population, employment, and land use information. As discussed in *TM 3 Regional Trunk Sewer Alternatives Analysis*, the WFMP planning effort is based on IEUA's preferred Flow Diversion Alternative 2, which includes diverting flows from Whispering Lakes and Haven pump stations to RP-1. The corresponding influent wastewater flow and loading projections under this alternative for the planning year 2035 form the basis of the master planning effort and treatment plant capacity evaluation presented herein. Projections are also presented for the 2060 ultimate buildout year; these projections are used for site planning considerations. Influent wastewater flows are projected to increase at RP-1 between 2020 and 2060 as a result of population growth in areas served by RP-1.

A summary of the current and projected average influent wastewater flows and loads for RP-1 are presented in Tables 5-2 and 5-3, respectively.

TABLE 5-2
**RP-1 Current and Projected Average Influent Wastewater Flows**

| | Current | 2035[a] | 2060[a,b] |
|---|---|---|---|
| Average Influent Flow (mgd)[c] | 27.8 | 33.1 | 36.3 |

[a] Projections developed by IRP Consultant and IEUA based on November 2013 flow monitoring period. Reflects projected flows for IEUA preferred Flow Diversion Alternative 2.
[b] Site planning considerations are based on the projections established for the 2060 ultimate buildout planning year.
[c] Assumes Whispering Lakes pump station and Montclair Pipeline infrastructure improvements discussed in *TM 3 Regional Trunk Sewer Alternatives Analysis* are complete and operational by 2020, with both pump stations online and conveying flow to RP-1.

TABLE 5-3
**RP-1 Current and Projected Average Influent Wastewater Characteristics**

| | Current Concentration (mg/L) | Current Load (lb/day) | 2035 Load[a] (lb/day) | 2060 Load[a] (lb/day) |
|---|---|---|---|---|
| BOD | 434 | 101,197 | 119,771 | 131,350 |
| TSS | 472 | 109,880 | 130,296 | 142,893 |
| NH3-N | 32 | 7,544 | 8,937 | 9,801 |
| TKN | 55 | 12,975 | 15,249 | 16,723 |

[a] Load projections based on projected flows, concentrations, and load peaking factors presented in *TM 4 Wastewater Flow and Loading Forecast.*

# 4.0 Treatment Requirements

IEUA operates under an umbrella permit and must meet water quality requirements for discharge and recycled water.

## 4.1 Discharge Requirements

The tertiary effluent from RP-1 is discharged at two discharge points (DPs) – Prado Park Lake (DP 001) and Cucamonga Creek (DP 002), both regulated by RWQCB Order No. R8-2009-0021, which replaced Order No. 01-1 and Order No. 95-43, National Pollutant Discharge Elimination System (NPDES) No. CA 0105279. This permit is an umbrella permit governing all of IEUA's wastewater treatment plants (RP-1, RP-4, RP-5, and Carbon Canyon Water Recycling Facility). It includes a stormwater discharge permit and the enforcement of an industrial pretreatment program. Effluent quality standards require tertiary treatment with filters and disinfection equivalent to Title 22 requirements for recycled water, due to the use of receiving waters for water contact recreation. A summary of the main effluent quality limits is provided in Table 5-4.

## 4.2 Recycled Water Requirements

As mentioned previously, effluent from RP-1 and RP-4 is used as recycled water for irrigation and groundwater recharge via spreading in seven Phase I recharge basin sites and six Phase II recharge basin sites. Specifically, recycled water from RP-1 is discharged to a use area overlying Chino North "Max Benefit"

Groundwater Management Zone (DP 005). Recycled water quality requirements for groundwater recharge are governed under RWQCB Order No. R8-2007-0039. Table I, Table II, and Table III in the permit provide concentration limits for many constituents of concern, such as inorganic chemicals, volatile organic chemicals, radionuclides, metals, and disinfection byproducts. Recycled water quality for irrigation is regulated by Order No. R8-2009-0021 and must meet the discharge requirements described in Table 5-4.

TABLE 5-4
**Summary of Effluent Quality Limits[a]**

| Parameter | Weekly Average | Monthly Average | Annual Average | Daily Maximum | Notes |
|---|---|---|---|---|---|
| BOD | 30 mg/L[b] | 20 mg/L[b] | - | - | 45 mg/L weekly average and 30 mg/L monthly average with 20:1 dilution. |
| TSS | 30 mg/L[b] | 20 mg/L[b] | - | - | |
| $NH_4$-N | - | 4.5 mg/L | - | - | |
| Chlorine Residual | - | - | - | 0.1 | Instantaneous maximum ceiling 2 mg/L |
| TIN | - | - | 8 mg/L | - | |
| TDS | - | - | 550 mg/L | - | Shall not exceed 12-month running average TDS concentration in water supply by more than 250 mg/L |
| Turbidity | - | - | - | - | 1. Daily average – 2 NTU<br>2. 5% maximum in 24 hr – 5 NTU<br>3. Instantaneous maximum – 10 NTU |
| Coliform | < 2.2 MPN | - | - | - | Maximum 23 MPN, once per month |
| pH | - | - | - | 6.5 – 8.5 | 99% compliance |
| Free Cyanide | - | 4.2 µg/L | - | 8.5 µg/L | |
| Bis(2-ethylhexyl) Phthalate | - | 5.9 µg/L | - | 11.9 µg/L | |
| Selenium | - | 4.1 µg/L | - | 8.2 µg/L | |

[a] RWQCB Order No. R8-2009-0021
[b] Without 20:1 dilution and for recycled water.
TIN – total inorganic nitrogen
TDS – total dissolved solids
$NH_4$-N – ammonia as nitrogen
NTU – nephelometric turbidity unit(s)
MPN – most probable number
mg/L – milligrams per liter
µg/L – micrograms per liter

# 5.0 Existing Plant Capacity and Limitations

Existing facilities and the current performance of RP-1 were used as the basis for process model development. A whole plant model was developed using PRO2D and calibrated based on plant influent data and plant operations data for the period between October 15, 2011, and October 15, 2013. This period was selected as the basis after a review of the influent and plant data to reflect a 2-year-long complete data set. Existing plant operation and the findings of the capacity evaluation through the use of process modeling is presented below for the liquid and solids treatment facilities at RP-1.

## 5.1 Existing Plant Operation

A summary of RP-1 plant operations is provided in Table 5-5 for the liquid treatment and solids handling facilities. Unit process performance values were averaged over the evaluation period, with operating ranges noted. These values were used in development and calibration of the process models. Detailed data summaries for the evaluation period are provided in Appendix 5-A.

TABLE 5-5
**RP-1 Average Plant Operations Summary**

| Parameter | Value |
|---|---|
| ***Primary Treatment*** | |
| TSS Removal Rate (%) | 73 |
| TOC Removal Rate (%) | 47 |
| Primary Sludge (mgd) | 1.01 |
| ***Secondary Treatment (Average of System A, B, C)*** | |
| MLSS (mg/L) | 4,400 |
| MLVSS (%) | 77 |
| RAS SS (mg/L) | 7,900 |
| Solids Inventory (Basins Only) (lb) | 141 |
| Solids Inventory (Basins, Clarifiers, RAS) (lb) | 194 |
| Secondary Clarifier Loading (gpd/ft$^2$) | 500 |
| Secondary Clarifier Loading (lb/d/ft$^2$) | 40 |
| SVI (mL/g) | 150-190 |
| SRT (Basins Only) (d) | 18 |
| Residual Alkalinity (mg as $CaCO_3$/L) | 138 |
| ***Solids Handling*** | |
| Gravity Thickened Solids (% TS) | 4-5 |
| DAF Thickened Solids (%TS) | 4.5-6.5 |
| Acid Phase (Digester 1) HRT (day) | 3 |
| Gas / Second Phase Digestion HRT (day) | 12 |
| Gas / Third Phase Digestion HRT (day) | 6 |
| Centrifuge Cake Solids (%TS) | 20-25 |

gpd – gallons per day
MLSS – mixed liquor suspended solids
MLVSS – mixed liquor volatile suspended solids
RAS SS – return activated sludge suspended solids
lb – pound(s)
mL/g – milliliters per gram
gpd/ft$^2$ – gallons per day per square foot
lb/d/ft$^2$ – pounds per day per square foot
SVI – sludge volume index
SRT – solids retention time
$CaCO_3$/L – calcium carbonate per liter
TS – thickened solids
HRT – hydraulic retention time

A performance summary for the major treatment processes is presented in Table 5-6. These values, which represent the average over the evaluation period, were used in the subsequent plant process modeling and capacity evaluations for the major treatment units. Detailed data summaries for the evaluation period are provided in Appendix 5-A.

TABLE 5-6
**RP-1 Average Plant Performance Summary**

| Parameter | Primary Effluent | Secondary Effluent | | |
|---|---|---|---|---|
| | | System A | System B | System C |
| TOC (mg/L) | 125 | 6.1 | 5.8 | 5.1 |
| BOD (mg/L) | 224 | 1.7 | 1.6 | 1.4 |
| TSS (mg/L) | 126 | 6.3 | 3.9 | 4.4 |
| NH3-N (mg/L) | 29 | 0.17 | 0.12 | 0.22 |
| NO3-N (mg/L) | N/A | 6.9 | 7.1 | 6.2 |
| NO2-N (mg/L) | N/A | 0.20 | 0.07 | 0.19 |
| TIN (mg/L) | N/A | 7.3 | 7.3 | 6.6 |
| Alkalinity (mg as $CaCO_3$/L) | N/A | 138 | N/A | 139 |

N/A – Not applicable
NO3-N – nitrate as nitrogen
NO2-N – nitrite as nitrogen

The values above are for the current operation, which includes secondary treatment operation without internal mixed liquor recycling, configured in an anoxic-oxic-anoxic-oxic biological nutrient removal (BNR) configuration with step feed capability. IEUA is currently planning to add internal mixed liquor pumping capability to the bioreactors, converting them to be closer to a Modified Ludzack-Ettinger (MLE) configuration with step feed capability, which is expected to improve the nitrogen removal capability of the secondary treatment system.

## 5.2 Existing Plant Capacity

### 5.2.1 Process Modeling

The capacity of the existing system was evaluated through process modeling using CH2M HILL's whole plant simulator, PRO2D. PRO2D is a process simulation model that takes into account the mass balances through an entire facility for particulate and soluble components and, similar to other commercially available process models, is based on the International Water Association (IWA) ASM2D biological process kinetics. The base model was constructed to reflect the actual facility setup, including flow splits and backwash. The process model facility setup flow diagram is presented in Figure 5-2. The model was constructed with the operations and performance criteria reflective of the evaluation period, and then calibrated to reflect the actual performance, solids yields, and water quality data.

As shown in Figure 5-2, the model was constructed to represent the actual plant operation for all the major process units. The model also allows establishing sizing and design considerations for each major unit process tankage and equipment. Similar to the actual operations, the plant model was built with the filter backwash and solids thickening recycles being returned to the main plant for further treatment, with the dewatering recycles being diverted offsite. The liquid and solids mass balances calculated for the current conditions allow calibration of the model against the actual field data. The calibrated model is then used to evaluate current capacity as well as establish expansion needs and process bottlenecks.

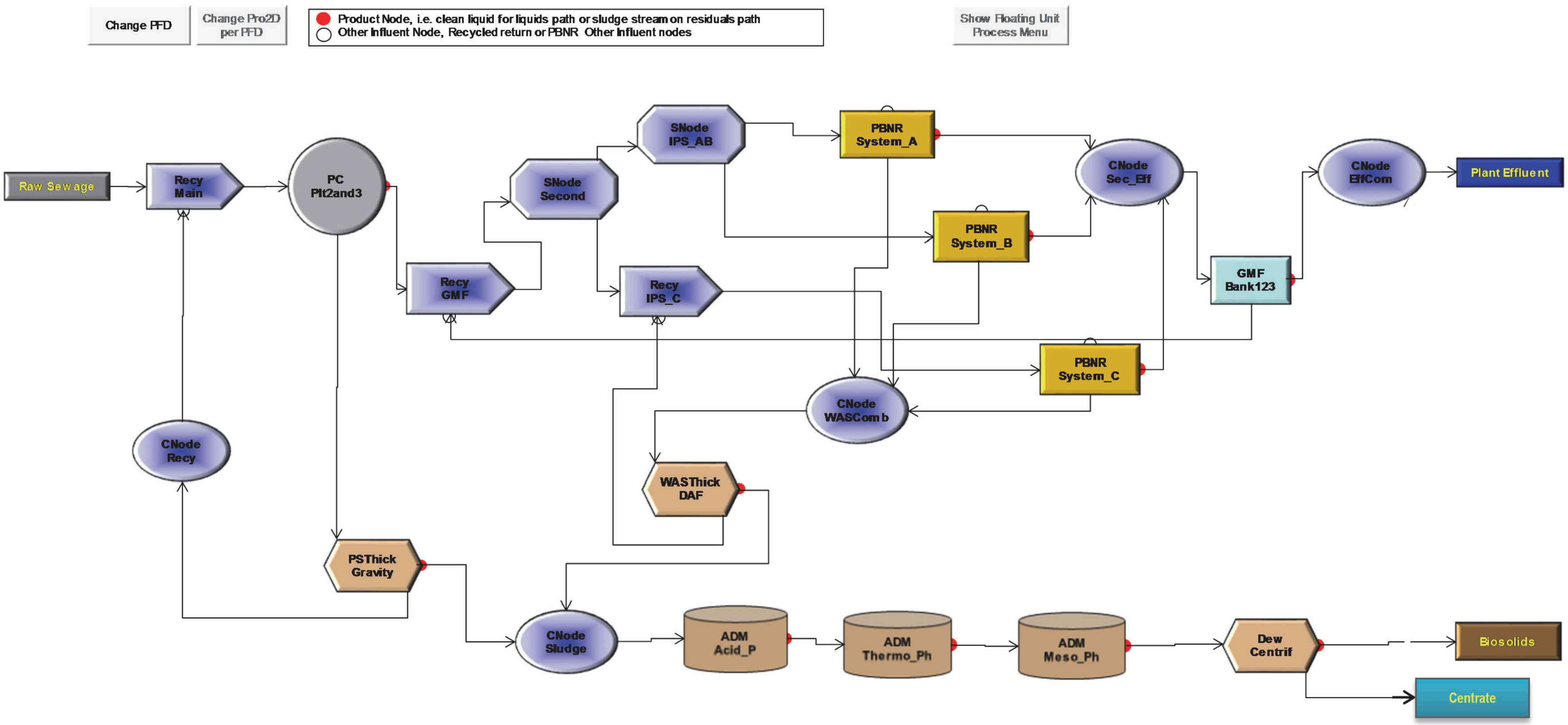



FIGURE 5-2

**RP-1 Process Model Facility Setup**

INLAND EMPIRE UTILITIES AGENCY

*WASTEWATER FACILITIES MASTER PLAN*

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The process model was constructed and calibrated using the current influent and operating data available for the facility. The purpose of the model calibration step is to establish a baseline condition that closely resembles current operations and provides a means to reliably predict operations and system limitations under different scenarios or alternatives. Key model calibration results are presented in Table 5-7. As the listed values show, the model was calibrated such that the simulation results are within a value range that is 5 percent or smaller relative to the actual data. This level of accuracy will allow reliable capacity estimations to be made for the various capacity scenarios and future operation needs.

TABLE 5-7
**RP-1 Average Plant Performance Summary**

| Parameter | Actual Data Average Values | Model Results |
|---|---|---|
| Effluent BOD (mg/L) | 1.43 | 2.6 |
| Effluent TSS (mg/L) | 4.9 | 5.2 |
| Effluent TIN (mg/L) | 7.3 | 7.2 |
| Effluent Alkalinity (mg as $CaCO_3$/L) | 139 | 144 |
| Total MLSS Inventory (lb) | 424,000 | 408,000 |
| Sludge VS Content | 77% | 76% |
| Biosolids (Dry Solids lb/day) | 44,400 | 47,400 |

Subsequent process modeling using the calibrated model as the base model was conducted to evaluate the following scenarios:

- Current plant capacity
  - Liquid treatment capacity to meet 8-mg/L effluent TIN level under average and maximum month flow and load conditions
  - Liquid treatment capacity to meet 5-mg/L effluent TIN level under average and maximum month flow and load conditions
  - Solids handling capacity under average and maximum month flow and load conditions
- Flow equalization options and future capacity implications for the planning year 2035
- Future facility footprint implications for the planning years 2035 and 2060

Findings of the current plant capacity evaluation are presented next in this section. Flow equalization and future capacity needs are presented in Sections 6.0 and 7.0, respectively.

### 5.2.2 Liquid Treatment Capacity

An evaluation of the liquid treatment capacity was conducted using the whole plant process model under both the average and maximum month conditions. The capacity evaluation was conducted based on achieving a plant effluent TIN concentration of 8 mg/L and 5 mg/L. As established at the onset of the project, the facility reliability and redundancy considerations are based on the IEUA's overall wastewater treatment system, with RP-5 being the end-of-the-line facility receiving all flow diversions, if needed, from other Regional Water Recycling Plants. Additional reliability and redundancy considerations driven by the regulatory requirements, such as Title 22 requirements, were taken into account. Dewatering recycles were considered to be handled separately or treated separately onsite.

Process modeling showed that the primary treatment system is not capacity limiting, because the liquid treatment capacity is limited by the secondary treatment system. One of the limitations was found to be the aeration and the ability to control dissolved oxygen (DO) in the anoxic and oxic zones in the aeration basins. The implications of DO are TIN fluctuations in the effluent and SVI values that are greater than 150 mL/g, which indicates sludge settleability could be impaired at times.

Another limitation of the secondary treatment system was found to be the secondary clarification solids loading resulting from the current operations and the influent wastewater solids loading rates. Maintaining the SVI values at or below 150 mL/g is important for this reason also.

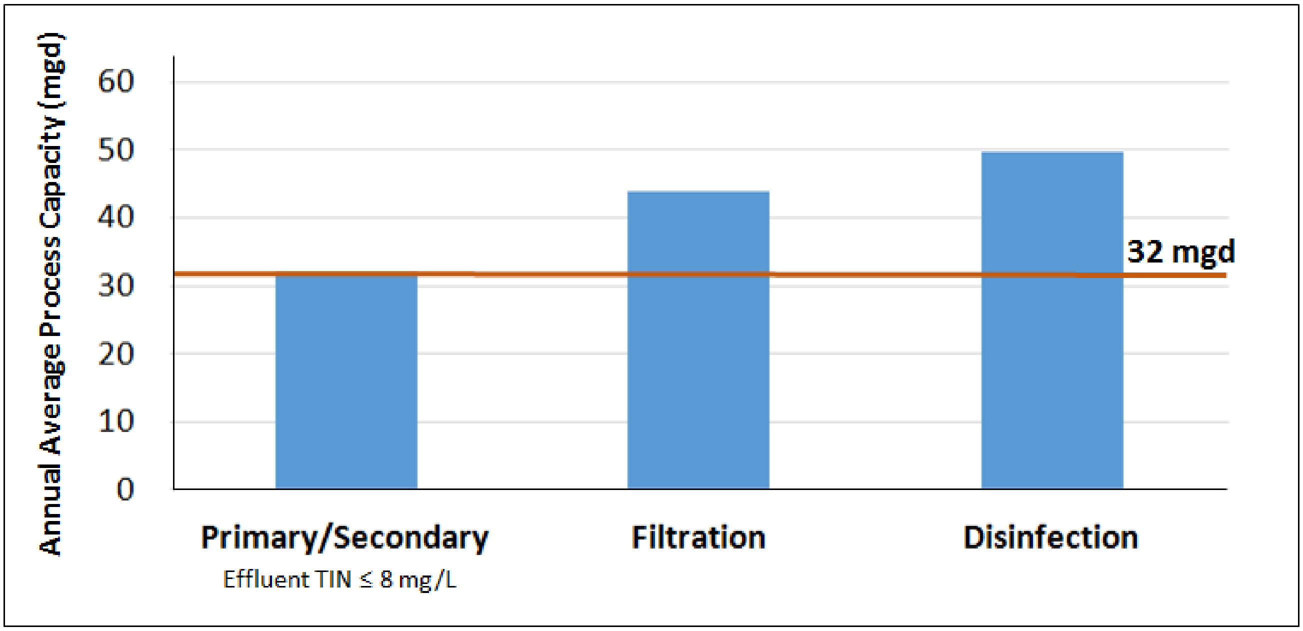
The capacity of the RP-1 tertiary processes also were evaluated; the methodologies employed are consistent with those presented in the Title 22 Engineering Report (DDB Engineering, Inc. [DDB], 2010). The filters were designed based on a California Department of Public Health (CDPH) maximum filter loading rate of 5 gallons per minute per square foot (gpm/ft$^2$) for dual-media gravity filters, with one filter in backwash and one filter offline. In order not to exceed the maximum approved filter loading rate, the maximum flow the filtration system can handle is 51.7 mgd. Applying a peak hourly dry weather peaking factor of 1.18, the resulting average filtration capacity is 43.8 mgd.

The disinfection system was designed based on the Title 22 concentration and time (CT) and modal contact requirements of 450 milligrams per minute per liter (mg-min/L), and 90 minutes during the peak hourly dry weather flow, respectively. Tracer testing completed in 2002 showed that Tanks 1 and 2 can handle a peak flow of 41.3 mgd while maintaining a modal contact time of 90 minutes (DDB, 2010). Applying a peak hourly dry weather peaking factor of 1.18, the resulting average disinfection capacity of Tanks 1 and 2 is 35 mgd. Tank 3 was designed based on 90 minutes modal contact time resulting in a peak dry weather capacity of 17.5 mgd. Applying a peak hourly dry weather peaking factor of 1.18, the resulting average disinfection capacity of Tank 3 is 14.8 mgd. Thus, the overall average disinfection capacity is approximately 49.8 mgd.

The overall liquid treatment capacity is determined by its most limiting process capacity. For RP-1, the secondary treatment is limited to 32 mgd with all units in service, with primary flow equalization, for an effluent TIN of 8 mg/L, assuming that the mixed liquor return system is installed and dewatering recycles go to the Non-Reclaimable Wastewater (NRW) system or are treated separately. Therefore, the RP-1 liquid treatment capacity is 32 mgd. This is less than the rated capacity of 44 mgd, which was based on completion of Train D not yet constructed, as well as the wastewater strength and permit requirements at the time.

The liquid treatment capacity of the plant to achieve an effluent TIN value of 8 mg/L is illustrated in Figure 5-3. As shown, the current plant influent represents 88 percent of the plant liquid treatment capacity. To achieve 5 mg/L effluent TIN, the plant can only treat 28 mgd and will be at capacity.

FIGURE 5-3
**RP-1 Existing Liquid Treatment Capacity**




### 5.2.3 Solids Handling Capacity

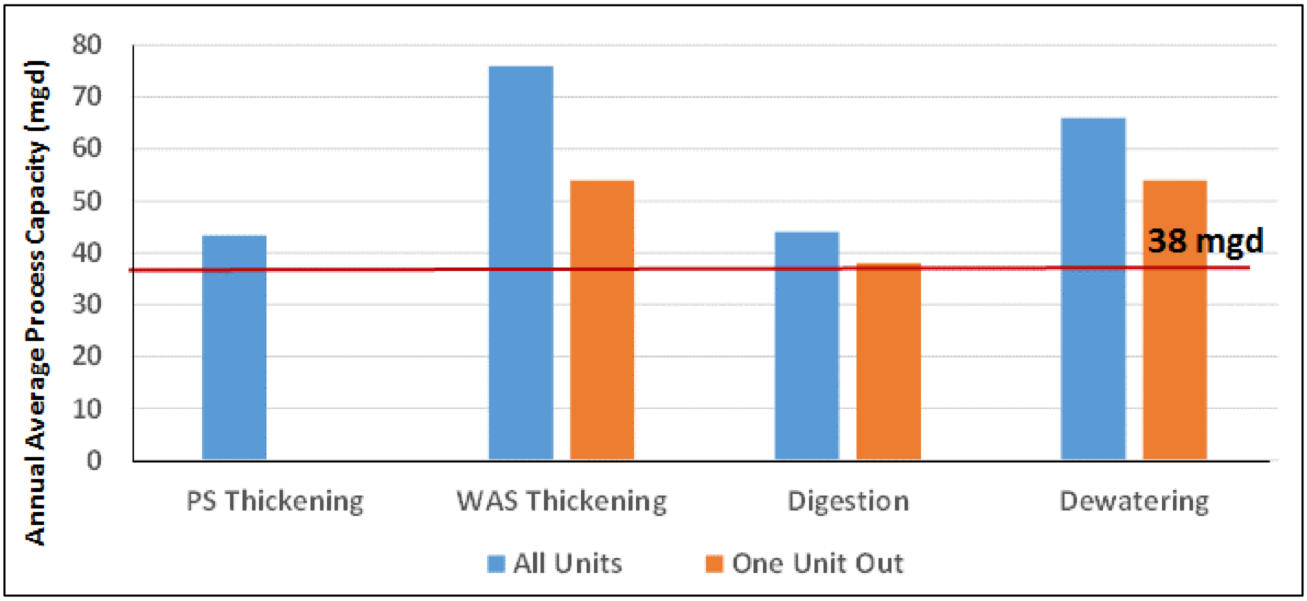
In evaluating the solids handling system capacity, operational considerations as well as Part 503 Rule requirements were taken into account when considering the average and maximum month loading. The system capacity with and without one unit out of service was evaluated using the industry standard loading rates and operational criteria. The capacity values calculated are considered to represent equivalent plant influent flow values at the current wastewater characteristics. The plant influent includes the RP-4 solids diverted to RP-1 via the sewer system for further treatment.

Primary sludge (PS) thickening is currently achieved using one gravity thickener. IEUA will review options to address RP-4 scalping plant and biosolids discharge effects on RP-1 in the future. Thickening can be achieved in the primary clarifiers if the gravity thickener is taken out of service. WAS thickening is achieved in dissolved air floatation thickeners (DAFTs). The WAS effect on the treatment process at RP-1 should be evaluated during preliminary design. Possible options would be to install piping directly to the thickeners or treat solids at RP-4. Capacity was evaluated by maintaining a solids loading rate of 45 $lb/d/ft^2$ or less for the DAFTs.

Waste solids digestion, achieved in the phased digestion system, was evaluated based on the current operating conditions as well as Part 503 Rule requirements. Digester loading rates of 0.1 to 0.2 pounds per day per cubic foot ($lb/d/ft^3$) and a digester SRT of 15 days with one large unit out of service were used to establish digestion capacity, using an active digester volume of 90 percent of the total digester volume including the cone space. The dewatering capacity of the centrifuges was calculated considering the hydraulic loading rate to be maintained at or below 340 gallons per minute (gpm) under the current solids loading conditions.

The solids handling capacity of the plant to meet the Part 503 Rule requirements for Class B biosolids is illustrated in Figure 5-4. As shown, the digestion is the limiting unit process of the solids handling system. The current equivalent RP-1/RP-4 plant influent flows (28 + 10 = 38 mgd) represent 100 percent of the anaerobic digestion capacity with one large unit out of service at the current influent wastewater characteristics and RP-4 solids loading diversion. It is important to note that since the RP-1 plant influent solids data includes solids diverted from RP-4, the solids handling capacities are based on the RP-1 current plant influent flow and loading in order to avoid double counting solids from RP-4.

FIGURE 5-4
**RP-1 Existing Solids Handling Capacity**




## 5.3 RP-1 Capacity Summary

The current RP-1 plant capacity is summarized in Table 5-8. These values constitute the basis of the future capacity requirements assessment presented later in this TM. As discussed in Section 5.2.3, the digestion capacity is evaluated based on a minimum SRT of 15 days for Class B biosolids production, one large digester out of service, maximum month solids loading, and a 90 percent active digester volume including cone volume. While the digestion capacity is limited to 38 mgd under these criteria, greater digestion capacity may be realized with improved digester feed thickening or if IEUA targets a different biosolids classification since IEUA biosolids are composted at IERCF.

TABLE 5-8
**RP-1 Existing Process Capacity Summary**

| | All Units in Service | One Unit Out of Service |
|---|---|---|
| **Secondary Treatment** | | |
| Plant Effluent TIN ≤ 8 mg/L[b] | 32 mgd | 28 mgd[a] |
| Plant Effluent TIN ≤ 5 mg/L[b,c] | 29 mgd | 26 mgd |
| **Solids Handling**[d] | | |
| PS Thickening | 43.3 mgd | 0 mgd[e] |
| WAS Thickening | 76 mgd | 54 mgd[e] |
| Digestion | 44 mgd | 38 mgd[e] |
| Dewatering | 66 mgd | 54 mgd[e] |
| **Tertiary Treatment** | | |
| Filtration | 47.4 | 43.8[f] |
| Disinfection | 49.8 | N/A |

TABLE 5-8
**RP-1 Existing Process Capacity Summary**

[a] One secondary clarifier and one aeration basin out of service.
[b] Assumes internal mixed liquor return (IMLR) is in place and SVI is 150 mL/g or better.
[c] Assumes IMLR is in place, DO control is added, and DO management is practiced.
[d] Values represent equivalent plant influent capacity and include RP-4 solids diverted to RP-1. Dewatering recycles were considered to be handled separately or treated onsite, not adding to the main plant nutrient loads.
[e] One large unit out of service.
[f] Two filter cells out of service, one in backwash one for maintenance.

# 6.0 Flow Equalization Alternatives Evaluation

As part of the capacity and site planning for RP-1, primary flow equalization was evaluated for the projected RP-1 influent flows of 33.1 mgd in 2035 and 36.3 mgd in 2060 (ultimate capacity). The facility currently has three flow management lagoons as shown in Figures 5-5 and 5-6. These lagoons are used for flow management for primary effluent and secondary effluent. While all three lagoons were constructed to receive primary effluent, Lagoon 3 primarily receives secondary effluent. The primary effluent is diverted to remaining lagoons on an as needed basis to manage flow peaks at the facility. IEUA strives to minimize odors that are sometimes experienced with the storage of primary effluent in these lagoons that are not covered and are in close proximity to the neighboring community and businesses. However, IEUA is considering retaining Lagoons 1 and 2 for emergency primary effluent storage in the future.

The following flow equalization alternatives were considered for detailed review of the monetary and nonmonetary considerations:

1. Keep the existing system, continuing the current operations as long as possible.
2. Replace with a modern covered tank system with the capability to mix, drain, and clean the contents of the equalization tanks, as well as provide continuous odor control for the tank headspace.
3. Eliminate primary effluent equalization by adding planned aeration basin improvements and secondary clarifiers, and converting the lagoons for other uses.

A nonmonetary evaluation was completed considering the advantages and disadvantages of these flow equalization alternatives. The evaluation criteria included factors that are of varying levels of importance for IEUA. For example, operational flexibility, operational risk and reliability, and impacts on plant odors were of greatest importance, while footprint and space considerations had the lowest importance. The criteria, definitions, and weighting factors are listed in Table 5-9. As illustrated in Table 5-10 and Figure 5-7, the benefit scores were calculated for each alternative through independent evaluation of each criterion. Resultant total benefit scores show that Alternative 3 (eliminating the primary effluent equalization by adding secondary clarifiers, and converting the existing lagoons to secondary effluent equalization or recycled water storage) has the highest nonmonetary benefit for IEUA. This is in larger part due to the fact that this alternative significantly eliminates the plant odors from primary effluent storage and pumping, improves the overall plant aesthetics, does not have any constructability or space constraints, and provides ease of operation and maintenance because it eliminates primary effluent storage and associated pond/ mechanical equipment maintenance.

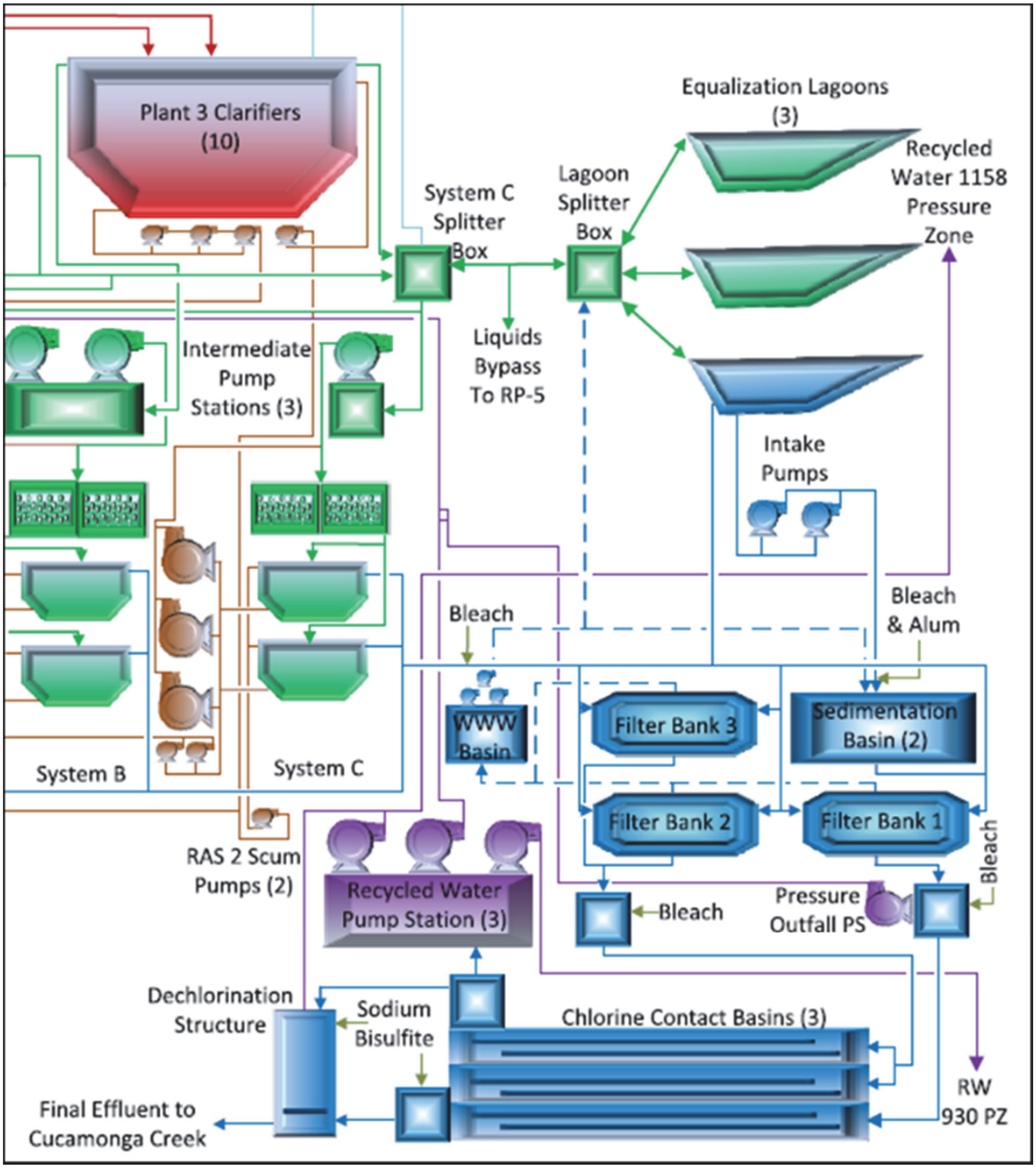



FIGURE 5-5

**RP-1 Existing Flow Management Schematic**

INLAND EMPIRE UTILITIES AGENCY
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WT0122151041SCO 480772.03.31.60.03 inland_empire_fig5_5.ai 1/15

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FIGURE 5-6

**RP-1 Existing Flow Management Infrastructure**

INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

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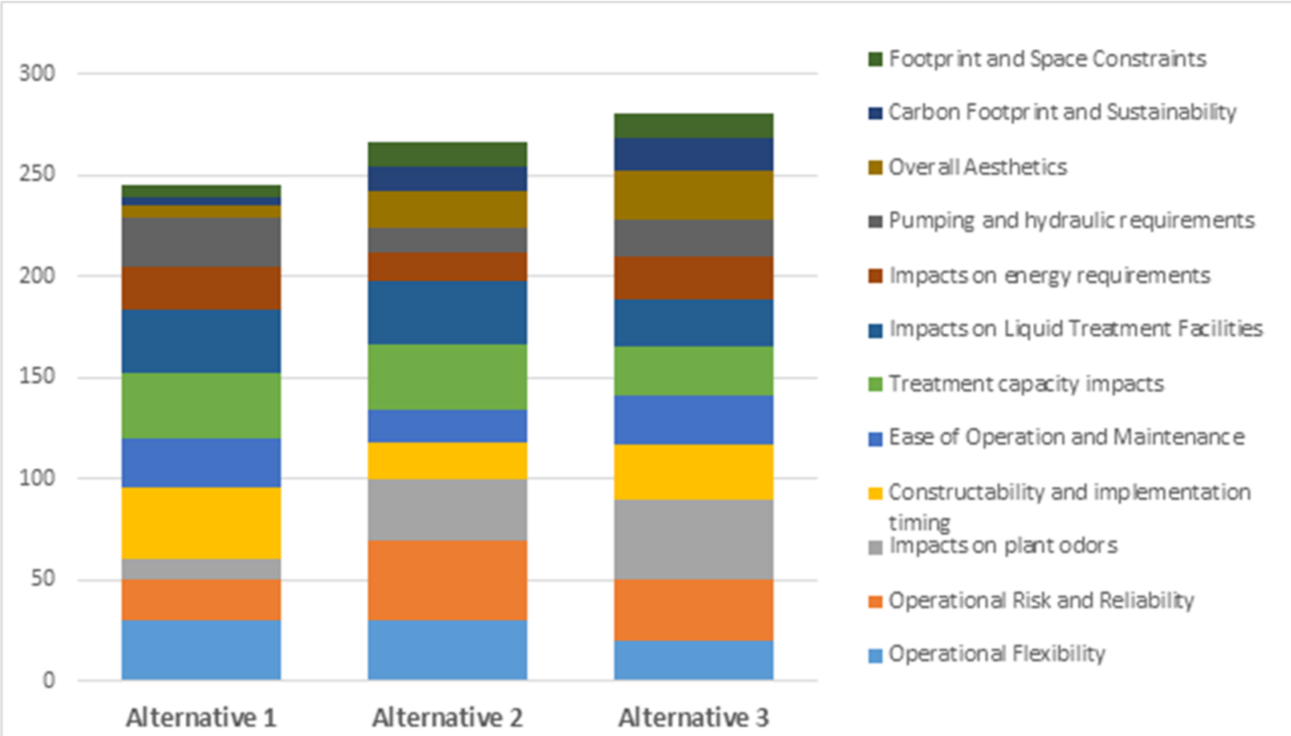
TABLE 5-9
**Nonmonetary Evaluation Criteria, Definitions, and Assigned Weighting Factors**

| Criteria | Description | Weighting Factor |
|---|---|---|
| Operational flexibility | Ability of the system to respond to potential internal or external changes affecting delivery of equalized flow or treated solids without any impact on system performance. | 10 |
| Operational risk and reliability | Operational implications on system reliability and redundancy and the associated risk involved in operating major facilities. Use of proven systems and technologies, with similar installations currently in operation. | 10 |
| Impacts on plant odors | Impacts of new processes on plant odors, and the need for additional odor control facilities to minimize plant odors. | 10 |
| Constructability and implementation timing | Construction implications, ease of construction, and integration with the existing systems, and the ability to implement the proposed alternative in phases. | 9 |
| Treatment capacity impacts | Impacts of the new facilities on treatment plant capacity. | 8 |
| Impacts on existing facilities | Impacts on existing facilities and the ability to use existing infrastructure. Implications of site planning and the need to demolish or relocate existing facilities. | 8 |
| Ease of operation and maintenance | Relative degree of ease and extent of time required to operate and maintain the facilities. | 8 |
| Impacts on energy requirements | Additional energy required to construct and maintain new facilities, as well as the impact of the new facilities on the overall plant energy balance and power demand (for example, pumping, mixing, etc.). | 7 |
| Pumping and hydraulic requirements | Implications of pumping and conveying to new facilities, and complexity of pumping and yard piping requirements. | 6 |
| Overall aesthetics | Aesthetic and visual considerations as a result of the new facilities. | 6 |
| Carbon footprint and sustainability | Potential impacts on the carbon footprint of each plant and added sustainability features as a result of construction and operation of the facilities. | 4 |
| Footprint and space constraints | Overall footprint requirements and space constraints, and impacts on site planning for future facilities. | 3 |

TABLE 5-10
**RP-1 Flow Equalization Non-Monetary Evaluation Results**

| Criteria | Weighting Factor | Alternative 1 Keep Existing | | Alternative 2 Build New Tanks | | Alternative 3 Eliminate PE EQ | |
|---|---|---|---|---|---|---|---|
| | | Score | Weighted Score | Score | Weighted Score | Score | Weighted Score |
| Operational Flexibility | 10 | 3 | 30 | 3 | 30 | 2 | 20 |
| Operational Risk and Reliability | 10 | 2 | 20 | 4 | 40 | 3 | 30 |
| Impacts on Plant Odors | 10 | 1 | 10 | 3 | 30 | 4 | 40 |
| Constructability and Implementation Timing | 9 | 4 | 36 | 2 | 18 | 3 | 27 |
| Treatment Capacity Impacts | 8 | 4 | 32 | 4 | 32 | 3 | 24 |
| Impacts on Existing Facilities | 8 | 4 | 32 | 4 | 32 | 3 | 24 |
| Ease of Operation and Maintenance | 8 | 3 | 24 | 2 | 16 | 3 | 24 |
| Impacts on Energy Requirements | 7 | 3 | 21 | 2 | 14 | 3 | 21 |
| Pumping and Hydraulic Requirements | 6 | 4 | 24 | 2 | 12 | 3 | 18 |
| Overall Aesthetics | 6 | 1 | 6 | 3 | 18 | 4 | 24 |
| Carbon Footprint and Sustainability | 4 | 1 | 4 | 3 | 12 | 4 | 16 |
| Footprint and Space Constraints | 3 | 2 | 6 | 4 | 12 | 4 | 12 |
| **Final Score** | | | **245** | | **266** | | **280** |

FIGURE 5-7
**RP-1 Flow Equalization Non-Monetary Evaluation Summary**




Monetary evaluation of these three flow equalization alternatives was completed to further assess the options. The monetary evaluation was conducted by developing life-cycle costs (LCC) for the three alternatives. The cost basis was the same for the overall master plan cost criteria:

- 20-year planning period
- 3 percent inflation
- 6 percent bond (interest) rate
- 30 percent contingency
- 30 percent engineering, construction management, environmental, legal, etc.

The monetary evaluation findings are listed in Table 5-11. Accordingly, Alternative 1 will have the lowest LCC because it is the baseline alternative with no addition of new infrastructure. Alternative 2 has the highest LCC because of the addition of new infrastructure including two 180-foot covered concrete primary effluent equalization tanks, associated recirculation and flow transfer pumps, mixing, cleaning and odor control components, and elimination of some of the existing lagoon volume to provide space to construct the new tanks. New infrastructure needed for Alternative 3 includes one new secondary clarifier for each secondary treatment train (two 120-foot units and one 130-foot unit) to accommodate the unequalized loads to the secondary treatment system and associated piping and flow splitting features. As a result, it has the second highest LCC value.

TABLE 5-11
**RP-1 Flow Equalization Monetary Evaluation Results**

| | Alternative 1 Keep Existing | Alternative 2 Build New Tanks | Alternative 3 Eliminate PE EQ |
|---|---|---|---|
| Capital Cost | $ - | $ 50,661,000 | $ 23,481,000 |
| O&M Cost | $ 50,000 | $ 468,000 | $ 130,000 |
| 20-yr LCC | $ 750,000 | $ 57,681,000 | $ 27,079,000 |

IEUA has decided that Alternative 1 is not a sustainable approach because this alternative does not eliminate the currently experienced odor problems or provide a resolution to the lagoon maintenance challenges (for example, the need to clean the open lagoons properly and promptly, etc.). Alternative 2 was not preferred due to its high cost and the operational complexity. Alternative 3 is the preferred alternative because it will free up the existing lagoons for other flow management needs such as emergency primary effluent storage, secondary effluent equalization, or recycled water storage.

# 7.0 Plant Expansion Needs

The flow projections for the planning years 2035 and 2060 were established as described under Section 3.0 of this TM. Accordingly, 2035 flow projections will be the basis of the facility expansion and CIP planning effort, while the facilities needed for the 2060 flow conditions will constitute the basis of site planning. The corresponding planning flows are listed in Table 5-12.

TABLE 5-12
**RP-1 Expansion Flow Scenarios**

| Planning Year | RP-1 Influent | RP-4 Influent (Equivalent Waste Solids) |
|---|---|---|
| 2035 | 33.1 mgd | 14.7 mgd |
| 2060 | 36.3 mgd | 18.4 mgd |

IEUA has decided to base the capacity expansion and footprint requirements on using the MBR technology for RP-1. The benefits of the MBR technology for long-term IEUA planning include small footprint requirements, elimination of secondary clarifiers and tertiary filters for recycled water production, superior water quality, and ability to produce thicker waste sludge compared to conventional technologies. The modular design capability of MBR technology also allows stepwise expansion of the treatment facility to meet both load capacity and different effluent TIN requirements. Also, the superior quality effluent can be directly fed to a reverse osmosis (RO) system if IEUA needs to produce higher-quality effluent or reduce final effluent TDS.

## 7.1 Facility Expansion Requirements

For the 2035 capacity expansion requirements that will constitute the basis of the CIP planning, facility sizing was determined using the whole plant PRO2D process model developed and calibrated for the current operation and wastewater quality. The PRO2D model simulations for average and maximum month flow and load conditions were completed to establish the facility requirements as well as liquid and mass balances for the facility. New facility sizing was based on the current IEUA operations as well as industry standards that apply to each unit process. RP-1 facility expansion requirements are summarized in Table 5-13.

TABLE 5-13
**RP-1 Facility Expansion Requirements for Planning Year 2035**

| Parameter | Size of New Units | Comments |
|---|---|---|
| Primary Clarifiers | - | No new units are needed. |
| Train D Secondary Treatment (MBR) | 1 module (8 mg/L TIN)<br>2 modules (5 mg/L TIN) | MBR system requirements include fine screening for the MBR system feed, MBR equipment includes permeate blowers and pumps. For site planning purposes, a 60-foot x 45-foot concrete equipment pad is reserved for this purpose. |
| Train D MBR Bioreactor Dimensions (Length x Width x Depth) | 1 module<br>130-foot x 60-foot x 18-foot | Two trains per module. |
| Train D Membrane Tank Dimensions (Length x Width x Depth) | 1 module<br>30-foot x 60-foot x 10-foot | Three trains per module. |
| Trains A, B, C New Secondary Clarifiers<br>(PE EQ Elimination) | 2 x 120-foot (Trains A and B)<br>1 x 130-foot (Train C) | Flow-splitting structure for each of the trains, as well as considerations for new RAS/WAS piping and pumping requirements, were included. |
| Anaerobic Digesters | 2 digesters<br>110-foot diameter<br>30-foot sidewater depth | New digesters with complete sludge transfer and recirculation, mixing and heating, and pumping equipment. |
| Flow Management Lagoons | - | Modifications only to piping and pumping systems to be able to use the lagoons for secondary effluent equalization. |

As an alternative or perhaps an addition to digester expansion, IEUA is considering expanding the existing sludge thickening facility to reduce hydraulic loading and delay the need for additional digestion capacity. Thickening improvements should be considered during the preliminary design phase to provide RP-1 with greater and more reliable thickening capacity.

The facility expansion configured in Table 5-13 was used as the basis of the capital and site planning under this master plan because it allows independent implementation of various facilities listed in the table. For example, elimination of primary effluent equalization impacts on secondary treatment needs to be balanced with the addition of secondary clarifiers, as noted previously. Because the clarifier addition and the MBR system addition are independent projects, they can be implemented separately.

There is an alternative that combines the elimination of primary flow equalization and addition of an MBR system; this alternative needs to be further evaluated as a part of the preliminary design effort. It involves dedicating the existing six secondary clarifiers to Trains A and B, while converting Train C to MBR technology. Under this alternative, Trains A and B will have adequate capacity to handle diurnal peaks. After conversion to MBR through the addition of membrane tanks and bioreactors, as needed, Train C can provide additional capacity for treatment of RP-1 flows. Train D can be constructed in the future, if needed. This way, no new secondary clarifiers would be built, and more flows could be treated through MBR as compared to constructing Train D only. The constructability and sizing details for the conversion of existing infrastructure for this alternative need to be further evaluated during preliminary design.

## 7.2 Ultimate Facilities Site Plan

For ultimate site planning purposes, the facilities for the ultimate capacity increase and other site planning considerations were established. In addition to the liquid treatment and solids handling facilities expansion requirements, the following site space needs were reserved for the listed future uses:

1. **Secondary Treatment**: Ultimate site space planning was completed using the expansion scheme listed in Table 5-13. To achieve 5-mg/L effluent TIN, both MBR modules of Train D needs to be implemented. However, an alternative ultimate site plan by converting Train C to MBR technology and adding Train D also could be implemented. As indicated above, Train C conversion requirements and related site planning requirements need to be further explored during preliminary design. The secondary treatment footprint, as shown in Figure 5-8, represents the worst-case scenario.
2. **Dewatering Recycles Treatment**: Currently, IEUA diverts the dewatering recycles to the NRW line through an interagency agreement. The NRW delivers non-reclaimable wastewater flows from the inland areas to the Los Angeles County Sanitation Districts (Sanitation Districts) Joint Water Pollution Control Facility (JWPCF) located in Carson, California. IEUA is planning to eliminate this discharge and manage the dewatering recycle flows onsite in the future. Dewatering recycles represent significant nutrient load (especially ammonia as nitrogen) that need to be treated. The flow can either be recycled back to the head of the plant, or be treated separately. Current advancements in treatment technologies, such as the Demon process, will allow IEUA to cost-effectively treat the ammonia load separately in a biological treatment system that uses the specialty microorganisms to achieve short-cut nitrogen removal. To reserve space to implement dewatering recycle treatment, a 20,000-$ft^2$ site space was reserved as shown in Figure 5-8.
3. **Advanced Water Treatment (AWT)**: Currently IEUA does not need to implement AWT to further treat the tertiary effluent. However, to manage the needs for higher-quality effluent or increasing TDS in the tertiary effluent, IEUA would like to reserve space for future implementation of an AWT system that could treat up to 5,000 acre feet per year (AFY) using a microfiltration (MF)/RO system and its appurtenances. If the MBR technology is implemented for the main plant expansion, the MF facility could be eliminated, depending on the AWT flow requirements. For this purpose, a 60,000-$ft^2$ site space was reserved as shown in Figure 5-8.

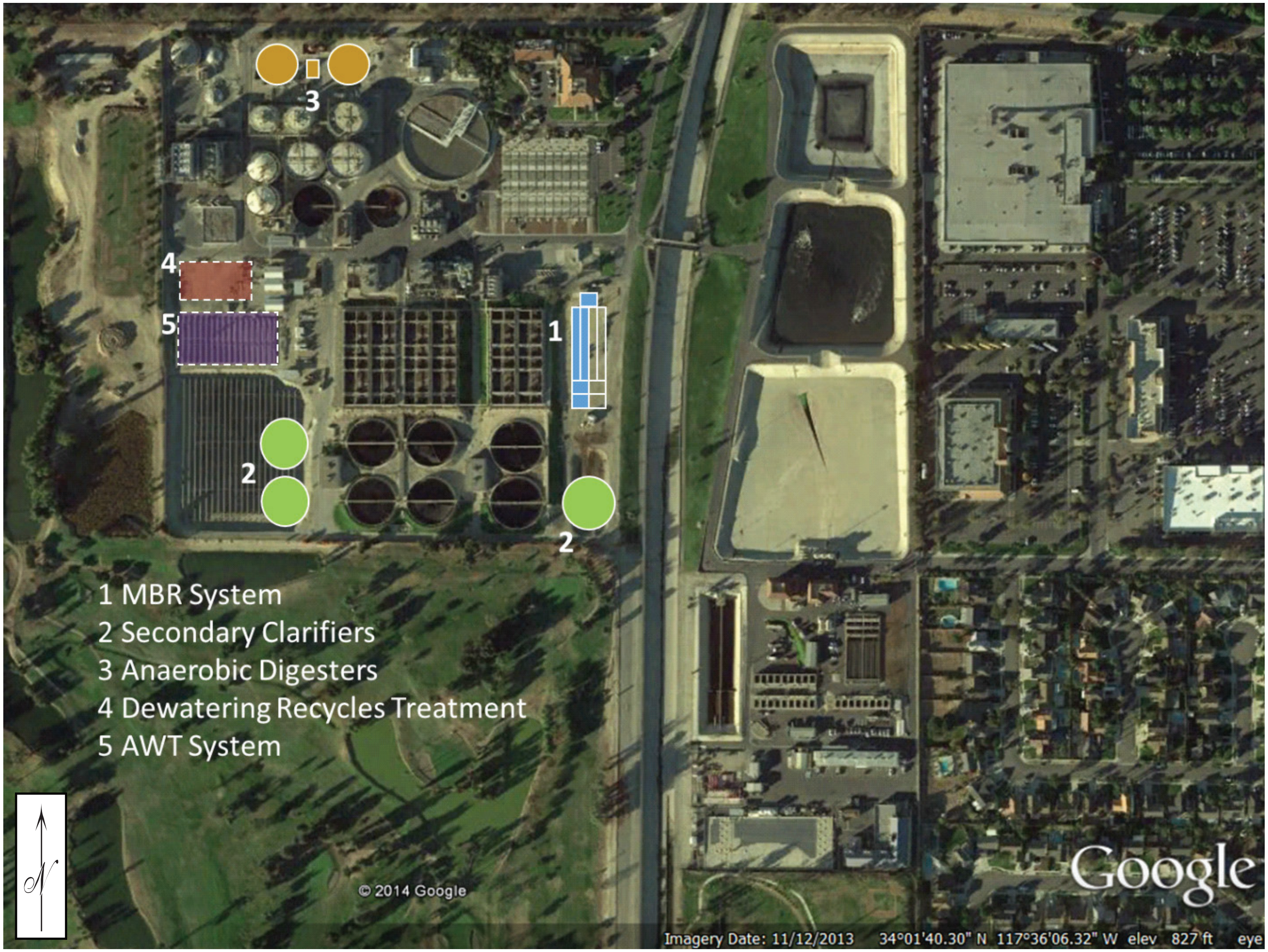



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FIGURE 5-8

**RP-1 Ultimate Facilities Site Plan**

INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

WT0122151041SCO 480772.03.31.60.03 inland_empire_fig5_8.ai 1/15

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# 8.0 20-Year CIP Plant Expansion Projects and Capital Cost

Three plant expansion projects were identified during the 20-year CIP: the RP-1 Primary Effluent Equalization Elimination Project, the RP-1 Liquid Treatment Expansion Project, and the RP-1 Solids Treatment Expansion Project. Capital costs were estimated for each project and those costs were placed into the 20-year CIP. The planning-level capital costs for each facility identified were developed based on cost curves established from previous projects and known direct costs for similar-sized projects. Additionally, several assumptions were made to estimate the total construction cost and total project costs for each expansion project. The assumptions include the following:

- The WFMP assumed a 20-year planning period.
- 10 percent of facilities subtotal for civil/site work.
- 0 to 5 percent of facilities subtotal for demolition depending on existing site conditions.
- 20 percent of facilities subtotal for electrical and instrumentation.
- 10 percent of total direct cost for contractor general conditions.
- 15 percent of total direct cost for contractor overhead and profit.
- 8 percent sales tax was applied to 50 percent of the total direct cost.
- 30 percent for construction contingency.
- 30 percent for engineering, construction management, environmental, and legal costs was applied to the total construction cost to estimate the total project cost.

The total construction cost and total project cost for each expansion project are summarized in Table 5-14.

# 9.0 Conclusion

The following conclusions can be made from the evaluation of RP-1:

- Elimination of existing primary effluent flow equalization by adding secondary clarifiers and using the existing lagoons for other flow management needs such as emergency primary effluent storage, secondary effluent equalization, or recycled water storage.
- The RP-1 liquid treatment facilities will need to be expanded during the 20-year planning period with the construction of a new MBR facility (Train D).
- The RP-1 solids treatment facilities will need to be expanded during the 20-year planning period with the construction of new anaerobic digesters.

# 10.0 References

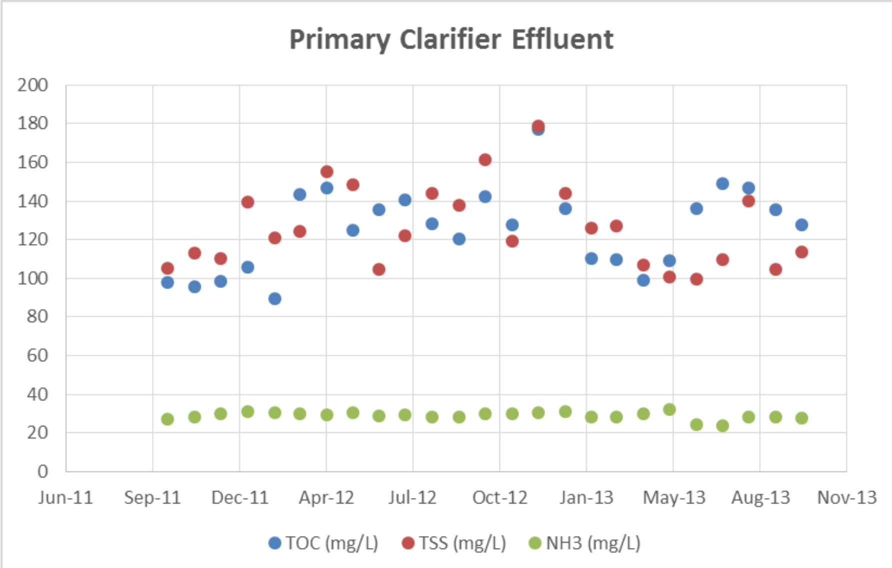
DDB Engineering, Inc. (DDB). 2010. *Inland Empire Utilities Agency Regional Plant No. 1 Title 22 Engineering Report.* January.

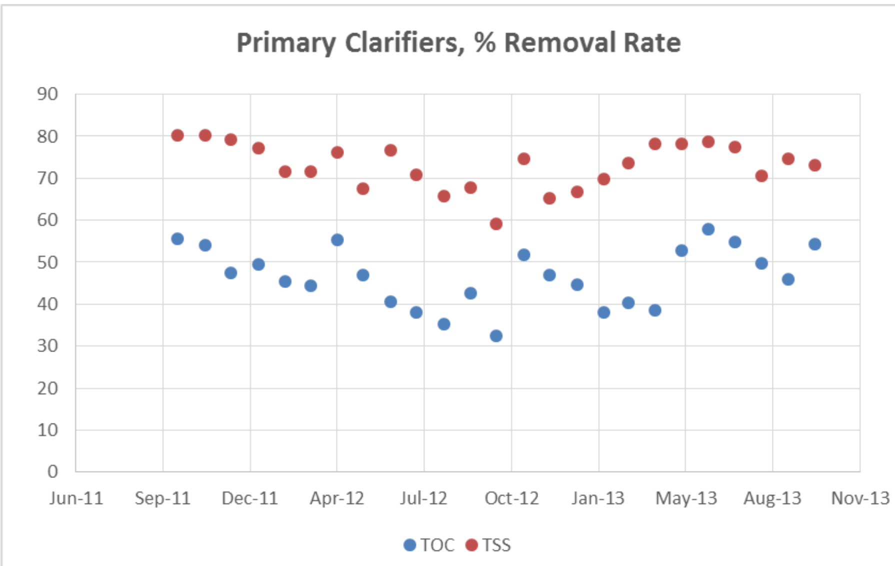
TABLE 5-14
**RP-1 Expansion Projects Capital Cost Estimate**

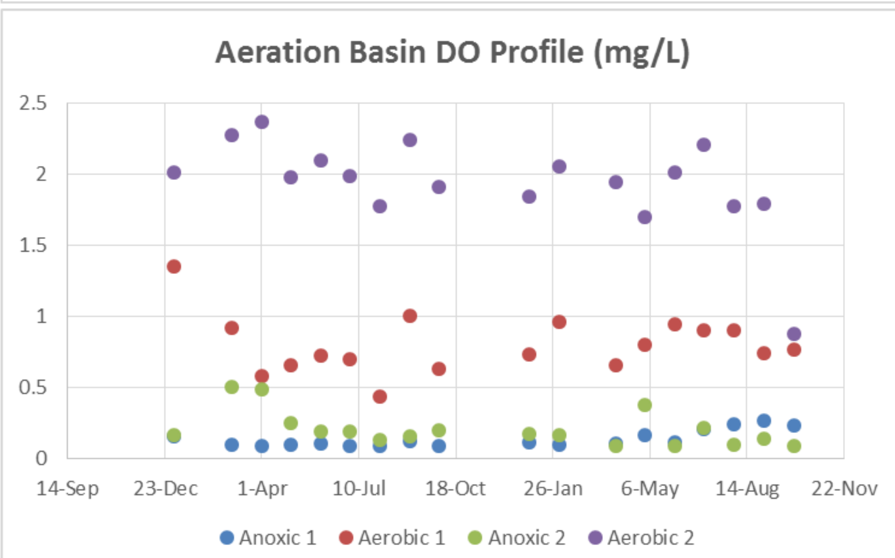
| Component Description | RP-1 Primary Effluent Equalization Elimination Project | RP-1 Liquid Treatment Expansion Project | RP-1 Solids Treatment Expansion Project |
|---|---|---|---|
| Secondary Treatment (MBR) – 5 mgd | - | $21,400,000 | |
| Secondary Clarifiers | $7,200,000 | - | |
| Aeration Basin Distribution Box Modifications | $360,000 | - | |
| RAS/WAS Pump Station Modifications | $1,100,000 | - | |
| Equalization Pond Piping Modifications | $500,000 | - | |
| Methane-Phase Digestion | - | | $7,000,000 |
| **Facilities Subtotal** | **$9,160,000** | **$21,400,000** | **$7,000,000** |
| Civil/Site Work (10%) | $916,000 | $2,140,000 | $700,000 |
| Demolition (5%) | $458,000 | $1,070,000 | $350,000 |
| Electrical and Instrumentation (20%) | $1,832,000 | $4,280,000 | $1,400,000 |
| **Total Direct Cost**[a] | **$12,366,000** | **$28,890,000** | **$9,450,000** |
| General Conditions (10%) | $1,237,000 | $2,889,000 | $945,000 |
| General Contractor Overhead and Profit (15%) | $1,855,000 | $4,334,000 | $1,418,000 |
| Sales Tax (8%)[b] | $495,000 | $1,156,000 | $378,000 |
| **Subtotal** | **$15,953,000** | **$37,269,000** | **$12,191,000** |
| Construction Contingency (30%) | $4,786,000 | $11,181,000 | $3,657,000 |
| **Total Estimated Construction Cost**[c] | **$20,739,000** | **$48,450,000** | **$15,848,000** |
| Engineering, Construction Management, Environmental, and Legal Costs (30%) | $6,222,000 | $14,535,000 | $4,754,000 |
| **Total Estimated Project Costs** | **$26,961,000** | **$62,985,000** | **$20,602,000** |

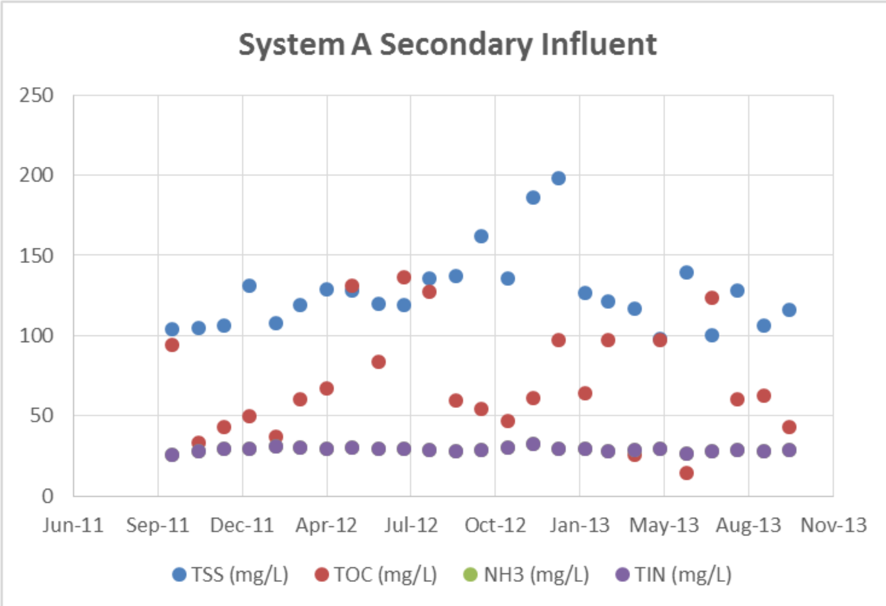
[a] ENR CCI Index for Los Angeles (August 2014 - 10,737).
[b] Calculated assuming 50% of direct costs are taxable.
[c] Cost does not include escalation to midpoint of construction.
*The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. The Consultant Team has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. The Consultant Team cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.*

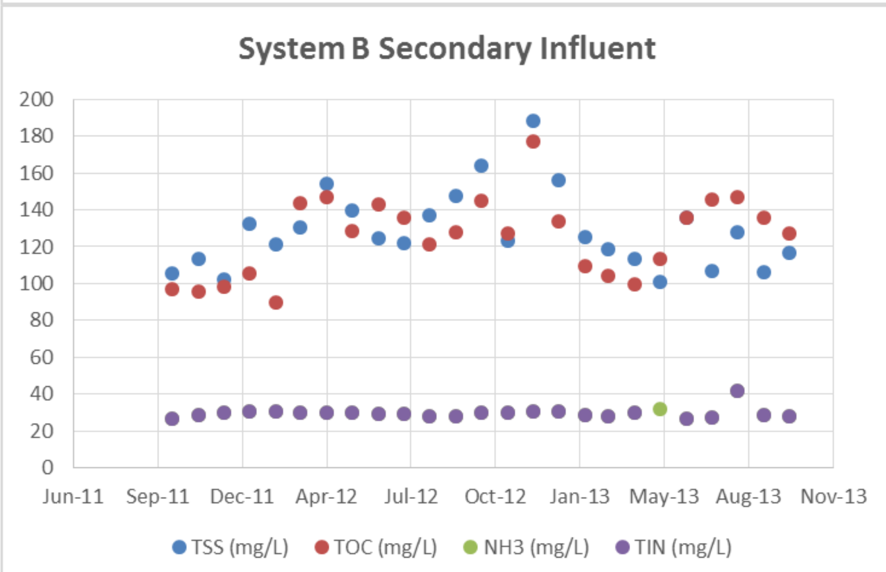
# Appendix 5-A
# RP-1 Plant Operations Summary (2011-2013)

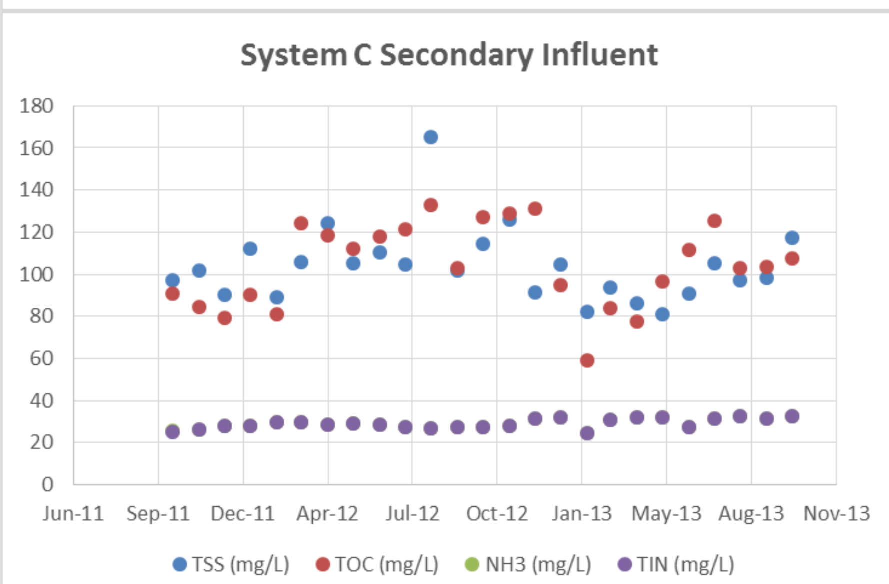

Primary Clarifier Effluent
200
180
160
140
120
100
80
60
40
20
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TOC (mg/L)
TSS (mg/L)
NH3 (mg/L)

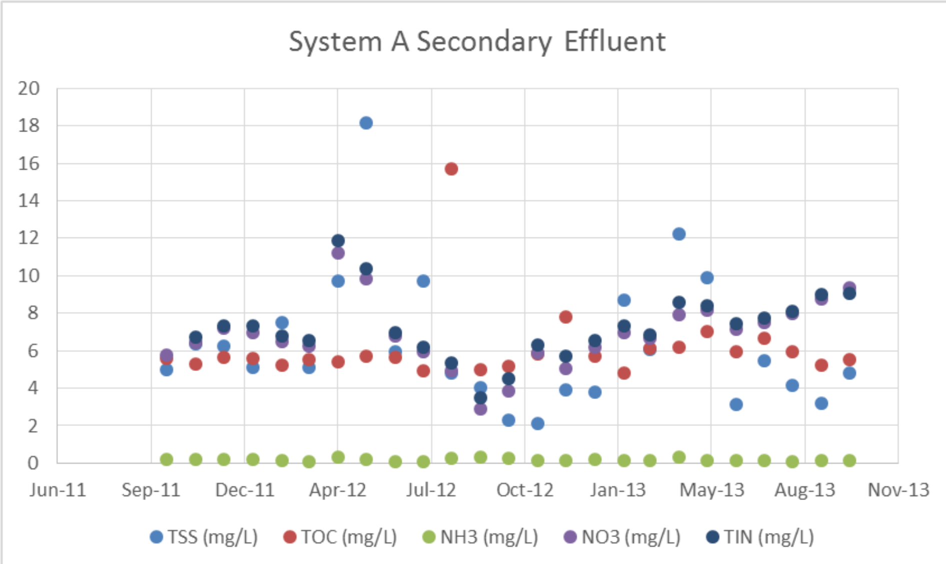

Primary Clarifiers, % Removal Rate
90
80
70
60
50
40
30
20
10
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TOC
TSS

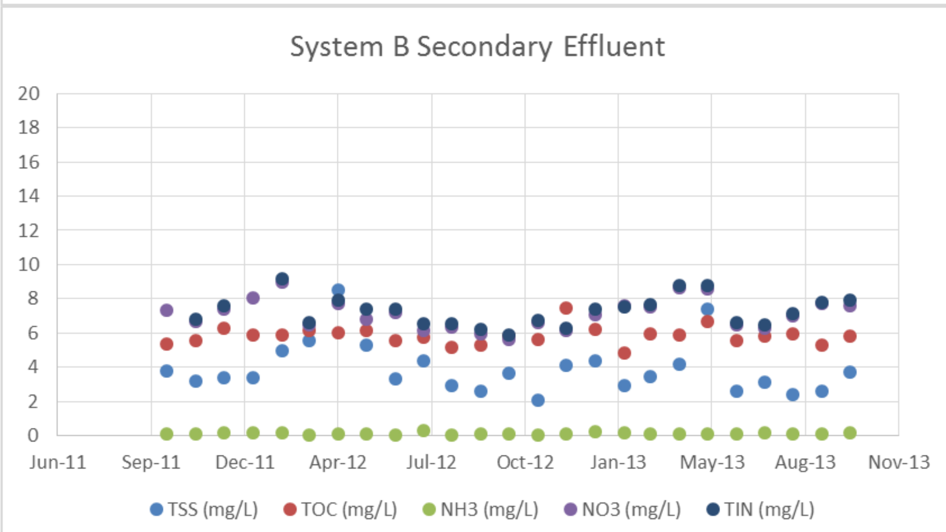

Aeration Basin DO Profile (mg/L)
2.5
2
1.5
1
0.5
0
14-Sep
23-Dec
1-Apr
10-Jul
18-Oct
26-Jan
6-May
14-Aug
22-Nov
Anoxic 1
Aerobic 1
Anoxic 2
Aerobic 2

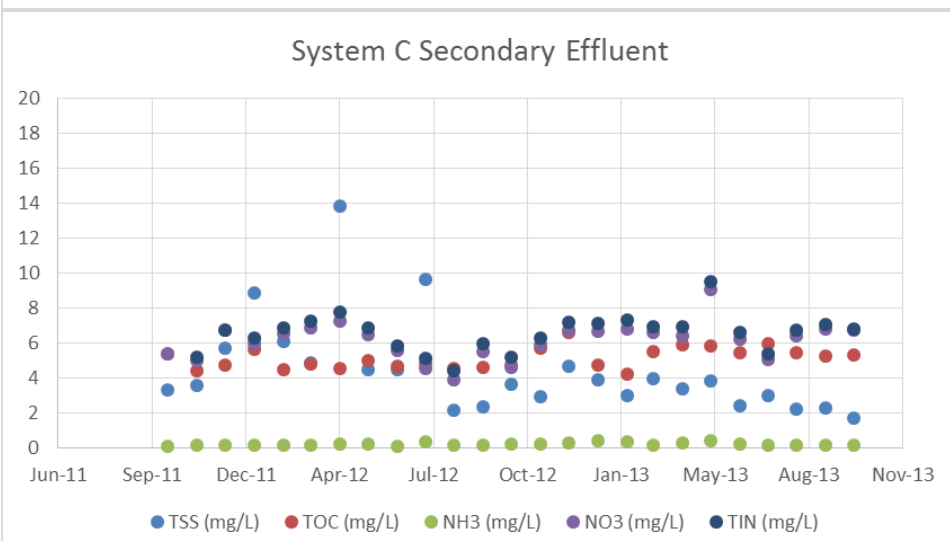

System A Secondary Influent
250
200
150
100
50
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
NH3 (mg/L)
TIN (mg/L)

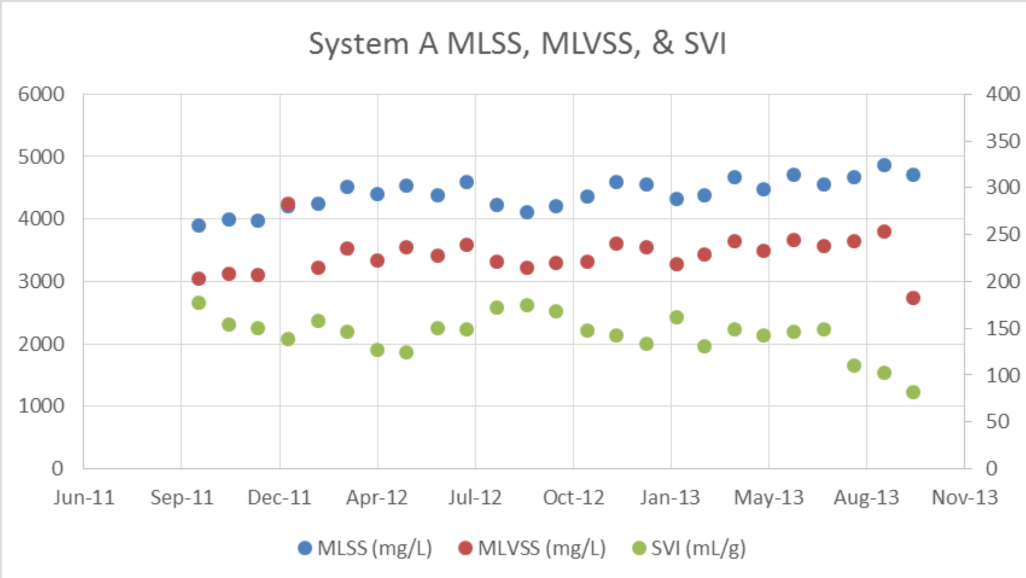

System B Secondary Influent
200
180
160
140
120
100
80
60
40
20
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
NH3 (mg/L)
TIN (mg/L)

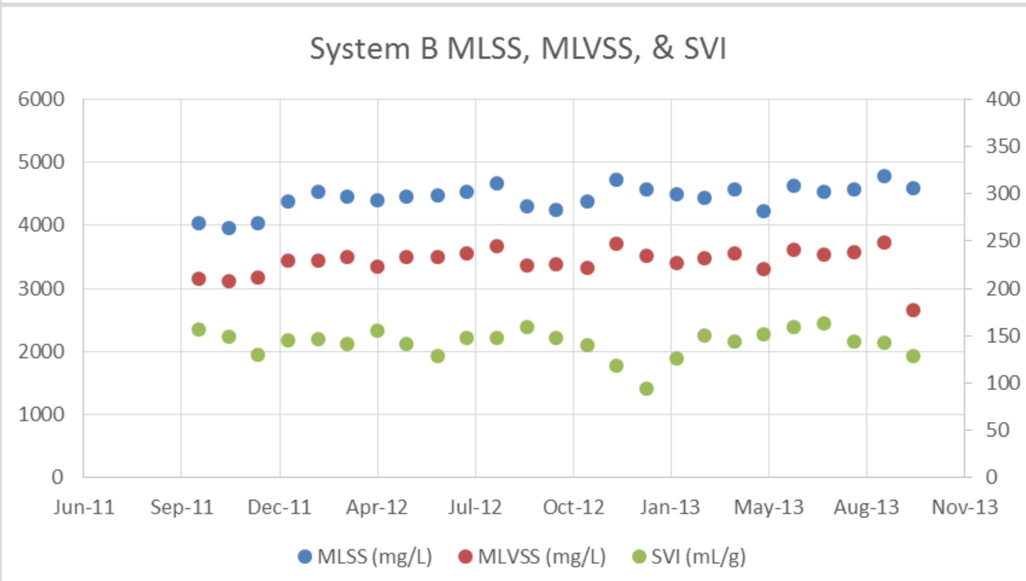

System C Secondary Influent
180
160
140
120
100
80
60
40
20
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
NH3 (mg/L)
TIN (mg/L)

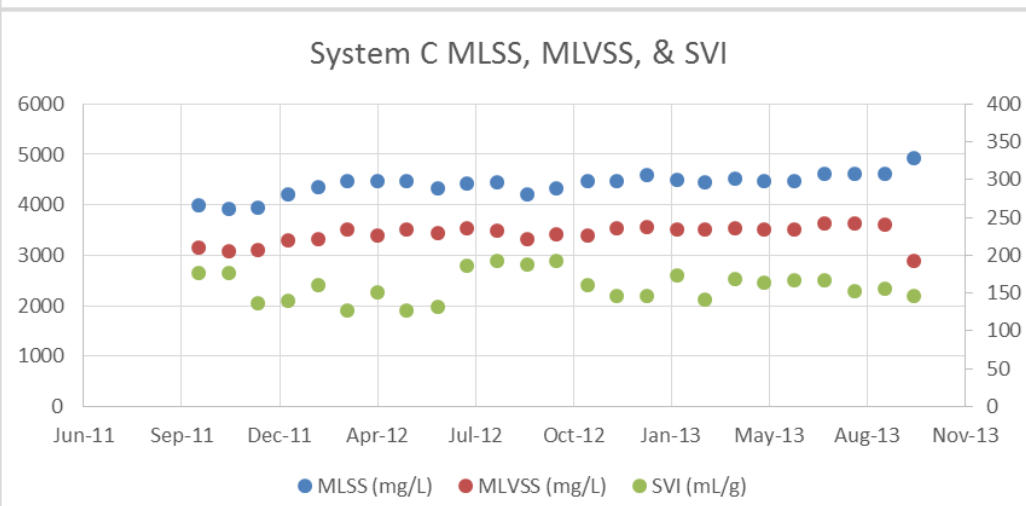

System A Secondary Effluent
20
18
16
14
12
10
8
6
4
2
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
NH3 (mg/L)
NO3 (mg/L)
TIN (mg/L)

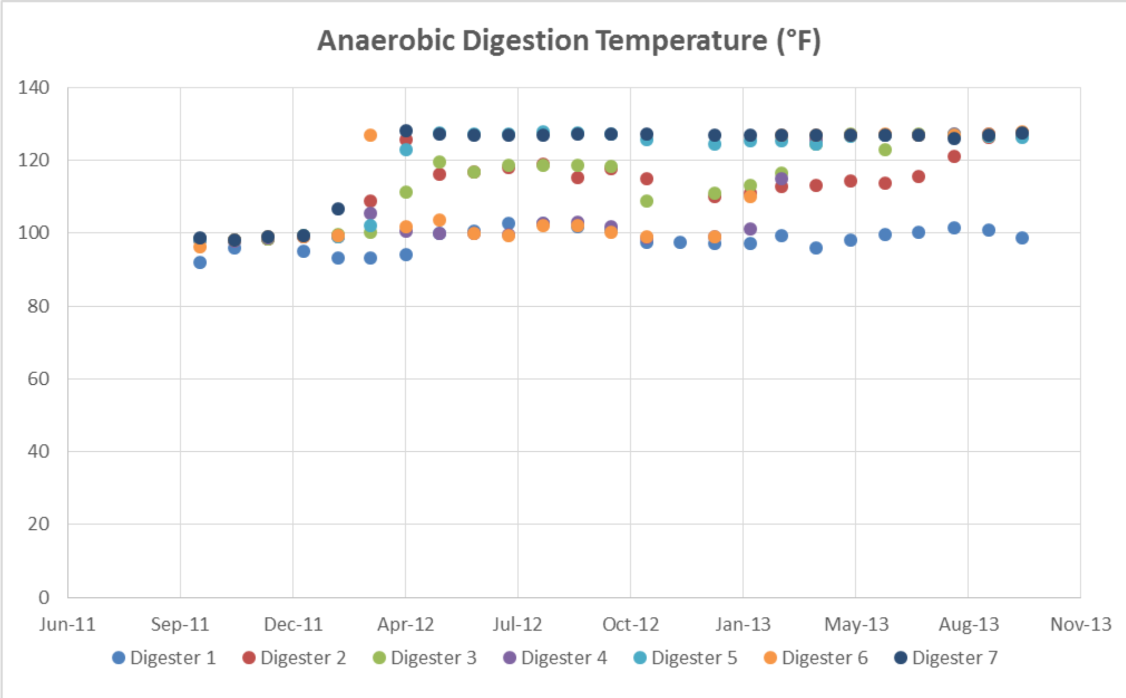

System B Secondary Effluent
20
18
16
14
12
10
8
6
4
2
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
NH3 (mg/L)
NO3 (mg/L)
TIN (mg/L)

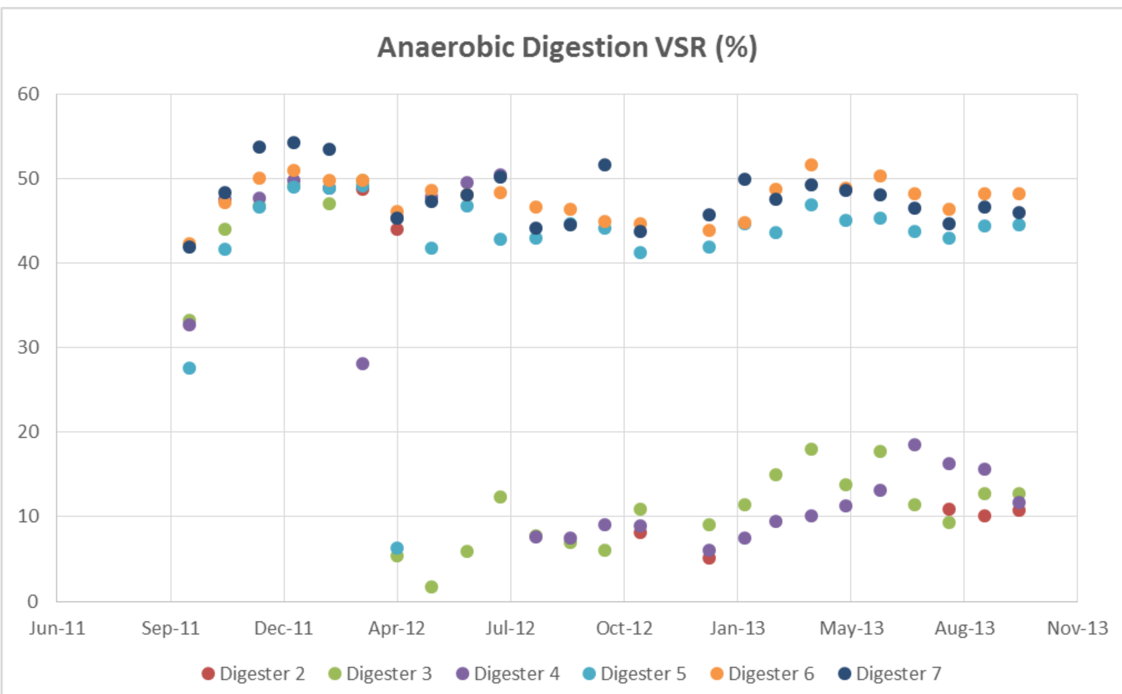

System C Secondary Effluent
20
18
16
14
12
10
8
6
4
2
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
NH3 (mg/L)
NO3 (mg/L)
TIN (mg/L)

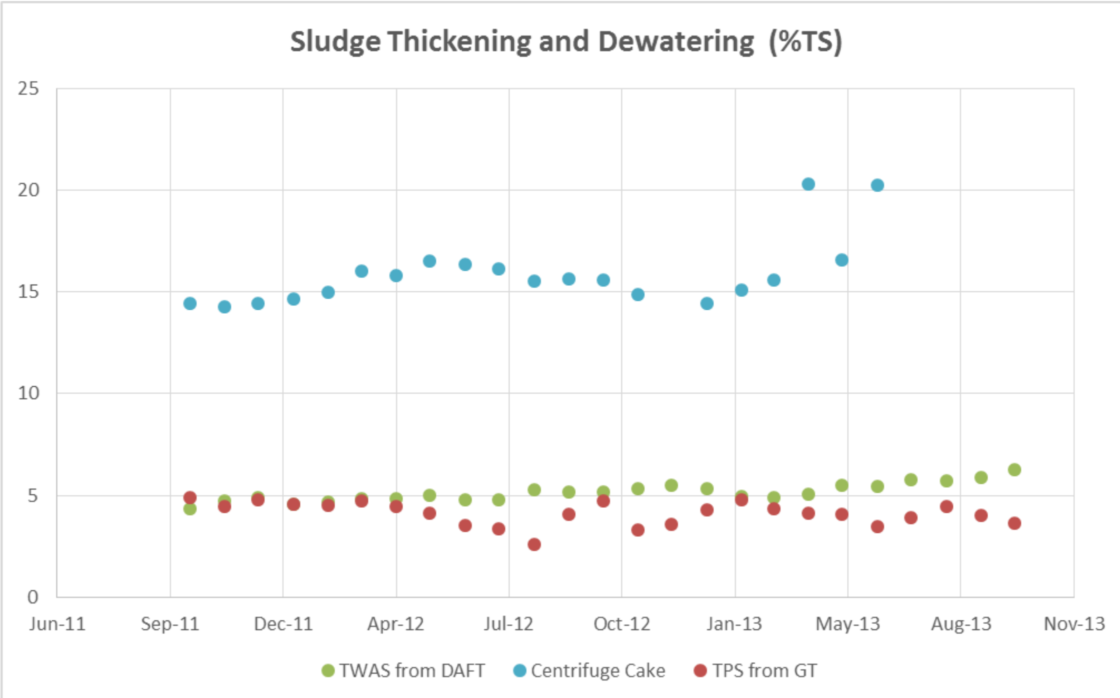

System A MLSS, MLVSS, & SVI
6000
5000
4000
3000
2000
1000
0
400
350
300
250
200
150
100
50
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
MLSS (mg/L)
MLVSS (mg/L)
SVI (mL/g)


System B MLSS, MLVSS, & SVI
6000
5000
4000
3000
2000
1000
0
400
350
300
250
200
150
100
50
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
MLSS (mg/L)
MLVSS (mg/L)
SVI (mL/g)


System C MLSS, MLVSS, & SVI
6000
5000
4000
3000
2000
1000
0
400
350
300
250
200
150
100
50
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
MLSS (mg/L)
MLVSS (mg/L)
SVI (mL/g)


Anaerobic Digestion Temperature (°F)
140
120
100
80
60
40
20
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
Digester 1
Digester 2
Digester 3
Digester 4
Digester 5
Digester 6
Digester 7


Anaerobic Digestion VSR (%)
60
50
40
30
20
10
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
Digester 2
Digester 3
Digester 4
Digester 5
Digester 6
Digester 7


Sludge Thickening and Dewatering (%TS)
25
20
15
10
5
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TWAS from DAFT
Centrifuge Cake
TPS from GT

# TM 6 RP-4 Future Plans

# IEUA Wastewater Facilities Master Plan
# TM 6 RP-4 Future Plans

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: CH2M HILL

DATE: April 2015

# Executive Summary

Regional Water Recycling Plant No. 4 (RP-4) began operation in 1997 and treats wastewater from the Cities of Rancho Cucamonga and Fontana, as well as unincorporated areas of San Bernardino County. RP-4 consists of liquid treatment facilities and sends solids to Regional Water Recycling Plant No. 1 (RP-1) for treatment.

The current and future flows and loads for RP-4 were estimated in *Technical Memorandum (TM) 4 Wastewater Flow and Loading Forecast*. An analysis of the influent wastewater characteristics at RP-4 was conducted to establish current average and peak influent flows, concentrations, and loads at the plant, and to develop flow and load projections for the 2035 planning year and the 2060 ultimate buildout year. These projections and the effluent requirements detailed in the Santa Ana Regional Water Quality Control Board (RWQCB) Order No. R8-2009-0021 were used to evaluate the existing capacities of the RP-4 liquid treatment facilities. The estimated capacities were then compared to the projected flow and loads to determine the RP-4 processes that require expansion within the 20-year planning period, and when those facilities would need to be online.

Due to the incorporation of septic flows into the Inland Empire Utilities Agency (IEUA) sewer system, RP-4 plant influent flows and loads are projected to increase substantially by 2035. Although the existing primary and secondary treatment processes at RP-4 have sufficient capacity to treat projected flows and loads through planning year 2035, the tertiary processes will need to be expanded. Additional filtration and disinfection units will be needed by 2035 to handle the increased flows and loads. The RP-4 Tertiary Expansion Project would expand the RP-4 tertiary treatment capacity beyond 14 mgd to match that of the primary and secondary treatment processes. The capital costs included in the 20-year CIP for this project are summarized in Table 6-1.

TABLE 6-1
**RP-4 Expansion Projects Capital Cost Estimate Summary**

| Component Description | RP-4 Tertiary Expansion Project |
|---|---|
| Total Direct Cost[a] | $2,160,000 |
| Total Estimated Construction Cost[b] | $3,622,000 |
| Total Estimated Project Costs | $4,709,000 |

[a] *Engineering-News Record* Construction Cost Index (ENR CCI) for Los Angeles (August 2014 - 10,737).
[b] Cost does not include escalation to midpoint of construction.
*The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. The Consultant Team has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. The Consultant Team cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.*

# 1.0 Background and Objectives

The objective of the Wastewater Facilities Master Plan (WFMP) is to plan IEUA’s wastewater treatment and conveyance improvements and develop a Capital Improvement Program (CIP). The capital program will guide IEUA in the development of major improvements to treatment and conveyance facilities. There are five goals for this TM:

- Summarize information from TMs 1 through 4 as it pertains to RP-4.
- Evaluate the current capacities and limitations of the existing facilities.

- Determine treatment facilities required to treat projected flows and loads through planning year 2035.
- Estimate timing and preliminary capital costs for plant expansion projects required during the 20-year planning period.

# 2.0 RP-4 Overview

RP-4 has been in operation since 1997 and serves the Cities of Rancho Cucamonga and Fontana, as well as unincorporated areas of San Bernardino County. It acts as an upstream satellite facility to RP-1 by scalping flow from the Etiwanda sewer, which is tributary to RP-1. RP-4 includes preliminary, primary, secondary, and tertiary liquid treatment facilities. The liquid facilities are permitted to treat an annual average flow of 14 million gallons per day (mgd) and produce an effluent quality meeting Title 22 standards for spray irrigation, nonrestricted recreational and landscape impoundments, and groundwater recharge. Solids produced at RP-4 are returned to the collection system and conveyed to RP-1 for treatment. A schematic of the RP-4 facility is shown in Figure 6-1.

Preliminary treatment at RP-4 includes screening that consists of two mechanical bar screens, influent pumping, flow measurement by magnetic flowmeter, and grit removal by two vortex-type grit chambers. As flow enters RP-4, it passes through the screening process and is pumped to the headworks splitter box, where it is split between two vortex grit basins. Foul air from the preliminary and primary treatment facilities is sent to a biofilter for treatment and discharge. Primary treatment consists of two circular primary clarifiers. Ferric chloride and polymer are added upstream to improve settling performance and reduce odors in the solids handling facilities.

Secondary treatment includes three parallel, multistage Bardenpho activated sludge treatment systems and three circular clarifiers. Each system consists of an anoxic basin and an aeration basin. Each aeration basin is divided into two trains; each train is further subdivided into four zones: an extended anoxic zone, oxic zone, anoxic zone, and oxic zone. Aerobic zones are equipped with fine bubble diffused air strips that are supplied with air by three centrifugal blowers. Tertiary treatment consists of coagulation/flocculation, filtration, and disinfection. Secondary effluent is split between two tertiary trains. In the first train, coagulation/flocculation and filtration processes are achieved using US Filter's "Trident" process. Alum is added upstream of an upflow "contra-clarifier" followed by dual media filtration. Effluent is sent to two chlorine contact basins operated in series. In the second train, alum is added upstream of three flocculation basins operated in series and followed by cloth disc filtration. Effluent is directed to a chlorine contact basin. Disinfection is achieved using sodium hypochlorite, and recycled water is pumped to the distribution system for reuse. Excess recycled water from RP-4 is conveyed to RP-1 where it is combined with effluent from RP-1, dechlorinated, and discharged. Further details of the facilities are summarized in *TM 1 Existing Facilities*.

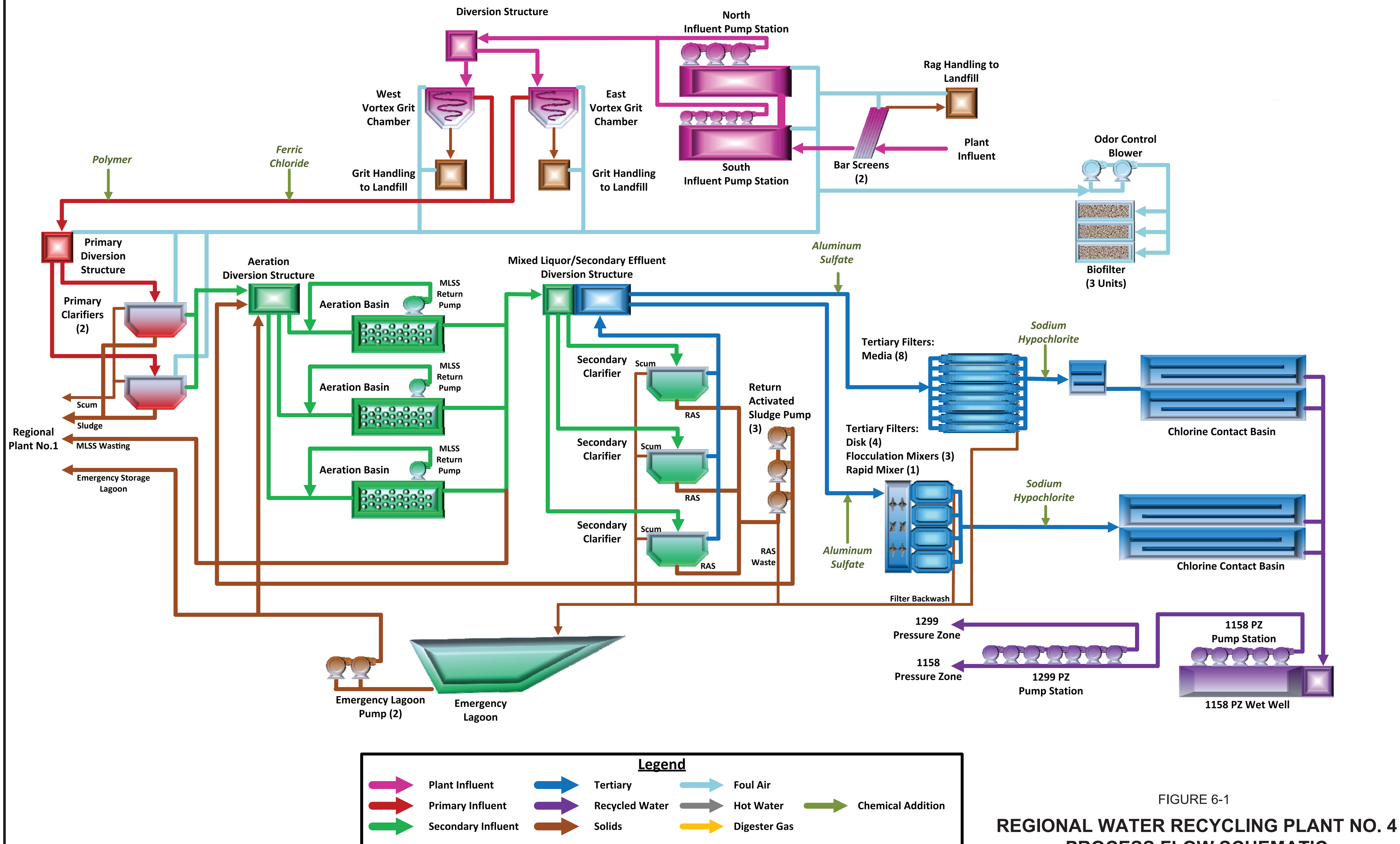



FIGURE 6-1

## REGIONAL WATER RECYCLING PLANT NO. 4
## PROCESS FLOW SCHEMATIC

INLAND EMPIRE UTILITIES AGENCY

*WASTEWATER FACILITIES MASTER PLAN*

20-IEUA-10-14F6-1-9370A00.AI

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# 3.0 Current and Future Flows and Loads

As presented in *TM 4 Wastewater Flow and Loading Forecast*, an analysis of the influent wastewater characteristics at RP-4 was conducted as part of this WFMP effort to establish current average and peak influent flows, concentrations, and loads at the plant and to develop flow and load projections for the 2035 planning year and 2060 ultimate buildout year. The data analysis is based on 2 consecutive years of recent data provided by IEUA for influent flow and key wastewater quality constituents including biological oxygen demand (BOD), total organic carbon (TOC), total suspended solids (TSS), ammonia (NH3-N), and total Kjeldahl nitrogen (TKN).

Flow projections were developed by the Integrated Water Resources Plan (IRP) Consultant and are based on the average influent wastewater flows measured during the flow monitoring period in November 2013 and projected through the year 2060 using population, employment, and land use information. As discussed in *TM 3 Regional Trunk Sewer Alternatives Analysis*, the WFMP planning effort is based on IEUA's preferred Flow Diversion Alternative 2, which includes diverting flows from Whispering Lakes and Haven Pump Stations to RP-1. The corresponding influent wastewater flow and loading projections under this alternative for the planning year 2035 form the basis of the master planning effort and treatment plant capacity evaluation presented herein. Projections are also presented for the 2060 ultimate buildout year; these projections are used for site planning considerations. Influent wastewater flows are projected to increase significantly at RP-4, largely due to the gradual incorporation of septic flows into the system between 2020 and 2060.

A summary of the current and projected average influent wastewater flows and loads for RP-4 are presented in Tables 6-2 and 6-3.

TABLE 6-2
**RP-4 Current and Projected Average Influent Wastewater Flows**

| | Current | 2035[a] | 2060[a,b] |
|---|---|---|---|
| Average Influent Flow (mgd) | 10.5 | 14.7 | 18.4 |

[a] Projections developed by IRP Consultant and IEUA based on November 2013 flow monitoring period. Reflects projected flows for IEUA preferred Flow Diversion Alternative 2 and includes septic flows tributary to RP-4.
[b] Site planning considerations are based on the projections established for the 2060 ultimate buildout planning year.

TABLE 6-3
**RP-4 Current and Projected Average Influent Wastewater Characteristics**

| | Current Concentration (mg/L) | Current Load (lb/day) | 2035 Load[a] (lb/day) | 2060 Load[a] (lb/day) |
|---|---|---|---|---|
| BOD | 352 | 30,543 | 43,207 | 54,082 |
| TSS | 318 | 27,630 | 38,948 | 48,752 |
| NH3-N | 41 | 3,550 | 5,010 | 6,271 |
| TKN | 59 | 5,015 | 7,186 | 8,994 |

[a] Load projections based on projected flows, concentrations, and load peaking factors presented in *TM 4 Wastewater Flow and Loading Forecast.*

mg/L = milligrams per liter
lb/day = pounds per day

# 4.0 Treatment Requirements

IEUA operates under an umbrella permit and must meet water quality requirements for discharge and recycled water.

## 4.1 Discharge Requirements

The tertiary effluent from RP-4 is discharged at Reach 1 of Cucamonga Creek (Discharge Point [DP] 002), regulated by RWQCB Order No. R8-2009-0021, which replaced Order No. 01-1 and Order No. 95-43, National Pollutant Discharge Elimination System (NPDES) No. CA 0105279. This permit is an umbrella permit governing all of IEUA's wastewater treatment plants (RP-1, RP-4, RP-5, and Carbon Canyon Water Recycling Facility [CCWRF]). It includes a stormwater discharge permit and the enforcement of an industrial pretreatment program. Effluent quality standards require tertiary treatment with filters and disinfection equivalent to Title 22 requirements for recycled water, due to the use of receiving waters for water contact recreation. A summary of the key effluent quality limits is provided in Table 6-4.

TABLE 6-4
**Summary of Effluent Quality Limits[a]**

| Parameter | Weekly Average | Monthly Average | Annual Average | Daily Maximum | Notes |
|---|---|---|---|---|---|
| BOD | 30 mg/L[b] | 20 mg/L[b] | - | - | 45 mg/L weekly average and 30 mg/L monthly average with 20:1 dilution. |
| TSS | 30 mg/L/[b] | 20 mg/[b] | - | - | |
| $NH_4$-N | - | 4.5 mg/L | - | - | |
| Chlorine Residual | - | - | - | 0.1 | Instantaneous maximum ceiling 2 mg/L |
| TIN | - | - | 8 mg/L | - | |
| TDS | - | - | 550 mg/L | - | Shall not exceed 12-month running average TDS concentration in water supply by more than 250 mg/L |
| Turbidity | - | - | - | - | 1. Daily average – 2 NTU<br>2. 5% maximum in 24 hr – 5 NTU<br>3. Instantaneous maximum – 10 NTU |
| Coliform | < 2.2 MPN | - | - | - | Maximum 23 MPN, once per month |
| pH | - | - | - | 6.5 – 8.5 | 99% compliance |
| Free Cyanide | - | 4.2 µg/L | - | 8.5 µg/L | |
| Bis(2-ethylhexyl) Phthalate | - | 5.9 µg/L | - | 11.9 µg/L | |
| Selenium | - | 4.1 µg/L | - | 8.2 µg/L | |

[a] RWQCB Order No. R8-2009-0021.
[b] Without 20:1 dilution and for recycled water.
TIN = total inorganic nitrogen
TDS = total dissolved solids
NTU = nephelometric turbidity unit(s)
MPN = most probable number
µg/L = micrograms per liter

## 4.2 Recycled Water Requirements

As mentioned previously, effluent from RP-1 and RP-4 is used as recycled water for irrigation and groundwater recharge via spreading in seven Phase I recharge basin sites and six Phase II recharge basin sites. Specifically, recycled water from RP-1 is discharged to a use area overlying Chino North "Max Benefit" Groundwater Management Zone (DP 005). Recycled water quality requirements for groundwater recharge are governed under RWQCB Order No. R8-2007-0039. Table I, Table II, and Table III in the permit provide concentration limits for many constituents of concern, such as inorganic chemicals, volatile organic chemicals, radionuclides, metals, and disinfection byproducts. Recycled water quality for irrigation is regulated by Order No. R8-2009-0021 and must meet the discharge requirements described in Table 6-4.

# 5.0 Existing Plant Capacity and Limitations

Existing facilities and the current plant performance were used as the basis for RP-4 process model development. A whole plant model was developed using PRO2D and calibrated based on plant influent data and plant operations data for the period between October 15, 2011, and October 15, 2013. This period was selected as the basis after a review of the influent and plant data to reflect a 2-year-long complete data set. Existing plant operation and the findings of the capacity evaluation through the use of process modeling are presented below for the liquid treatment facilities at RP-4.

## 5.1 Existing Plant Operation

A summary of RP-4 plant operations is provided in Table 6-5 for the liquid treatment and solids handling facilities. Unit process performance values were averaged over the evaluation period, with operating ranges noted. These values were used in development and calibration of the process models. Detailed data summaries for the evaluation period are provided in Appendix 6-A.

TABLE 6-5
**RP-4 Average Plant Operations Summary**

| Parameter | Value |
|---|---|
| ***Primary Treatment*** | |
| TSS Removal Rate (%) | 69 |
| TOC Removal Rate (%) | 38 |
| Primary Sludge (gpd) | 174,000 |
| ***Secondary Treatment*** | |
| MLSS (mg/L) | 4,600 |
| MLVSS (%) | 81 |
| RAS SS (mg/L) | 7,430 |
| Solids Inventory (klb) | 350 – 385 |
| Basins DO (mg/L) | 0.8 – 1.5 |
| WAS (mgd) | 0.050 – 0.194 |
| SVI (mL/g) | 193 |
| SRT (Basins Only) (day) | 46 – 190[a] |
| Residual Alkalinity (mg as $CaCO_3$/L) | 135 |

[a] Wide range of SRT values experienced due to solids wasting practices.
gpd = gallons per day
MLSS = mixed liquor suspended solids
MLVSS = mixed liquor volatile suspended solids
RAS = return activated sludge
SS = suspended solids
klb = kilopounds
DO = dissolved oxygen
WAS = waste activated sludge
mL/g = milliliters per gram
SVI = sludge volume index
SRT = solids retention time
$CaCO_3$/L = calcium carbonate per liter

A performance summary for the major treatment processes is presented in Table 6-6. These values, which represent the average over the evaluation period, were used in the subsequent plant process modeling and the capacity evaluations for the major treatment units. Detailed data summaries for the evaluation period are provided in Appendix 6-A.

TABLE 6-6
**RP-4 Average Plant Performance Summary**

| Parameter | Primary Effluent | Secondary Effluent |
|---|---|---|
| TOC (mg/L) | 120 | 4.2 |
| BOD (mg/L) | 217 | 1.2 |
| TSS (mg/L) | 91 | 3.5 |
| NH3-N (mg/L) | 30 | 0.2 |
| NO3-N (mg/L) | N/A | 4.2 |
| NO2-N (mg/L) | N/A | 0.1 |
| TIN (mg/L) | N/A | 4.5 |
| Alkalinity (mg as $CaCO_3$/L) | N/A | 135 |

NO3-N = nitrate as nitrogen
NO2-N = nitrite as nitrogen

The values in Table 6-6 are for the current operation, which includes secondary treatment with internal mixed liquor recycling, configured in an anoxic-oxic-anoxic-oxic biological nutrient removal (BNR) configuration with step feed capability, consisting of pre-anoxic tanks followed by plug flow reactors.

## 5.2 Existing Plant Capacity

### 5.2.1 Process Modeling

The capacity of the existing system was evaluated through process modeling using CH2M HILL's whole plant simulator, PRO2D. PRO2D is a process simulation model that takes into account the mass balances through an entire facility for particulate and soluble components and, similar to other commercially available process models, is based on the International Water Association (IWA) ASM2D biological process kinetics. The base model was constructed to reflect the actual facility setup, including flow splits and backwash. The process model facility setup flow diagram is presented in Figure 6-2. The model was constructed with the operations and performance criteria reflective of the evaluation period, and then calibrated to reflect the actual performance, solids yields, and water quality data.

As shown in Figure 6-2, the model was constructed to represent the actual plant operation for all the major process units. The model also allows establishing sizing and design considerations for each major unit process tankage and equipment. Similar to the actual operations, the plant model was built with the filter backwash and solids thickening recycles being returned to the main plant for further treatment, with the dewatering recycles being diverted offsite. The liquid and solids mass balances calculated for the current conditions allow calibration of the model against the actual field data. The calibrated model is then used to evaluate current capacity as well as establish expansion needs and process bottlenecks.

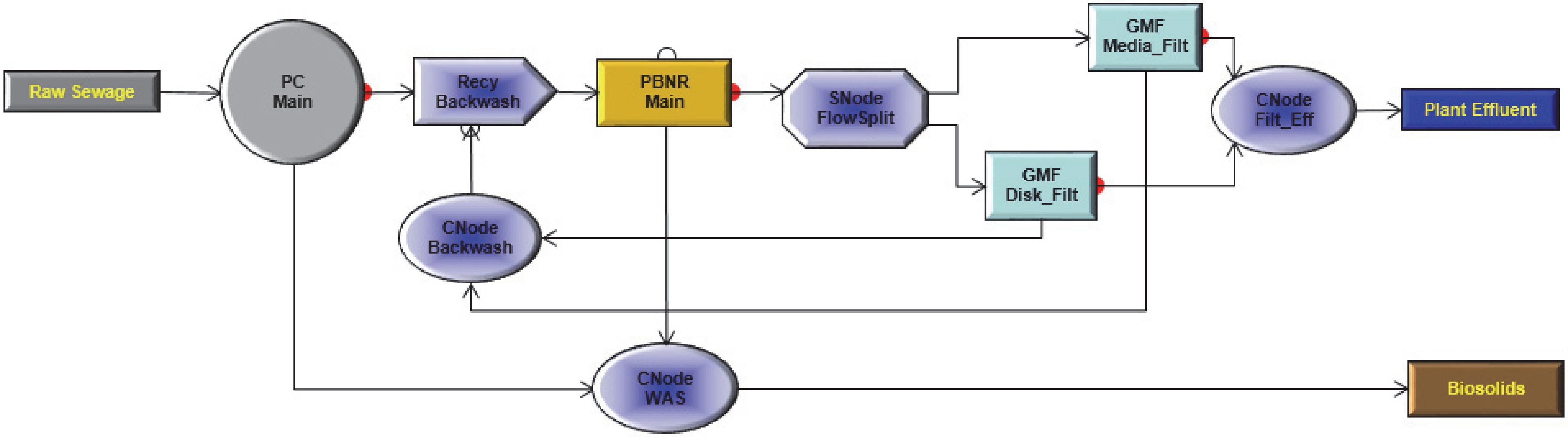


FIGURE 6-2
**RP-4 Process Model**
**Facility Setup**
INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

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The process model was constructed and calibrated using the current influent and operating data available for the facility. The purpose of the model calibration step is to establish a baseline condition that closely resembles current operations and provides a means to reliably predict operations and system limitations under different scenarios or alternatives. Key model calibration results are presented in Table 6-7. As the listed values show, the model was calibrated such that the simulation results are within a value range that is 5 percent or smaller as compared to the actual data. This level of accuracy will allow reliable capacity estimations to be made for the various capacity scenarios and future operation needs.

TABLE 6-7
**RP-4 Average Plant Performance Summary**

| Parameter | Actual Data Average Values | Model Results |
|---|---|---|
| Effluent BOD (mg/L) | 1.2 | 0.1 |
| Effluent TSS (mg/L) | <5 | <5 |
| Effluent TIN (mg/L) | 4.5 | 4.3 |
| Effluent Alkalinity (mg as $CaCO_3$/L) | 135 | 140 |
| MLSS Inventory (pounds [lb]) | 367,500 | 364,300 |
| Sludge Volatile Solids Content (%) | 81 | 80 |
| Total Waste Solids (Dry Solids lb/day) | 30,500 | 31,400 |

Subsequent process modeling using the calibrated model as the base model was conducted to evaluate the following scenarios:

- Current Plant Capacity
  - Liquid treatment capacity to meet 8-mg/L effluent TIN level under average and maximum month flow and load conditions
  - Liquid treatment capacity to meet 5-mg/L effluent TIN level under average and maximum month flow and load conditions
  - Solids generation rates under average and maximum month flow and load conditions
- Future capacity implications for the planning year 2035
- Future facility footprint implications for the planning years 2035 and 2060

Findings of the current plant capacity evaluation are presented next in this section. Future capacity needs are presented in Section 6.0.

### 5.2.2 Liquid Treatment Capacity

An evaluation of the liquid treatment capacity was conducted using the whole plant process model under both the average and maximum month conditions. The capacity evaluation was conducted based on achieving a plant effluent TIN concentration of 5 mg/L and 8 mg/L. As established at the onset of the project, the facility reliability and redundancy considerations are based on the IEUA’s overall wastewater treatment system, with RP-5 being the end-of-the-line facility receiving all flow diversions, if needed, from other Regional Water Recycling Plants. Since redundancy is provided by taking the largest unit out of service for each process at RP-5, the RP-4 plant capacity is based on all RP-4 units in service.

The facility has two primary clarifiers in service. The average hydraulic loading rates with two units in service are around 800 gallons per day per square foot (gpd/$ft^2$). If one unit needs to be taken out of service, especially under peak flow conditions, the primary clarifiers will be hydraulically loaded at 1,600 gpd/$ft^2$ or greater. Considering that flow diversion to RP-5 is available for times if a primary clarifier needs to be taken out of service, chemically enhanced primary treatment (CEPT) could be implemented under these conditions to avoid overloading the downstream secondary treatment system. The facility already has a ferric chloride system in place and injecting 16 mg/L ferric on average.

Process modeling showed that the liquid treatment capacity can be limited by the secondary treatment system. SVI values are reportedly greater than 190 mL/g, which indicates sludge settleability could be impaired at times. One limitation of the secondary treatment system was found to be the secondary clarification solids loading resulting from the current operations and the influent wastewater solids loading rates. Maintaining the SVI values at or below 150 mL/g is important for this reason also.

Waste solids (primary sludge and WAS) generated at RP-4 are diverted to RP-1 via the sewer system. For this reason, there are no solids handling recycles processed at this facility. RP-4 waste solids will continue to be diverted offsite. The solids are not continuously discharged, but maintained in the system; wasting is achieved intermittently.

Primary and secondary treatment capacity is presented in Table 6-8.

TABLE 6-8
**RP-4 Existing Primary/Secondary Process Capacity**

| | All Units in Service | One Unit Out of Service[a] |
|---|---|---|
| Plant Effluent TIN $\leq$ 8 mg/L | 16 mgd | 14 mgd |
| Plant Effluent TIN $\leq$ 5 mg/L | 14 mgd | 12 mgd |

[a] One secondary clarifier out of service.

The capacity of the RP-4 tertiary processes also were evaluated; the methodologies employed are consistent with those presented in the Title 22 Engineering Report (DDB Engineering, Inc. [DDB], 2009). The filters were designed based on a California Department of Public Health (CDPH) maximum filter loading rate of 5 gallons per minute per square foot (gpm/$ft^2$) for dual-media filters and 6 gpm/ $ft^2$ for cloth filters, with one dual-media filter cell in backwash and one cloth filter out of service. In order not to exceed the maximum approved filter loading rates, the maximum flow the filtration system can handle is 32.5 mgd. Applying a peak hourly wet weather peaking factor of 2.3, based on current plant data, the resulting average filtration capacity is 14.1 mgd. In the future, IEUA can adjust the wet weather peaking factor to a lower value by sending flow to the lagoon.

As described in Section 2.0, the disinfection system consists of the original Chlorine Contact Basins No. 1A and 1B and the expanded Chlorine Contact Basin No. 2. Basins 1A and 1B were designed based on Title 22 requirements with a minimum concentration and time (CT) value of 450 milligrams per minute per liter (mg-min/L) and a minimum modal contact time of 90 minutes during the peak hourly dry weather flow. Tracer testing conducted by IEUA at RP-4 in 2005 showed that Basins 1A and 1B can handle a peak flow of 14.3 mgd while maintaining a modal contact time of 90 minutes (DDB, 2009). Applying a peak hourly dry weather peaking factor of 2.0, the resulting average disinfection capacity of Basins 1A and 1B is 7.2 mgd.

Basin 2 was designed based on an annual average capacity of 7 mgd and estimated peak dry weather capacity of 14 mgd while providing 90 minutes modal contact time (DDB, 2009). The Title 22 Engineering Report indicated the actual modal contact time and capacity of Basin 2 needs to be confirmed by tracer testing. Thus, the overall average disinfection capacity of Basins 1A, 1B, and 2 is approximately 14.2 mgd. The results of the tertiary treatment capacity evaluation are summarized in Table 6-9.

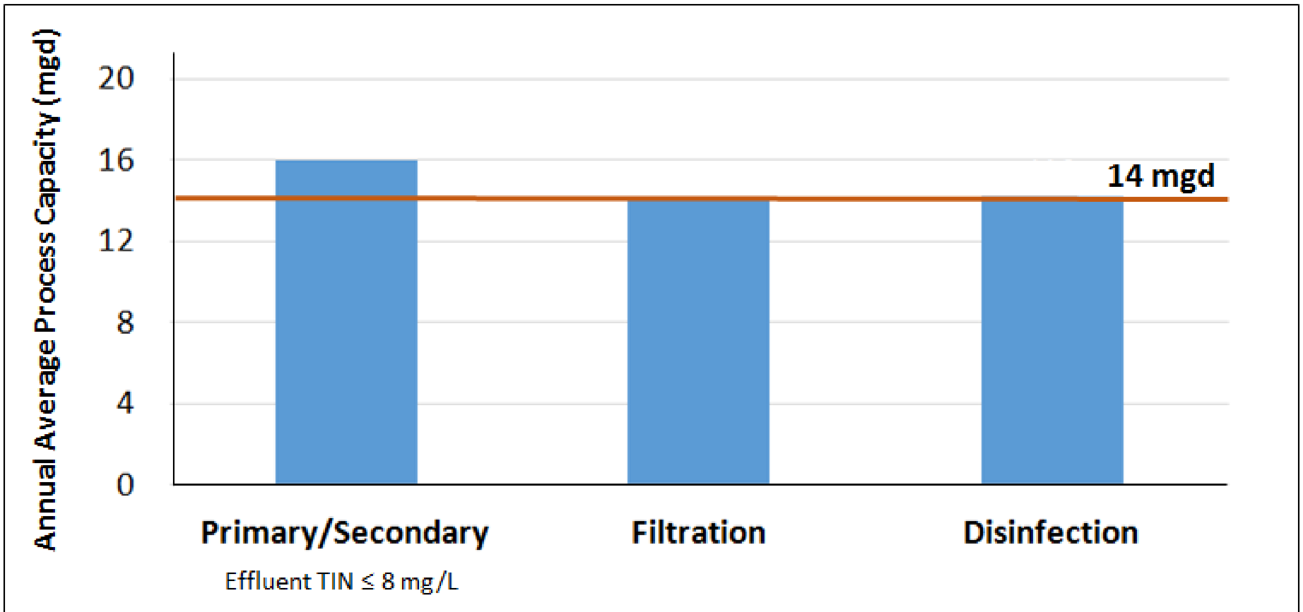
TABLE 6-9
**RP-4 Existing Tertiary Process Capacity**

| | All Units in Service | Two Filters Out of Service[a] |
|---|---|---|
| Average Filtration Capacity | 17.5 mgd | 14.1 mgd |
| Average Disinfection Capacity | 14.2 mgd | N/A |

[a] One dual-media filter cell in backwash and one cloth filter out of service.

The overall plant capacity is determined by its most limiting process capacity. For RP-4, the tertiary processes are limited to approximately 14 mgd. Therefore, the RP-4 plant capacity is approximately 14 mgd under the assumptions presented in this section including the system reliability and redundancy being provided at RP-5. The primary and secondary process capacity will be 14 mgd if one unit of service is considered to meet 8-mg/L effluent TIN. A summary of the individual process capacities in comparison to the overall plant capacity is depicted in Figure 6-3.

FIGURE 6-3
**RP-4 Existing Plant Capacity**




# 6.0 Plant Expansion Needs

The flow projections for the planning years 2035 and 2060 were established as described under Section 3.0 of this TM. Accordingly, 2035 flow projections will be the basis of facility expansion and the CIP planning effort, while the facilities needed for the 2060 flow conditions will constitute the basis of site planning. The corresponding planning flows are listed in Table 6-2.

## 6.1 Facility Expansion Requirements

For the 2035 capacity expansion requirements that will constitute the basis of the CIP planning, facility sizing was determined using the whole plant PRO2D process model developed and calibrated for the current operation and wastewater quality, and for future average and maximum month flow and load conditions. Accordingly, the capacity requirement at RP-4 is in the tertiary treatment facilities for the 2035 flow projections, considering the facility could meet 5-mg/L or 8-mg/L effluent TIN with all primary and secondary process units in service. The expansion requirements are summarized in Table 6-10.

TABLE 6-10
**RP-4 Facility Expansion Requirements for Planning Year 2035**

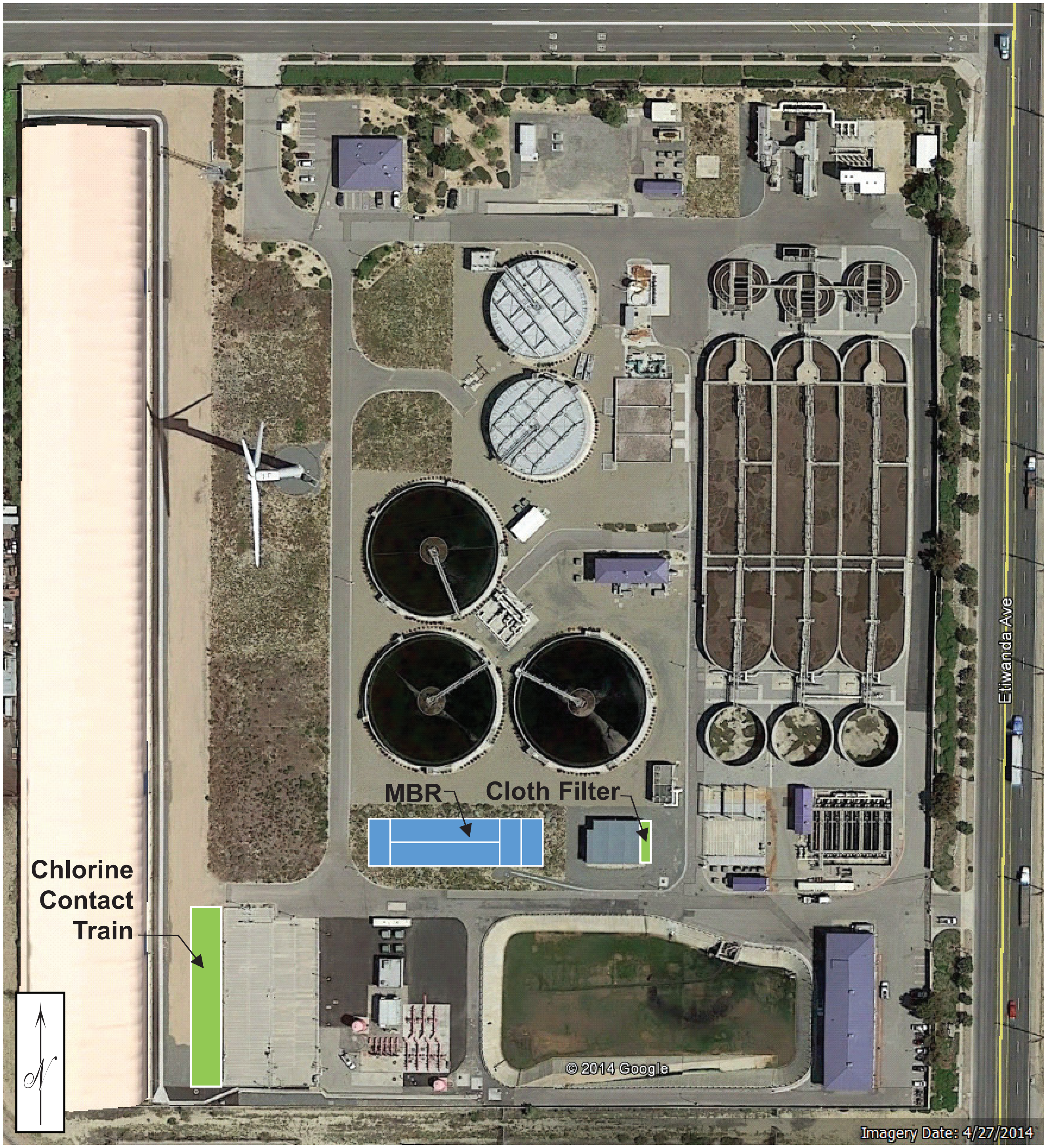
| Parameter | Size of New Units | Comments |
|---|---|---|
| Primary Clarifiers | - | No new units are needed. |
| Secondary Treatment | - | No new units are needed. |
| Tertiary Filters | 1 Cloth Filter | Same size as existing cloth filters, with 12 discs per filter. |
| Disinfection | 1 Train | Same size as existing Chlorine Contact Tank No. 2 train, with 3 passes or channels per train. |

## 6.2 Ultimate Facilities Site Plan

For ultimate site planning purposes, the facilities for the ultimate capacity increase were established and are presented in Figure 6-4. Facility sizing was determined using the whole plant PRO2D process model developed and calibrated for the current operation and wastewater quality, and for future average and maximum month flow and load conditions. Accordingly, the ultimate capacity needs include secondary treatment capacity expansion as well as tertiary treatment expansion, with RP-5 serving to provide reliability and redundancy for the system.

IEUA has decided to base the capacity expansion and footprint requirements on the membrane bioreactor (MBR) technology for RP-4. The benefits of the MBR technology for long term IEUA planning include small footprint requirements, elimination of secondary clarifiers as well as tertiary filters for recycled water production, superior water quality, and ability to produce thicker waste sludge compared to conventional technologies. Modular design capability of the MBR technology also allows stepwise expansion of the treatment facility to meet both load capacity and different effluent TIN requirements. Furthermore, the superior-quality effluent can be directly fed to a reverse osmosis (RO) system if IEUA needs to produce higher-quality effluent or reduce final effluent TDS. Therefore, a 4.5-mgd average capacity MBR train was included in site planning. This eliminates the need to implement filter expansion beyond planning year 2035.

No other site planning considerations were identified by the project team.




Aerial image © Google Earth, 2014. Annotation by CH2M HILL, 2014.

WT012215104SCO 480772.03.31.60.03 inland_empire_fig6_4.ai 1/15

FIGURE 6-4

**RP-4 Ultimate Facilities Site Plan**

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# 7.0 20-Year CIP Plant Expansion Projects and Capital Cost

One plant expansion project was identified during the 20-year CIP, the RP-4 Tertiary Expansion Project. Capital costs were estimated for the project and placed into the 20-year CIP. The planning-level capital costs for each process identified were developed based on cost curves established from previous projects and known direct costs for similar-sized projects. Additionally, several assumptions were made to estimate the total construction cost and total project costs for the expansion project. The assumptions included the following:

- The WFMP assumed a 20-year planning period.
- 10 percent of facilities subtotal for civil/site work.
- 0 to 5 percent of facilities subtotal for demolition depending on existing site conditions.
- 20 percent of facilities subtotal for electrical and instrumentation.
- 10 percent of total direct cost for contractor general conditions.
- 15 percent of total direct cost for contractor overhead and profit.
- 8 percent sales tax was applied to 50 percent of the total direct cost.
- 30 percent for construction contingency.
- 30 percent for engineering, construction management, environmental, and legal costs was applied to the total construction cost to estimate the total project cost.

The total construction cost and total project cost for the expansion project are summarized in Table 6-11. For planning purposes, the estimated costs for ultimate buildout improvements are also provided.

# 8.0 Conclusion

The following conclusions can be made from the evaluation of RP-4:

- RP-4 influent flows and loads are projected to increase substantially due to incorporation of septic flows tributary to RP-4.
- Primary and secondary treatment processes have sufficient capacity to treat projected liquid flows through the 20-year planning period.
- Additional filtration and disinfection capacity will be needed by 2035.

# 9.0 References

DDB Engineering, Inc. (DDB). 2009. *Inland Empire Utilities Agency Regional Plant No. 4 Title 22 Engineering Report.* September.

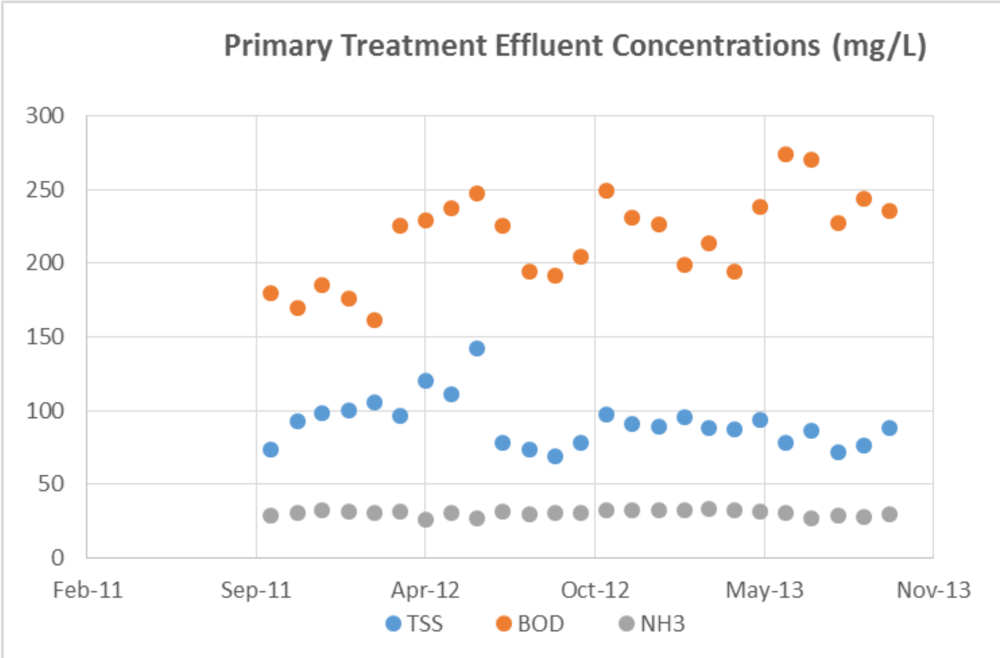
TABLE 6-11
**RP-4 Expansion Projects Capital Cost Estimate**

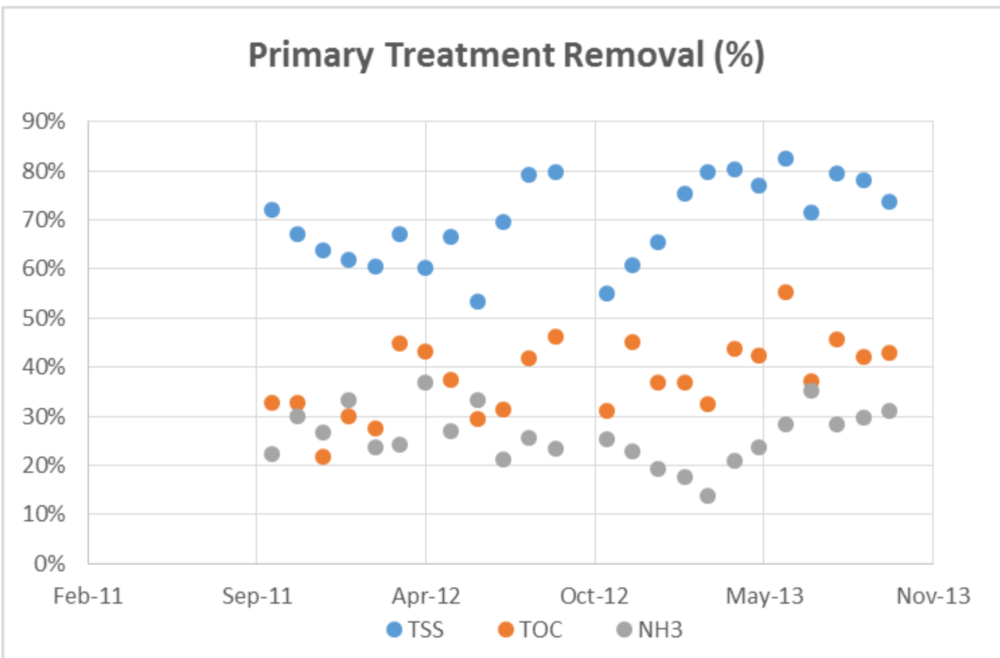
| Component Description | RP-4 Tertiary Expansion Project | RP-4 Ultimate Buildout Expansion Project |
|---|---|---|
| Secondary Treatment (MBR) – 4.5 mgd | | $19,900,000 |
| Filtration | $700,000 | |
| Chlorine Contact Basin | $900,000 | |
| **Facilities Subtotal** | **$1,600,000** | **$19,900,000** |
| Civil/Site Work (10%) | $160,000 | $1,990,000 |
| Demolition (5%) | $80,000 | $- |
| Electrical and Instrumentation (20%) | $320,000 | $3,980,000 |
| **Total Direct Cost[a]** | **$2,160,000** | **$25,870,000** |
| General Conditions (10%) | $216,000 | $2,587,000 |
| General Contractor Overhead and Profit (15%) | $324,000 | $3,881,000 |
| Sales Tax (8%)[b] | $86,000 | $1,035,000 |
| **Subtotal** | **$2,786,000** | **$33,373,000** |
| Construction Contingency (30%) | $836,000 | $10,012,000 |
| **Total Estimated Construction Cost[c]** | **$3,622,000** | **$43,385,000** |
| Engineering, Construction Management, Environmental, and Legal Costs (30%) | $1,087,000 | $13,016,000 |
| **Total Estimated Project Costs** | **$4,709,000** | **$56,401,000** |

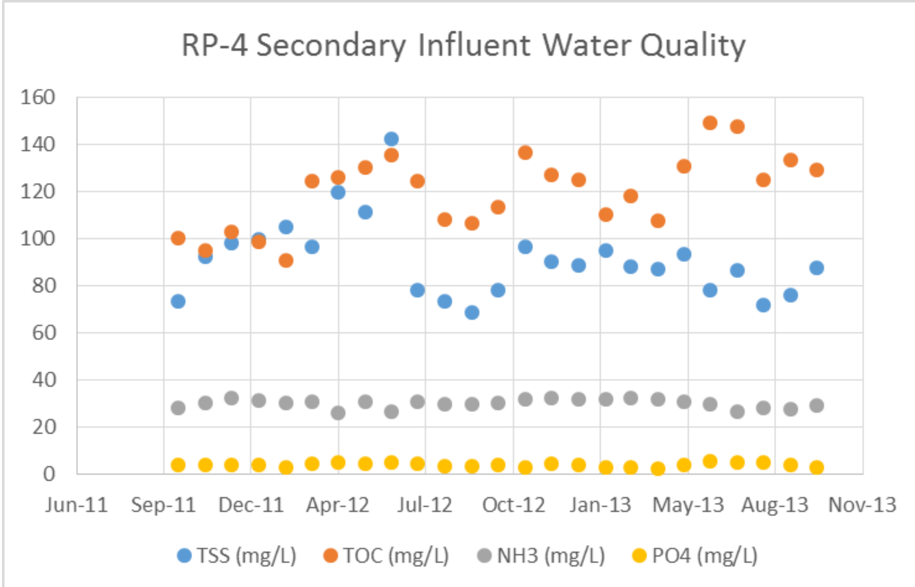
[a] *Engineering-News Record* Construction Cost Index (ENR CCI) for Los Angeles (August 2014 - 10,737).
[b] Calculated assuming 50% of direct costs are taxable.
[c] Cost does not include escalation to midpoint of construction.

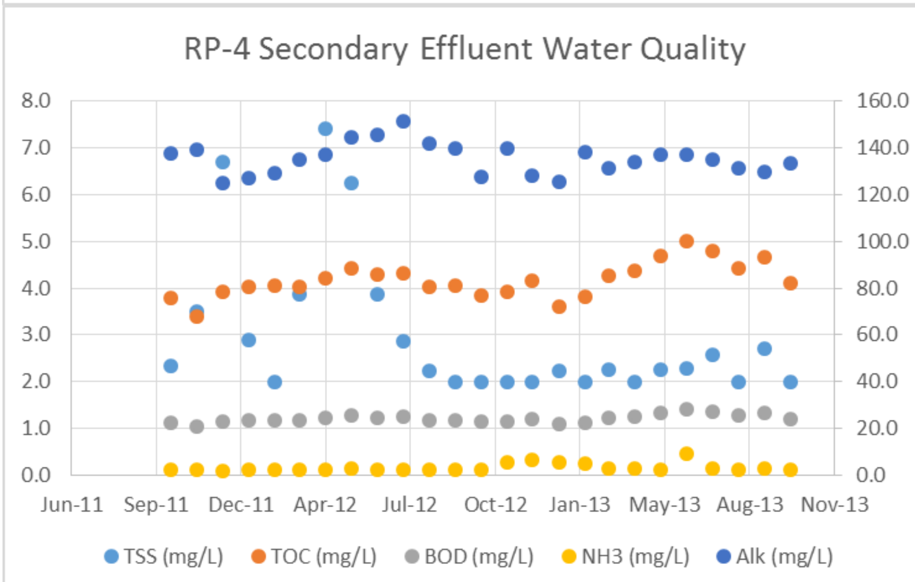
*The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. The Consultant Team has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. The Consultant Team cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.*

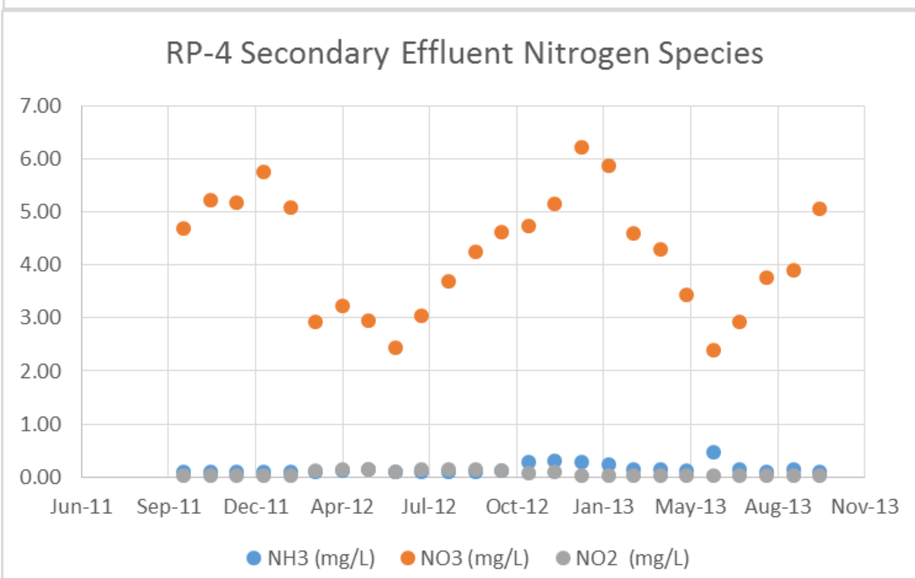
# Appendix 6-A
# RP-4 Plant Operations Summary (2011-2013)

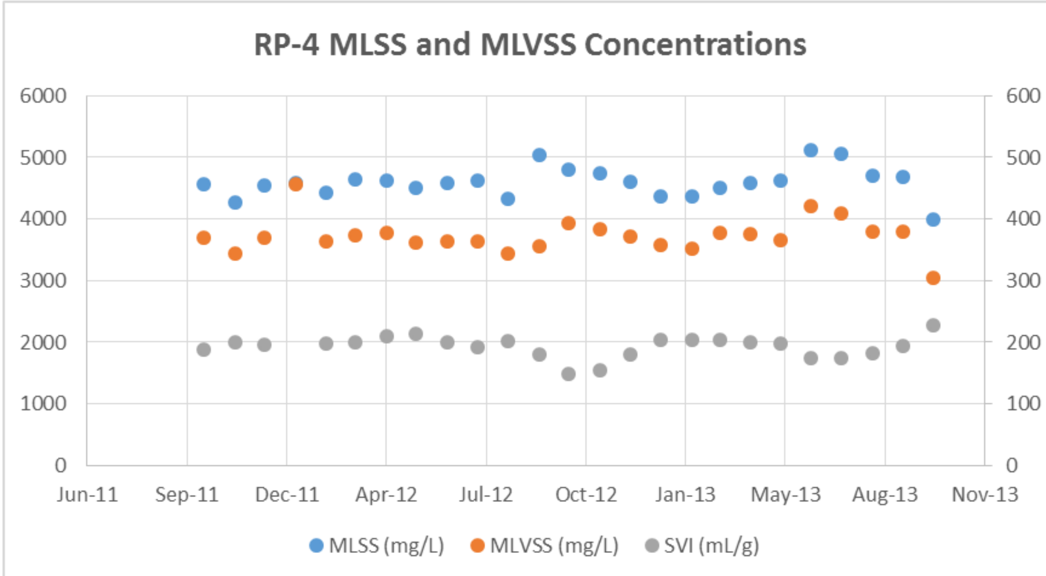

Primary Treatment Effluent Concentrations (mg/L)
300
250
200
150
100
50
0
Feb-11
Sep-11
Apr-12
Oct-12
May-13
Nov-13
TSS
BOD
NH3

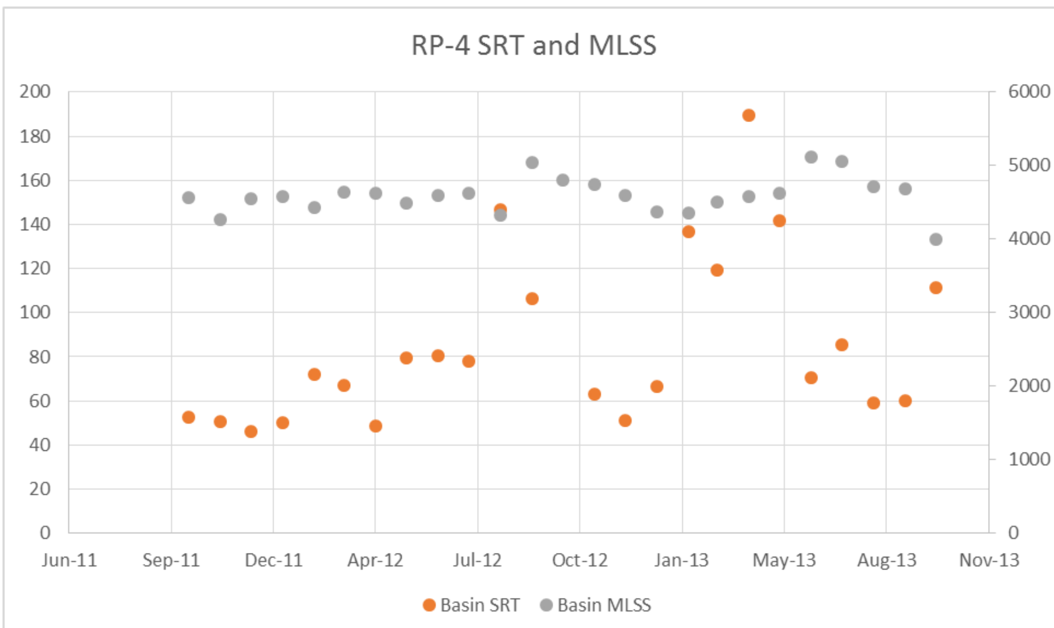

Primary Treatment Removal (%)
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Feb-11
Sep-11
Apr-12
Oct-12
May-13
Nov-13
TSS
TOC
NH3


RP-4 Secondary Influent Water Quality
160
140
120
100
80
60
40
20
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
NH3 (mg/L)
PO4 (mg/L)


RP-4 Secondary Effluent Water Quality
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
TSS (mg/L)
TOC (mg/L)
BOD (mg/L)
NH3 (mg/L)
Alk (mg/L)


RP-4 Secondary Effluent Nitrogen Species
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
NH3 (mg/L)
NO3 (mg/L)
NO2 (mg/L)


RP-4 MLSS and MLVSS Concentrations
6000
5000
4000
3000
2000
1000
0
600
500
400
300
200
100
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
MLSS (mg/L)
MLVSS (mg/L)
SVI (mL/g)


RP-4 SRT and MLSS
200
180
160
140
120
100
80
60
40
20
0
6000
5000
4000
3000
2000
1000
0
Jun-11
Sep-11
Dec-11
Apr-12
Jul-12
Oct-12
Jan-13
May-13
Aug-13
Nov-13
Basin SRT
Basin MLSS

# TM 7 RP-5 and RP-2 Complex Future Plans

# IEUA Wastewater Facilities Master Plan
# TM 7 RP-5 and RP-2 Complex Future Plans

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: Carollo Engineers, Inc.

REVIEWED BY: CH2M HILL

DATE: April 2015

# Executive Summary

Regional Water Recycling Plant No. 2 (RP-2) and Regional Water Recycling Plant No. 5 (RP-5) are located approximately 1 mile from each other. RP-5 treats wastewater from the Cities of Chino, Chino Hills, Ontario, Montclair, and Upland. RP-2 treats solids from RP-5 and Carbon Canyon Water Recycling Facility (CCWRF). Due to the United States Army Corps of Engineers (USACE) decision to raise the elevation of the Prado Dam, all facilities at RP-2 need to be abandoned and moved to RP-5. The liquid treatment capacity was relocated in March 2004; the solids facilities will be relocated during the 20-year planning period. This technical memorandum (TM) evaluates potential locations for the RP-2 solids facilities at RP-5, identifies RP-5 plant expansion projects within the 20-year planning period, and provides preliminary capital cost estimates for the projects. Information from this TM will be incorporated into the updated 20-year Capital Improvement Program (CIP).

The current and future flows and loads for RP-5 were estimated in *TM 4 Wastewater Flow and Loading Forecast*. An analysis of the influent wastewater characteristics at RP-5 was conducted to establish current average and peak influent flows, concentrations, and loads at the plant, and to develop flow and load projections for the 2035 planning year and the 2060 ultimate buildout year. The influent flow and loading projections and the effluent requirements detailed in the Santa Ana Regional Water Quality Control Board (RWQCB) Order No. R8-2009-0021 were used to evaluate the existing capacities of the RP-5 liquid treatment facilities. The estimated capacities were then compared to the projected flow and loads to determine the RP-5 facilities that require expansion within the 20-year planning period, and when those facilities would need to be online.

Two plant expansion projects were identified during the 20-year CIP: the RP-5 Solids Handling Facilities Project and the RP-5 Expansion Project. The RP-5 Solids Handling Facilities Project would relocate solids handling facilities from RP-2 to RP-5, demolish RP-2 facilities, and relocate the RP-2 Lift Station to a location above the flood plain. This project would include the construction of thickening, digestion, dewatering, and ancillary facilities at RP-5. A nonmonetary evaluation of potential sites for the solids handling facilities identified the eastern side of the RP-5 site as the most favorable location for the solids handling facilities. The RP-5 Expansion Project would expand the RP-5 liquid treatment capacity from 15 million gallons per day (mgd) to 22.5 mgd, and would include the construction of primary treatment, a membrane bioreactor (MBR), disinfection, and ancillary facilities. The capital costs included in the 20-year CIP for these projects are summarized in Table 7-1.

The evaluation of RP-2 and RP-5 identified three main conclusions:

- Solids handling facilities will need to be relocated from RP-2 to RP-5 within the 20-year planning period.
- The location along the east side of the RP-5 site (Alternative 2) is the most favorable due to its location near the liquid treatment facilities and minimal impacts on the existing solar facilities.
- The RP-5 liquid treatment facilities will need to be expanded during the 20-year planning period.

TABLE 7-1
**RP-5 Expansion Projects Capital Cost Estimate Summary**

| Component Description | RP-5 Solids Handling Facilities Project[a] | RP-5 Expansion Project |
|---|---|---|
| Total Direct Cost[b] | $59,605,000 | $47,580,000 |
| Total Estimated Construction Cost[c] | $99,958,000 | $79,791,000 |
| Total Estimated Project Costs | $129,945,000 | $103,728,000 |

[a] Costs include the demolition of the RP-2 facility, which is estimated to range between $7 million and $10 million assuming removal of all assets (above and below ground) and grading to match surrounding contours.
[b] *Engineering-News Record* Construction Cost Index (ENR CCI) for Los Angeles (August 2014 - 10,737).
[c] Cost does not include escalation to midpoint of construction.

*The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. The Consultant Team has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. The Consultant Team cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.*

# 1.0 Background and Objectives

Currently, RP-5 consists of liquid treatment facilities and sends primary and secondary solids to RP-2 for treatment. RP-2 only operates the solids handling facilities and accepts primary and secondary solids from CCWRF and RP-5. RP-2 was constructed in the 1960s and was purchased from the city of Chino at the onset of the regional wastewater program. Due to the USACE decision to raise the elevation of the Prado Dam, the RP-2 liquid treatment capacity was relocated to RP-5, which began operation in March 2004. The Inland Empire Utilities Agency (IEUA) decided to continue to use the RP-2 solids handling facilities until the end of their useful lives because they were constructed in 1990 and were above the 100-year flood plain at the time. Since that decision was made, USACE has decided to raise the Prado Dam. When the Prado Dam elevation change is complete, the RP-2 solids handling facilities will then be at risk of being inundated by a flood because they will be below the new 100-year flood elevation.

The objective of the Wastewater Facilities Master Plan (WFMP) is to plan IEUA's wastewater treatment and conveyance improvements and develop a capital program. The capital program will guide IEUA in the development of major improvements to their treatment and conveyance facilities. There are five specific goals for this TM:

- Summarize information from TMs 1 through 4 as it pertains to RP-2 and RP-5.
- Evaluate the current capacities and limitations of the existing facilities.
- Evaluate three location alternatives for the relocation of RP-2 solids handling facilities to RP-5.
- Determine treatment facilities required to treat predicted flows and loads through the planning year 2035.
- Estimate timing and preliminary capital costs for plant expansion projects required during the 20-year planning period.

# 2.0 RP-5/RP-2 Overview

## 2.1 RP-2

Solids from RP-5 and CCWRF are processed in the RP-2 solids handling facilities. Facilities include thickening, stabilization, and dewatering processes. A schematic of the RP-2 facility is shown in Figure 7-1 There are two thickening processes in operation at RP-2: gravity thickening for primary solids, and dissolved air flotation (DAF) thickening for secondary solids. Thickened biosolids are stabilized in a two-stage anaerobic digestion process, consisting of mesophilic-acid and mesophilic stages. Methane gas produced is sent to the cogeneration facility, while biosolids are dewatered using belt filter presses or centrifuges and loaded onto trucks for delivery to the Inland Empire Regional Composting Facility for composting.

RP-2 also includes the RP-2 Lift Station. The lift station pumps solids processing recycle flows and raw sewage flows to the RP-5 headworks for treatment. The solids processing recycle flows are from the RP-2 thickening and dewatering processes. The raw sewage flows are from the portion of the collection system tributary to RP-2 that cannot flow by gravity to RP-5. These flows have been pumped to RP-5 since RP-2 liquid treatment facilities were abandoned after RP-5 was placed into service.

Further details on the facilities are summarized in *TM 1 Existing Facilities*.

## 2.2 RP-5

Liquid treatment facilities at RP-5 include influent pumping, and preliminary, primary, secondary, and tertiary treatment; these facilities are designed to treat an annual average flow of 15 mgd plus 1.3 mgd of return flows from the RP-2 Lift Station. Recycled water is discharged to IEUA's recycled water distribution system for landscape irrigation and other approved recycled water uses. Recycled water in excess of demand is dechlorinated and discharged to Chino Creek. A schematic of the RP-5 facility is shown in Figure 7-2.

Preliminary treatment includes screening and grit removal. Wastewater passes through the screening process, which consists of one manual and two mechanical bar screens. The screened influent is conveyed to one vortex grit basin. Foul air from preliminary and primary treatment facilities is sent to a biofilter for treatment and discharge. Primary treatment consists of two, 100-foot-diameter, circular primary clarifiers and a primary effluent emergency storage basin. The clarifiers are center-feed, peripheral-draw-off with sludge hoppers and scum removal. They have a common sludge and scum pump station, which pumps solids to RP-2 for processing.

Secondary treatment includes two parallel two-stage biological nutrient removal (BNR) activated sludge treatment trains and four circular secondary clarifiers. Aerobic zones are equipped with fine bubble diffused aeration panels supplied by two centrifugal blowers. Tertiary treatment consists of coagulation/flocculation, filtration, and disinfection. Secondary effluent is fed to a rapid mix basin, where alum is added upstream of four flocculation basins operated in series, and followed by 12 upflow, continuous backwash filters. Effluent is sent to a chlorine contact basin and then conveyed to the Recycled Water Pump Station. Disinfection is achieved using sodium hypochlorite; recycled water is pumped to the distribution system for reuse, or dechlorinated and discharged to Chino Creek. Further details of the facilities are summarized in *TM 1 Existing Facilities*.

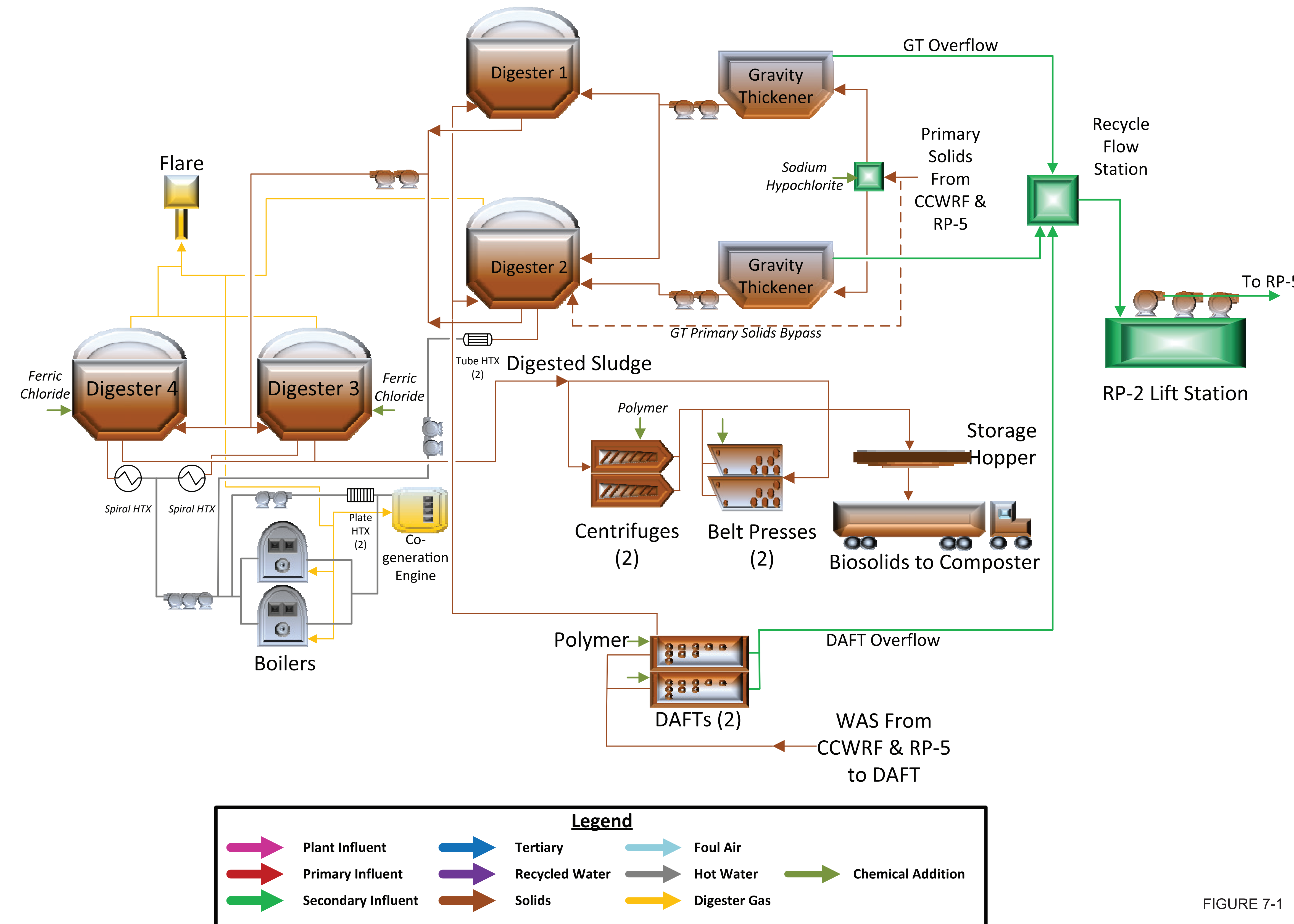



FIGURE 7-1

**REGIONAL WATER RECYCLING PLANT NO. 2**
**PROCESS FLOW SCHEMATIC**

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*WASTEWATER FACILITIES MASTER PLAN*

20-IEUA-10-14F7-1-9370A00.AI

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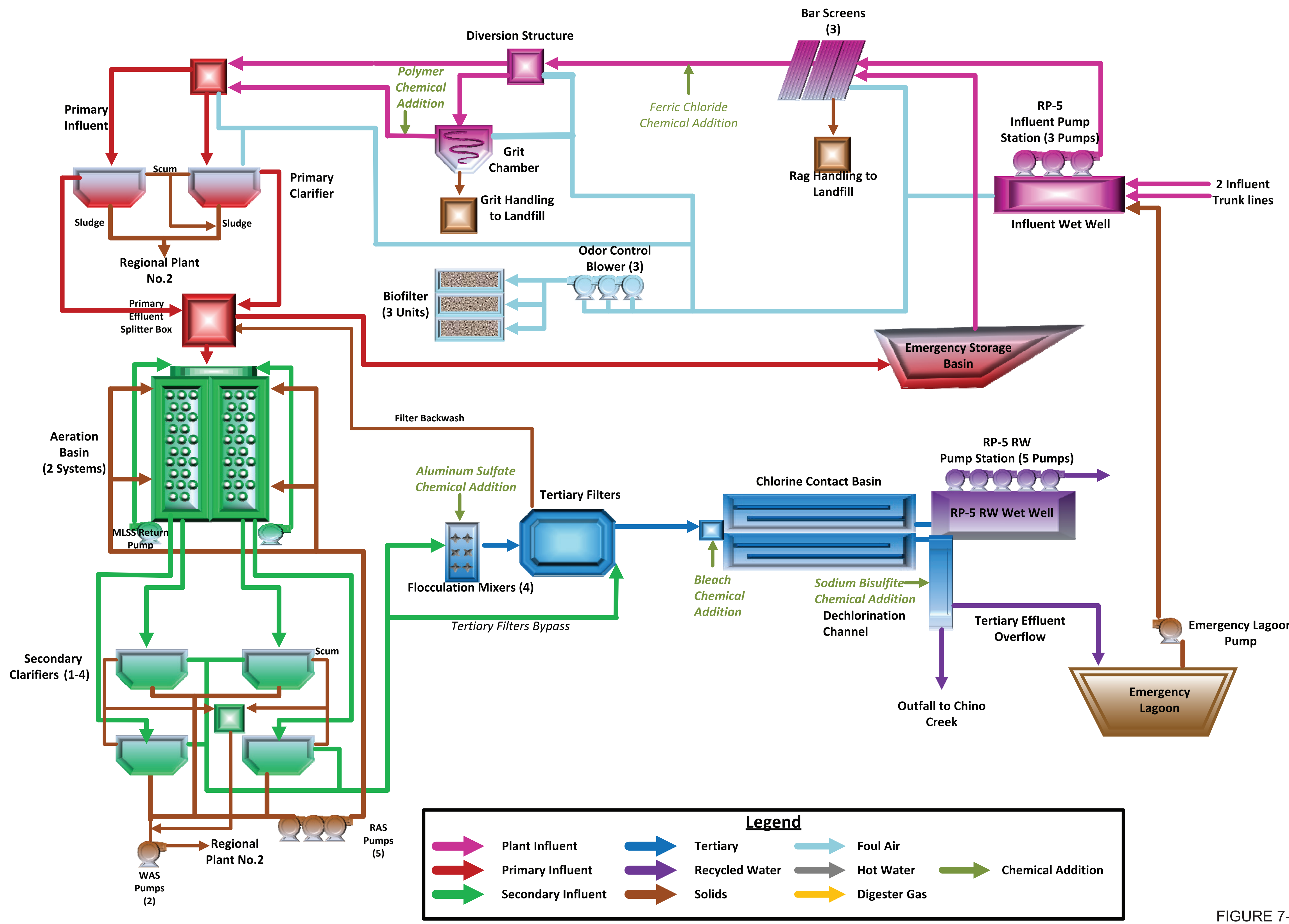


FIGURE 7-2

**REGIONAL WATER RECYCLING PLANT NO. 5**
**PROCESS FLOW SCHEMATIC**

INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

20-IEUA-10-14F7-2-9370A00.AI

# 3.0 Current and Future Flows and Loads

As presented in *TM 4 Wastewater Flow and Loading Forecast*, an analysis of the influent wastewater characteristics at RP-5 was conducted as part of this WFMP effort in order to establish current average and peak influent flows, concentrations, and loads at the plant, and to develop flow and load projections for the 2035 planning year and 2060 ultimate buildout year. The data analysis is based on two consecutive years of recent data provided by IEUA for influent flow, and key wastewater quality constituents including biological oxygen demand (BOD), total organic carbon (TOC), total suspended solids (TSS), ammonia as nitrogen (NH3-N), and total Kjeldahl nitrogen (TKN).

Flow projections were developed by the Integrated Resources Plan (IRP) Consultant and are based on the average influent wastewater flows measured during the flow monitoring period in November 2013 and projected through the year 2060 using population, employment, and land use information. As discussed in *TM 3 Regional Trunk Sewer Alternatives Analysis*, the WFMP planning effort is based on IEUA's preferred Flow Diversion Alternative 2, which includes diverting flows from Whispering Lakes and Haven pump stations to RP-1. At the request of IEUA and as a subset of Alternative 2, the impact on RP-5 flow projections with both the Whispering Lakes and Haven pump stations offline was also evaluated. Under this scenario, the flows from each of these tributary areas would be conveyed to RP-5 rather than to RP-1. In order to provide greater system reliability and redundancy, RP-5 facilities planning assumes that both pump stations are offline. The influent wastewater flow and loading projections under this scenario for the planning year 2035 form the basis of the master planning effort and treatment plant capacity evaluation presented herein. Projections are also presented for the 2060 ultimate buildout year; these projections are used for site planning considerations. Influent wastewater flows are projected to more than double by the year 2060 at RP-5 as a result of population growth in Chino and other areas served by RP-5.

Summaries of the current and projected average influent wastewater flows and loads for RP-5 are presented in Tables 7-2 and 7-3. The RP-5 flow and load projections for the two scenarios (pump stations online and pump stations offline) are also presented.

TABLE 7-2
**RP-5 Current and Projected Average Influent Wastewater Flows**

| | **Current** | **2035**[a] | **2060**[a,b] |
|---|---|---|---|
| Flow w/ Pump Stations Online (mgd)[c] | 10.0 | 18.4 | 25.3 |
| Flow w/ Pump Stations Offline (mgd) | 10.0 | 20.2 | 27.2 |

[a] Projections developed by IRP Consultant and IEUA based on November 2013 flow monitoring period. Reflects projected flows for IEUA preferred Flow Diversion Alternative 2.
[b] Site planning considerations are based on the projections established for the 2060 ultimate buildout planning year.
[c] Assumes Whispering Lakes pump station and Haven pump station are online and conveying flow to RP-1.The projected flow for each lift station in 2035 is 1.6 mgd (Whispering Lakes pump station) and 0.2 mgd (Haven pump station).

TABLE 7-3
**RP-5 Current and Projected Average Influent Wastewater Characteristics**

| | | | Pump Stations Online[a,b] | | Pump Stations Offline[a,c] | |
|---|---|---|---|---|---|---|
| | Current Concentration (mg/L) | Current Load (lb/day) | 2035 Load (lb/day) | 2060 Load (lb/day) | 2035 Load (lb/day) | 2060 Load (lb/day) |
| BOD | 321 | 27,771 | 49,290 | 67,774 | 54,112 | 72,864 |
| TSS | 267 | 23,181 | 40,964 | 56,326 | 44,972 | 60,556 |
| NH3-N | 35 | 3,005 | 5,422 | 7,456 | 5,953 | 8,016 |
| TKN | 52 | 4,602 | 8,036 | 11,050 | 8,823 | 11,880 |

[a] Load projections based on projected flows, concentrations, and load peaking factors presented in TM 4.
[b] Assumes Whispering Lakes pump station and Haven pump station are online and conveying flow to RP-1.
[c] Assumes Whispering Lakes pump station and Haven pump station are offline with flow conveyed by gravity to RP-5.
mg/L – milligrams per liter
lb/day – pounds per day

# 4.0 Treatment Requirements

IEUA operates under an umbrella permit and must meet water quality requirements for discharge and recycled water.

## 4.1 Discharge Requirements

The tertiary effluent from RP-5 is discharged at Reach 1B of Chino Creek (Discharge Point [DP] 003), regulated by RWQCB Order No. R8-2009-0021, which replaced Order No. 01-1 and Order No. 95-43, National Pollutant Discharge Elimination System (NPDES) No. CA 0105279. This permit is an umbrella permit, governing all of IEUA's wastewater treatment plants (RP-1, RP-4, RP-5, and CCWRF). It includes a stormwater discharge permit and the enforcement of an industrial pretreatment program. Effluent quality standards require tertiary treatment with filters and disinfection equivalent to Title 22 requirements for recycled water, due to the use of receiving waters for water contact recreation. A summary of main effluent quality limits is provided in Table 7-4.

## 4.2 Recycled Water Requirements

Recycled water from RP-5 is used for irrigation in the area overlying Chino North "Max Benefit" Groundwater Management Zone (DP 007). Recycled water quality requirements are governed under RWQCB Order No. R8-2009-0021 and must meet the discharge requirements set forth in Table 7-4.

TABLE 7-4
**Summary of Effluent Quality Limits for RP-5[a]**

| Parameter | Weekly Average | Monthly Average | Annual Average | Daily Maximum | Notes |
|---|---|---|---|---|---|
| BOD | 30 mg/L[b] | 20 mg/L[b] | - | - | 45 mg/L weekly average and 30 mg/L monthly average with 20:1 dilution. |
| TSS | 30 mg/L[b] | 20 mg/L[b] | - | - | |
| $NH_4$-N | - | 4.5 mg/L | - | - | |
| Chlorine Residual | - | - | - | 0.1 | Instantaneous maximum ceiling 2 mg/L |
| TIN | - | - | 8 mg/L | - | |
| TDS | - | - | 550 mg/L | - | Shall not exceed 12-month running average TDS concentration in water supply by more than 250 mg/L |
| Turbidity | - | - | - | - | 1. Daily average – 2 NTU<br>2. 5% maximum in 24 hours – 5 NTU<br>3. Instantaneous maximum – 10 NTU |
| Coliform | < 2.2 MPN | - | - | - | Max 23 MPN, once per month |
| pH | - | - | - | 6.5 – 8.5 | 99% compliance |
| Free Cyanide | - | 4.6 µg/L | - | 7.3 µg/L | |
| Bromodichloro-methane | - | 46 µg/L | - | 92 µg/L | |

[a] RWQCB Order No. R8-2009-0021.
[b] Without 20:1 dilution and for recycled water.
TIN – total inorganic nitrogen
TDS – total dissolved solids
$NH_4$-N – ammonia as nitrogen
NTU – nephelometric turbidity unit(s)
MPN – most probable number
µg/L – micrograms per liter

# 5.0 Existing Plant Capacity and Limitations

Existing facilities and current plant performance were used as the basis for RP-5/RP-2 process model development. A whole plant model was developed using PRO2D and calibrated based on plant influent data and plant operations data for the period between October 15, 2011, and October 15, 2013. This period was selected as the basis after a review of the influent and plant data to reflect a 2-year-long complete data set. Existing plant operation and the findings of the capacity evaluation through the use of process modeling are presented below for the liquid and the solids treatment facilities at RP-5/RP-2, respectively.

## 5.1 Existing Plant Operation

A summary of RP-5/RP-2 plant operations is provided in Table 7-5 for the liquid treatment and solids handling facilities. Unit process performance values were averaged over the evaluation period, with operating ranges noted. These values were used in development and calibration of the process models. Detailed data summaries for the evaluation period are provided in Appendix 7-A.

TABLE 7-5
**RP-5/ RP-2 Average Plant Operations Summary**

| Parameter | Value |
|---|---|
| ***Primary Treatment*** | |
| TSS Removal Rate (%) | 70 |
| TOC Removal Rate (%) | 41 |
| Primary Sludge (mgd) | 0.180 |
| ***Secondary Treatment*** | |
| MLSS (mg/L) | 3,920 |
| MLVSS (%) | 83 |
| RAS SS (mg/L) | 5,990 |
| Solids Inventory (Basins, Clarifiers, RAS) (lb) | 337,000 |
| Secondary Clarifier Loading (gpd/ft$^2$) | 200 (4 Clarifiers) |
| SVI (mL/g) | 210 |
| SRT (day) | >50 |
| Residual Alkalinity (mg as $CaCO_3$/L) | 145 |
| ***Solids Handling*** | |
| Gravity Thickened Solids (%TS) | 4.2 |
| DAF Thickened Solids (%TS) | 4.9 |
| Acid Phase (Digester 1) HRT (day) | 3.4 |
| Gas / Second Phase Digestion HRT (day) | 14.1 |
| Dewatered Solids (%TS) | N/A |

gpd – gallons per day
MLSS – mixed liquor suspended solids
MLVSS – mixed liquor volatile suspended solids
RAS – return activated sludge
SS – suspended solids
gpd/ft$^2$ – gallons per day per square foot
mL/g – milliliters per gram
SVI – sludge volume index
SRT – solids retention time
$CaCO_3$/L – calcium carbonate per liter
TS – thickened solids
HRT – hydraulic retention time

A performance summary for the major treatment processes is presented in Table 7-6. These values, which represent the average over the evaluation period, were used in the subsequent plant process modeling and the capacity evaluations for the major treatment units. Detailed data summaries for the evaluation period are provided in Appendix 7-A.

TABLE 7-6
**RP-5/ RP-2 Average Plant Performance Summary**

| Parameter | Primary Effluent | Secondary Effluent |
|---|---|---|
| TOC (mg/L) | 102 | 4.5 |
| BOD (mg/L) | 180 | 1.5 |
| TSS (mg/L) | 72 | <5 |
| NH3-N (mg/L) | 32 | 0.15 |
| NO3-N (mg/L) | N/A | 6.60 |
| NO2-N (mg/L) | N/A | 0.06 |
| TIN (mg/L) | N/A | 6.81 |
| Alkalinity (mg as $CaCO_3$/L) | N/A | 145 |

N/A – Not applicable
NO3-N – nitrate as nitrogen
NO2-N – nitrite as nitrogen

The values in Table 7-6 represent the current operation including secondary treatment operation configured in an anoxic-oxic-anoxic-oxic BNR configuration with step feed capability. Both basins and all basin zones, as well as both primary clarifiers and three out of four secondary clarifiers, were in service throughout the evaluation period.

## 5.2 Existing Plant Capacity

### 5.2.1 Process Modeling

The capacity of the existing RP-5/RP-2 system was evaluated through process modeling using CH2M HILL's whole plant simulator, PRO2D. PRO2D is a process simulation model that takes into account the mass balances through an entire facility for particulate and soluble components, and similar to other commercially available process models, is based on the International Water Association (IWA) ASM2D biological process kinetics. The base model was constructed to reflect the actual facility setup, including flow splits and backwash. The process model facility setup flow diagram depicting the integrated RP-5/RP-2 operation is presented in Figure 7-3. The model was constructed with the operations and performance criteria reflective of the evaluation period, and then calibrated to reflect the actual performance, solids yields, and water quality data.

As shown in Figure 7-3, the model was constructed to represent the actual plant operation for all the major process units. The model also allows establishing sizing and design considerations for each major unit process tankage and equipment. Similar to the actual operations, the plant model was built with the filter backwash and solids thickening/dewatering recycles being returned to the main plant for further treatment, with the CCWRF sludge diverted to RP-2 for solids handling. The liquid and solids mass balances calculated for the whole system under the current conditions allow calibration of the model against the actual field data. The calibrated model is then used to evaluate current capacity as well as establish expansion needs and process bottlenecks.

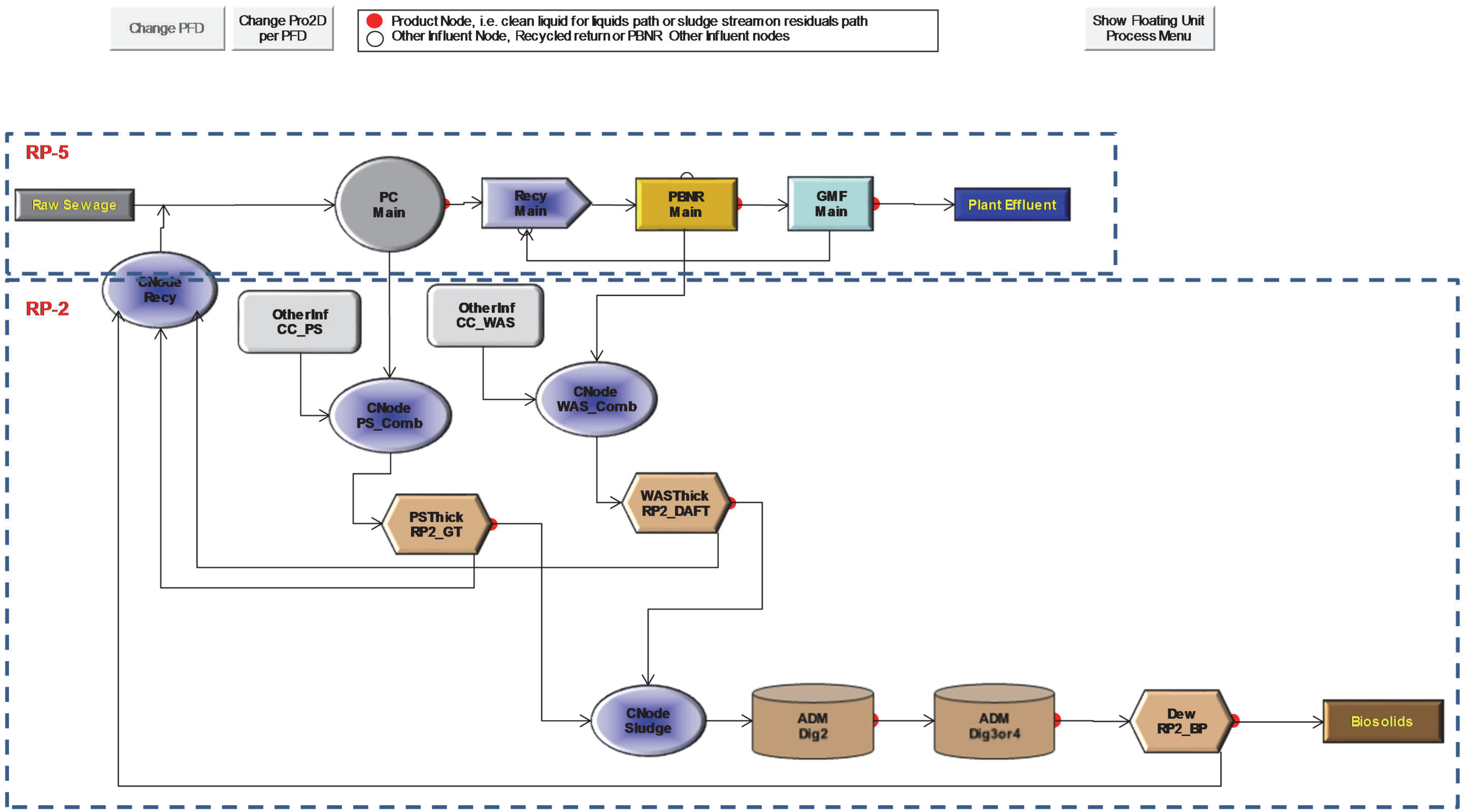


FIGURE 7-3

**RP-5/RP-2 Process Model Facility Setup**

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The process model was constructed and calibrated using the current influent and operating data available for the facility. The purpose of the model calibration step is to establish a baseline condition that closely resembles current operations and provides a means to reliably predict operations and system limitations under different scenarios or alternatives. Key model calibration results are presented in Table 7-7. As the listed values show, the model was calibrated such that the simulation results are within a value range that is 5 percent or smaller relative to the actual data. This level of accuracy will allow reliable capacity estimations to be made for the various capacity scenarios and future operation needs.

TABLE 7-7
**RP-5/ RP-2 Average Plant Performance Summary**

| Parameter | Actual Data Average Values | Model Results |
|---|---|---|
| Effluent BOD (mg/L) | 1.5 | 1.6 |
| Effluent TSS (mg/L) | <5 | <5 |
| Effluent TIN (mg/L) | 6.81 | 7.1 |
| Effluent Alkalinity (mg as $CaCO_3$/L) | 145 | 139 |
| MLSS (mg/L) | 3,922 | 3,910 |
| Total MLSS Inventory (lb) | 337,000 | 336,800 |
| Sludge Volatile Solids Content | 83 | 83 |
| RP-5/CCWRF Primary Sludge, Thickener Feed (gpd) | 378,800 | 382,400 |
| RP-5/CCWRF Waste Activated Sludge, Thickener Feed (gpd) | 246,100 | 247,200 |
| Biosolids (Dry Solids lb/day) | 25,800 | 25,500 |

Subsequent process modeling using the calibrated model as the base model was conducted to evaluate the following scenarios:

- Current plant capacity
  - Liquid treatment capacity to meet 8-mg/L effluent TIN level under average and maximum month flow and load conditions with solids handling recycles
  - Liquid treatment capacity to meet 5-mg/L effluent TIN level under average and maximum month flow and load conditions without solids handling recycles
  - Solids handling capacity under average and maximum month flow and load conditions
- RP-2 (solids handling) facility relocation options and future capacity implications for the planning year 2035
- Future facility footprint implications for the planning years 2035 and 2060

Findings of the current plant capacity evaluation are presented next in this section. Flow equalization and future capacity needs are presented in Sections 6.0 and 7.0, respectively.

### 5.2.2 Liquid Treatment Capacity

An evaluation of the liquid treatment capacity was conducted using the whole plant process model under both the average and maximum month conditions. The capacity evaluation was conducted based on achieving a plant effluent TIN concentration of 8 mg/L. As established at the onset of the project, the facility reliability and redundancy considerations are based on IEUA's overall wastewater treatment system, with

RP-5 being the end-of-the-line facility receiving all flow diversions, if needed, from other Regional Water Recycling Plants (RWRPs). Additional reliability and redundancy considerations driven by the regulatory requirements, such as Title 22 requirements, were taken into account. Dewatering recycles were considered to be handled at RP-5 along with other plant recycles and filter backwash.

The facility has two primary clarifiers in service. The average hydraulic loading rates with two units in service are around 1,070 gallons per day per square foot (gpd/ft$^2$). Under peak day flow conditions, and especially if one unit needs to be taken out of service, the primary clarifiers will be hydraulically overloaded. Considering that flow diversions to RP-5 are available for all other RWRPs and RP-5 needs to have robust reliability to handle the diversions, this needs to be considered as part of future capacity evaluations. Chemically enhanced primary treatment is available and could be implemented under high primary clarifier loading conditions to avoid overloading the downstream secondary treatment system.

Process modeling showed that both the primary clarifiers and the secondary treatment system are the capacity limiting factors for liquid treatment. One of the key parameters was found to be the aeration and the ability to control dissolved oxygen (DO) in the anoxic and oxic zones in the aeration basins, especially under peak flows with one large aeration zone out of service. The implications of DO are TIN fluctuations in the effluent and SVI values that are greater than 200 mL/g, which indicates sludge settleability is impaired most of the time. Another limitation of the secondary treatment system was found to be the secondary clarification solids loading resulting from the current operations and the influent wastewater solids loading rates. Maintaining the SVI values at or below 150 mL/g is important for this reason as well. Also, the system is reportedly operated at SRT values greater than 50 days. Although the current lower flows could allow this practice, much lower SRT values will need to be maintained to be able to treat flows greater than currently experienced.

Primary and secondary treatment capacity values established through modeling are presented in Table 7-8.

TABLE 7-8
**RP-5 Existing Primary/Secondary Treatment Capacity**

| | All Units in Service | One Unit Out of Service[a] |
|---|---|---|
| Capacity with effluent TIN $\leq$ 8 mg/L and with dewatering recycles (1.3 mgd) | 17 mgd | 15 mgd |
| Capacity with effluent TIN $\leq$ 8 mg/L and without dewatering recycles | 20 mgd | 18 mgd |

[a] One large aeration zone and one secondary clarifier out of service.

The capacities of the RP-5 tertiary processes also were evaluated; the methodologies employed are consistent with those presented in the Title 22 Engineering Report (DDB Engineering, Inc. [DDB], 2010). The filters were designed based on a California Department of Public Health (CDPH) maximum filter loading rate of 5 gallons per minute per square foot (gpm/ft$^2$) for continuous backwash upflow sand filters, with one filter out of service. In order not to exceed the maximum approved filter loading rate, the maximum flow that the filtration system can handle is 23.8 mgd. Applying a tertiary system peaking factor of 1.44, based on the availability of short-term storage for primary effluent flow equalization, the resulting average filtration capacity is 16.5 mgd.

The chlorine contact basins were designed based on Title 22 requirements with a minimum concentration and time (CT) value of 450 milligrams per minute per liter (mg-min/L) and a minimum modal contact time of 90 minutes during the peak hourly dry weather flow. Tracer testing conducted by IEUA in 2004 showed that the disinfection system could handle a peak flow of 23.5 mgd while maintaining a modal contact time of 90 minutes (DDB, 2010). Applying a tertiary system peaking factor of 1.44, the resulting average disinfection capacity is 16.3 mgd.

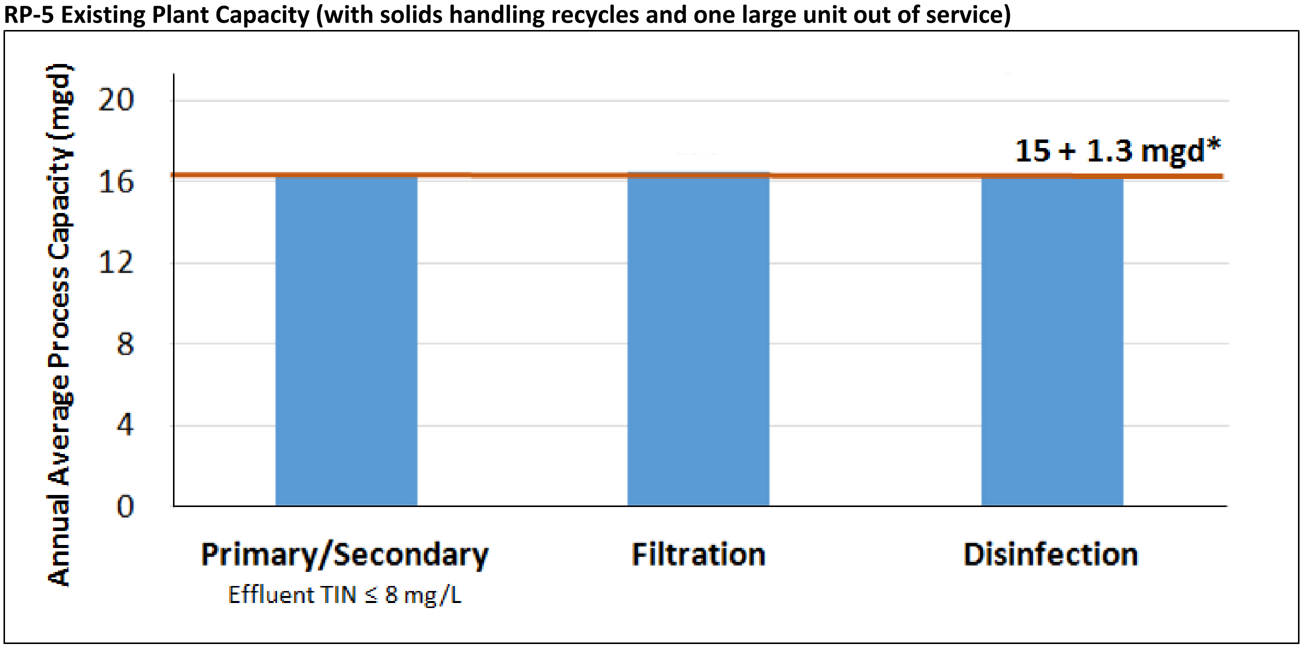
It is important to note that the primary effluent weir gate elevation is set to allow up to only 23.4 mgd to the downstream processes, with excess flow diverted to the Emergency Storage Pond. Thus, the tertiary processes do not receive more than 23.4 mgd of flow. The results of the tertiary capacity evaluation are summarized in Table 7-9.

TABLE 7-9
**RP-5 Existing Tertiary Process Capacity**

| | All Units in Service | One Filter Out of Service |
|---|---|---|
| Average Filtration Capacity | 18.0 mgd | 16.5 mgd |
| Average Disinfection Capacity | 16.3 mgd | N/A |

The overall plant capacity is determined by its most limiting process capacity. However, the RP-5 primary, secondary, and tertiary process capacities are all equally limited to about 16.3 mgd. The primary/secondary treatment capacity of 15 mgd with one unit out of service plus 1.3 mgd of return flow from the RP-2 Lift Station, results in a 16.3 mgd primary/secondary treatment capacity. Therefore, the RP-5 plant capacity is approximately 16.3 mgd under the assumptions presented in this section and the current wastewater characteristics. Flows considered in this evaluation include approximately 1.3 mgd of recycle flows and other flows diverted from the RP-2 Lift Station. Thus, the evaluated capacity is consistent with the permitted capacity of 15 mgd previously established for RP-5 during design. A summary of the individual process capacities in comparison to the overall plant capacity is depicted in Figure 7-4.

FIGURE 7-4
**RP-5 Existing Plant Capacity (with solids handling recycles and one large unit out of service)**




*15 mgd plus 1.3 mgd of RP-2 Lift Station flows and recycles

## 5.2.3 Solids Handling Capacity

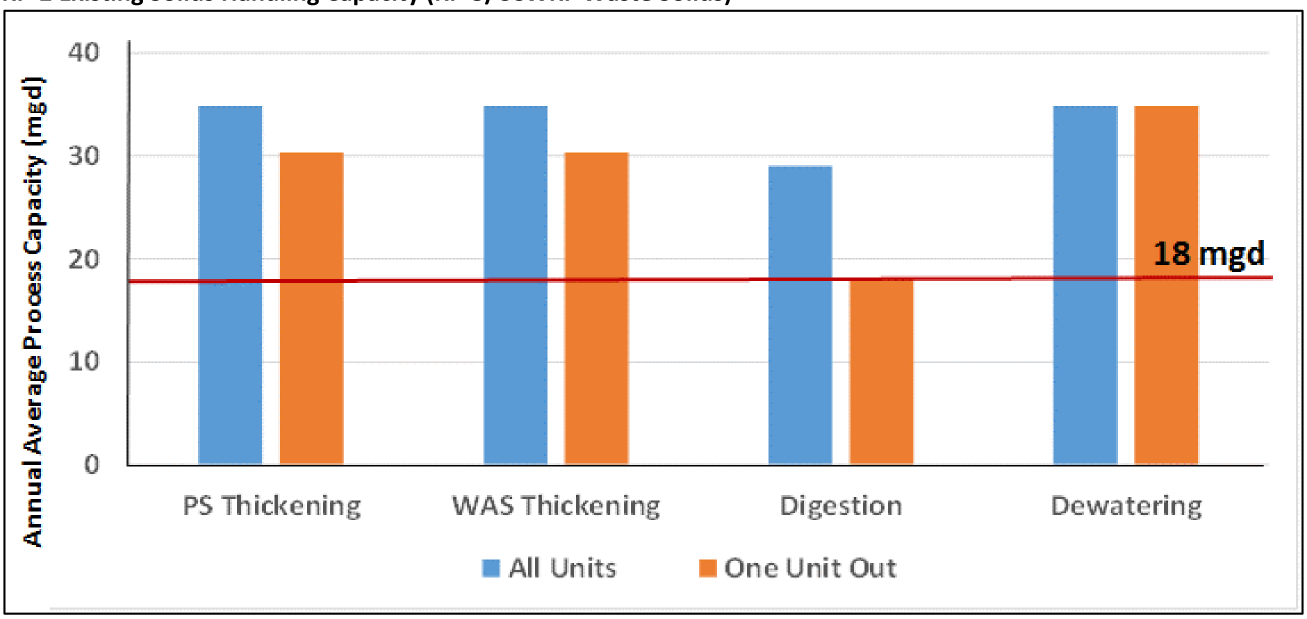
In evaluating the solids handling system capacity, operational considerations and Rule 503 requirements were taken into account considering the average and maximum month loading. The system capacity with and without one unit out of service was evaluated using the industry standard loading rates and operational criteria. The capacity values calculated are considered to represent equivalent plant influent flow values at the current wastewater characteristics.

Primary sludge (PS) thickening is currently achieved using gravity thickening. Thickening cannot be achieved in the primary clarifiers, because the sludge needs to be diverted to RP-2 at a solids content of about 1 to 1.5 percent solids. WAS thickening is achieved in dissolved air floatation thickeners (DAFT). Capacity was evaluated by maintaining a solids loading rate of 45 pounds per day per square foot (lb/d/ft$^2$) or less for the DAFTs.

Waste solids digestion, achieved in the phased digestion system, was evaluated based on the current operating conditions as well as Part 503 Rule requirements. A digester SRT of 15 day with one large unit out service was used to establish digestion capacity, using an active digester volume of 90 percent of the total digester volume including the cone space. Dewatering capacity of the belt filter presses was calculated considering the hydraulic loading rate to be maintained at or below 75 gallons per minute per meter (gpm/m) and the solids loading rate to be maintained at or below 1,000 pounds per hour per meter (lb/hr/m) under the current solids loading conditions.

The solids handling capacity of the plant to meet the Part 503 Rule requirements for Class B biosolids is illustrated in Figure 7-5. As shown, the digestion is the limiting unit process of the solids handling system. The current equivalent RP-5/CCWRF plant influent flows (10 + 7.2 = 17.2 mgd) represent almost 96 percent of the anaerobic digestion capacity with one large unit out of service at the current influent wastewater characteristics and CCWRF solids loading diversion.

FIGURE 7-5
**RP-2 Existing Solids Handling Capacity (RP-5/CCWRF Waste Solids)**




## 5.3 RP-5/RP-2 Capacity Summary

Current RP-5/RP-2 liquid treatment and solids handling facility capacity values are summarized in Table 7-10. These values constitute the basis of the future capacity requirements assessment presented later in this TM.

TABLE 7-10
**RP-5/RP-2 Existing Process Capacity Summary**

| | All Units in Service | One Unit Out of Service |
|---|---|---|
| **Secondary Treatment** | | |
| Plant Effluent TIN $\leq$ 8 mg/L [b] | 17 mgd | 15 mgd[a] |
| Plant Effluent TIN $\leq$ 8 mg/L [c] | 20 mgd | 18 mgd[a] |
| **Solids Handling**[d] | | |
| PS Thickening | 34.8 mgd | 30.3 mgd[d] |
| WAS Thickening | 34.8 mgd | 30.3 mgd[d] |
| Digestion | 29 mgd | 18 mgd[d] |
| Dewatering | 34.8 mgd | 34.8 mgd[d] |
| **Tertiary Treatment** | | |
| Filtration | 18 | 16.5[e] |
| Disinfection | 16.3 | N/A |

[a] One secondary clarifier and one aeration basin out of service.
[b] With solids handling recycles.
[c] Without solids handling recycles.
[d] One large unit out of service.
[e] One filter out of service.

# 6.0 Solids Handling Alternatives Evaluation

As previously mentioned, solids handling facilities at RP-2 will be below the 100-year flood plain with the rise of the Prado Dam elevation. Thus, the solids handling capacity of the RP-2 facility will be relocated to RP-5. Three solids facilities location alternatives were considered:

1. Southwest corner of the RP-5 site
2. East side of the RP-5 site
3. Solids Handling Site (SHS) at the corner of Flowers Street and Mountain Avenue

Figure 7-6 shows the three proposed site layouts for the RP-5 solids handling facilities. The RP-5 solids facilities were preliminarily sized based on flow and loading projections for RP-5 described in *TM 4 Wastewater Flow and Loading Forecast* and summarized in Section 3.0 of this TM, Current and Future Flows and Loads. Table 7-11 presents the various facilities, the number of units, and their corresponding size for expansion through 2060.

In addition to the RP-2 facilities that need to be relocated to RP-5, the existing facilities at the RP-2 site need to be demolished and removed from the site, since RP-2 is on land that is leased from the U.S. Army Corp of Engineers. This demolition would be performed on the existing solids handling facilities, the RP-2 Lift Station, and the RP-2 liquid treatment facilities that were abandoned after RP-5 was placed into service.

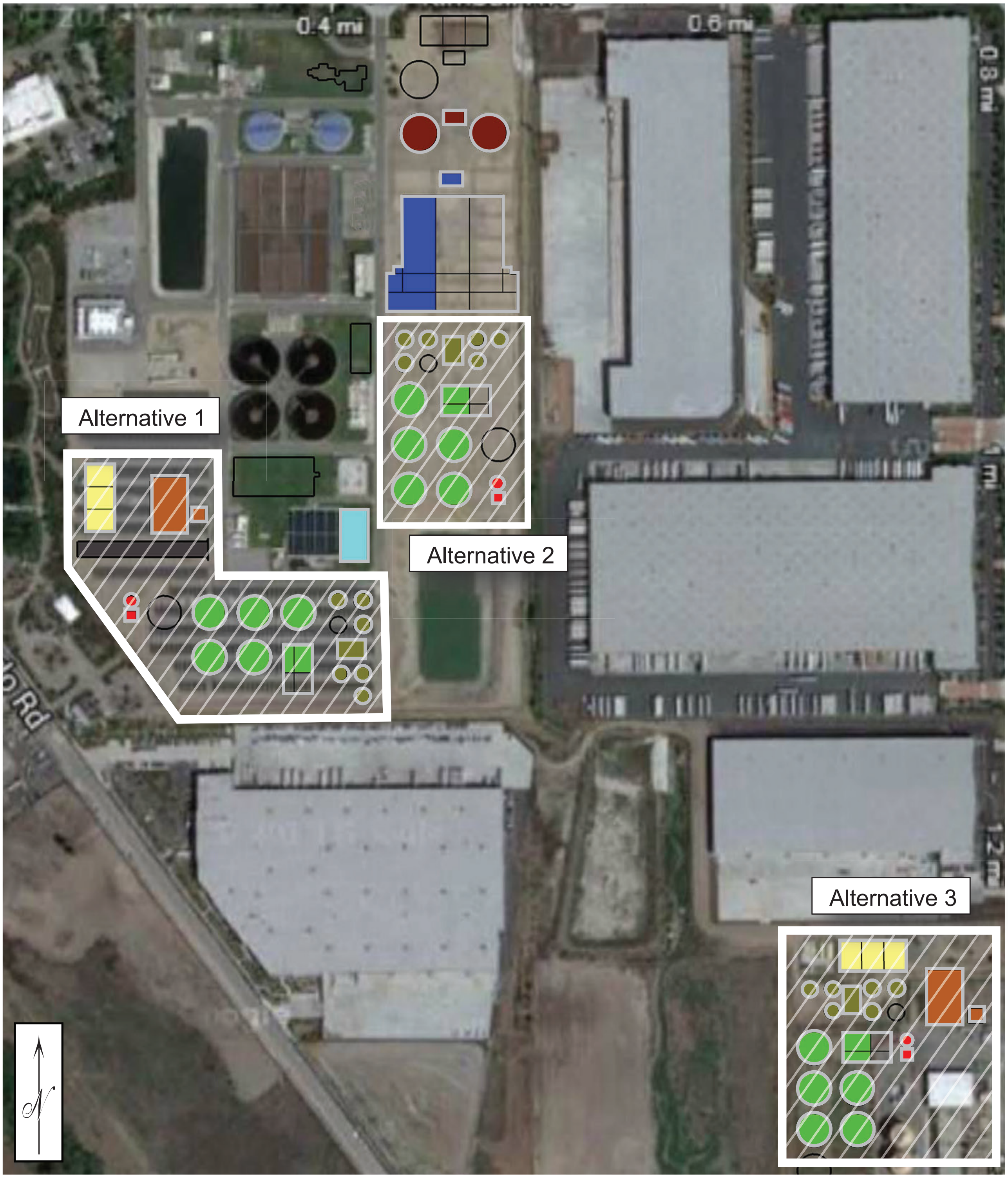



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FIGURE 7-6

**RP-5 Solids Handling Alternatives**

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TABLE 7-11
**RP-5 Proposed Solids Handling Facilities (Ultimate)**

| Facility | Number of Units | Size |
|---|---|---|
| Gravity Thickener | 4 | 45-foot Diameter |
| Dissolved Air Flotation Thickening (DAFT) | 3 | 40-foot Diameter |
| *Anaerobic Digestion* | | |
| Acid-Phase | 10 Cells | 20-$ft^2$ 30-foot sidewater depth per cell |
| Methane-Phase | 5 | 90-foot diameter 35-foot sidewater depth |
| Sludge Holding | 1 | 90-foot diameter 35-foot sidewater depth |
| High Pressure Gas Storage | 1 | 35-foot diameter w/ 30- $ft^2$ equipment pad |
| Dewatering | 1 | 100-foot x 150-foot |
| Biofilter | 1 | 60-foot x 80-foot per cell (3 total cells) |

Using the facility sizes described in Table 7-11, site layouts were developed for each of the three alternatives. Figures 7-7 through 7-9 present the preliminary site layouts for Alternatives 1 through 3, respectively.

The three alternatives were evaluated based on both economic and nonmonetary criteria. The economic difference between the three alternatives was assumed to be negligible. Each alternative requires the same facilities and equipment and the site work during construction would also be similar. The difference between the alternatives is identified in the nonmonetary evaluation.

The three alternatives were evaluated based on 12 specific nonmonetary criteria. Each alternative was assigned a ranking of 1 through 5, with 1 being the least favorable and 5 being optimal, for each of the nonmonetary criteria. The assigned rankings were then multiplied by the weighting factor selected for each criterion and summed to determine the overall score for each alternative. Table 7-12 presents the nonmonetary evaluation criteria and the corresponding weighting factor that was utilized in the decision analysis matrix. The results of the evaluation are summarized in Table 7-13.

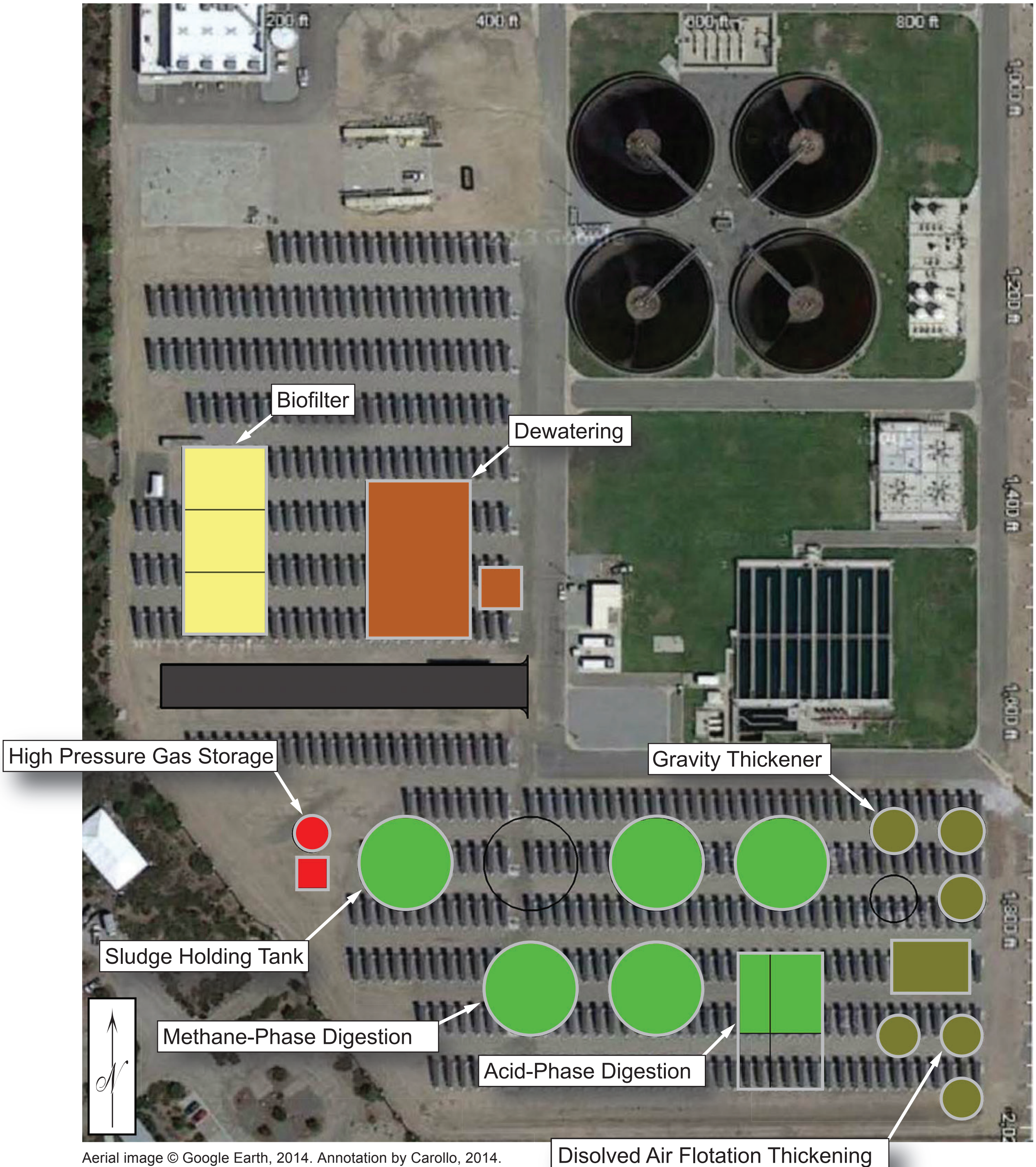


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FIGURE 7-7

**Solids Handling Alternative 1**

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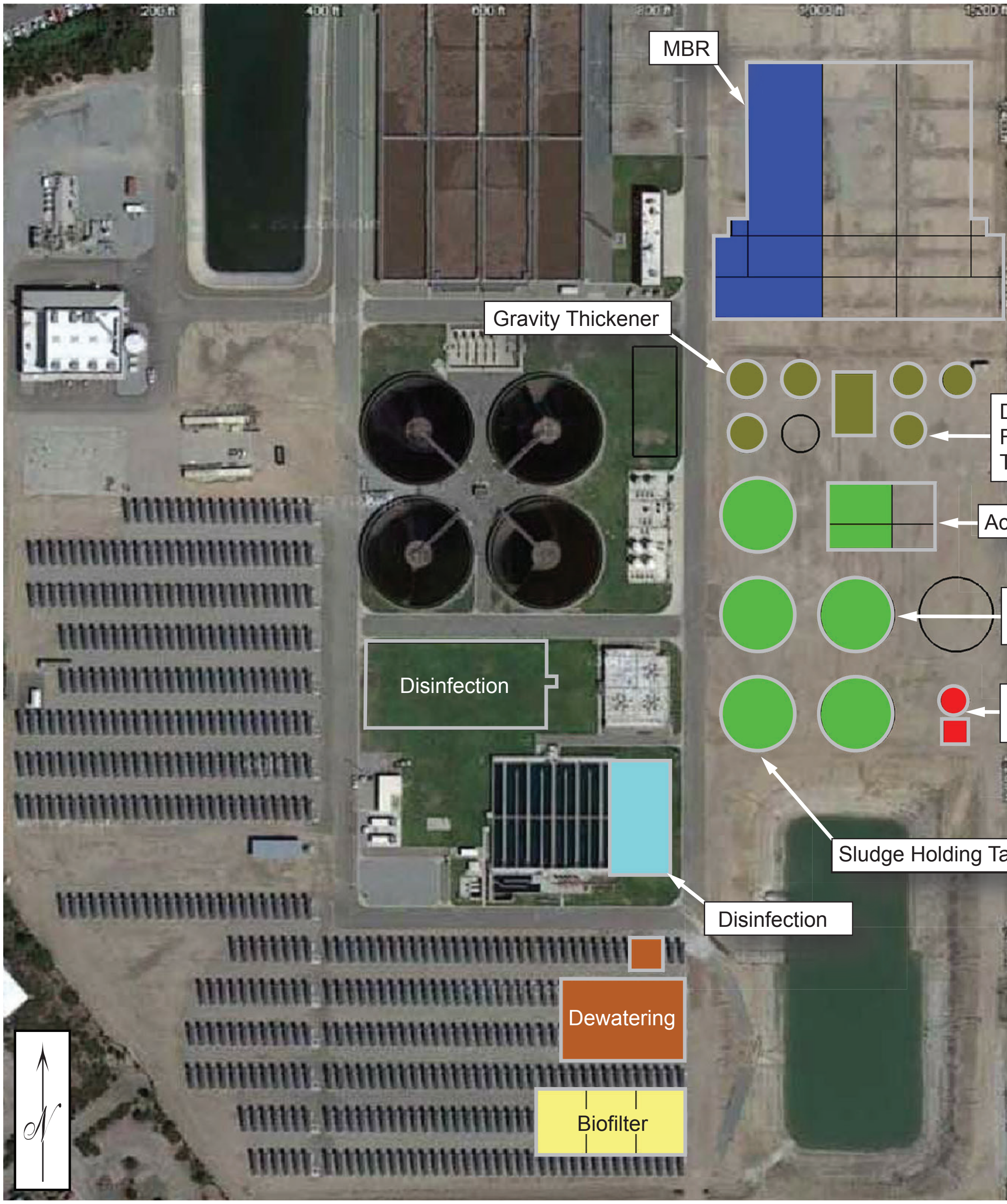


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FIGURE 7-8

## Solids Handling Alternative 2

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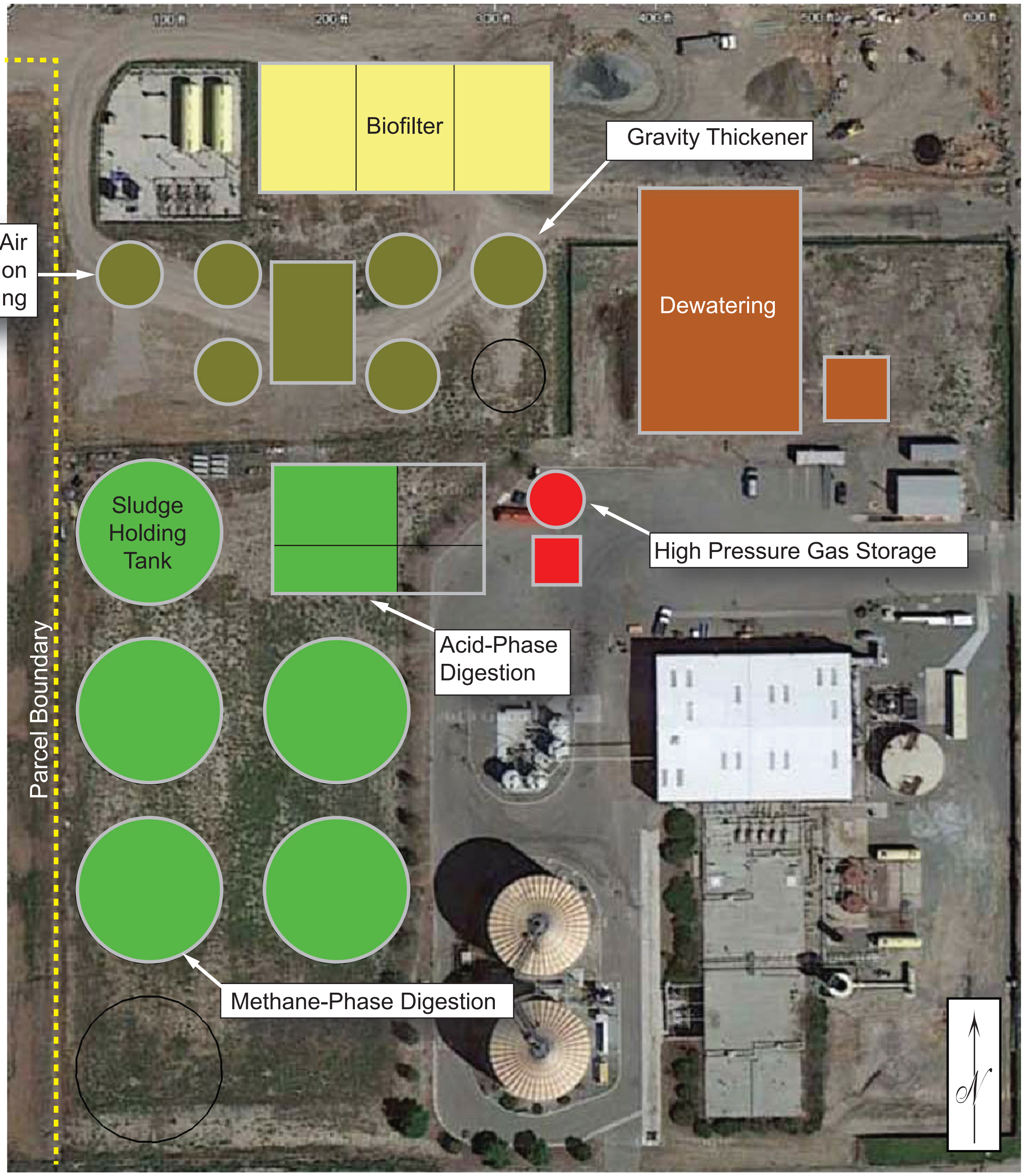


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FIGURE 7-9

**Solids Handling Alternative 3**

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TABLE 7-12
**Non-Monetary Evaluation Criteria, Definitions, and Assigned Weighting Factors**

| Criteria | Description | Weighting Factor |
|---|---|---|
| Operational flexibility | Ability of the system to respond to potential internal or external changes affecting delivery of equalized flow or treated solids without any impact on system performance. | 10 |
| Operational risk and reliability | Operational implications on system reliability and redundancy and the associated risk involved in operating major facilities. Use of proven systems and technologies, with similar installations currently in operation. | 10 |
| Impacts on plant odors | Impacts of new processes on plant odors, and the need for additional odor control facilities to minimize plant odors. | 10 |
| Constructability and implementation timing | Construction implications, ease of construction, and integration with the existing systems, and the ability to implement the proposed alternative in phases. | 9 |
| Treatment capacity impacts | Impacts of the new facilities on treatment plant capacity. | 8 |
| Impacts on existing facilities | Impacts on existing facilities and the ability to use existing infrastructure. Implications of site planning and the need to demolish or relocate existing facilities. | 8 |
| Ease of operation and maintenance | Relative degree of ease and extent of time required to operate and maintain the facilities. | 8 |
| Impacts on energy requirements | Additional energy required to construct and maintain new facilities, as well as the impact of the new facilities on the overall plant energy balance and power demand (for example, pumping, mixing, etc.). | 7 |
| Pumping and hydraulic requirements | Implications of pumping and conveying to new facilities, and complexity of pumping and yard piping requirements. | 6 |
| Overall aesthetics | Aesthetic and visual considerations as a result of the new facilities. | 6 |
| Carbon footprint and sustainability | Potential impacts on the carbon footprint of each plant and added sustainability features as a result of construction and operation of the facilities. | 4 |
| Footprint and space constraints | Overall footprint requirements and space constraints, and impacts on site planning for future facilities. | 3 |

TABLE 7-13
**RP-5 Solids Handling Non-Monetary Evaluation Results**

| Criteria | Weighting Factor | Alternative 1 RP-5 Southwest Corner | | Alternative 2 RP-5 East Side | | Alternative 3 SHS | |
|---|---|---|---|---|---|---|---|
| | | Score | Weighted Score | Score | Weighted Score | Score | Weighted Score |
| Operational Flexibility | 10 | 4 | 40 | 4 | 40 | 1 | 10 |
| Operational Risk and Reliability | 10 | 3 | 30 | 3 | 30 | 3 | 30 |
| Impacts on Plant Odors | 10 | 3 | 30 | 3 | 30 | 3 | 30 |
| Constructability and Implementation Timing | 9 | 3 | 27 | 3 | 27 | 3 | 27 |
| Treatment Capacity Impacts | 8 | 3 | 24 | 3 | 24 | 3 | 24 |
| Impacts on Existing Facilities | 8 | 2 | 16 | 3 | 24 | 3 | 24 |
| Ease of Operation and Maintenance | 8 | 3 | 24 | 3 | 24 | 1 | 8 |
| Impacts on Energy Requirements | 7 | 4 | 28 | 4 | 28 | 1 | 7 |
| Pumping and Hydraulic Requirements | 6 | 4 | 24 | 4 | 24 | 1 | 6 |
| Overall Aesthetics | 6 | 3 | 18 | 3 | 18 | 3 | 18 |
| Carbon Footprint and Sustainability | 4 | 3 | 12 | 4 | 16 | 2 | 8 |
| Footprint and Space Constraints | 3 | 3 | 9 | 4 | 12 | 2 | 6 |
| **Final Score** | | | **282** | | **297** | | **198** |

From Table 7-13, the recommended alternative is shown as the one with the greatest score. Using these nonmonetary criteria, Alternative 2 was selected as the proposed alternative and Alternative 3 (SHS) was the least favorable option using the evaluation matrix. Alternative 3 was ranked lower in several categories due to the location being further away from the RP-5 liquid treatment facilities, being closer to neighbors, and having space constraints compared to the other alternatives. As shown in Table 7-13, the scores for Alternatives 1 and 2 are close. The main difference between these two alternatives is their impact to the existing solar facility. Alternative 1 would require the demolition or relocation of a significant portion of the solar facility, while Alternative 2 would have much less impact.

# 7.0 Plant Expansion Needs

Using the flow and loading projections for RP-5 described in *TM 4 Wastewater Flow and Loading Forecast* and summarized in Section 3.0 of this TM, the RP-5 expansion needs were determined for the 20-year planning period and the estimated ultimate flow. Preliminary sizing of the solids and liquid facilities associated with expanding RP-5 are shown in Tables 7-11 and 7-14, respectively. The facility sizes shown in Tables 7-11 and 7-14 were used to determine the number of units required for planning years 2035 and 2060. Site layouts were then developed for each planning year.

TABLE 7-14
**RP-5 Proposed Liquid Treatment Facilities (Ultimate)**

| Facility | Number of Units | Size |
|---|---|---|
| Primary Clarifiers | 2 | 100-foot diameter |
| Secondary Treatment (MBR) | 2 | 7.5 mgd per module, includes fine screens, bioreactor, membrane tank, blowers, and RAS/WAS pump station |
| Chlorine Contact Tank | 2 | 0.8 million gallons (MG) per module |

## 7.1 Facility Expansion Requirements

### 7.1.1 Planning Year 2035

Flows at RP-5 were projected for planning year 2035, and are summarized below:

- 20.2-mgd RP-5 plant influent (represents influent flow with Whispering Lakes and Haven pump stations offline and includes flows from the relocated RP-2 Lift Station)
- 7.3-mgd CCWRF waste solids equivalent

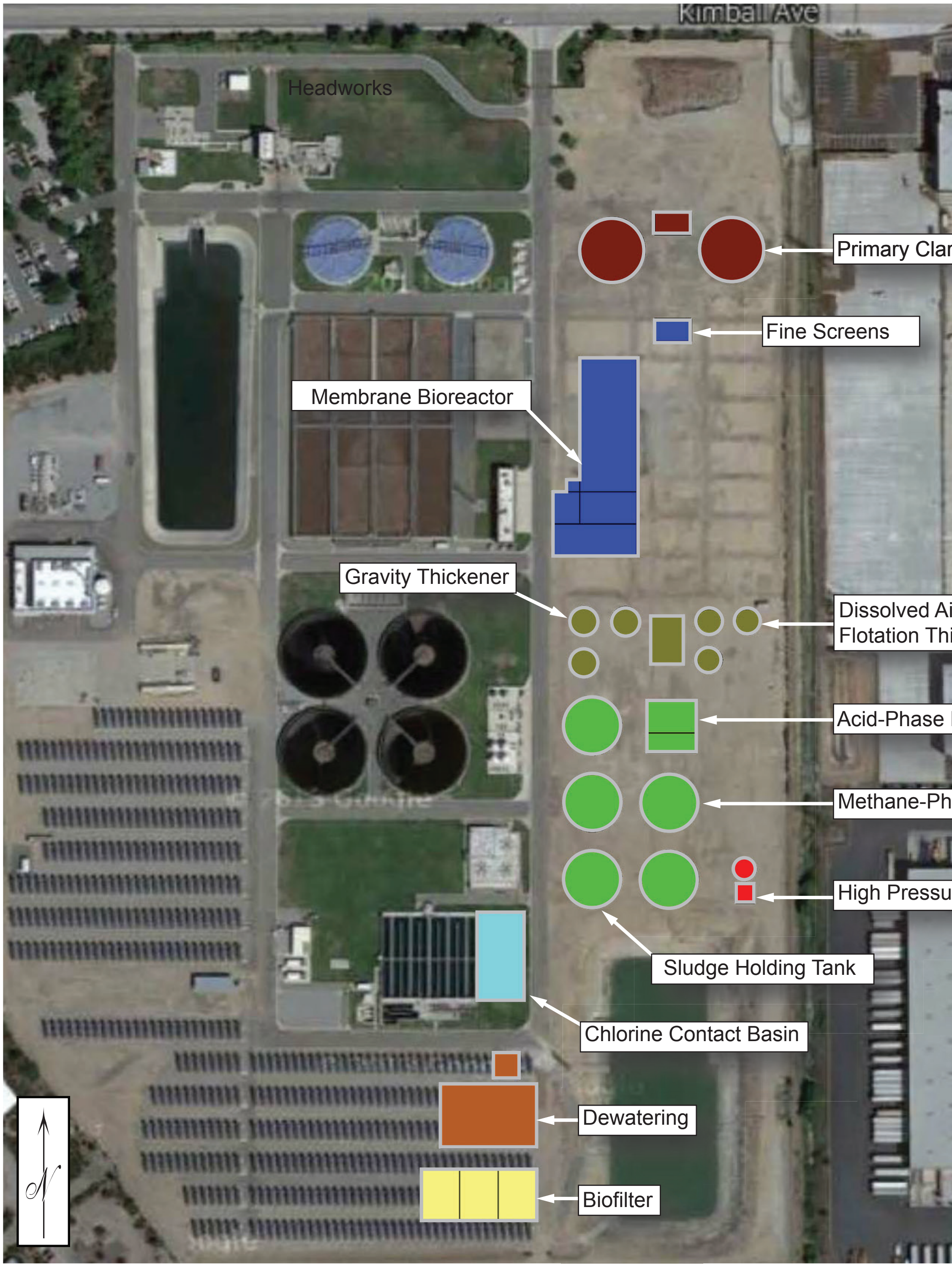
The facilities required to treat the planning year 2035 flows and loads are described in Table 7-15 and shown in Figure 7-10. It is assumed that the RP-2 solids handling facilities will be relocated during the 20-year planning period.

In addition to the facilities presented in Figure 7-10 and Table 7-15, the existing RP-2 Lift Station would also have to be relocated. The RP-2 Lift Station collects RP-2 solids processing recycle flows and the raw sewage flows tributary to it, and transfers those flows to RP-5 for treatment. The current plan is to relocate the pump station to a location along Mountain Avenue that is above the flood plain.

TABLE 7-15
**RP-5 Facility Expansion Requirements for Planning Year 2035**

| Facility | Number of Units | Size of Unit |
|---|---|---|
| ***Liquid Treatment*** | | |
| Primary Clarifier | 2 | 100-foot diameter |
| Membrane Bioreactor | 1[a] | 7.5 mgd |
| Chlorine Contact Tank | 1 | 0.8 MG |
| ***Solids Treatment*** | | |
| Gravity Thickener | 3 | 45-foot diameter |
| DAFT | 3 | 40-foot diameter |
| *Anaerobic Digestion* | | |
| Acid-Phase | 6 Cells | 20-$ft^2$ 30-foot SWD per cell |
| Methane-Phase | 4 | 90-foot diameter 35-foot SWD |
| Sludge Holding Tank | 1 | 90-foot diameter 35-foot SWD |
| High-Pressure Gas Storage | 1 | 35-foot diameter w/ 30- $ft^2$ equipment pad |
| Dewatering | 1 | 100-foot x 150-foot Building |
| Biofilter | 3 Cells | 60-foot x 80-foot per cell |
| RP-2 Lift Station | 1 | 10 mgd |

[a] Includes fine screens, bioreactor, blowers, membrane tanks, RAS/WAS pump station, and associated equipment.




Aerial image © Google Earth, 2014. Annotation by Carollo, 2014.

WT0122151041SCO 480772.03.31.60.03 inland_empire_fig7_10.ai 1/15

FIGURE 7-10

**RP-5 Planning Year 2035 Facilities Site Plan**

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*WASTEWATER FACILITIES MASTER PLAN*

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The liquid treatment facilities listed in Table 7-15 are based on switching from the current conventional activated sludge process to MBR for future plant expansions. The intent of this process change is to provide both a higher quality recycled water and a water that is better suited to even higher levels of treatment to meet potentially stricter future regulatory requirements. An alternative for adding a new MBR train at RP-5 would be to convert the existing secondary treatment facilities to MBR. Although not evaluated in this TM, this could be accomplished by converting the existing aeration basins to MBR. The details of this alternative can be evaluated further during the RP-5 preliminary design.

### 7.1.2 Ultimate Buildout Year 2060

Flows at RP-5 were projected for planning year 2060, and are summarized below:

- 27.2 mgd RP-5 plant influent (represents influent flow with Whispering Lakes and Haven pump stations offline)
- 7.9 mgd CCWRF waste solids equivalent

The facilities required to treat the planning year 2060 flows and loads are described in Table 7-16 and shown in Figure 7-11.

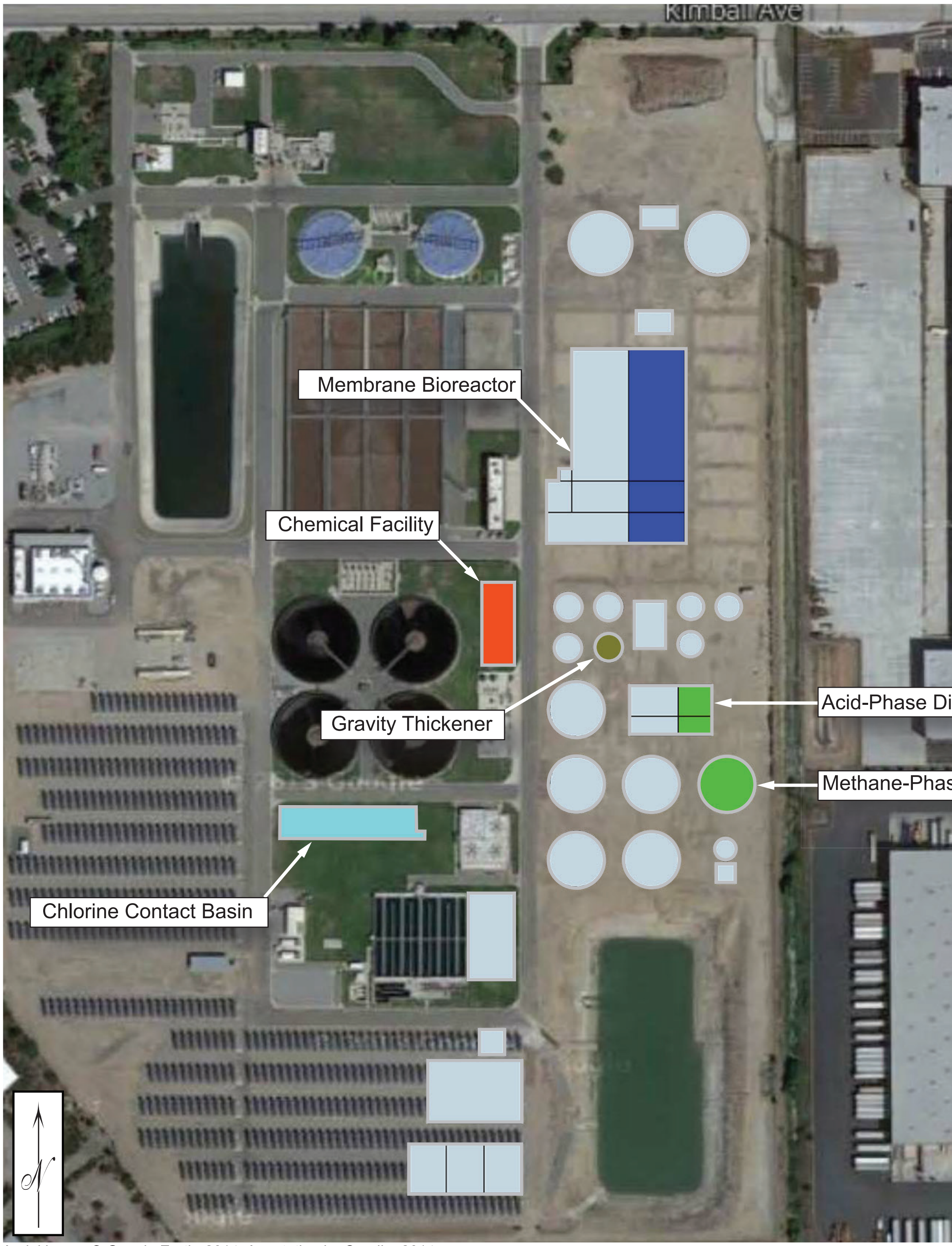
TABLE 7-16
**RP-5 Facility Expansion Requirements for Ultimate Buildout Year 2060**

| Facility | Number of Units | Size of Unit |
|---|---|---|
| ***Liquid Treatment*** | | |
| Membrane Bioreactor | 1[a] | 7.5 mgd |
| Chlorine Contact Tank | 1 | 0.8 MG |
| Chemical Facilities | 1 | |
| ***Solids Treatment*** | | |
| Gravity Thickener | 1 | 45-foot diameter |
| *Anaerobic Digestion* | | |
| Acid-Phase | 4 Cells | 20- $ft^2$ 30-foot SWD per cell |
| Methane-Phase | 1 | 90-foot diameter 35-foot SWD |

[a] Includes fine screens, bioreactor, blowers, membrane tanks, RAS/WAS pump station, and associated equipment.

## 7.2 Ultimate Facilities Site Plan

The ultimate facilities site plan is presented in Figure 7-11. All proposed solid and liquid facilities expansions are shown.




Aerial image © Google Earth, 2014. Annotation by Carollo, 2014.

Legend:

Planning year 2035.

FIGURE 7-11

**RP-5 Ultimate Facilities Site Plan**

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WT0122151041SCO 480772.03.31.60.03 inland_empire_fig7_11.ai 1/15

# 8.0 20-Year CIP Plant Expansion Projects and Capital Cost

Two plant expansion projects were identified during the 20-year CIP: the RP-5 Solids Handling Facilities Project and the RP-5 Expansion Project. Capital costs were estimated for each project and those costs were placed into the 20-year CIP. The planning level capital costs for each process identified were developed based on cost curves established from previous projects and known direct costs for similar-sized projects. Additionally, several assumptions were made to estimate the total construction cost and total project costs for each expansion project. The assumptions include the following:

- The WFMP assumed a 20-year planning period.
- 10 percent of facilities subtotal for civil/site work.
- 0 to 5 percent of facilities subtotal for demolition depending on existing site conditions.
- 20 percent of facilities subtotal for electrical and instrumentation.
- 10 percent of total direct cost for contractor general conditions.
- 15 percent of total direct cost for contractor overhead and profit.
- 8 percent sales tax was applied to 50 percent of the total direct cost.
- 30 percent for construction contingency.
- 30 percent for engineering, construction management, environmental, and legal costs was applied to the total construction cost to estimate the total project cost.

The total construction cost and total project cost for each expansion project are summarized in Table 7-17. For planning purposes, the estimated costs for ultimate buildout improvements are also provided.

As presented in Table 7-17, the estimated cost of demolition for RP-2 would be in the range of $7 to $10 million. This estimate is based on a site visit with a local demolition contractor. The estimate includes the contractor's estimate of removing all existing structures and piping from the site (above and below ground), and grading the site to match the natural contours. Additional mitigation measures may be required once a more detailed site assessment is performed.

# 9.0 Conclusion

The following conclusions can be made from the evaluation of RP-2 and RP-5:

- Solids handling facilities will need to be relocated from RP-2 to RP-5 within the 20-year planning period.
- The most favorable location for the relocated RP-2 solids handling facilities is along the east side of the RP-5 site (Alternative 2) near the existing liquid treatment facilities. This alternative has a minimal impact on the existing solar facility.
- The RP-5 liquid treatment facilities will need to be expanded during the 20-year planning period.

# 10.0 References

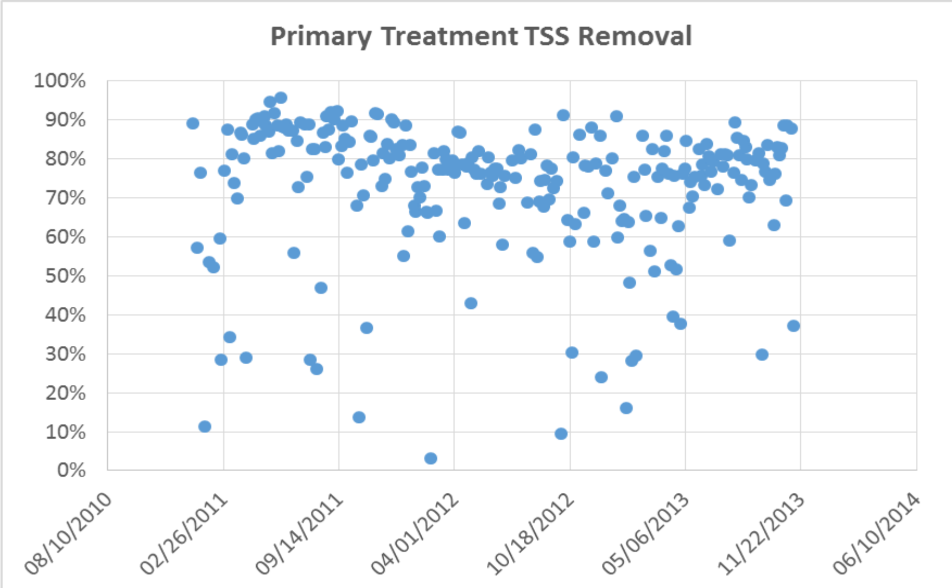
DDB Engineering, Inc. (DDB). December 2010. *Inland Empire Utilities Agency Regional Plant No. 5 Title 22 Engineering Report.*

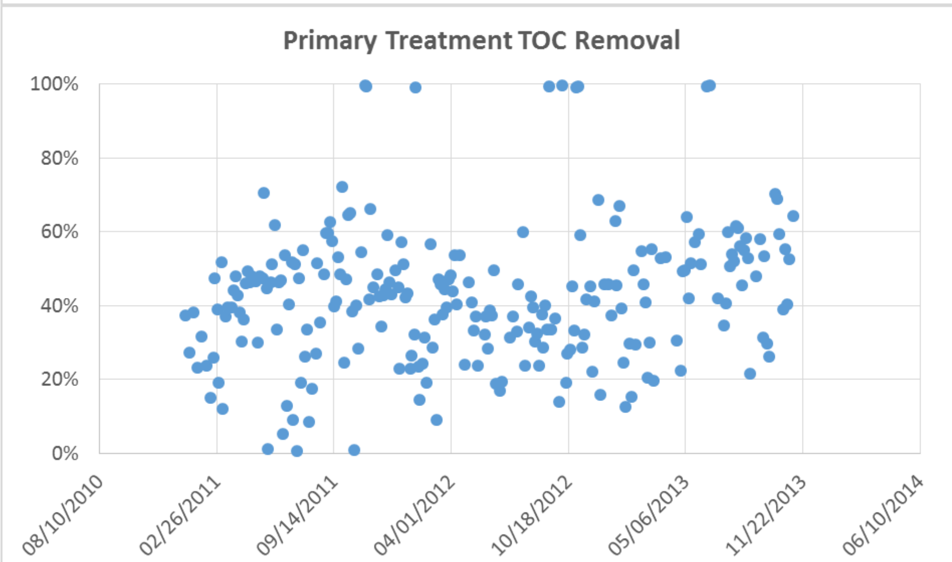
TABLE 7-17
**RP-5 Expansion Projects Capital Cost Estimate**

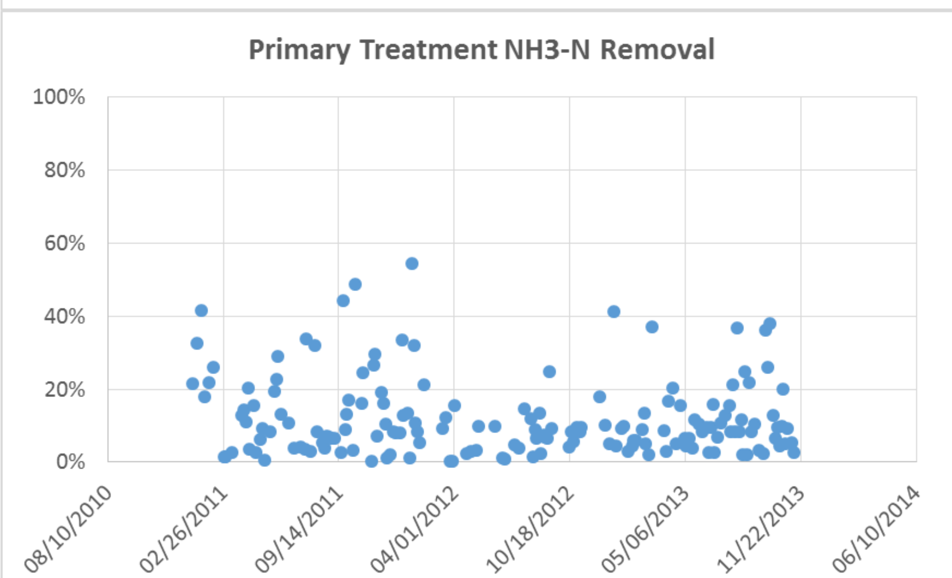
| Component Description | RP-5 Solids Handling Facilities Project[a] | RP-5 Expansion Project | RP-5 Ultimate Buildout Expansion Project |
|---|---|---|---|
| Primary Clarifiers | | $3,600,000 | |
| Primary Sludge Pump Station | | $1,600,000 | |
| Secondary Treatment (MBR) – 7.5 mgd | | $30,200,000 | $30,200,000 |
| Chemical Facilities | | | $1,000,000 |
| Chlorine Contact Basin | | $1,200,000 | $1,200,000 |
| RP-2 Lift Station | $2,500,000 | | |
| RP-2 Demolition and Site Rehabilitation | $3,500,000 | | |
| Gravity Thickener | $2,400,000 | | $800,000 |
| Dissolved Air Flotation Thickening | $4,200,000 | | |
| Acid-Phase Digestion | $4,900,000 | | $4,900,000 |
| Methane-Phase Digestion[b] | $14,000,000 | | $2,800,000 |
| High-Pressure Gas Storage | $3,000,000 | | |
| Dewatering | $10,250,000 | | |
| Biofilter | $1,100,000 | | |
| **Facilities Subtotal** | **$45,850,000** | **$36,600,000** | **$40,900,000** |
| Civil/Site Work (10%) | $4,585,000 | $3,660,000 | $4,090,000 |
| Demolition (0%) | $- | $- | $- |
| Electrical and Instrumentation (20%) | $9,170,000 | $7,320,000 | $8,180,000 |
| **Total Direct Cost[c]** | **$59,605,000** | **$47,580,000** | **$53,170,000** |
| General Conditions (10%) | $5,961,000 | $4,758,000 | $5,317,000 |
| General Contractor Overhead and Profit (15%) | $8,941,000 | $7,137,000 | $7,976,000 |
| Sales Tax (8%)[d] | $2,384,000 | $1,903,000 | $2,127,000 |
| **Subtotal** | **$76,891,000** | **$61,378,000** | **$68,590,000** |
| Construction Contingency (30%) | $23,067,000 | $18,413,000 | $20,577,000 |
| **Total Estimated Construction Cost[e]** | **$99,958,000** | **$79,791,000** | **$89,167,000** |
| Engineering, Construction Management, Environmental, and Legal Costs (30%) | $29,987,000 | $23,937,000 | $26,750,000 |
| **Total Estimated Project Costs** | **$129,945,000** | **$103,728,000** | **$115,917,000** |

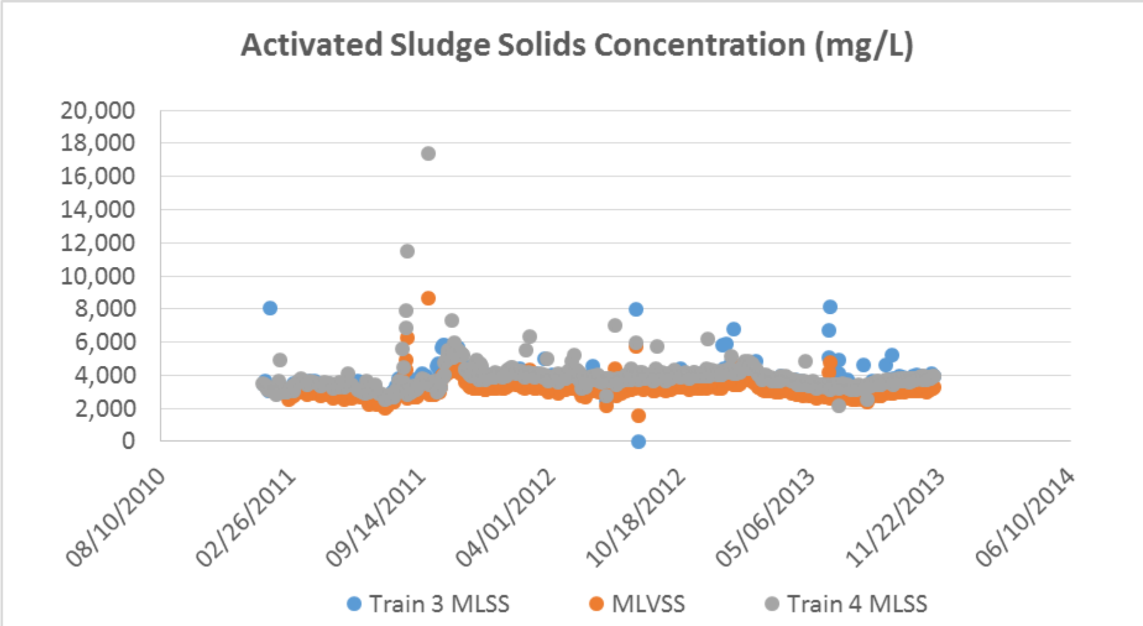
[a] Costs include the demolition of the RP-2 facility, which is estimated to range between $7 million and $10 million assuming removal of all assets (above and below ground) and grading to match surrounding contours.
[b] Includes cost of sludge holding tank.
[c] ENR CCI Index for Los Angeles (August 2014 - 10,737).
[d] Calculated assuming 50% of direct costs are taxable.
[e] Cost does not include escalation to midpoint of construction.
*The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. The Consultant Team has no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices, or bidding strategies. The Consultant Team cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented as shown.*

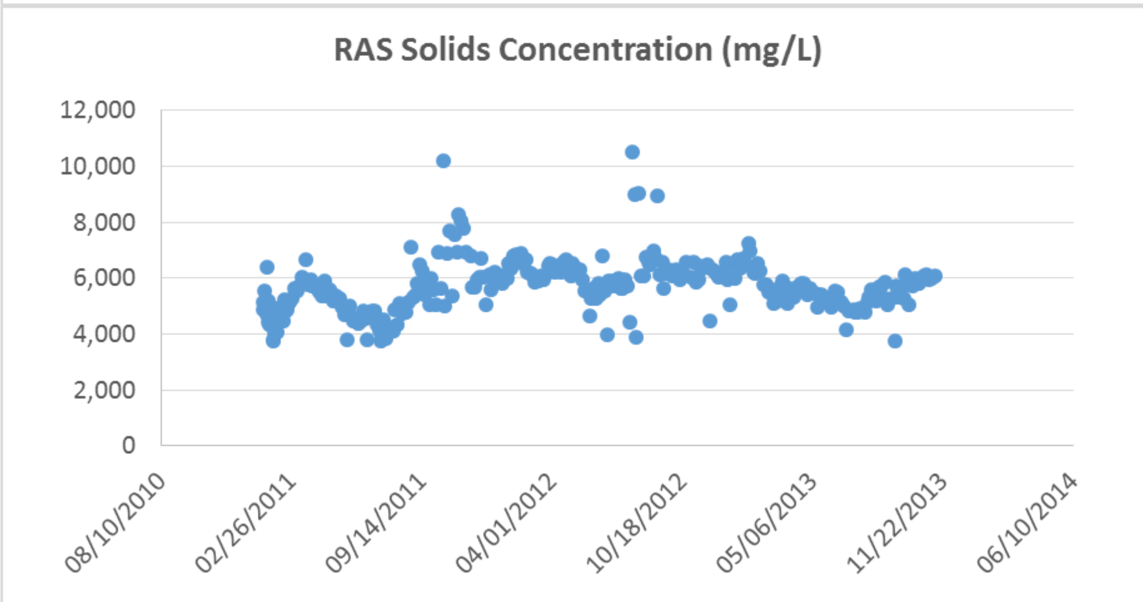
# Appendix 7-A
# RP-5 / RP-2 Plant Operation Summary (2011-2013)

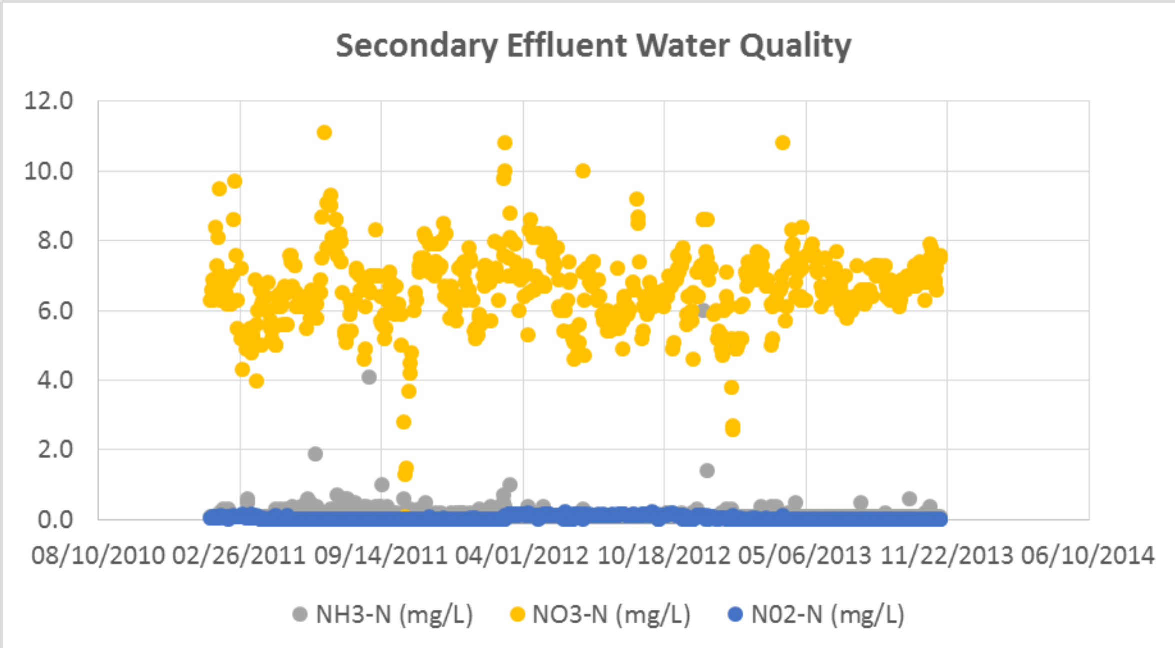

Primary Treatment TSS Removal
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014

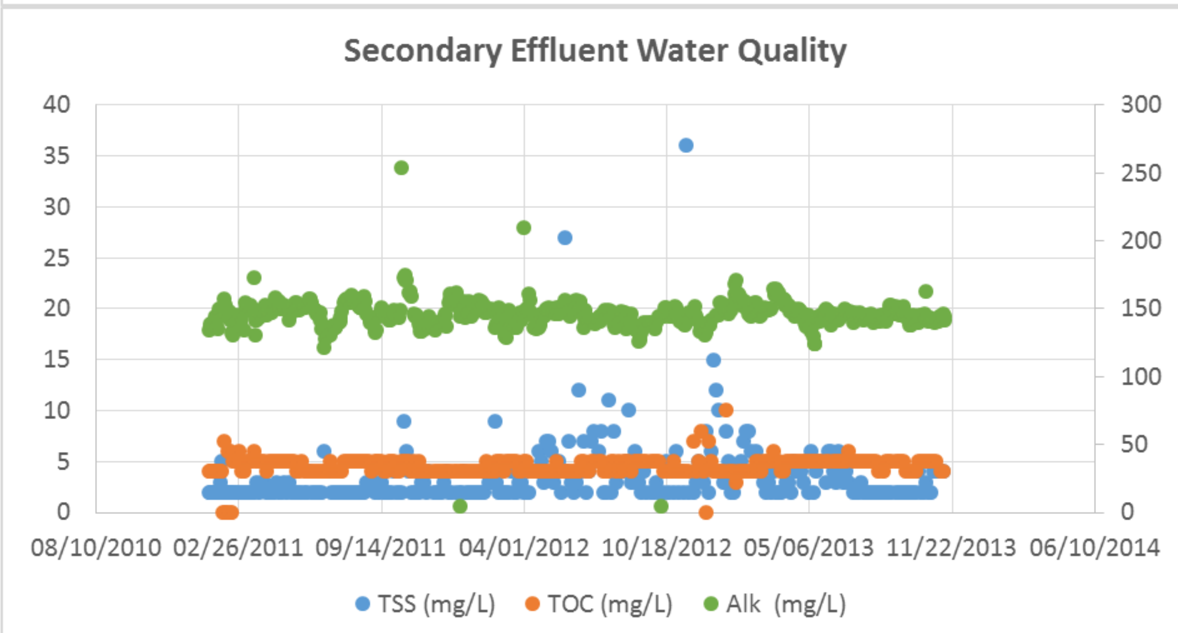

Primary Treatment TOC Removal
100%
80%
60%
40%
20%
0%
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014


Primary Treatment NH3-N Removal
100%
80%
60%
40%
20%
0%
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014


Activated Sludge Solids Concentration (mg/L)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014
Train 3 MLSS
MLVSS
Train 4 MLSS


RAS Solids Concentration (mg/L)
12,000
10,000
8,000
6,000
4,000
2,000
0
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014


Secondary Effluent Water Quality
12.0
10.0
8.0
6.0
4.0
2.0
0.0
08/10/2010 02/26/2011 09/14/2011 04/01/2012 10/18/2012 05/06/2013 11/22/2013 06/10/2014
NH3-N (mg/L)
NO3-N (mg/L)
N02-N (mg/L)


Secondary Effluent Water Quality
40
35
30
25
20
15
10
5
0
300
250
200
150
100
50
0
08/10/2010 02/26/2011 09/14/2011 04/01/2012 10/18/2012 05/06/2013 11/22/2013 06/10/2014
TSS (mg/L)
TOC (mg/L)
Alk (mg/L)

# TM 8 Carbon Canyon WRF Future Plans

# IEUA Wastewater Facilities Master Plan
# TM 8 CCWRF Future Plans

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: Carollo Engineers, Inc.

REVIEWED BY: CH2M HILL

DATE: April 2015

# Executive Summary

Carbon Canyon Water Recycling Facility (CCWRF) began operation in 1992 and treats wastewater from the Cities of Chino, Chino Hills, Ontario, Montclair, and Upland. CCWRF consists of liquid treatment facilities and sends primary and secondary solids to RP-2 for treatment.

The current and future flows and loads for CCWRF were estimated in *TM 4 Wastewater Flow and Loading Forecast*. An analysis of the influent wastewater characteristics at CCWRF was conducted to establish current average and peak influent flows, concentrations, and loads at the plant, and to develop flow and load projections for the 2035 planning year and the 2060 ultimate buildout year. The influent flow and loading projections and the effluent requirements detailed in the Santa Ana Regional Water Quality Control Board (RWQCB) Order No. R8-2009-0021 were used to evaluate the existing capacities of the CCWRF liquid treatment facilities. The estimated capacities were then compared to the projected flow and loads to determine the CCWRF processes that require expansion within the 20-year planning period and when those facilities would need to be online.

This evaluation indicated that the existing capacity of CCWRF was sufficient to treat predicted flows and loads through planning years 2035 and 2060. No expansion projects are planned during the 20-year planning period.

# 1.0 Background and Objectives

The objective of the Wastewater Facilities Master Plan (WFMP) is to plan Inland Empire Utilities Agency (IEUA)'s wastewater treatment and conveyance improvements and develop a Capital Improvement Program (CIP). The capital program will guide IEUA in the development of major improvements to their treatment and conveyance facilities. There are five specific goals for this technical memorandum (TM):

- Summarize information from TMs 1 through 4 as it pertains to CCWRF.
- Evaluate the current capacities and limitations of the existing facilities.
- Determine treatment facilities required to treat predicted flows and loads through planning year 2035.
- Estimate timing and preliminary capital costs for plant expansion projects required during the 20-year planning period.

# 2.0 CCWRF Overview

Liquid facilities include influent pumping, and preliminary, primary, secondary, and tertiary treatment. The facilities are designed to treat an annual average flow of 11.4 million gallons per day (mgd). A schematic of the CCWRF is shown in Figure 8-1.

Preliminary treatment at CCWRF includes influent diversion, flow measurement, screening, and grit removal. Raw wastewater enters the plant through the influent diversion structure and then is directed to the headworks where it is split between two mechanical bar screens. Following screening, flow enters a vortex grit chamber and is then metered by a Parshall flume. Foul air from the preliminary and primary treatment facilities is sent to a chemical scrubber for treatment and discharge. Primary treatment at CCWRF consists of two 95-foot-diameter, circular primary clarifiers. Ferric chloride is added upstream of the headworks to enhance settling performance. The two clarifiers have a common sludge and scum pump station, which pumps solids to RP-2 for processing.

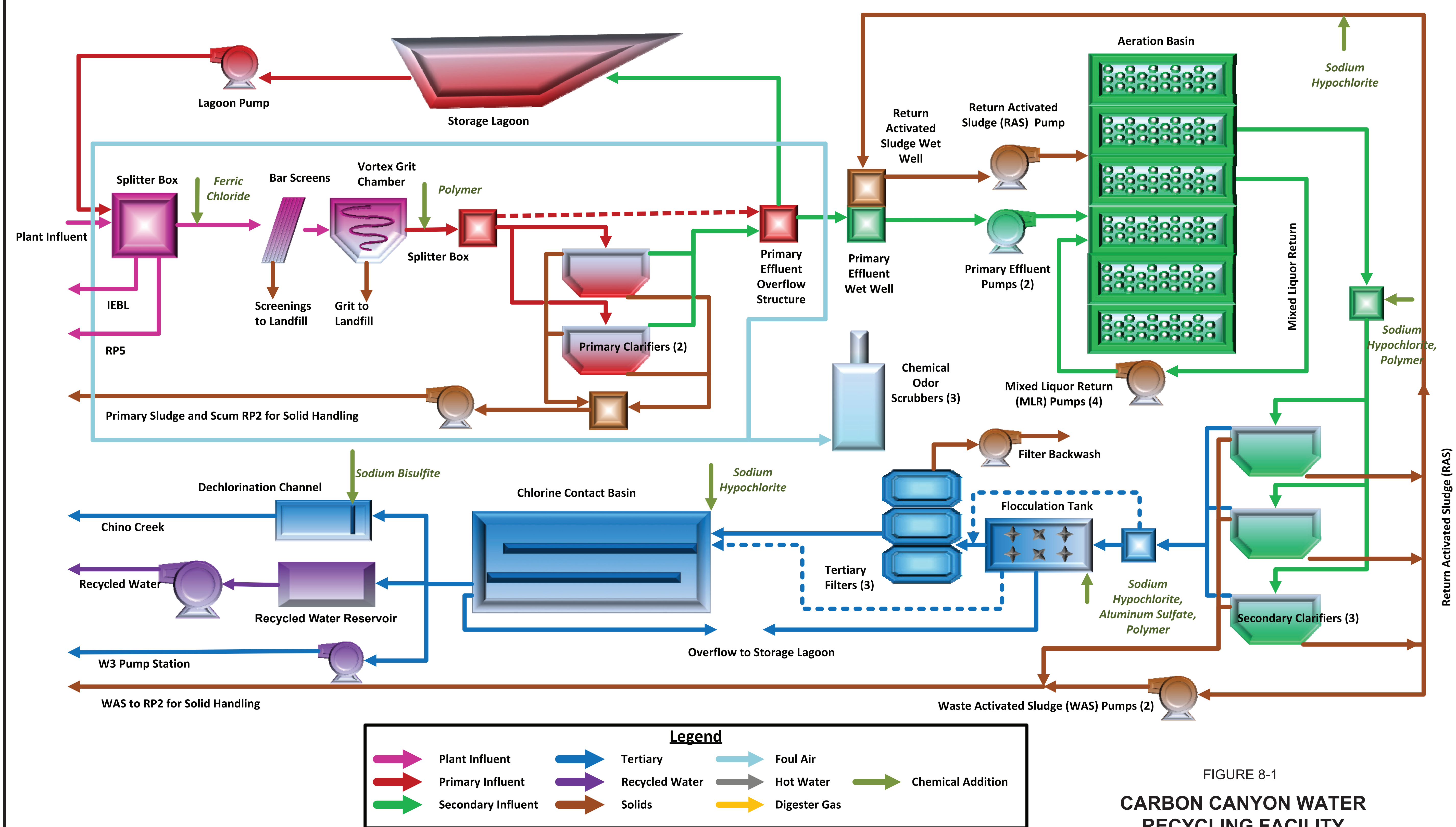



FIGURE 8-1

**CARBON CANYON WATER RECYCLING FACILITY PROCESS FLOW SCHEMATIC**

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*WASTEWATER FACILITIES MASTER PLAN*

20-IEUA-10-14F8-1-9370A00.AI

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Secondary treatment at CCWRF includes six parallel, two-stage biological nutrient removal activated sludge treatment trains and three circular secondary clarifiers. The aerobic zones are equipped with fine bubble tube diffusers supplied by three centrifugal blowers. Tertiary treatment at CCWRF consists of coagulation/ flocculation (not typically used), filtration, and disinfection. Secondary effluent is fed to a rapid mix basin upstream of a baffled, serpentine flocculation basin. After the flocculation basin, secondary effluent is fed to one of three continuous backwash, shallow bed, traveling bridge filters. Following the filter, filter effluent is directed to a chlorine contact basin and finally conveyed to the Recycled Water Pump Station. Disinfection is achieved using sodium hypochlorite, which is added to either the filter influent or effluent and fed to the contact tank. Recycled water is sent to a water storage reservoir prior to being pumped to the distribution system for reuse; excess recycled water is dechlorinated using sodium bisulfite and discharged to Chino Creek. Further details of the facilities are summarized in *TM 1 Existing Facilities*.

# 3.0 Current and Future Flows and Loads

As presented in *TM 4 Wastewater Flow and Loading Forecast*, an analysis of the influent wastewater characteristics at CCWRF was conducted as part of this WFMP effort in order to establish current average and peak influent flows, concentrations, and loads at the plant and to develop flow and load projections for the 2035 planning year and 2060 ultimate buildout year. The data analysis is based on two consecutive years of recent data provided by IEUA for influent flow and key wastewater quality constituents including biological oxygen demand (BOD), total organic carbon (TOC), total suspended solids (TSS), ammonia as nitrogen (NH3-N), and total Kjeldahl nitrogen (TKN).

Flow projections were developed by the Integrated Resources Plan (IRP) Consultant and are based on the average influent wastewater flows measured during the flow monitoring period in November 2013 and projected through the year 2060 using population, employment, and land use information. As discussed in *TM 3 Regional Trunk Sewer Alternatives Analysis*, the WFMP planning effort is based on IEUA's preferred Flow Diversion Alternative 2, which includes diverting flows from Whispering Lakes and Haven pump stations to RP-1. The corresponding influent wastewater flow and loading projections under this alternative for the planning year 2035 form the basis of the master planning effort and treatment plant capacity evaluation presented herein. Projections are also presented for the 2060 ultimate buildout year and are used for site planning considerations. Influent wastewater flows are projected to increase slightly at CCWRF between 2020 and 2060 as a result of population growth in areas served by CCWRF.

A summary of the current and projected average influent wastewater flows and loads for CCWRF are presented in Tables 8-1 and 8-2.

TABLE 8-1
**CCWRF Current and Projected Average Influent Wastewater Flows**

| | Current | 2035[a] | 2060 [a,b] |
|---|---|---|---|
| Average Influent Flow (mgd) | 7.2 | 7.3 | 7.9 |

[a] Projections developed by IRP Consultant and IEUA based on November 2013 flow monitoring period. Reflects projected flows for IEUA preferred Flow Diversion Alternative 2.
[b] Site planning considerations are based on the projections established for the 2060 ultimate buildout planning year.

TABLE 8-2
**CCWRF Current and Projected Average Influent Wastewater Characteristics**

| | Current Concentration (mg/L) | Current Load (lb/day) | 2035 Load[a] (lb/day) | 2060 Load[a] (lb/day) |
|---|---|---|---|---|
| BOD | 455 | 26,839 | 27,708 | 29,985 |
| TSS | 367 | 21,683 | 22,353 | 24,190 |
| NH3-N | 34 | 1,993 | 2,048 | 2,217 |
| TKN | 53 | 3,105 | 3,257 | 3,524 |

[a] Load projections based on projected flows, concentrations, and load peaking factors presented in TM 4.
mg/L – milligrams per liter
lb/day – pounds per day

# 4.0 Treatment Requirements

IEUA operates under an umbrella permit and must meet water quality requirements for discharge and recycled water.

## 4.1 Discharge Requirements

The tertiary effluent from CCWRF is discharged at Reach 2 of Chino Creek (Discharge Point [DP] 004), regulated by RWQCB Order No. R8-2009-0021, which replaced Order No. 01-1 and Order No. 95-43, National Pollutant Discharge Elimination System (NPDES) No. CA 0105279. This permit is an umbrella permit, governing over all of IEUA's water recycling plants (RP-1, RP-4, RP-5, and CCWRF). It includes a stormwater discharge permit and the enforcement of an industrial pretreatment program. Effluent quality standards require tertiary treatment with filters and disinfection equivalent to Title 22 requirements for recycled water, due to the use of receiving waters for water-contact recreation. A summary of the main effluent quality limits is provided in Table 8-3.

TABLE 8-3
**Summary of Effluent Quality Limits for RP-5[a]**

| Parameter | Weekly Average | Monthly Average | Annual Average | Daily Maximum | Notes |
|---|---|---|---|---|---|
| BOD | 30 mg/L[(b)] | 20 mg/L[(b)] | - | - | 45 mg/L weekly average and 30 mg/L monthly average with 20:1 dilution. |
| TSS | 30 mg/L[(b)] | 20 mg/L[(b)] | - | - | |
| $NH_4$-N | - | 4.5 mg/L | - | - | |
| Chlorine Residual | - | - | - | 0.1 | Instantaneous maximum ceiling 2 mg/L |
| TIN | - | - | 8 mg/L | - | |
| TDS | - | - | 550 mg/L | - | Shall not exceed 12-month running average TDS concentration in water supply by more than 250 mg/L |
| Turbidity | - | - | - | - | 1. Daily average – 2 NTU<br>2. 5% maximum in 24 hour – 5 NTU<br>3. Instantaneous maximum – 10 NTU |

TABLE 8-3
**Summary of Effluent Quality Limits for RP-5[a]**

| Parameter | Weekly Average | Monthly Average | Annual Average | Daily Maximum | Notes |
|---|---|---|---|---|---|
| Coliform | < 2.2 MPN | - | - | - | Maximum 23 MPN, once per month |
| pH | - | - | - | 6.5 – 8.5 | 99% compliance |
| Free Cyanide | - | 4.3 µg/L | - | 8.5 µg/L | |
| Bis(2-ethylhexyl) Phthalate | - | 5.9 µg/L | - | 11.9 µg/L | |

[a] RWQCB Order No. R8-2009-0021
[b] Without 20:1 Dilution and for recycled water
TIN – total inorganic nitrogen
NTU – nephelometric turbidity unit(s)
MPN – most probable number
µg/L – micrograms per liter

## 4.2 Recycled Water Requirements

Recycled water from CCWRF is used for irrigation in the area overlying Chino North “Max Benefit” Groundwater Management Zone (DP 008). Recycled water quality requirements are governed under RWQCB Order No. R8-2009-0021 and must meet the discharge requirements set forth in Table 8-3.

# 5.0 Existing Plant Capacity and Limitations

Existing facilities and current plant performance were used as the basis for CCWRF process model development. A whole plant model was developed using PRO2D and calibrated based on plant influent data and plant operations data for the period between October 15, 2011, and October 15, 2013. This period was selected as the basis after a review of influent and plant data to reflect a 2-year-long complete data set. Existing plant operation and the findings of the capacity evaluation through the use of process modeling is presented below for the liquid treatment facilities at CCWRF.

## 5.1 Existing Plant Operation

A summary of CCWRF plant operations is provided in Table 8-4 for the liquid treatment and solids handling facilities. Unit process performance values were averaged over the evaluation period, with operating ranges noted. These values were used in development and calibration of the process models. Detailed data summaries for the evaluation period are provided in Appendix 8-A.

A performance summary for the major treatment processes is presented in Table 8-5. These values, which represent the average over the evaluation period, were used in the subsequent plant process modeling and the capacity evaluations for major treatment units. Detailed data summaries for the evaluation period are provided in Appendix 8-A.

TABLE 8-4
**CCWRF Average Plant Operations Summary**

| Parameter | Value |
|---|---|
| ***Primary Treatment*** | |
| TSS Removal Rate (%) | 73 |
| TOC Removal Rate (%) | 38 |
| Primary Sludge (gpd) | 80,500 |
| ***Secondary Treatment*** | |
| MLSS (mg/L) | 3,500 |
| MLVSS (%) | 84 |
| RAS SS (mg/L) | 7,300 |
| Solids Inventory (Basins Only) (lb) | 260,000 |
| Solids Inventory (Basins, Clarifiers, RAS) (lb) | 281,000 |
| Secondary Clarifier Loading (gpd/$ft^2$) | 550 |
| Secondary Clarifier Loading (lb/d/ $ft^2$) | 16 |
| Basins DO (mg/L) | 1.75 |
| Waste Activated Sludge (WAS) (mgd) | 0.116 |
| SVI (mL/g) | 189 |
| SRT (Basins Only) (day) | 36 |
| Residual Alkalinity (mg as $CaCO_3$/L) | 142 |

Notes:
gpd – gallons per day
lb – pound(s)
RAS – return activated sludge
gpd/ $ft^2$ – gallons per day per square foot
lb/d/ $ft^2$ – pounds per day per square foot
SVI – sludge volume index
SRT – solids retention time
$CaCO_3$/L – calcium carbonate per liter

TABLE 8-5
**CCWRF Average Plant Performance Summary**

| Parameter | Primary Effluent | Secondary Effluent | Final Effluent |
|---|---|---|---|
| TOC (mg/L) | 138 | 5 | 4.8 |
| BOD (mg/L) | 249 | 1.5 | 1.2 |
| TSS (mg/L) | 83 | 5 | 2 |
| NH3-N (mg/L) | 30 | 0.15 | 0.10 |
| NO3-N (mg/L) | N/A | 4.60 | 4.71 |
| NO2-N (mg/L) | N/A | 0.07 | 0.06 |
| TIN (mg/L) | N/A | 5.0 | 4.87 |
| Alkalinity (mg as $CaCO_3$/L) | N/A | 142 | 138 |

The values above are for the current operation, which includes secondary treatment operation with internal mixed liquor recycling, representing a Modified Ludzack-Ettinger biological nutrient removal (BNR) configuration.

## 5.2 Existing Plant Capacity

### 5.2.1 Process Modeling

The capacity of the existing system was evaluated through process modeling using CH2M HILL's whole plant simulator, PRO2D. PRO2D is a process simulation model that takes into account the mass balances through an entire facility for particulate and soluble components. Similar to other commercially available process models, PRO2D is based on the International Water Association (IWA) ASM2D biological process kinetics. The base model was constructed to reflect the actual facility setup, including flow splits and backwash. The process model facility setup flow diagram is presented in Figure 8-2. The model was constructed with operations and performance criteria reflective of the evaluation period; it was then calibrated to reflect the actual performance, solids yields and water quality data.

As shown in Figure 8-2, the model was constructed to represent the actual plant operation for all the major process units. The model also allows establishing sizing and design considerations for each major unit process tankage and equipment. Similar to the actual operations, the plant model was built with the filter backwash and solids thickening recycles being returned to the main plant for further treatment, with the dewatering recycles being diverted offsite. The liquid and solids mass balances calculated for the current conditions allow calibration of the model against the actual field data. The calibrated model is then used to evaluate current capacity as well as establish expansion needs and process bottlenecks.

The process model was constructed and calibrated using the current influent and operating data available for the facility. The purpose of the model calibration step is to establish a baseline condition that closely resembles current operations and provides a means to reliably predict operations and system limitations under different scenarios or alternatives. Key model calibration results are presented in Table 8-6. As the listed values show, the model was calibrated such that the simulation results and actual plant data are within a value range that is 5 percent or smaller relative to the actual data. This level of accuracy will allow reliable capacity estimations to be made for the various capacity scenarios and future operation needs.

TABLE 8-6
**CCWRF Average Plant Performance Summary**

| Parameter | Actual Data Average Values | Model Results |
|---|---|---|
| Effluent BOD (mg/L) | 1.5 | 1.5 |
| Effluent TSS (mg/L) | <5 | <5 |
| Effluent TIN (mg/L) | 4.71 | 4.86 |
| Effluent Alkalinity (mg as $CaCO_3$/L) | 138 | 141 |
| Train 2-6 MLSS Inventory (lb) | 215,600 | 217,320 |
| Train 1 MLSS Inventory (lb) | 44,200 | 43,960 |
| Sludge VS Content | 84 | 84 |
| Total Waste Solids (Dry Solids lb/d) | 7,000 | 6,720 |
| Total Primary Sludge (gpd) | 80,500 | 80,720 |
| Filter Backwash (gpd) | 90,200 | 91,200 |

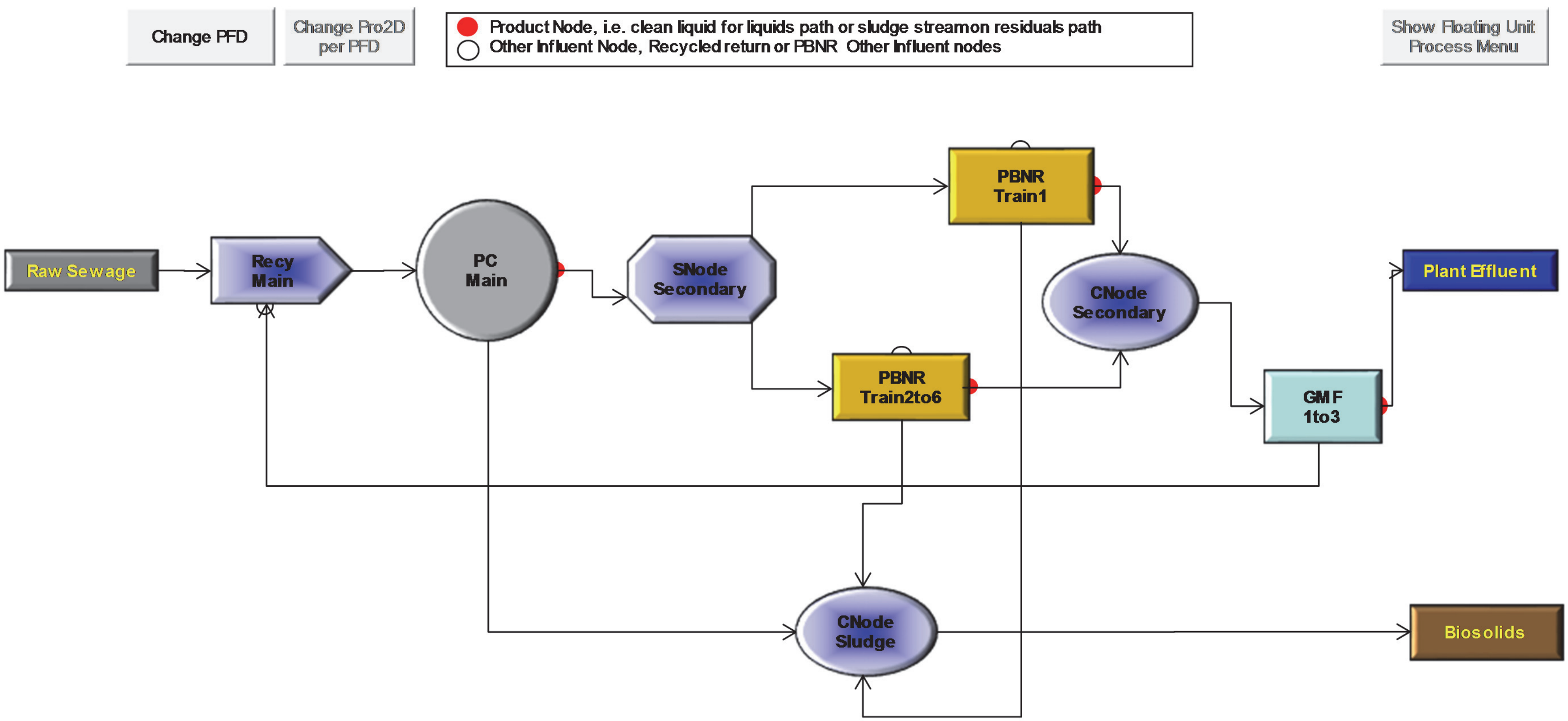


FIGURE 8-2

## CCWRF Process Model Facility Setup

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*WASTEWATER FACILITIES MASTER PLAN*

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Subsequent process modeling using the calibrated model as the base model was conducted to evaluate the following scenarios:

- Current Plant Capacity
  - Liquid treatment capacity to meet 8-mg/L effluent TIN level under flow and load conditions
  - Liquid treatment capacity to meet 8-mg/L effluent TIN level under maximum month flow and load conditions
  - Solids generation rates under average and maximum month flow and load conditions
- Future capacity implications for the planning year 2035
- Future facility footprint implications for the planning years 2035 and 2060

Findings of the current plant capacity evaluation are presented next in this section. Future capacity needs are presented in Section 6.0.

### 5.2.2 Liquid Treatment Capacity

An evaluation of the liquid treatment capacity was conducted using the whole plant process model under both the average and maximum month conditions. The capacity evaluation was conducted based on achieving a plant effluent TIN concentration of 8 mg/L. As established at the onset of the project, the facility reliability and redundancy considerations are based on the IEUA's overall wastewater treatment system, with RP-5 being the end of the line facility receiving all flow diversions if needed from other Regional Water Recycling Plants. Since redundancy is provided by taking the largest unit out of service for each process at RP-5, the CCWRF plant capacity is based on all CCWRF units in service.

The facility has two primary clarifiers in service. The average hydraulic loading rates with two units in service are around 1,100 gpd/ $ft^2$. Under peak day, and especially if one unit needs to be taken out of service, the primary clarifiers will be hydraulically overloaded. Considering that flow diversion to RP-5 is available for times if a primary clarifier needs to be taken out of service, the facility will need to operate at a lower treatment capacity under these temporary conditions. Alternatively, chemically enhanced primary treatment (CEPT) could be implemented under these conditions to avoid overloading the downstream secondary treatment system.

Waste solids (primary sludge and WAS) generated at CCWRF are diverted to RP-2 currently. CCWRF waste solids will continue to be diverted offsite, either to RP-2 or to the new solids handling facility that will be located at the RP-5 site. Therefore, there are no solids handling recycles processed at this facility.

Process modeling showed that the liquid treatment capacity is also limited by the secondary treatment system. One of the limitations was found to be the aeration and the ability to control dissolved oxygen (DO) in the anoxic and oxic zones in the aeration basins. The implications of DO are TIN fluctuations in the effluent and SVI values that are greater than 180 milliliters per gram (mL/g), which indicates sludge settleability could be impaired at times. Another limitation of the secondary treatment system was found to be the secondary clarification solids loading resulting from the current operations and the influent wastewater solids loading rates. Maintaining the SVI values at or below 150 mL/g is important for this reason also. Primary and secondary treatment capacity is presented in Table 8-7.

TABLE 8-7
**CCWRF Existing Primary/Secondary Treatment Capacity**

| | All Units in Service | One Unit Out of Service[a] |
|---|---|---|
| Capacity with Effluent TIN $\leq$ 8 mg/L | 14 mgd | 12 mgd |

[a] One secondary clarifier out of service.

The CCWRF tertiary filters were designed based on a California Department of Public Health (CDPH) maximum filter loading rate of 4.0 gpm/ft$^2$ for shallow bed sand filters (RWQCB, 2010). As indicated in the Title 22 Engineering Report (DDB Engineering, Inc. [DDB], 2014) and confirmed by IEUA, the filters are rated based on all three filters in service, with average capacity equal to maximum capacity, on the premise that reliability and redundancy are provided by the ability to discharge peak flows to RP-5, the availability of short-term onsite storage, the availability of standby equipment, and the use of automatic flow controls. In order not to exceed the maximum approved filter loading rate, the maximum flow that the filtration system can handle is 27.6 mgd. Given the flexibilities discussed above, the Title 22 Engineering Report equates the average flow for the plant to the peak flow. As such, the CCWRF average filtration capacity is reported as 27.6 mgd in the current Title 22 report.

The disinfection system was designed based on the Title 22 concentration and time (CT) and modal contact requirements of 450 milligrams per minute per liter (mg-min/L) and 90 minutes during the peak hourly dry weather flow, respectively. Tracer testing conducted at CCWRF in 2004 showed that the disinfection system can handle a peak flow of 15.4 mgd while maintaining a modal contact time of 90 minutes (DDB, 2014). The resulting average disinfection capacity is therefore also 15.4 mgd for the reasons discussed above. The results of the tertiary capacity evaluation are summarized in Table 8-8.

TABLE 8-8
**CCWRF Existing Tertiary Treatment Capacity**

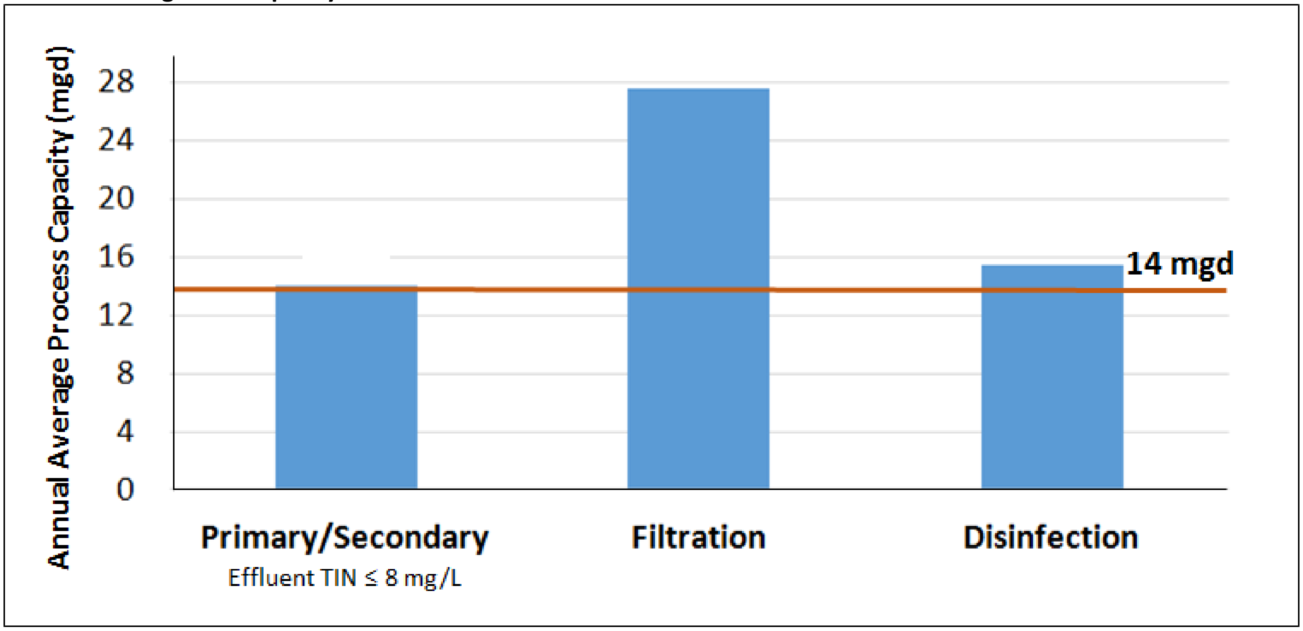
| | All Units in Service | One Filter Out of Service |
|---|---|---|
| Average Filtration Capacity[a] | 27.6 mgd | 18.4 mgd |
| Average Disinfection Capacity[a] | 15.4 mgd | N/A |

[a] Per Title 22 Engineering Report, the reliable annual average capacity is equal to peak capacity due to the ability to discharge to RP-5, availability of short-term onsite storage, standby equipment, and use of automatic flow controls to provide reliability and redundancy.

The overall plant capacity is determined by its most limiting process capacity. As shown in Figure 8-3, the limiting treatment process is the secondary treatment system. Therefore, the average CCWRF plant capacity is 14 mgd under the current wastewater flow and loads, as well as the reliability and redundancy considerations outlined previously.

By comparing the CCWRF flow and load projections in Table 8-1 to the plant capacity presented in Table 8-8, it is clear that the CCWRF will have excess capacity through the WFMP planning period. Since some of the CCWRF service area is also tributary to the RP-5 service area, it may be possible to use some of the CCWRF excess capacity by diverting flow that is tributary to both CCWRF and RP-5 to CCWRF. The analysis presented in *TM 7 RP-5 and RP-2 Complex Future Plans* shows that RP-5 will require a capacity expansion during the planning period. This expansion can be delayed if some of the RP-5 flow can be diverted to use the excess capacity at CCWRF. Based on a collection system model run of the flows tributary to both RP-5 and CCWRF, approximately 1.0 mgd of the RP-5 average daily flow can be diverted to CCWRF. The diversion can be accomplished by lowering or removing the weir that currently diverts flow into CCWRF. This diversion could delay the RP-5 expansion by about 2 years beyond that projected in the current CIP.

FIGURE 8-3
**CCWRF Existing Plant Capacity**




# 6.0 Plant Expansion Needs

CCWRF has sufficient capacity to treat estimated flows and loads presented in Section 3.0 for planning years 2035 and 2060. There are no expansion projects planned for CCWRF during the 20-year planning period.

## 6.1 Facility Expansion Requirements

There are no projects planned for CCWRF in planning years 2035 or 2060.

## 6.2 Ultimate Facilities Site Plan

As there are no projects planned for the expansion of CCWRF, the plant will remain as currently operated. Figure 8-4 presents the current site layout, which is estimated to be the ultimate facilities site plan.

# 7.0 20-Year CIP Plant Expansion Projects and Capital Cost

CCWRF has sufficient capacity to treat estimated flows and loads projected for planning years 2035 and 2060. No expansion projects are planned during the 20-year planning period.

# 8.0 Conclusion

The following conclusions can be made from the evaluation of CCWRF:

- CCWRF has sufficient capacity to treat predicted liquid flows through the 20-year planning period.

# 9.0 References

DDB Engineering, Inc. (DDB). 2014. *Inland Empire Utilities Agency Carbon Canyon Water Recycling Facility Title 22 Engineering Report.* March.

Regional Water Quality Control Board (RWQCB). 2010. *Effluent Monitoring Point and Filter Loading Rate Approval – Waste Discharge and Producer/User Reclamation Requirements Order No. R8-2009-0021 for the Inland Empire Utilities Agency.* July 30.


Aerial image © Google Earth, 2014. Annotation by Carollo, 2014.

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FIGURE 8-4

## CCWRF Ultimate Facility Site Plan

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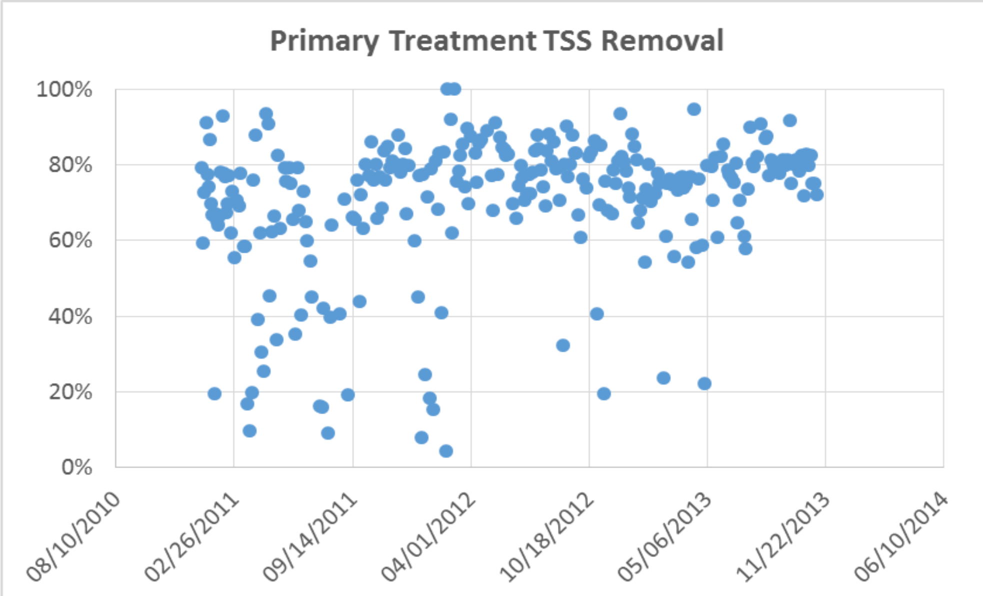
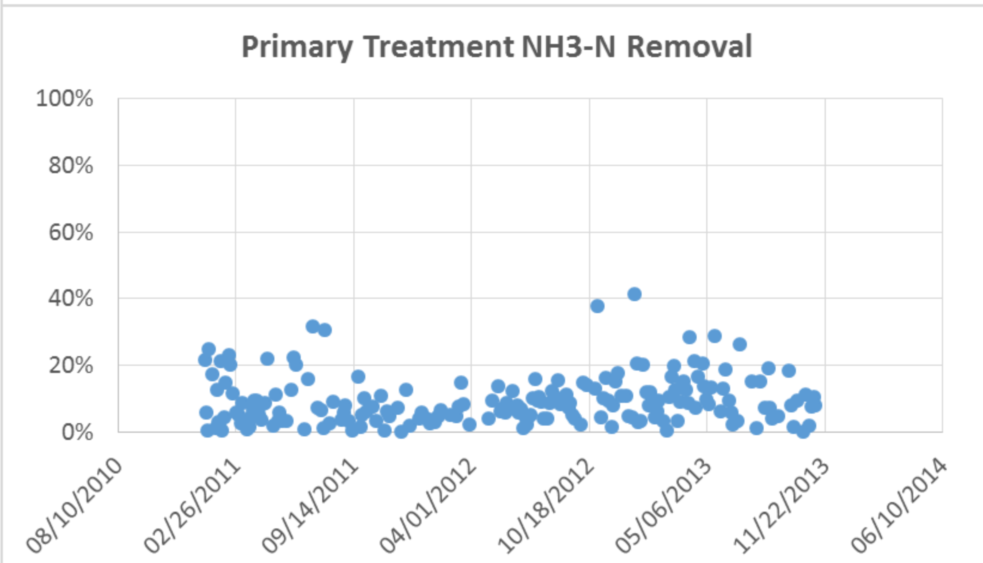
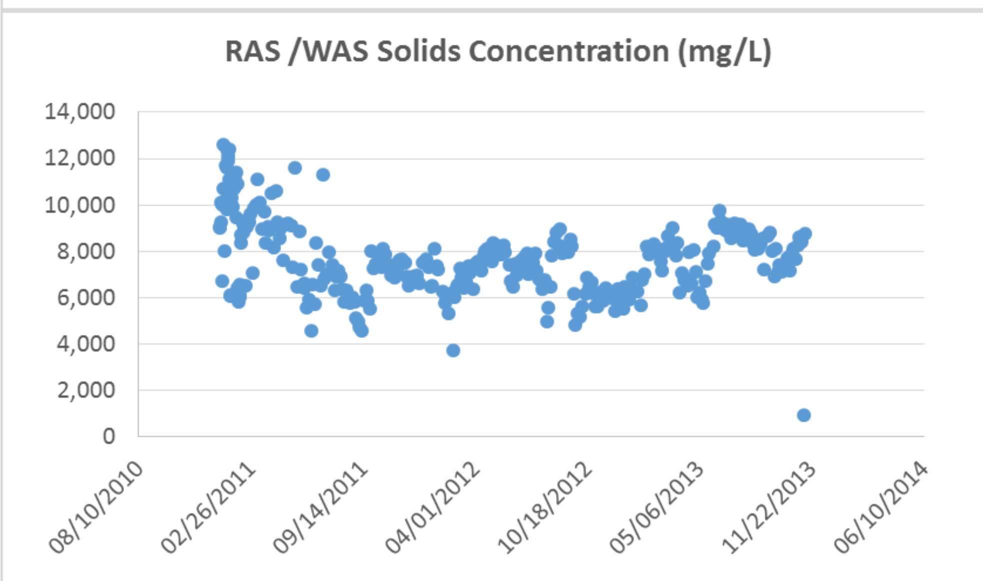
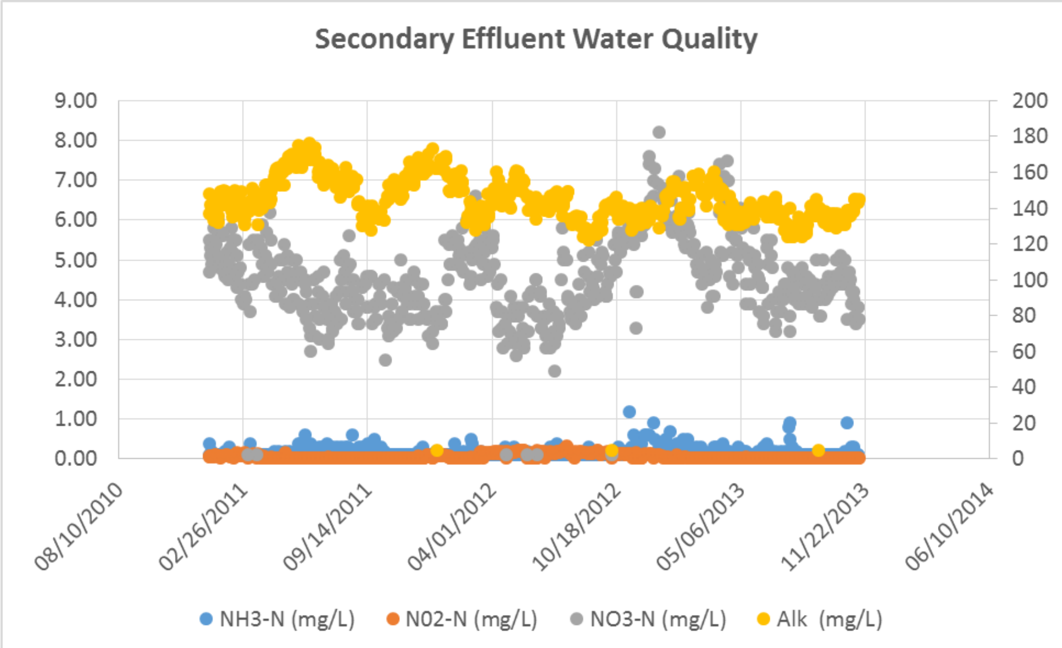
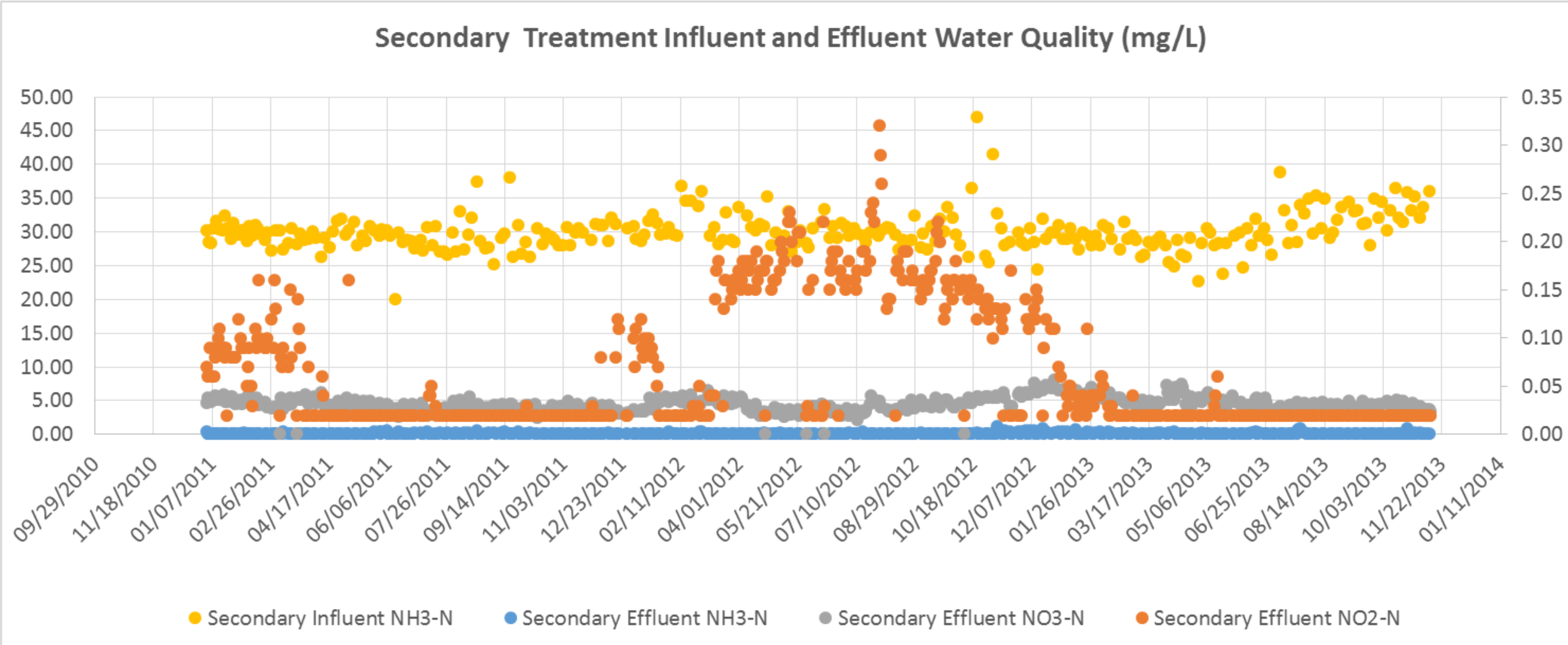
# Appendix 8-A
# CCWRF Plant Operations Summary (2011-2013)


Primary Treatment TSS Removal
100%
80%
60%
40%
20%
0%
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014


Primary Treatment NH3-N Removal
100%
80%
60%
40%
20%
0%
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014


RAS /WAS Solids Concentration (mg/L)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014


Secondary Effluent Water Quality
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
200
180
160
140
120
100
80
60
40
20
0
08/10/2010
02/26/2011
09/14/2011
04/01/2012
10/18/2012
05/06/2013
11/22/2013
06/10/2014
NH3-N (mg/L)
N02-N (mg/L)
NO3-N (mg/L)
Alk (mg/L)



Secondary Treatment Influent and Effluent Water Quality (mg/L)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
09/29/2010
11/18/2010
01/07/2011
02/26/2011
04/17/2011
06/06/2011
07/26/2011
09/14/2011
11/03/2011
12/23/2011
02/11/2012
04/01/2012
05/21/2012
07/10/2012
08/29/2012
10/18/2012
12/07/2012
01/26/2013
03/17/2013
05/06/2013
06/25/2013
08/14/2013
10/03/2013
11/22/2013
01/11/2014
Secondary Influent NH3-N
Secondary Effluent NH3-N
Secondary Effluent NO3-N
Secondary Effluent NO2-N

# TM 9 Organics Management Plan

# IEUA Wastewater Facilities Master Plan
# TM 9 Organics Management Plan

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: CH2M HILL

DATE: April 2015

# Executive Summary

The purpose of the Inland Empire Utilities Agency (IEUA) Organics Management Plan is to assess the existing solids handling and composting capacities within the northern and southern service areas and determine the facilities expansion needs through the ultimate buildout year 2060 based on the projected plant influent flows and loads, and the corresponding projected biosolids quantities. Based on the influent flow and load projections presented in *Technical Memorandum (TM) 4 Wastewater Flow and Loading Forecast*, the solids handling facilities at RP-1 and RP-5/RP-2 will need to be expanded beyond their existing solids handling capacities of 38 million gallons per day (mgd) and 18 mgd, respectively, to meet future demands in the northern and southern service areas, respectively. RP-1 solids handling will require the addition of anaerobic digesters, while RP-5/RP-2 solids handling facilities need to be relocated to RP-5. The RP-2 solids handling facilities will need to be decommissioned and relocated to the RP-5 site by 2023 in anticipation of the United States Army Corps of Engineers (USACE) raising the Prado Spillway. In addition, the RP-2 Lift Station will also need to be relocated to a location above the flood plain. New RP-5 solids handling facilities to be completed by 2035 include thickening, anaerobic digestion, dewatering, digester gas storage and utilization, and odor control. Additional thickening and digestion capacity would be needed at RP-5 by 2060 to meet the projected demands in the southern service area.

As a result of the anticipated increased flows and loads to each plant, the estimated biosolids quantities from the northern and southern service areas are projected to reach up to 198 wet tons per day by 2035 and 241 wet tons per day by 2060. Based on recent discussions with the Inland Empire Regional Composting Facility (IERCF) Manager of Operations and Organics, the facility currently has a throughput capacity of 209,625 annual wet tons of biosolids and amendment permitted by the Air Quality Management District (AQMD). Based on the joint powers agreement, IEUA may contribute up to half of this amount, which equates to 200 wet tons of biosolids per day. Thus, IERCF has adequate capacity to receive and process IEUA biosolids over the next 20 years. However, the projected ultimate biosolids are expected to surpass the current permitted capacity of IERCF by 2060, at which time IEUA needs to explore additional biosolids management options. Options may include implementing technologies such as heat drying, improved dewatering technologies to reduce the amount of wet tons produced, or diversifying biosolids management by contracting with private companies for land application, composting, energy production, and other biosolids product markets.

# 1.0 Background and Objectives

As part of the Wastewater Facilities Master Plan (WFMP) effort, this Organics Management Plan TM has been prepared to summarize existing solids handling and composting facility capacities, establish biosolids projections through the ultimate buildout year 2060, and determine expansion needs for solids handling and composting facilities within the service area.

The expected solids generation in wet and dry tons per day from now until ultimate buildout was calculated based on the current wastewater characteristics and projected influent wastewater flows to each of the four Regional Water Recycling Plants (RWRPs) established in *TM 4 Wastewater Flow and Loading Forecast* as the basis of all capacity and planning considerations. Projected biosolids quantities were then compared to the existing capacity of the solids handling and composting facilities to assess the biosolids handling capacity requirements for the biosolids generated in the northern and southern portions of the IEUA service area, and determine what options are available for expansion, if expansion is deemed necessary.

As discussed in *TM 7 RP-5 and RP-2 Complex Future Plans*, the RP-2 solids handling facilities will need to be decommissioned and relocated to the RP-5 site by 2023 in anticipation of the USACE raising the Prado Spillway. The RP-2 Lift Station will also need to be relocated to a location above the flood plain. For the northern part of the service area, the timing needed for developing a management strategy will be determined for handling the biosolids based on how long it may take to develop a strategy and when the current capacity will be exceeded.

# 2.0 Organics Management Plan Overview

The existing solids handling and composting facilities are described in *TM 1 Existing Facilities*. As presented in TM 1, biosolids are produced at each of the four RWRPs and require stabilization and beneficial use. Currently, IEUA operates two solids handling facilities located at RP-1 and RP-2. RP-1 solids handling processes treat biosolids produced at RP-1 and RP-4, while RP-2 solids handling processes treat biosolids produced at RP-5 and Carbon Canyon Water Recycling Facility (CCWRF). Biosolids are thickened, stabilized, and dewatered at RP-1 and RP-2 and then trucked to IERCF for composting. IERCF is operated by the Inland Empire Regional Composting Authority (IERCA), which was created by a joint powers agreement between IEUA and the Sanitation Districts of Los Angeles County (Sanitation Districts). IERCF accepts biosolids from both IEUA and the Sanitation Districts treatment facilities and produces a high-quality soil amendment.

# 3.0 Projections of Biosolids Quantities

In the northern service area, IEUA currently produces approximately 100 wet tons of biosolids per day at 24 percent solids content on average. In the southern service area, IEUA produces approximately 45 wet tons per day at 24 percent solids content on average. The resulting total biosolids production is currently about 145 wet tons per day.

With influent wastewater flows projected to increase through the ultimate buildout year 2060 as a result of increased population growth and incorporation of septic flows into the IEUA system, biosolids production is similarly expected to increase. Biosolids projections are calculated based on the projected influent flows to each RWRP and the wastewater characteristics established for each RWRP. A detailed discussion of the influent flow and load projections is presented in *TM 4 Wastewater Flow and Loading Forecast*. The projected average biosolids quantities for the northern and southern service areas for the 2035 and 2060 planning years are presented in Table 9-1.

TABLE 9-1
**Estimated Current and Projected Average Biosolids Quantities**

| | **Current** | | | **Planning Year 2035[a]** | | | **Planning Year 2060[a,b]** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Influent Flow (mgd)** | **Biosolids (WT/d)** | **Biosolids (DT/d)** | **Influent Flow (mgd)** | **Biosolids (WT/d)** | **Biosolids (DT/d)** | **Influent Flow (mgd)** | **Biosolids (WT/d)** | **Biosolids (DT/d)** |
| RP-1 / RP-4 | 38.5 | 100 | 24 | 47.8 | 130 | 31 | 54.7 | 139 | 33 |
| RP-5 / CCWRF | 17.2 | 45 | 11 | 25.7 | 68 | 16 | 33.2 | 102 | 25 |
| Total | 55.7 | 145 | 35 | 73.5 | 198 | 47 | 87.9 | 241 | 58 |

[a] Reflects projected flows for IEUA preferred Flow Diversion Alternative 2, with Whispering Lakes and Haven Pump Stations online, and a biosolids cake solids content of 24 percent.
[b] Site planning considerations are based on the projections established for the 2060 ultimate planning year.
WT/d = wet tons per day
DT/d = dry tons per day
TS = total solids

As listed in Table 9-1, the northern service area biosolids production is projected to increase by 30 percent from 100 to 130 wet tons per day by 2035, to as much as 139 wet tons per day by 2060. In comparison, the southern service area biosolids production is projected to increase by 51 percent from 45 to 68 wet tons per day by 2035, to as much as 102 wet tons per day by 2060, which is aligned with the projected increase in plant flows and loads. Overall, the total biosolids production is projected to increase by 37 percent from 145 to 198 wet tons per day by 2035, and up to 241 wet tons per day by 2060.

# 4.0 Summary of Existing Solids Handling Facilities Capacities

The existing capacity of the solids handling facilities and the composting facility are summarized briefly in this section. A description of each facility is presented in *TM 1 Existing Facilities*, and a detailed discussion of the capacity evaluation of each solids handling facility is presented in *TM 5 RP-1 Future Plans* and *TM 7 RP-5 and RP-2 Complex Future Plans.*

## 4.1 RP-1 Solids Handling Facilities

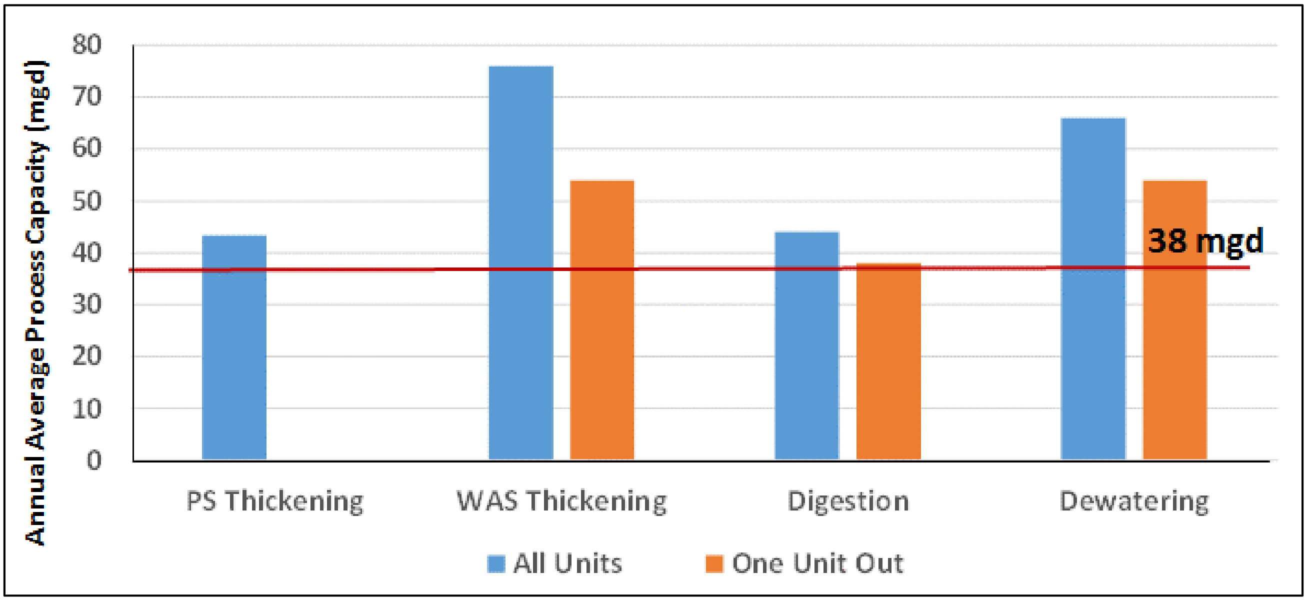
Solids removed from RP-1 and RP-4 liquid streams are processed in the RP-1 solids handling facilities. The RP-1 solids handling facilities consist of thickening, stabilization, and dewatering processes. Two thickening processes are in operation at RP-1: gravity thickening for primary solids, and dissolved air flotation (DAF) thickening for secondary solids. Thickened waste solids from the primary and secondary processes are stabilized in a three-stage anaerobic digestion process, which consists of acid and gas (thermophilic and mesophilic) digestion stages. Digested solids are then dewatered using centrifuges. Dewatered biosolids are loaded onto trucks and delivered to IERCF for composting.

As presented in *TM 5 RP-1 Future Plans*, the existing RP-1 solids handling capacity is limited to 38 mgd due to digestion capacity limitations with one digester out of service. The plant influent includes the RP-4 solids diverted to RP-1 via the sewer system for further treatment. Primary sludge thickening is currently achieved using one gravity thickener, and thickening can be achieved in the primary clarifiers if the gravity thickener is taken out of service. The capacity of the DAF thickeners was evaluated using a maximum solids loading rate of 45 pounds per day per square foot. Waste solids digestion, achieved in the phased digestion system, was evaluated based on the current operating conditions as well as Part 503 Rule requirements for Class B biosolids. Digester loading rates and a digester solids retention time (SRT) of 15 days with one large unit out of service were used to establish digestion capacity, using an active digester volume of 90 percent of the total digester volume including the cone space. Dewatering capacities of the centrifuges were calculated considering the hydraulic loading rate to be maintained at or below 340 gallons per minute (gpm) under the current solids loading conditions. The existing RP-1 solids handling process capacities are summarized in Table 9-2 and illustrated in Figure 9-1.

TABLE 9-2
**RP-1 Existing Solids Handling Capacity**

| | **All Units in Service** | **One Unit Out of Service** |
|---|---|---|
| Primary Sludge Thickening | 43.3 mgd | 0 mgd |
| Waste Activated Sludge Thickening | 76 mgd | 54 mgd |
| Digestion | 44 mgd | 38 mgd |
| Dewatering | 66 mgd | 54 mgd |

FIGURE 9-1
**RP-1 Existing Solids Handling Capacity**




## 4.2 RP-5/RP-2 Solids Handling Facilities

### 4.2.1 RP-2 Solids Handling Facilities

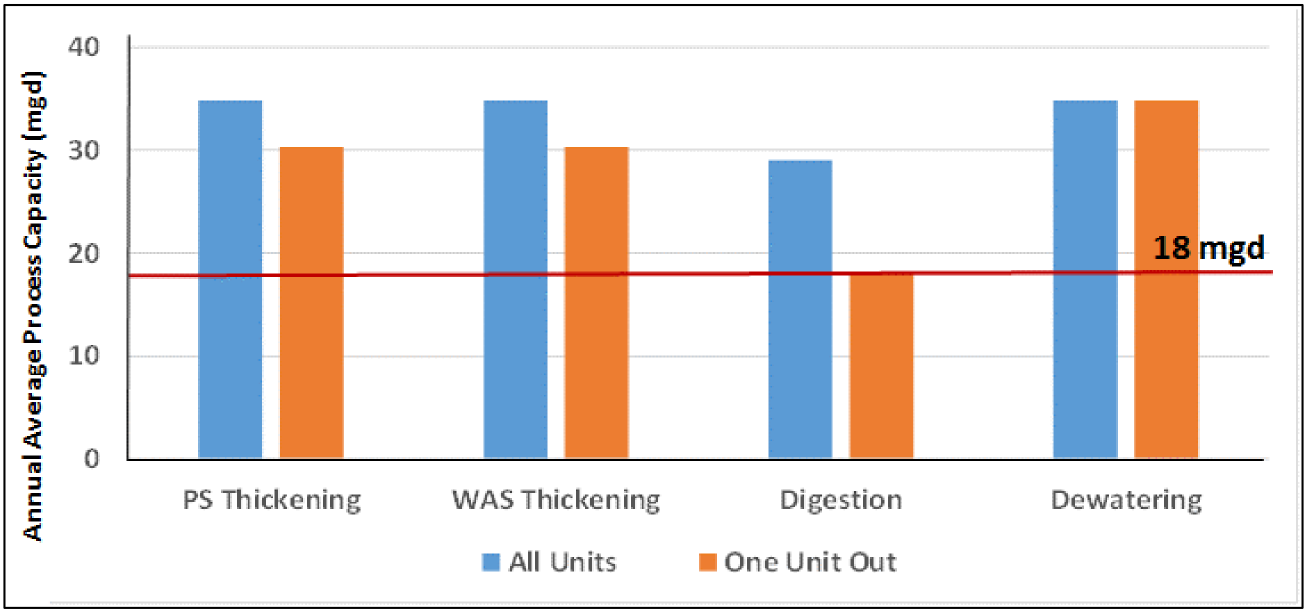
Solids removed from the RP-5 and CCWRF liquid streams are processed in the RP-2 solids handling facilities. RP-5 and CCWRF primary and secondary solids are individually conveyed to RP-2 for treatment. The RP-2 solids handling facilities consist of thickening, stabilization, and dewatering processes. There are two thickening processes in operation at RP-2: gravity thickening for primary solids, and DAF thickening for secondary solids. Thickened solids from the primary and secondary processes are stabilized in a two-stage anaerobic digestion process, which consists of mesophilic-acid and mesophilic gas digestion stages. Digested biosolids are then dewatered using belt filter presses or centrifuges. Currently, the belt filter presses are in operation with the centrifuges on standby. Dewatered biosolids are loaded onto trucks and delivered to IERCF for composting.

As presented in *TM 7 RP-5 and RP-2 Complex Future Plans*, the existing RP-2 solids handling capacity is limited to 18 mgd due to digestion capacity limitations with one digester out of service. Primary sludge thickening is currently achieved using gravity thickening. Thickening cannot be achieved in the primary clarifiers because the sludge needs to be diverted to RP-2 at a solids content of about 1 to 1.5 percent solids. WAS thickening is achieved in DAF thickeners. Waste solids digestion, achieved in the phased digestion system, was evaluated based on the current operating conditions as well as Part 503 Rule requirements. A digester SRT of 15 days with one large unit out of service was used to establish digestion capacity, using an active digester volume of 90 percent of the total digester volume including the cone space. The dewatering capacity of the belt filter presses was calculated considering the hydraulic loading rate to be maintained at or below 75 gallons per minute per meter, and the solids loading rate to be maintained at or below 1,000 pounds per hour per meter under the current solids loading conditions. The existing RP-2 solids handling process capacities are summarized in Table 9-3 and illustrated in Figure 9-2.

TABLE 9-3
**RP-2 Existing Solids Handling Capacity**

| | All Units in Service | One Unit Out of Service |
|---|---|---|
| Primary Sludge Thickening | 34.8 mgd | 30.3 mgd |
| Waste Activated Sludge Thickening | 34.8 mgd | 30.3 mgd |
| Digestion | 29 mgd | 18 mgd |
| Dewatering | 34.8 mgd | 34.8 mgd |

FIGURE 9-2
**RP-2 Existing Solids Handling Capacity**




## 4.2.2 RP-5 Solids Handling Site

To help reduce the impacts of manure from dairy farms on local groundwater and produce energy, IEUA built a 5-million gallon (MG) plug flow digester at the RP-5 complex. This facility began accepting manure in 2001. In 2005, two aboveground vertical stirred digesters were added to allow food-waste processing in addition to the dairy manure. In 2009, IEUA shut down the food-waste processing unit and began looking for a third-party operator. In 2010, IEUA signed a 10-year lease agreement with Environ Strategy Consultants, Inc. (ESCI). ESCI operates the food-waste processing facility and sells power to IEUA. A capacity evaluation of this food-waste processing facility was therefore not conducted as part of this WFMP effort.

## 4.3 Inland Empire Regional Composting Facility

IERCF is North America's largest indoor biosolids composting facility, encompassing 24 acres with 445,275 square feet dedicated specifically to the compost process building. The facility is operated by the IERCA, a joint powers authority created by IEUA and the Sanitation Districts in 2002 to construct, operate, and maintain a regional composting facility. Both IEUA and the Sanitation Districts send biosolids to the facility for processing and reuse as a high-quality soil amendment. IERCF produces high-quality compost that is marketed under the name of SoilPro Premium Products and sold to landscapers, farmers, and gardeners around the region.

Biosolids and amendments are trucked to IERCF and deposited into solids hoppers prior to conveying the biosolids and amendment material to the pug mills via belt conveyors for mixing. After mixing in the pug mills, the material flows via belt conveyors to the active compost area and is piled using front-end loaders for approximately 21 days of active composting. Compost materials are then transferred via front-end loader to the curing area for approximately 30 days of curing. The cured materials are then transported to the screening belt conveyor using front-end loaders. After screening, the product flows via belt conveyors to the product load-out area, where it is loaded onto trucks and hauled to customers. A process flow schematic of IERCF is provided in Figure 9-3.

Based on recent discussions with the IERCF Manager of Operations and Organics, Mr. Jeff Ziegenbein, the facility currently processes up to approximately 205,000 wet tons of biosolids and amendment annually, or 98 percent of the maximum throughput permitted by the AQMD. The AQMD permits a total of 209,625 wet tons per year of biosolids and amendment throughput, excluding recycled material (AQMD, 2010) based on the air emissions control system capacity and emission limits. This includes approximately 150,000 tons of biosolids and 60,000 tons of amendment materials such as green waste, wood waste, and stable bedding. Thus, IERCF processes approximately 400 wet tons of biosolids on average per day. Based on the joint powers agreement, IEUA and the Sanitation Districts contribute equal shares of biosolids. Thus, IEUA may contribute up to approximately 200 wet tons of biosolids per day to IERCF.

# 5.0 Expansion Considerations

Expansion needs for the RP-1 solids handling facilities, RP-5/RP-2 solids handling facilities, and IERCF were determined based on the flow and load projections discussed in *TM 4 Wastewater Flow and Loading Forecast* and the biosolids projections presented above in Section 3.0 of this TM. Expansion needs for RP-1 and RP-5/RP-2 are discussed in detail in *TM 5 RP-1 Future Plans* and *TM 7 RP-5 and RP-2 Complex Future Plans*, respectively. Expansion needs for the solids handling and composting facilities for the planning year 2035 and ultimate buildout year 2060 are summarized below.

## 5.1 RP-1 Solids Handling Facilities

As discussed in Section 4.1, the existing RP-1 solids handling capacity is limited to 38 mgd due to digestion capacity limitations with one digester out of service. As presented in Table 9-1, the projected influent flow to RP-1 and RP-4 is approximately 47.8 mgd by 2035 and 54.7 mgd by 2060. Therefore, the existing solids handling facilities at RP-1 do not have adequate capacity to accommodate either the 2035 or ultimate projected influent flows in the northern service area. Two new anaerobic digesters with complete sludge transfer and recirculation, mixing and heating, and pumping equipment are recommended by 2035. No additional solids handling facilities are needed beyond this since the new digesters would provide adequate capacity for the planning year 2035 and ultimate buildout year 2060.

As an alternative or perhaps an addition to digester expansion, IEUA is considering expanding the existing sludge thickening facility to reduce hydraulic loading and delay the need for additional digestion capacity. Thickening improvements should be considered during the preliminary design phase to provide RP-1 with greater and more reliable thickening capacity.

The RP-1 solids handling facilities expansion needs are summarized in Table 9-4. The ultimate site layout and estimated costs for the recommended improvements are presented in *TM 5 RP-1 Future Plans.*

TABLE 9-4
**RP-1 Solids Handling Facilities Expansion Needs for Planning Year 2035**

| Facility | Number of Units | Size of Unit |
|---|---|---|
| Anaerobic Digesters | 2 | 110 ft diameter<br>30 ft sidewater depth |

ft = foot/feet

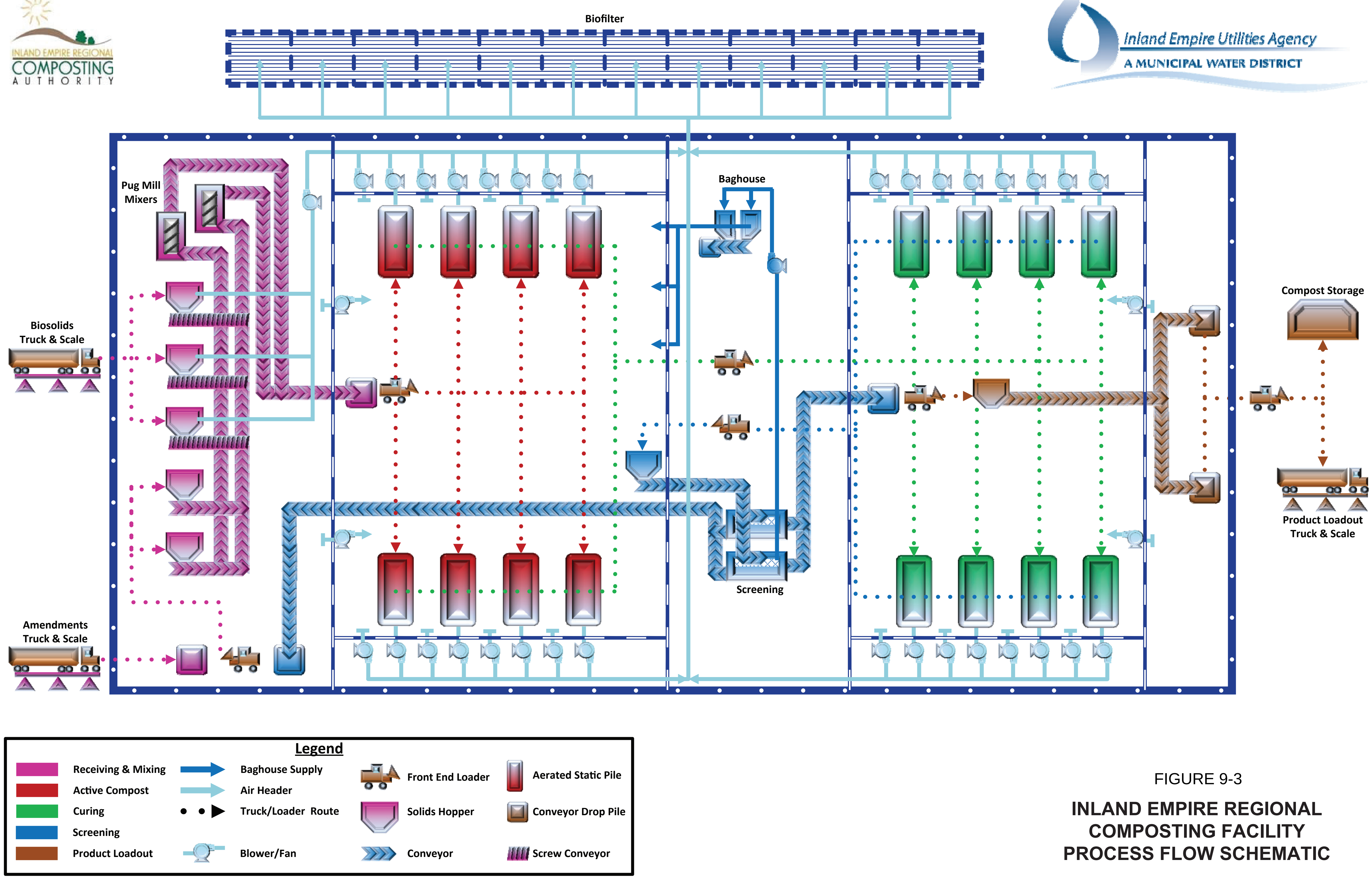



FIGURE 9-3

# INLAND EMPIRE REGIONAL COMPOSTING FACILITY PROCESS FLOW SCHEMATIC

INLAND EMPIRE UTILITIES AGENCY
*WASTEWATER FACILITIES MASTER PLAN*

## 5.2 RP-5/RP-2 Solids Handling Facilities

The RP-2 solids handling facilities will be relocated to the RP-5 site by 2035 to meet biosolids management needs for the southern part of the service area. The RP-2 Lift Station will also need to be relocated to a location above the flood plain. As discussed in Section 4.2, the existing RP-2 solids handling capacity is limited to 18 mgd due to digestion capacity limitations with one digester out of service. As presented in Table 9-1, the projected influent flow to RP-5 and CCWRF is approximately 25.7 mgd by 2035 and 33.2 mgd by 2060. Thus, the solids handling facilities do not have adequate capacity to accommodate either the 2035 or 2060 projected influent flows in the southern service area. RP-5 solids handling facilities expansion needs by 2035 include new thickening, anaerobic digestion, dewatering, digester gas storage and utilization, and odor control. Additional thickening and digestion capacity would be needed by 2060 to meet the projected demands.

The RP-5 solids handling facilities expansion needs for planning year 2035 and ultimate buildout year 2060 are summarized in Table 9-5 and Table 9-6, respectively. The ultimate site layout and estimated costs for the recommended improvements are presented in *TM 7 RP-5 and RP-2 Complex Future Plans.*

TABLE 9-5
**RP-5 Solids Handling Facilities Expansion Needs for Planning Year 2035**

| Facility | Number of Units | Size of Unit |
|---|---|---|
| Gravity Thickener | 3 | 45 ft diameter |
| DAF Thickener | 3 | 40 ft diameter |
| Anaerobic Digestion | | |
| Acid-Phase | 6 Cells | 20 $ft^2$, 30 ft sidewater depth per cell |
| Methane-Phase | 4 | 90 ft diameter 35 ft sidewater depth |
| Sludge Holding Tank | 1 | 90 ft diameter 35 ft sidewater depth |
| High-Pressure Gas Storage | 1 | 35 ft diameter w/ 30 $ft^2$ equipment pad |
| Dewatering | 1 | 100 ft x 150 ft building |
| Biofilter | 3 Cells | 60 ft x 80 ft per cell |
| RP-2 Lift Station | 1 | 10 mgd |

TABLE 9-6
**RP-5 Solids Handling Facilities Expansion Needs for Planning Year 2060**

| Facility | Number of Units | Size of Unit |
|---|---|---|
| Gravity Thickener | 1 | 45 ft diameter |
| Anaerobic Digestion | | |
| Acid-Phase | 4 Cells | 20 $ft^2$ 30 ft sidewater depth per cell |
| Methane-Phase | 1 | 90 ft diameter 35 ft sidewater depth |

## 5.3 Inland Empire Regional Composting Facility

As shown in Table 9-1, the total projected biosolids quantities produced from the northern and southern service areas is approximately 198 wet tons per day by planning year 2035 and 241 wet tons per day by ultimate buildout year 2060. As described in Section 4.3, IEUA can contribute approximately 200 wet tons of biosolids per day to IERCF, based on the joint powers agreement between IEUA and the Sanitation Districts. Therefore, IERCF has adequate capacity to receive and process IEUA biosolids over the next 20 years.

The projected ultimate biosolids quantities in 2060 exceed the current permitted capacity of IERCF by approximately 40 wet tons per day, or 20 percent of the total IEUA daily biosolids production. The projection of biosolids quantities is based on a biosolids cake solids content of 24 percent. The biosolids quantities could be reduced if a higher solids content can be achieved. Additionally, the biosolids product markets in Southern California and its vicinity are still evolving and are subject to change. These product markets, in addition to composting, could include land application, heat drying to produce pellets, and pyrolysis or heat drying to generate energy. Given the changing nature of biosolids regulations and product markets, IEUA should consider these options at the time capacity expansion is needed.

IEUA may consider implementing different technologies such as heat drying for pellet production, similar to those installed at the city of Corona Plant 1 and Encina Water Pollution Control Facility in Carlsbad, both of which have been operational for over a decade. Irvine Ranch Water District is also currently constructing a heat drying facility at the Michelson Water Recycling Plant in Irvine. The new IEUA heat drying facility can be located either at RP-1 or RP-5 to reduce hauling costs.

IEUA may also consider diversifying biosolids management by contracting with private biosolids management companies who can utilize the excess 40 wet tons per day of biosolids for land application, composting, energy production, and other applications. With the biosolids management market changing rapidly, IEUA should explore these and other options to manage the 2060 projected biosolids quantities closer to this date.

# 6.0 Conclusion

Based on the projected plant influent flows and loads through 2060, the solids handling facilities at RP-1 and RP-5/RP-2 will need to be expanded to meet future demands in the northern and southern service areas, respectively. RP-1 solids handling will require the addition of anaerobic digesters by 2035, while the RP-2 solids handling facilities will need to be decommissioned and relocated to the RP-5 site by 2023 in anticipation of the USACE raising the Prado Spillway. In addition, the RP-2 Lift Station will also need to be relocated to a location above the flood plain. RP-5 solids handling facilities expansion needs by 2035 include new thickening, anaerobic digestion, dewatering, digester gas storage and utilization, and odor control. Additional thickening and digestion capacity would be needed at RP-5 by 2060 to meet the projected demands in the southern service area.

As a result of the anticipated increased flows and loads to each plant, the estimated biosolids quantities from the northern and southern service areas are projected to reach up to 198 wet tons per day by 2035 and 241 wet tons per day by 2060. Since IEUA’s capacity at IERCF is 200 wet tons of biosolids per day, IERCF has adequate capacity to receive and process IEUA biosolids over the next 20 years. However, the projected ultimate biosolids are expected to surpass the current permitted capacity of IERCF by 2060, at which time IEUA needs to explore additional biosolids management options. Options may include implementing technologies such as heat drying or improved dewatering technologies to produce dryer cake, or diversifying biosolids management by contracting with private companies for land application, composting, energy production, and other biosolids product markets.

# 7.0 References

Air Quality Management District (AQMD). 2010. *Facility Permit to Operate, Inland Empire Regional Composting Authority, Section H.* September.

# TM 10 Asset Management Program

# IEUA Wastewater Facilities Master Plan
# TM 10 Asset Management Program

PREPARED FOR: Inland Empire Utilities Agency

PREPARED BY: Carollo Engineers, Inc.

REVIEWED BY: CH2M HILL

DATE: April 2015

# Executive Summary

The Inland Empire Utilities Agency (IEUA) developed an Asset Management Plan as a means of providing an overview of their function, incorporating their business goals into their future planning, and evaluating their current assets. As part of the development of the Asset Management Plan, several existing and potential projects were identified to address rehabilitation, replacement, and upgrades to each asset to provide key information for budgeting and project planning. All projects that are expected to exceed $2 million are included in this technical memorandum (TM) to highlight initial projects for inclusion in the 20-year Capital Improvement Program (CIP). The 10-year total project cost for each asset system is summarized in Table 10-1.

TABLE 10-1
**Total Budget of All Asset Management Projects Greater than $2 Million**

| IEUA System | 10-Year Total Budget ($) |
|---|---|
| Agency-Wide | 38,504,000 |
| Regional Water Recycling Plant No. 1 (RP-1) | 24,606,000 |
| Regional Water Recycling Plant No. 2 (RP-2) | - |
| Carbon Canyon Water Recycling Facility (CCWRF) | 2,880,000 |
| Regional Water Recycling Plant No. 4 (RP-4) | - |
| Regional Water Recycling Plant No. 5 (RP-5) | 100,250,000 |
| Recycled Water Distribution and Groundwater Recharge (GWR) Systems | 72,910,000 |
| Inland Empire Regional Composting Facility (IERCF) | 5,000,000 |
| Agency Lift Stations (LS) | 8,915,000 |
| Regional Conveyance System (RC) | 2,500,000 |
| Agency Laboratory (AL) | 17,100,000 |
| Agency Headquarters (HQ) | - |
| Business (BIZ) and Process Automation Control (PAC) Networks | 14,625,000 |

# 1.0 Background and Objectives

The Asset Management Plan developed by the IEUA addresses two audiences. First, the document presents an overview of IEUA's function, service area, business goals, and future growth for those less familiar with IEUA. Second, the document presents detailed information on IEUA's asset valuation, financial projections, and physical assets for those with an in-depth understanding of IEUA and its functions.

IEUA's business goals are used in the development of several planning documents, including the Asset Management Plan. Objectives for the business goals, including fiscal responsibility, workplace environment, business practices, water reliability, wastewater management, and environmental stewardship, were used in conjunction with expected future growth to evaluate IEUA's physical assets. IEUA's physical assets are described in detail and organized according to the following systems:

1. Agency-Wide
2. Regional Water Recycling Plant No. 1 (RP-1)
3. Regional Water Recycling Plant No. 2 (RP-2)
4. Carbon Canyon Water Recycling Facility (CCWRF)
5. Regional Water Recycling Plant No. 4 (RP-4)

6. Regional Water Recycling Plant No. 5 (RP-5)
7. Recycled Water Distribution (RW) and Groundwater Recharge (GWR) Systems
8. Inland Empire Regional Composting Facility (IERCF)
9. Agency Lift Stations (LS)
10. Regional Conveyance System (RC)
11. Agency Laboratory (AL)
12. Agency Headquarters (HQ)
13. Business (BIZ) and Process Automation Control (PAC) Networks

The purpose of this TM is to provide a brief description of each system and summarize the Asset Management projects expected to cost $2 million or more. These projects address necessary rehabilitation, replacement, and upgrades to assets and should be included in the 20-year CIP.

# 2.0 Asset Management Systems Summaries

Significant projects are scheduled for each IEUA system. By highlighting projects that are expected to cost $2 million or more and any current projects, IEUA can easily review the major projects and allocations and prioritize for future CIP projects. For each system, a summary of all projects expected to exceed $2 million are presented.

## 2.1 Agency-Wide Project Summary

Agency-wide projects relate to multiple systems. Projects expected to cost more than $2 million are briefly described in Table 10-2. Additional details including the start and end date, and the cost per fiscal year for each listed project are included in Section 3.0 of this TM.

TABLE 10-2
**Summary of Agency-Wide Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| PA15008 | Major Asset Rehab/Replace | Agency-wide annual R&R of major assets (buildings, vehicles, etc.). | OM | 2,000,000 |
| FP10200 | Financial Planning Forecast GG Fund | Placeholder for ERP Improvements per Kanes March 3, 2014. | RP | 2,854,000 |
| EN14006 | Misc. RC Constr & Emergency Proj FY 2013/14 | Miscellaneous emergency construction under RC fund. | CC | 2,500,000 |
| EN14009 | CM Misc. RC Constr & Emergency Proj FY 2013/14 | Construction management: miscellaneous emergency construction under RC fund. | CC | 2,500,000 |
| EN17003 | Aeration System Improvements | Agency-wide aeration system improvements. | CC | 6,250,000 |
| PA15005 | Biofilter Media Replacement | Agency-wide annual biofilter media replacement. | OM | 2,000,000 |
| PA15004 | Tertiary Facility Rehab | Agency-wide annual rehab to the tertiary facilities (e.g., sedimentation basin, filters, and chlorine contact basins). | OM | 3,800,000 |
| PA15006 | Aeration Systems Rehab | Agency-wide annual rehab (e.g., diffuser rehab) of aeration systems. | OM | 2,200,000 |
| EP15002 | Major Equipment Rehab/Replace | Agency-wide annual R&R of major equipment (pumps, heat exchangers, compressors, etc.). | EQ | 4,400,000 |
| PA15001 | Underground Piping Rehab | Annual underground piping rehab Agency-wide within facilities. | OM | 5,000,000 |

TABLE 10-2
**Summary of Agency-Wide Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN14024 | CM Misc. RO Constr & Emergency Proj FY 2013/14 | Construction management: miscellaneous emergency construction under RO fund. | CC | 2,500,000 |
| EN14026 | Misc. RO O&M Emergency Proj FY 2013/14 | Miscellaneous emergency O&M work under RO fund. | OM | 2,500,000 |
| | | | **Total Cost** | **38,504,000** |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Construction Project (CC), Capital Major Equipment Project (EQ), Operations & Maintenance Project (O&M), Reimbursable Project (RE), or Capital Replacement Project (RP).
R&R = rehabilitation and replacement
CM = construction management
FY = fiscal year

## 2.2 RP-1 Project Summary

RP-1 was constructed in 1948 and has since undergone many expansions and improvements to serve the Cities of Ontario, Rancho Cucamonga, Upland, Fontana, Montclair, and Chino. The treatment plant includes preliminary, primary, secondary, and tertiary liquid treatment facilities and primary and secondary solids treatment facilities. The liquid facilities are designed to produce an effluent quality meeting Title 22 standards for spray irrigation, nonrestricted recreational and landscape impoundments, and groundwater recharge. The solids handling facilities are operated to achieve Class B biosolids, which are trucked to the IERCF for further treatment and composting.

RP-1 projects identified in the Asset Management Plan that are expected to cost more than $2 million are briefly described in Table 10-3. Additional details, including each listed project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-3
**Summary of RP-1 Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN13046 | RP-1 Flare System Improvements | Project to upgrade the flare control system and increase flare capacity. Evaluation being done to determine design intent. | RP | 3,400,000 |
| EN14019 | RP-1 Headworks Rehab (aka Headworks Gate Replacement) | Engineering project to comprehensively rehab and upgrade the preliminary treatment process. Start design in FY 2018/19. | CC | 10,510,000 |
| EN14020 | RP-1 Sludge Thickening Upgrades | Project to upgrade the sludge thickening processes for primary and secondary sludge. Start design in FY 2018/19. | CC | 8,446,000 |
| EN20006 | RP-1 Digester Mixing Upgrade | Potential engineering project to upgrade the digester mixing systems. Start design in FY 2019/20. | CC | 2,250,000 |
| | | | **Total Cost** | 24,606,000 |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Construction Project (CC), Capital Replacement Project (RP).

## 2.3 RP-2 Project Summary

RP-2 and RP-5 are located approximately 1 mile from each other and RP-5 treats wastewater from the Cities of Chino, Chino Hills, Ontario, Montclair, and Upland. Due to flooding events and the United States Army Corps of Engineers (USACE) decision to raise the elevation of the Prado Dam, all facilities at RP-2 will be abandoned and moved to RP-5. The liquid treatment capacity was relocated in March 2004. The solids facilities will be relocated during the 20-year planning period. This solids facilities relocation project is included in the RP-5 System Summary; no other major projects were identified in the Asset Management Plan for the RP-2 System.

## 2.4 CCWRF Project Summary

CCWRF began operation in 1992 and treats wastewater from the Cities of Chino, Chino Hills, Ontario, Montclair, and Upland. CCWRF consists of liquid treatment facilities and sends primary and secondary solids to RP-2 for treatment. Liquid facilities include influent pumping, and preliminary, primary, secondary, and tertiary treatment; these facilities are designed to produce an effluent quality meeting Title 22 requirements for nonrestricted reuse.

The Asset Management Plan identified one CCWRF project that is expected to cost more than $2 million. It is briefly described in Table 10-4. Additional details, including the listed project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-4
**Summary of CCWRF Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN13018 | CCWRF Odor Control System Replacement | The project entails replacing the existing odor control systems and screens. | RP | 2,880,000 |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Replacement Project (RP).

## 2.5 RP-4 Project Summary

RP-4 has been in operation since 1997 and serves the Cities of Rancho Cucamonga, Fontana, and unincorporated areas of San Bernardino County. It acts as an upstream satellite facility to RP-1 by scalping flow from the Etiwanda sewer, a tributary to RP-1. RP-4 includes preliminary, primary, secondary, and tertiary liquid treatment facilities. The liquid facilities are designed to produce an effluent quality meeting Title 22 standards for spray irrigation, nonrestricted recreational and landscape impoundments, and groundwater recharge. Solids produced at RP-4 are returned to the collection system and conveyed to RP-1 for treatment.

The Asset Management Plan identified no projects that were expected to exceed $2 million over the next 10 years for RP-4.

## 2.6 RP-5 Project Summary

RP-5 began operation in March 2004 to replace the liquid treatment process at RP-2. RP-5 treats domestic and commercial/industrial wastewater from the Cities of Chino, Chino Hills, Ontario, Montclair, and Upland. In addition, RP-1 and CCWRF have the capability to divert influent peak flows to RP-5. The liquid treatment facilities include influent pumping, and preliminary, primary, secondary, and tertiary treatment; the facilities are designed to produce an effluent quality meeting Title 22 requirements for nonrestricted reuse.

Recycled water from RP-5 is discharged to IEUA's recycled water distribution system for landscape irrigation and other approved recycled water uses.

As mentioned in Section 2.3, RP-5 will be the final destination of the solid handling facilities relocated from RP-2. This is the only project identified by the Asset Management Plan that is expected to exceed $2 million. A brief overview of the project is included in Table 10-5, while additional details, including the project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-5
**Summary of RP-5 Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN19006 | RP-5 SHF | Construct new solids handling facility at RP-5 to decommission RP-2. | CC | 100,250,000 |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Construction Project (CC).

## 2.7 RW and GWR Project Summary

The RW and GWR system is comprised of extensive pump stations, pipelines, and auxiliary systems for each of the six pressure zones within the IEUA boundaries: (1) 800, (2) 930, (3) 1050, (4) 1158, (5) 1299, and (6) 1630. Recycled water from RP-1, RP-4, and RP-5 is distributed to various storage reservoirs, and groundwater recharge basins.

RW and GWR projects identified in the Asset Management Plan that are expected to cost more than $2 million are briefly described in Table 10-6. Additional details, including each listed project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-6
**Summary of RW and GWR Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN14041 | RP-4 1158 and 1299 Pump Station Upgrades | Pump upgrades to increase capacity, and new backup generator. | CC | 5,600,000 |
| EN14042 | RP-1 1158 Pump Station Improvements | Pump station improvements to increase capacity. | CC | 4,000,000 |
| EN06025 | Wineville Extension Pipeline Segment A | A new 24-inch recycled water pipeline along Wineville Avenue from Airport Drive to Jurupa Street continuing with a new 36-inch recycled water pipeline to RP-3 Groundwater Recharge Basin. The project includes a recycled water turnout to feed RP-3 Basin and a turnout to feed Declez Basin. | CC | 15,700,000 |
| EN09007 | 1630 East Reservoir & Segment B Pipeline | Construction of about 11,000 LF of 36-inch pipeline from the Segment A pipeline end to the new 1630 East Reservoir. Construction of an 8.0 MG recycled water reservoir at the Lloyd Michael's Water Treatment Plant. | CC | 5,401,000 |
| EN19002 | 800 Pressure Zone Reservoir | Construction of an 800 pressure zone reservoir in the city of Chino Hills. | CC | 3,400,000 |
| EN19003 | RP-1 Parallel Outfall Pipeline | This project will provide for a parallel pipeline following the TP-1 outfall Pipeline from RP-1 to Edison Avenue to address the existing pipeline capacity issues. | CC | 5,700,000 |

TABLE 10-6
**Summary of RW and GWR Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN20001 | Lower Day Basin Pipeline | Construction of a pipeline to provide recycled water to Lower Day Basin. | CC | 2,525,000 |
| EN21001 | Upland Basin | Upland Basin. | CC | 3,000,000 |
| EN13045 | Wineville Extension Pipeline Segment B | A new 24-inch recycled water pipeline along Wineville Avenue from Airport Drive to Jurupa Street continuing with a new 36-inch recycled water pipeline to RP-3 Groundwater Recharge Basin. The project includes a recycled water turnout to feed RP-3 Basin and a turnout to feed Declez Basin. | CC | 11,794,000 |
| WR15019 | RP-3 Basin Improvements | Groundwater Recharge Master Plan Update 2013 project #11. IEUA cost share = 50% total cost (committee approved October 9, 2013; to board October 16, 2013). | CC | 5,290,000 |
| WR15021 | Napa Lateral | Napa Lateral. | CC | 6,000,000 |
| EN15034 | CM Misc. WC Construction & Emergency Proj FY 2014/15 | CM Misc. WC Construction & Emergency Proj FY 2014/15. | CC | 2,500,000 |
| EN15035 | Misc. RW Projects FY 2014/15 | Misc. RW Projects FY 2014/15. | CC | 2,000,000 |
| | | **Total Cost per Fiscal Year** | | **72,910,000** |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Construction Project (CC).
LF = linear feet
MG = million gallons

## 2.8 IERCF Project Summary

The IERCF receives biosolids transported by truck from the Los Angeles County Sanitation Districts (Sanitation Districts), IEUA, and third-party sources. The facility includes biosolids and amendment hoppers; mixers; belt conveyors; active composting and curing composting; heating, ventilation, and air conditioning (HVAC) systems; and air treatment baghouses and biofilters.

The Asset Management Plan identified one IERCF project that is expected to cost more than $2 million. It is briefly described in Table 10-7. Additional details, including the listed project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-7
**Summary of IERCF Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| RA11001 | IERCF Capital Replacement | General project for facility/equipment repair and replacement, including replacement of front end loaders, and evaluation of the baghouse. | RP | 5,000,000 |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Replacement Project (RP).

## 2.9 LS Project Summary

The LS convey sewage to RP-1 and the four regional water recycling plants in IEUA's system, and wastewater to the Non-Reclaimable Wastewater System (NRWS). Six lift stations were identified in the Asset Management Plan: Montclair, Philadelphia, San Bernardino Avenue, RP-2, and Chino Institute for Women. LS projects identified in the Asset Management Plan that are expected to cost more than $2 million are briefly described in Table 10-8. Additional details, including each listed project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-8
**Summary of LS Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN16011 | Whispering Lakes LS Improvements | Complete rehab of LS. | CC | 3,000,000 |
| EN19005 | Haven LS SCADA Improvements | Connect to the SCADA enterprise system and potential sewer construction. | CC | 3,000,000 |
| EN13054 | Montclair Lift Station Upgrades | Replacement of all three lift pumps, as well as replacement and improvements of the control and instrumentation system and the electrical distribution system. | CC | 2,915,000 |
| | | **Total Cost per Fiscal Year** | | **8,915,000** |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Construction Project (CC).
SCADA = supervisory control and data acquisition

## 2.10 RC Project Summary

The RC system is divided into the Regional Sewer System (RSS) and the NRWS. The northern RSS directs domestic and industrial sewage to RP-1, while the southern RSS directs domestic and industrial sewage to the four regional recycling facilities. The NRWS provides the disposal means for discharges of high-salt-content industrial wastewater, which is not suitable for treatment at IEUA's facilities.

The Asset Management Plan identified one RC project that is expected to cost more than $2 million. It is briefly described in Table 10-9. Additional details, including the listed project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-9
**Summary of RC Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN15025 | CM Misc. NRWS Constr & Emergency Proj FY 2014/15 | Fund NRWS projects that require immediate attention. | CC | 2,500,000 |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Construction Project (CC).

## 2.11 AL Project Summary

The AL is located at RP-1 in the main control building. The laboratory performs more than 80,000 analyses annually and sends out another 5,000 samples. The laboratory is broken down into three groups: Wet Chemistry, Metals and Organic Chemistry, and Bioassay and Microbiology. The laboratory analyzes samples from IEUA's wastewater plants, pretreatment and source control programs, desalination facility, and groundwater recharge basins.

The Asset Management Plan identified one AL project that is expected to cost more than $2 million. It is briefly described in Table 10-10. Additional details, including the listed project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-10
**Summary of AL Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| EN15008 | New Water Quality Laboratory | This project will replace the existing operation laboratory at RP-1. A possible site location will be south of HQ at RP-5. | CC | 17,100,000 |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Construction Project (CC).

## 2.12 HQ Project Summary

The HQ consists of two Leadership in Energy and Environmental Design (LEED)-certified buildings and a 22-acre Chino Creek Wetlands and Educational Park. The park was designed to restore the native habitat and natural drainage that feeds into Chino Creek Reach I, and showcases the environmental values of the ecologically rich region.

The Asset Management Plan identified no projects that were expected to exceed $2 million over the next 10 years for HQ.

## 2.13 BIZ and PAC Project Summary

The BIZ network connects local area business networks throughout IEUA through a wireless Wide Area Network (WAN). The BIZ is composed of servers located at the HQ, RP-1, and RP-5. The PAC system connects local area process automation networks through WAN. Primary communication towers are located at RP-1, CCWRF, RP-4, RP-5, and the Northwest 6B Tower. An operator is able to log on the PAC network to control and monitor a facility using the SCADA system or Distributed Control System (DCS).

BIZ and PAC projects identified in the Asset Management Plan that are expected to cost more than $2 million are briefly described in Table 10-11. Additional details, including each listed project's start and end date and the cost per fiscal year, are included in Section 3.0 of this TM.

TABLE 10-11
**Summary of BIZ and PAC Projects Greater than $2 Million**

| Project Number[a] | Project Name | Project Description | Project Type[b] | 10-Year Total Cost ($) |
|---|---|---|---|---|
| IS15012 | Business Network IT Improvements | Annual business network improvements. (Placeholder) | RP | 2,000,000 |
| EN13016 | SCADA Enterprise System | SCADA Enterprise System. Replacing the DCS. | CC | 9,625,000 |
| IS15020 | PAC IT Improvements | Annual PAC network improvements. (Placeholder) | RP | 3,000,000 |
| | | **Total Cost per Fiscal Year** | | **14,625,000** |

[a] Project Number – from 10-year CIP Final Capital Project List, dated March 17, 2014.
[b] Project Type – Capital Construction Project (CC), Capital Replacement Project (RP).

# 3.0 Summary of Projects for CIP Inclusion

Summaries of all Asset Management Plan projects greater than $2 million are listed in Table 10-12 through Table 10-21 for each IEUA system. These projects initially will be included in the 20-year CIP.

# 4.0 References

Inland Empire Utilities Agency (IEUA). 2014. *Asset Management Plan for Fiscal Year 2014/2015*.

## Agency-Wide Project Summary

TABLE 10-12
**Agency-Wide Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
| PA15008 | Major Asset Rehab/Replace | Agency-wide annual R&R of major assets (buildings, vehicles, etc.). | 2014/2024 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 2,000,000 |
| FP10200 | Financial Planning Forecast GG Fund | Placeholder for ERP Improvements per Kanes March 3, 2014. | 2014/2024 | 298,000 | 298,000 | 298,000 | 310,000 | 400,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 2,854,000 |
| EN14006 | Misc. RC Constr & Emergency Proj FY 2013/14 | Miscellaneous emergency construction under RC fund. | 2014/2024 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 2,500,000 |
| EN14009 | CM Misc. RC Constr & Emergency Proj FY 2013/14 | Construction management: miscellaneous emergency construction under RC fund. | 2014/2024 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 2,500,000 |
| EN17003 | Aeration System Improvements | Agency-wide aeration system improvements. | 2016/2019 | 0 | 0 | 250,000 | 3,000,000 | 3,000,000 | 0 | 0 | 0 | 0 | 0 | 6,250,000 |
| PA15005 | Biofilter Media Replacement | Agency-wide annual biofilter media replacement. | 2014/2024 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 2,000,000 |
| PA15004 | Tertiary Facility Rehab | Agency-wide annual rehab to the tertiary facilities (e.g., sedimentation basin, filters, and chlorine contact basins). | 2014/2024 | 100,000 | 100,000 | 100,000 | 1,500,000 | 1,500,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 3,800,000 |
| PA15006 | Aeration Systems Rehab | Agency-wide annual rehab (e.g., diffuser rehab) of aeration systems. | 2014/2024 | 300,000 | 300,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 2,200,000 |
| EP15002 | Major Equipment Rehab/Replace | Agency-wide annual R&R of major equipment (pumps, heat exchangers, compressors, etc.). | 2014/2024 | 700,000 | 500,000 | 400,000 | 400,000 | 400,000 | 400,000 | 400,000 | 400,000 | 400,000 | 400,000 | 4,400,000 |
| PA15001 | Underground Piping Rehab | Annual underground piping rehab Agency-wide within facilities. | 2014/2024 | 500,000 | 500,000 | 500,000 | 500,000 | 1,000,000 | 400,000 | 400,000 | 400,000 | 400,000 | 400,000 | 5,000,000 |
| EN14024 | CM Misc. RO Constr & Emergency Proj FY 2013/14 | Construction management: miscellaneous emergency construction under RO fund. | 2014/2024 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 2,500,000 |
| EN14026 | Misc. RO O&M Emergency Proj FY 2013/14 | Miscellaneous emergency O&M work under RO fund. | 2014/2024 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 2,500,000 |
| | | **Total Cost per Fiscal Year** | | **3,298,000** | **3,098,000** | **3,148,000** | **7,310,000** | **7,900,000** | **2,750,000** | **2,750,000** | **2,750,000** | **2,750,000** | **2,750,000** | **38,504,000** |

## RP-1 Project Summary

TABLE 10-13
**RP-1 Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EN13046 | RP-1 Flare System Improvements | Project to upgrade the flare control system and increase flare capacity. Evaluation being done to determine design intent. | 2016/2018 | 0 | 0 | 1,550,000 | 1,850,000 | 0 | 0 | 0 | 0 | 0 | 0 | 3,400,000 |
| EN14019 | RP-1 Headworks Rehab (aka Headworks Gate Replacement) | Engineering project to comprehensively rehab and upgrade the preliminary treatment process. Start design in FY 2018/19. | 2016/2020 | 0 | 0 | 210,000 | 1,500,000 | 6,000,000 | 2,800,000 | 0 | 0 | 0 | 0 | 10,510,000 |
| EN14020 | RP-1 Sludge Thickening Upgrades | Project to upgrade the sludge thickening processes for primary and secondary sludge. Start design in FY 2018/19. | 2018/2022 | 0 | 0 | 0 | 0 | 240,000 | 1,250,000 | 3,478,000 | 3,478,000 | 0 | 0 | 8,446,000 |
| EN20006 | RP-1 Digester Mixing Upgrade | Potential engineering project to upgrade the digester mixing systems. Start design in FY 2019/20. | 2019/2024 | 0 | 0 | 0 | 0 | 0 | 250,000 | 500,000 | 500,000 | 500,000 | 500,000 | 2,250,000 |
| | | **Total Cost per Fiscal Year** | | **0** | **0** | **1,760,000** | **3,350,000** | **6,240,000** | **4,300,000** | **3,978,000** | **3,978,000** | **500,000** | **500,000** | **24,606,000** |

## CCWRF Project Summary

TABLE 10-14
**CCWRF Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EN13018 | CCWRF Odor Control System Replacement | The project entails replacing the existing odor control systems and screens. | 2014/2017 | 500,000 | 600,000 | 1,780,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,880,000 |

## RP-5 Project Summary

TABLE 10-15
**RP-5 Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EN19006 | RP-5 SHF | Construct new solids handling facility at RP-5 to decommission RP-2. | 2018/2023 | 0 | 0 | 0 | 0 | 250,000 | 25,000,000 | 25,000,000 | 25,000,000 | 25,000,000 | 0 | 100,250,000 |

## RW and GWR Project Summary

TABLE 10-16
**RW and GWR Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EN14041 | RP-4 1158 and 1299 Pump Station Upgrades | Pump upgrades to increase capacity, and new backup generator. | 2014/2018 | 50,000 | 550,000 | 3,000,000 | 2,000,000 | 0 | 0 | 0 | 0 | 0 | 0 | 5,600,000 |
| EN14042 | RP-1 1158 Pump Station Improvements | Pump station improvements to increase capacity. | 2014/2018 | 100,000 | 550,000 | 3,000,000 | 350,000 | 0 | 0 | 0 | 0 | 0 | 0 | 4,000,000 |
| EN06025 | Wineville Extension Pipeline Segment A | A new 24-inch recycled water pipeline along Wineville Avenue from Airport Drive to Jurupa Street continuing with a new 36-inch recycled water pipeline to RP-3 Groundwater Recharge Basin. The project includes a recycled water turnout to feed RP-3 Basin and a turnout to feed Declez Basin. | 2014/2016 | 3,000,000 | 12,700,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15,700,000 |
| EN09007 | 1630 East Reservoir & Segment B Pipeline | Construction of about 11,000 LF of 36-inch pipeline from the Segment A pipeline end to the new 1630 East Reservoir. Construction of an 8.0 MG recycled water reservoir at the Lloyd Michael's Water Treatment Plant. | 2020/2023 | 0 | 0 | 0 | 0 | 0 | 0 | 663,000 | 3,813,000 | 925,000 | 0 | 5,401,000 |
| EN19002 | 800 Pressure Zone Reservoir | Construction of an 800 pressure zone reservoir in the city of Chino Hills. | 2019/2022 | 0 | 0 | 0 | 0 | 0 | 500,000 | 2,500,000 | 400,000 | 0 | 0 | 3,400,000 |
| EN19003 | RP-1 Parallel Outfall Pipeline | This project will provide for a parallel pipeline following the TP-1 out-fall Pipeline from RP-1 to Edison Ave. to address the existing pipeline capacity issues. | 2019/2022 | 0 | 0 | 0 | 0 | 0 | 500,000 | 4,000,000 | 1,200,000 | 0 | 0 | 5,700,000 |
| EN20001 | Lower Day Basin Pipeline | Construction of a pipeline to provide recycled water to Lower Day Basin. | 2019/2023 | 0 | 0 | 0 | 0 | 0 | 300,000 | 2,000,000 | 200,000 | 25,000 | 0 | 2,525,000 |
| EN21001 | Upland Basin | Upland Basin. | 2020/2023 | 0 | 0 | 0 | 0 | 0 | 0 | 500,000 | 300,000 | 2,200,000 | 0 | 3,000,000 |
| EN13045 | Wineville Extension Pipeline Segment B | A new 24-inch recycled water pipeline along Wineville Ave. from Airport Dr. to Jurupa St. continuing with a new 36-inch recycled water pipeline to RP-3 Groundwater Recharge Basin. The project includes a recycled water turnout to feed RP-3 Basin and a turnout to feed Declez Basin. | 2014/2016 | 3,000,000 | 8,794,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11,794,000 |
| WR15019 | RP-3 Basin Improvements | Groundwater Recharge Master Plan Update 2013 project #11. IEUA cost share= 50% total cost (committee approved 10/9/13; to board 10/16). | 2014/2016 | 200,000 | 5,090,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,290,000 |
| WR15021 | Napa Lateral | Napa Lateral. | 2014/2017 | 50,000 | 3,150,000 | 2,800,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6,000,000 |
| EN15034 | CM Misc. WC Construction & Emergency Proj FY 2014/15 | CM Misc. WC Construction & Emergency Proj FY 2014/15. | 2014/2024 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 2,500,000 |
| EN15035 | Misc. RW Projects FY 2014/15 | Misc. RW Projects FY 2014/15. | 2014/2024 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 2,000,000 |
| | | **Total Cost per Fiscal Year** | | **6,850,000** | **31,284,000** | **9,250,000** | **2,800,000** | **450,000** | **1,750,000** | **10,113,000** | **6,363,000** | **3,600,000** | **450,000** | **72,910,000** |

## IERCF Project Summary

TABLE 10-17
**IERCF Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RA11001 | IERCF Capital Replacement | General project for facility/equipment repair and replacement, including replacement of front end loaders, and evaluation of the Baghouse. | 2014/2024 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 | 5,000,000 |

## LS Project Summary

TABLE 10-18
**LS Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EN16011 | Whispering Lakes LS Improvements | Complete rehab of lift station. | 2018/2020 | 0 | 0 | 0 | 0 | 300,000 | 2,700,000 | 0 | 0 | 0 | 0 | 3,000,000 |
| EN19005 | Haven LS SCADA Improvements | Connect to the SCADA enterprise system and potential sewer construction. | 2018/2020 | 0 | 0 | 0 | 0 | 300,000 | 2,700,000 | 0 | 0 | 0 | 0 | 3,000,000 |
| EN13054 | Montclair Lift Station Upgrades | Replacement of all three lift pumps as well as replacement and improvements of the control and instrumentation system and the electrical distribution system. | 2014/2016 | 2,500,000 | 415,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,915,000 |
| | | **Total Cost per Fiscal Year** | | **2,500,000** | **415,000** | **0** | **0** | **600,000** | **5,400,000** | **0** | **0** | **0** | **0** | **8,915,000** |

## RC Project Summary

TABLE 10-19
**RC Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EN15025 | CM Misc. NRWS Constr & Emergency Proj FY 2014/15 | Fund NRWS projects that require immediate attention. | 2014/2024 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 250,000 | 2,500,000 |

## AL Project Summary

TABLE 10-20
**AL Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EN15008 | New Water Quality Laboratory | This project will replace the existing operation laboratory at RP-1. A possible site location will be south of HQ at RP-5. | 2016/2019 | 0 | 0 | 1,100,000 | 10,000,000 | 6,000,000 | 0 | 0 | 0 | 0 | 0 | 17,100,000 |

## BIZ and PAC Project Summary

TABLE 10-21
**BIZ and PAC Summary of Projects Greater than $2 Million**

| Project Number | Project Name | Project Description | Start/End Date | Fiscal Year Budget (Dollars) 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 10-Year Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IS15012 | Business Network IT Improvements | Annual business network improvements. (Placeholder) | 2014/2024 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 2,000,000 |
| EN13016 | SCADA Enterprise System | SCADA Enterprise System. Replacing the DCS. | 2014/2018 | 1,000,000 | 2,625,000 | 3,000,000 | 3,000,000 | 0 | 0 | 0 | 0 | 0 | 0 | 9,625,000 |
| IS15020 | PAC IT Improvements | Annual PAC network improvements. (Placeholder) | 2014/2024 | 300,000 | 300,000 | 300,000 | 300,000 | 300,000 | 300,000 | 300,000 | 300,000 | 300,000 | 300,000 | 3,000,000 |
| | | **Total Cost per Fiscal Year** | | **1,500,000** | **3,125,000** | **3,500,000** | **3,500,000** | **500,000** | **500,000** | **500,000** | **500,000** | **500,000** | **500,000** | **14,625,000** |

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