GWRS

GROUNDWATER REPLENISHMENT SYSTEM

2018 Annual Report

ORANGE COUNTY WATER DISTRICT

ORANGE COUNTY WATER DISTRICT

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Groundwater Replenishment System

2018 Annual Report

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EXECUTIVE SUMMARY

The Groundwater Replenishment System (GWRS) is a water supply project jointly sponsored by Orange County Water District (OCWD) and Orange County Sanitation District (OCSD) that supplements existing water supplies by providing a reliable, high-quality source of water to recharge the Orange County Groundwater Basin (the Basin), to protect it from degradation due to seawater intrusion, and to provide a water source for limited non-potable uses.

This Annual Report examines the GWRS operation and performance for calendar year 2018. This Annual Report fulfills the GWRS permit requirements set forth in California Regional Water Quality Control Board, Santa Ana Region (RWQCB) Order No. R8-2004-0002 (RWQCB, 2004) and as amended by Order Nos. R8-2008-0058, R8-2014-0054, R8-2016-0051, and R8-2019-0007 (RWQCB, 2008, 2014a, 2016, and 2019).

Introduction

The GWRS, which is operated by OCWD, consists of five major components:

- Advanced Water Purification Facility (AWPF), which features treatment processes and pumping stations designed to produce up to 100 million gallons per day (MGD) of purified recycled water;
- Talbert Seawater Intrusion Barrier (Talbert Barrier) comprised of a series of injection wells that are supported by an extensive network of groundwater monitoring wells;
- Kraemer-Miller-Miraloma-La Palma Basins (K-M-M-L Basins), along with other nearby spreading basins, all of which are supported by numerous groundwater monitoring wells;
- Demonstration Mid-Basin Injection (DMBI) Project comprised of one test injection well supported by two downgradient monitoring wells; and
- Two non-potable customers: Anaheim Canyon Power Plant (Anaheim CPP) and Anaheim Regional Transportation Intermodal Center (ARTIC).

Figure ES-1 shows the location of the GWRS in central Orange County, California. The AWPF receives secondary-treated wastewater from OCSD Plant No. 1 and treats it to better than drinking water standards using microfiltration (MF), reverse osmosis (RO), advanced oxidation/disinfection consisting of hydrogen peroxide addition and ultraviolet light exposure (UV/AOP), followed by partial decarbonation and lime stabilization. Pumping stations and pipelines convey purified recycled water from the AWPF to the Talbert Barrier, K-M-M-L Basins, DMBI Project, and/or non-potable users.

The original AWPF began operation in January 2008 and was designed to produce 70 MGD, or approximately 72,000 acre-feet per year (AFY) (243,000 cubic meters per day [m^3/day]),

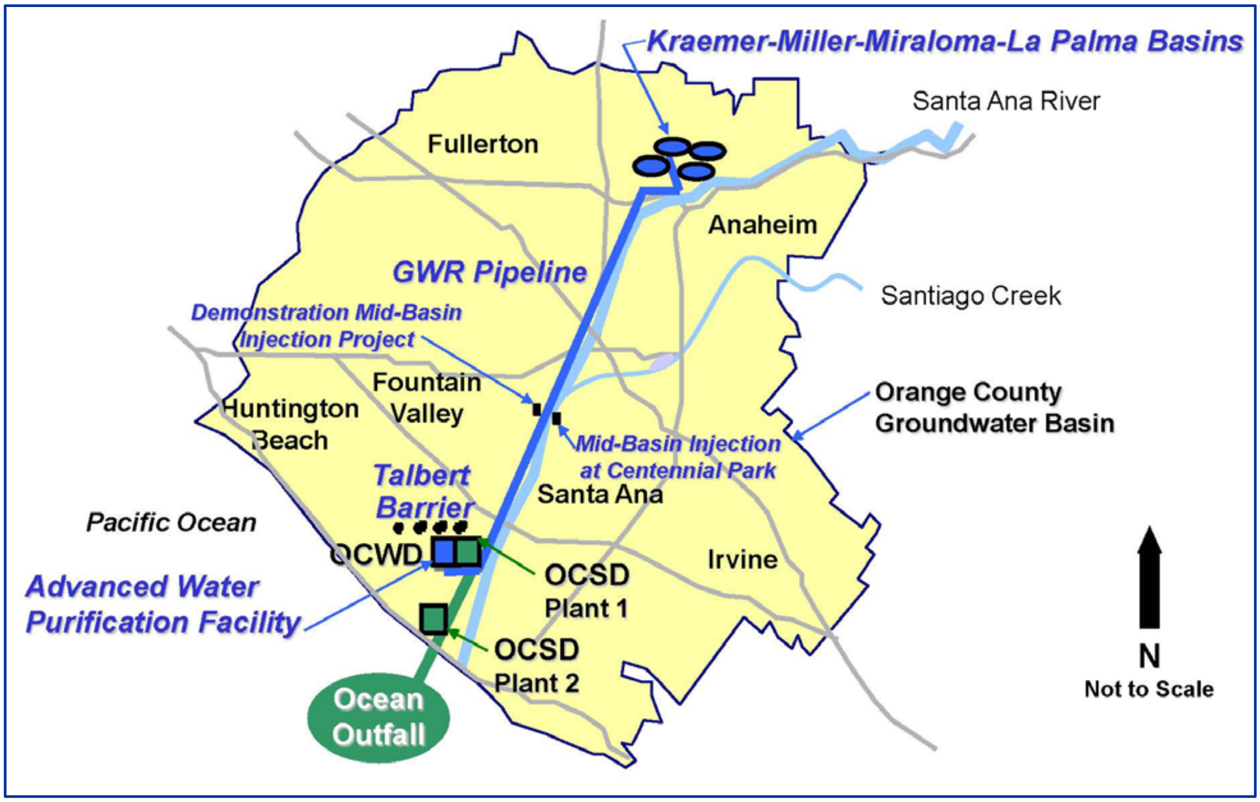


Figure ES-1. Groundwater Replenishment System Location Map

of purified recycled water based on a minimum on-line factor of 90%. The GWRS Initial Expansion began operation in May 2015, increasing the AWPF design production up to 100 MGD, or approximately 103,000 AFY (348,000 m^3/day), of purified recycled water based on a minimum on-line factor of 90%. The majority of the purified recycled water produced by the AWPF is injected at the Talbert Barrier and percolated at K-M-M-L Basins; a lesser volume is injected at the DMBI Project and supplied to non-potable customers.

The Talbert Barrier consists of a series of 36 injection well sites that are supplied by pipelines from the AWPF Barrier Pump Station. OCWD constructed the injection barrier to form an underground hydraulic mound, or pressure ridge, that helps prevent seawater intrusion near the coast in the Talbert Gap area. Without the Talbert Barrier, seawater would migrate inland and contaminate the fresh groundwater supply of the Basin. In addition to providing seawater intrusion control, the Talbert Barrier also injects purified recycled water into the deeper Main aquifer with the primary purpose of replenishing the Basin. Potable drinking water may also be injected at the barrier, although blending is not required.

In the Anaheim Forebay area, GWRS purified recycled water and other waters are percolated at K-M-M-L Basins. Other waters may include Santa Ana River (SAR) water and purchased imported water. GWRS recharge at Kraemer and Miller Basins began in January 2008 along with start-up of the rest of the original GWRS components. Miraloma Basin began spreading purified recycled water in July 2012. La Palma Basin began spreading purified recycled water in November 2016. Purified recycled water is conveyed from the AWPF to these four spreading basins by the 13-mile GWR Pipeline installed along the west levee of the SAR. While recharge with purified recycled water is restricted to K-M-M-L Basins, other waters may be recharged at those four basins as well as nearby spreading basins Anaheim Lake, Mini-Anaheim Lake, and La Jolla Basin. Blending of purified recycled water with other waters is not required.

Turnouts from the GWR Pipeline supply purified recycled water to the DMBI Project, Anaheim CPP and ARTIC. The DMBI Project began operation in April 2015 and consists of one test injection well supported by two downgradient monitoring wells near the SAR at Edinger Avenue in the Cities of Fountain Valley and Santa Ana. Purified recycled water deliveries to Anaheim CCP and to ARTIC for non-potable uses began in July 2011 and November 2014, respectively.

Advanced Water Purification Facility Performance

During 2018 the AWPF produced a total of approximately 31,532 million gallons (MG), or 96,769 acre-feet (AF) (119,363,000 cubic meters [m^3]), of purified recycled water to prevent seawater intrusion, replenish the Basin, and supply non-potable users. This represents nearly a 4% decrease from the 2017 calendar year production. A breakdown of the 2018 purified recycled water production and discharge by location is presented in Table ES-1 and illustrated on Figure ES-2.

Table ES-1. 2018 Summary of Purified Recycled Water Flows and Discharge Points

Purified Recycled Water Discharge Point	Annual Average Daily Flow Rate (Avg. MGD)	Annual Volume		Percent (rounded)
		Million Gallons (MG)	Acre-Feet (AF)	
Talbert Barrier	22.2	8,097	24,848	25.7%
Kraemer Basin	0.6	217	666	0.7%
Miller Basin	0.0	0	0	0.0%
Miraloma Basin	15.0	5,476	16,805	17.4%
La Palma Basin	47.2	17,217	52,836	54.6%
DMBI Project	1.4	496	1,521	1.6%
Anaheim CPP	<0.1	24	75	<0.1%
ARTIC	<0.1	5	18	<0.1%
Total	**86.4**	**31,532**	**96,769**	**100%**

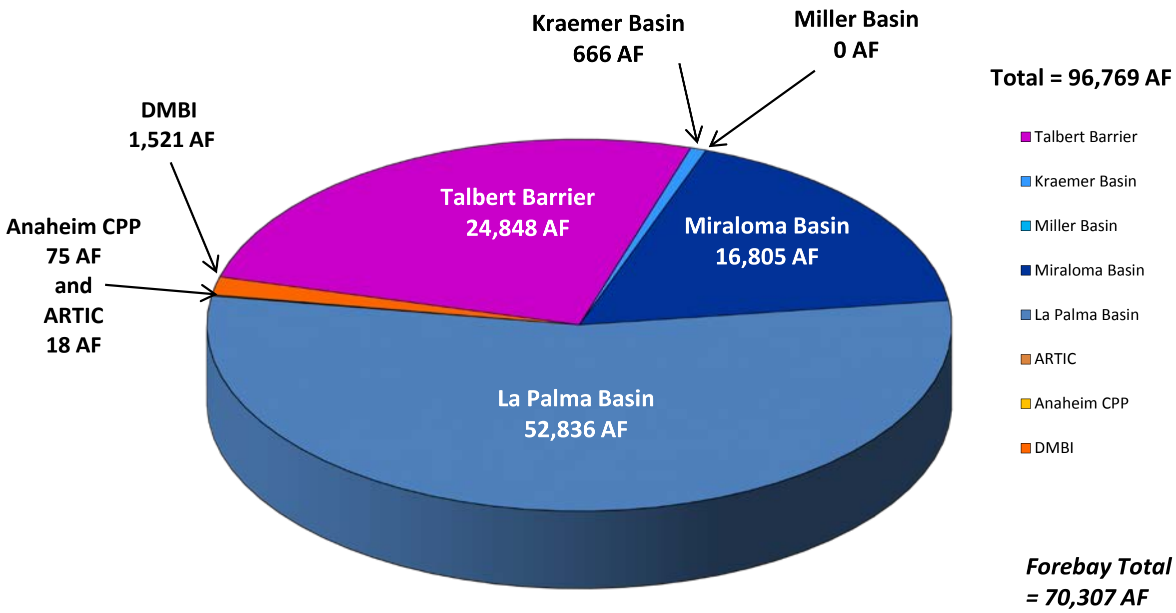


Figure ES-2. 2018 Purified Recycled Water Volume

In terms of average daily flows, the AWPF produced approximately 86.4 MGD (327,000 m^3/day) of purified recycled water in 2018. Figure ES-3 illustrates the average daily AWPF production by month with the reuse location. Production was well below average in Fall 2018 because the AWPF purified recycled water production was limited to supply only the Talbert Barrier needs for about six weeks (August 22 –October 3), as the GWR Pipeline Rehabilitation Project prevented deliveries to the Anaheim Forebay. During that period, the AWPF was also shut down completely for about a week for scheduled preventive maintenance.

The AWPF treatment processes operated satisfactorily during the year, producing high quality purified recycled water in compliance with all permit requirements. Table ES-2 summarizes the average purified recycled water, or finished product water (FPW), quality for selected parameters.

Concentrations of inorganic constituents in the purified recycled water, such as aluminum and chromium, were either non-detect or if detected, far below the permit limits. All potentially toxic organics, such as volatile organic compounds, pesticides, and other synthetic organic compounds, were also non-detect or far below the permit limits. Analyses of purified recycled water for unregulated compounds and chemicals of emerging concern (CECs), such as endocrine disrupting chemicals and pharmaceuticals, were either non-detect or if detected, not found at levels thought to pose any significant public health risk. In addition to the permit monitoring and reporting requirements, OCWD monitored the AWPF for CECs and surrogates in compliance with the State Water Resources Control Board amended Recycled Water Policy (SWRCB, 2013) (latest version in effect for calendar year 2018).

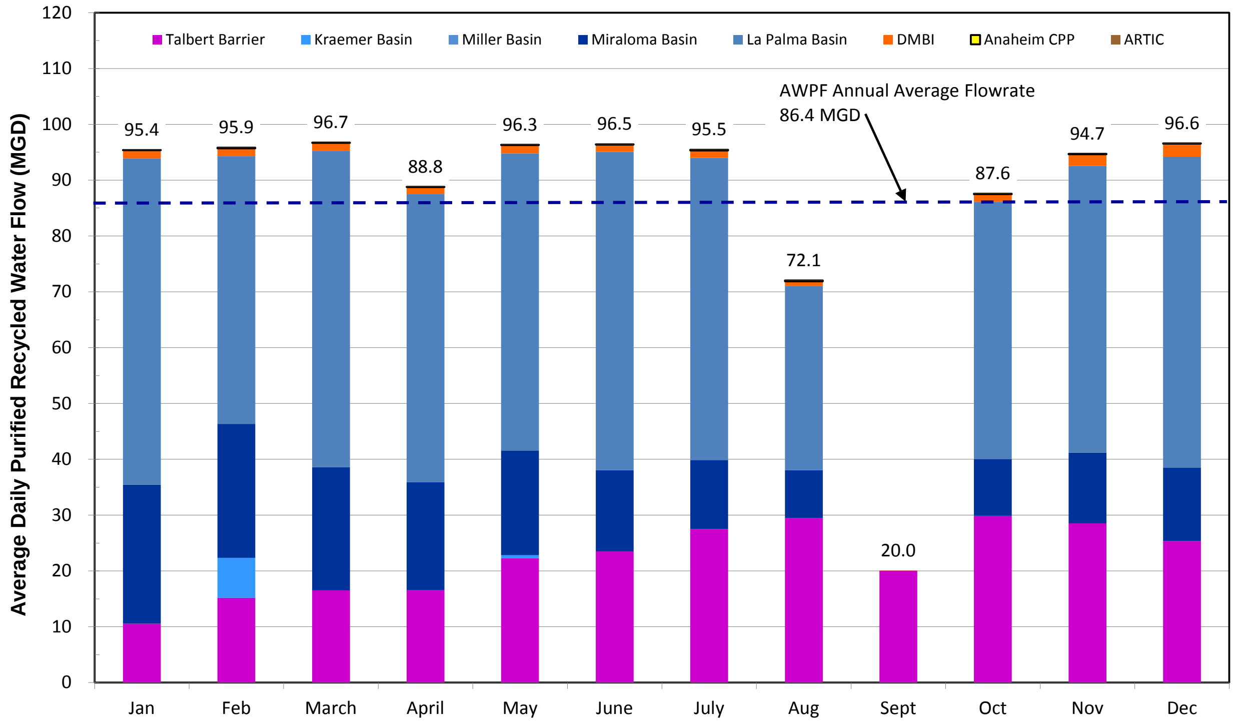


Figure ES-3. 2018 Average Daily Purified Recycled Water Flow By Month

Table ES-2. 2018 Average Purified Recycled Water Quality

Parameter Name	Units [1]	FPW [2,3]	Permit Limit
Electrical Conductivity	µmhos/cm	100 [4]	900
Total Dissolved Solids	mg/L	53	500
pH	units	8.5 [4]	6 – 9
Chloride	mg/L	5.3	55
Total Nitrogen	mg/L	1.0	5
Arsenic	µg/L	<1 [5]	10
1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	<0.005 [5]	0.005
N-nitrosodimethylamine (NDMA)	ng/L	1.6	N/A
1,4-Dioxane	µg/L	<1 [5]	N/A
Perfluorooctanoic Acid (PFOA)	ng/L	<4 [5]	N/A
Perfluorooctane Sulfonic Acid (PFOS)	ng/L	<4 [5]	N/A
Total Organic Carbon (unfiltered)	mg/L	0.10	0.5 [6]
Total Coliform	MPN/100 mL	0.3	2.2

1 See Acronyms list for units abbreviations.

2 FPW is GWRS Finished Product Water (Purified Recycled Water).

3 Arithmetic average of all available data in 2018. For purposes of calculating annual averages, 10% of the Reportable Detection Limit (RDL) was used for all non-detect (ND) values. Number of significant digits shown matches those in raw data.

4 On-line average.

5 If all data for the period were ND, then the average is shown as "<RDL."

6 20-sample running average; see Section 2.2.6 and Appendix A for more information.

During 2018 the GWRS complied with pathogenic microorganism reduction requirements using the MF, RO, and UV/AOP processes at the AWPF, plus underground retention time as an environmental buffer. Table ES-3 summarizes the minimum daily total pathogen log reduction values achieved in 2018 in comparison to the requirements.

Table ES-3. Summary of GWRS Minimum Pathogen Log Reduction Credits Achieved in 2018

Pathogen	Minimum Log Reduction Requirements[1]	Minimum Daily Total Pathogen Log Reduction Values Achieved
Giardia cysts	10	12.4
Cryptosporidium oocysts	10	12.4
Viruses	12	12.0

[1] Per Title 22 Water Recycling Criteria (CCR, 2014)

The GWR Pipeline Rehabilitation Project limited the AWPF production to approximately 30 MGD for about six weeks (August 22 – October 3); purified recycled water was delivered to the Talbert Barrier while the GWR Pipeline was out of service. The AWPF was completely off-line for planned preventive maintenance for one day in April and for one week in September. Overall, the AWPF was on-line approximately 353 days in 2018 (96.6% of the year), albeit sometimes at less than full production.

Talbert Barrier Operations

The Talbert Barrier injection supply in 2018 was predominately purified recycled water produced by the AWPF, as shown in Table ES-4. Negligible volumes of potable water from the Metropolitan Water District of Southern California (MWD) OC-44 turnout were also injected at the barrier; City of Fountain Valley potable water was available but not used. Of the total annual volume of approximately 8,104 MG (24,870 AF; 30,677,000 m^3) of all injection water, the vast majority (99.91%), approximately 8,097 MG (24,848 AF; 30,649,000 m^3), was GWRS purified recycled water. Only about 7.4 MG (22.6 AF; 27,900 m^3) of potable water were injected at the barrier during 2018. The potable water supply helped maintain a full, pressurized barrier supply pipeline during AWPF shutdowns until the purified recycled water injection was resumed. The total average daily flow rate injected at the Talbert Barrier in 2018 was 22.2 MGD.

Blending of purified recycled water with potable water is no longer required at the Talbert Barrier. While the maximum allowable recycled water contribution (RWC) at the Talbert Barrier is 100%, potable water may still be injected at the barrier.

Operation of the Talbert Barrier was consistent and stable throughout 2018 due to a constant, reliable purified recycled water supply (except for AWPF shutdowns) and on-going rehabilitation and backwashing of the injection wells. A minor amount of potable water from the MWD OC-44 connection was used to keep the barrier supply pipeline pressurized and to inject a small amount into selected wells for operational purposes while the AWPF was off-line. On an annual basis, large injection volumes were directed to the west and east ends of the barrier.

Table ES-4. 2018 GWRS Injection at the Talbert Barrier

Water Source	Flow Rate	Volume (rounded)			Description
	(Avg. MGD)	(MG)	(AF)	(m^3)	
Purified recycled water	22.2	8,097	24,848	30,649,000	GWRS finished product water (FPW)
OC-44 Potable water	<0.1	7	22	27,900	Imported water from MWD OC-44 turnout
FV Potable water	0.0	0	0	0	Blend of imported water and groundwater from City of Fountain
Total	**22.2**	**8,104**	**24,870**	**30,677,000**	

Groundwater Monitoring at the Talbert Barrier

The GWRS permit requires quarterly groundwater monitoring at the Talbert Barrier at five OCWD monitoring well sites: M10, M11, M45, M46, and M47. The GWRS groundwater monitoring program began in mid-2004. The original 2004 GWRS permit groundwater monitoring requirements were modified in 2011-12, 2014, and 2018 based on OCWD's historic records; the approved modifications reduced the frequency and eliminated a few constituents (DDW, 2018; RWQCB, 2018). In addition to the five required monitoring well sites, OCWD continued to periodically sample a sixth monitoring well site, M19, because of its long history and close proximity to the barrier. Groundwater level (piezometric elevation) measurements as well as groundwater quality monitoring for an extensive list of parameters were conducted during 2018 at these monitoring well sites in compliance with the GWRS permit.

Barrier compliance monitoring wells were tested for: (1) an extensive list of inorganic, organic and radiological parameters, (2) the majority of the U.S. Environmental Protection Agency (EPA) Priority Pollutants, and (3) 1,4-dioxane and NDMA. During 2018 groundwater quality at all of the Talbert Barrier compliance monitoring wells complied with all Federal and State Primary Drinking Water Standards with one exception: arsenic was detected slightly above the Primary Maximum Contaminant Level (MCL) in a single sample from one monitoring well. Groundwater quality testing at the compliance monitoring wells during 2018 revealed some results above the Federal and State Secondary Drinking Water Standards for apparent color and odor, similar to those in past years and unrelated to the injection of GWRS purified recycled water.

Dissolved chloride concentrations continued to be used as an intrinsic tracer to track the subsurface movement of injection water in 2018. Chloride is relatively unaffected by sorption, chemical, or biological reactions in the aquifer, making it a relatively good, conservative tracer, especially since the chloride concentration of GWRS purified recycled water is much lower than both native groundwater and pre-GWRS injection water.

Testing for NDMA and 1,4-dioxane at monitoring wells near the Talbert Barrier continued quarterly in 2018. NDMA was detected in one monitoring well during 2018 at a concentration well below the DDW Notification Level (NL) of 10 ng/L. As a result of historical discharges from the predecessor Water Factory 21 facility, four of the six barrier monitoring wells had one or more aquifer zones with 1,4-dioxane concentrations above the DDW NL of 1 μg/L for at least a portion of the year; all six monitoring wells had 1,4-dioxane concentrations below the DDW response level (RL) of 35 μg/L for drinking water systems. In general, OCWD has observed 1,4-dioxane to be more persistent than NDMA in groundwater in the vicinity of the Talbert Barrier. Since the addition of more comprehensive industrial source control by OCSD and UV/AOP treatment in 2001 after the discovery of 1,4-dioxane at Water Factory 21, the barrier injection has consistently been non-detect and/or below the DDW NL for 1,4-dioxane.

Kraemer-Miller-Miraloma-La Palma Basins Operations

Water from three sources was percolated at K-M-M-L Basins and nearby spreading basins (Anaheim Lake, Mini-Anaheim Lake, and La Jolla Basin) in 2018: (1) GWRS purified recycled water (only at K-M-M-L Basins); (2) SAR water; and (3) imported water.

Table ES-5 summarizes the volumes of various waters recharged at Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins during 2018. A total volume of approximately 44,530 MG (136,659 AF; 168,566,000 m^3) of purified recycled water and other water (SAR water and imported water) was recharged at these seven basins.

The GWRS purified recycled water discharge was divided between three of the four spreading basins during 2018:

- Kraemer Basin received approximately 217 MG (666 AF; 821,000 m^3), or 0.6 MGD on average;
- Miller Basin received no purified recycled water;
- Miraloma Basin received approximately 5,476 MG (16,805 AF; 20,729,000 m^3), or 15.0 MGD on average; and
- La Palma Basin received approximately 17,217 MG (52,836 AF; 65,173,000 m^3), or 47.2 MGD on average.

Table ES-5. 2018 GWRS Spreading in the Vicinity of Kraemer-Miller-Miraloma-La Palma Basins

Water Source[1]	Flow Rate (Avg. MGD)	Volume (rounded) (MG)	(AF)	(m^3)	Description
Purified recycled water[2]	62.8	22,910	70,307	86,723,000	GWRS finished product water (FPW) delivered
Other water[3]	59.8	21,837	67,017	82,664,000	SAR water and/or imported water percolated
Spreading basin storage[4]		217	665	821,000	Water in recharge basin storage at the end of calendar year
Total	**122.0**	**44,530**	**136,659**	**168,566,000**	

[1] Includes spreading at Anaheim Lake, Mini-Anaheim Lake, Kraemer Basin, Miller Basin, Miraloma Basin, La Palma Basin, and La Jolla Basin.

[2] Purified recycled water is recharged only at K-M-M-L Basins. Volume shown is based on AWPF production records.

[3] Other water volume is estimated based on total percolation and change in basin storage records from Forebay Operations.

[4] Storage is the estimated volume of water retained in the spreading basins that has not yet percolated by the end of said calendar year based on percolation records from Forebay Operations.

La Palma Basin has been dedicated solely to recharge of GWRS purified recycled water since its inception in November 2016. In 2018, La Palma and Miraloma Basins received only GWRS purified recycled water. Kraemer and Miller Basins typically receive both GWRS purified recycled water and other waters. Miller Basin received only other water in 2018.

Blending of purified recycled water with other waters is no longer required for the Anaheim Forebay recharge operations. While the sources and volumes of spreading water continue to be reported, determination of the RWC is no longer required.

Groundwater Monitoring at the Anaheim Forebay

Groundwater monitoring near K-M-M-L Basins is required by the GWRS permit at five OCWD monitoring well sites: AMD-10, AM-7, AMD-12, AM-8, and AM-10. In addition to these required monitoring wells, OCWD continued to periodically sample monitoring well site OCWD-KB1 because of its close proximity to Kraemer Basin and its long historical record. Groundwater level measurements as well as groundwater quality monitoring for an extensive list of parameters were conducted during 2018 at these monitoring well sites in compliance with the permit.

Anaheim Forebay compliance monitoring wells were tested for: (1) an extensive list of inorganic, organic and radiological parameters, (2) the majority of EPA Priority Pollutants, and (3) 1,4-

dioxane and NDMA. Groundwater quality at all of the monitoring wells complied with all Federal and State Primary Drinking Water Standards. No detections of NDMA or 1,4-dioxane were found in groundwater at any of the Forebay monitoring wells in 2018. Groundwater quality testing at the compliance monitoring well sites during 2018 revealed some results above the Federal and State Secondary Drinking Water Standards for apparent color, odor, iron, and manganese. No microbial detections were observed in groundwater samples from any of the compliance wells during the first quarter of 2018, which marked the end of the required reporting period.

DMBI Project Operation

The DMBI Project began injection of purified recycled water that is delivered via the GWR Pipeline to the MBI-1 site in April 2015. The DMBI Project provided operational and groundwater quality data to support the engineering design and permitting of the MBI Centennial Park Project, which is a nearby multi-well injection project in the central area of the Basin. The primary objective of the MBI Centennial Park Project is to more locally and directly replenish a heavily pumped region of the Principal aquifer. Over 90% of groundwater production in the Basin occurs from the Principal aquifer system.

During 2018 approximately 496 MG (1,521 AF; 1,877,000 m^3) of purified recycled water was injected at DMBI test injection well MBI-1. Blending of purified recycled water with potable water is not required at the DMBI Project, and no other water was injected in 2018. Frequent backwash pumping of MBI-1 totaled approximately 6 MG (20 AF; 24,000 m^3) during 2018, representing 1.3% of MBI-1 injection.

Overall in 2018, the MBI-1 injection rate averaged 1.4 MGD with a backwash pumping frequency of approximately weekly. The 2018 injection volume was fairly constant except for about six weeks (August 22 through October 3) during the GWR Pipeline Rehabilitation Project, which involved epoxy coating the interior mortar lining of the pipeline. Prior to the GWR Pipeline Rehabilitation Project, MBI-1 was backwashed more frequently (weekly) than the modern injection wells at the Talbert Barrier (6-8 weeks) due to a faster rate of clogging, which was likely due to both the predominance of less permeable finer-grained aquifers in the MBI area and increased suspended solids in the MBI-1 injectate from erosion of the GWR Pipeline's inner mortar lining. After the GWR Pipeline Rehabilitation Project, the MBI-1 injection rate was sustainably increased to approximately 2 MGD with a backwash pumping frequency of one to two weeks.

Building upon the success of the DMBI Project, OCWD began construction of the MBI Centennial Park Project in late 2017 by installing two nested monitoring wells located south (downgradient) of Centennial Park. During 2018, four additional MBI well sites were constructed at Centennial Park immediately southeast of the DMBI Project. Injection of GWRS purified recycled water at these four new MBI wells is scheduled to begin in 2019.

Groundwater Monitoring at the DMBI Project

Groundwater monitoring for the DMBI Project began in 2012 and continued through 2018. Two existing monitoring wells, SAR-10 and SAR-11, are located downgradient from MBI-1 along the southeasterly flow path towards the closest drinking water production wells IRWD-12 and IRWD-17, which are operated by the Irvine Ranch Water District (IRWD).

Groundwater quality monitoring for the DMBI Project was the same as that at the Talbert Barrier and Anaheim Forebay: (1) an extensive list of inorganic, organic and radiological parameters, (2) the majority of the U.S. EPA Priority Pollutants, and (3) 1,4-dioxane and NDMA. During 2018, groundwater quality at monitoring wells SAR-10 and SAR-11 complied with all Federal and State Primary Drinking Water Standards and yielded no results exceeding the Secondary MCLs. No microbial detections were found in groundwater samples taken from SAR-10 or SAR-11 during the first quarter of 2018, which marked the end of the required reporting period.

Groundwater at monitoring well sites SAR-10 and SAR-11 was sampled and analyzed for NDMA and 1,4-dioxane during 2018. The 1,4-dioxane results continued to be non-detect at both sites during 2018. The NDMA concentrations in all four zones of SAR-10 ranged from below the RDL (2 ng/L) to 6 ng/L, remaining below the NL (10 ng/L) during 2018. These NDMA concentrations at SAR-10 during 2018 were likely caused by injection of GWRS purified recycled water with similar NDMA concentrations at MBI-1 two to three years prior. Since the travel time from MBI-1 to SAR-10 is typically much faster than two to three years, a shift in the gradient direction likely occurred during 2018 due to abnormally high groundwater levels, allowing GWRS water than had already migrated past SAR-10 to arrive once again at this well. The NDMA concentrations in all three zones at SAR-11 were consistently non-detect.

Conclusions

The GWRS operated during 2018 in compliance with its permit, producing a total of 31,532 MG (96,769 AF; 119,363,000 m^3) of purified recycled water for injection at the Talbert Barrier, spreading at K-M-M-L Basins, injection at the DMBI Project, and delivery to Anaheim CPP and ARTIC for non-potable use. Of the purified recycled water produced, approximately 26% was injected at the barrier and almost 73% was recharged at the spreading basins. Nearly 2% was injected at the DMBI Project, and a negligible volume (0.1%) was used for non-potable water purposes. On an annual average daily basis, the AWPF produced 86.4 MGD (327,000 m^3/day) of purified recycled water and was on-line approximately 96.6% of the time in 2018.

The MBI Centennial Park Project is scheduled to begin injection in 2019. During 2018 OCWD designed the GWRS Final Expansion that will increase purified recycled water production up to 130 MGD (145,600 AFY; 179,630,000 m^3/year). When construction is completed in 2023, GWRS purified recycled water will continue to supply the Talbert Barrier, replenish the Basin at the

Anaheim Forebay and MBI Project (DMBI Project and MBI Centennial Park Project), and be used for non-potable purposes at the Anaheim CPP and ARTIC.

1. INTRODUCTION

The Groundwater Replenishment System (GWRS) is a water supply project jointly sponsored by Orange County Water District (OCWD) and Orange County Sanitation District (OCSD) that supplements existing water supplies by providing a reliable high-quality source of water to recharge the Orange County Groundwater Basin (the Basin), to protect the Basin from degradation due to seawater intrusion, and to provide a water source for non-potable uses.

This introductory section of the 2018 Annual Report for the GWRS presents the:

- Purpose of the Annual Report;
- Description of the GWRS and Advanced Water Purification Facility (AWPF);
- Description of the Talbert Seawater Intrusion Barrier (Talbert Barrier);
- Description of the Kraemer-Miller-Miraloma-La Palma Basins (K-M-M-L Basins);
- Description of the Mid-Basin Injection (MBI) Project (Demonstration [DMBI] and Centennial Park);
- History of OCWD Water Recycling Facilities;
- Water Recycling Permit Requirements; and
- Overview of the Operation Optimization Plan (OOP).

1.1 Purpose of the Annual Report

This Annual Report for 2018 is prepared in fulfillment of the requirements specified in the *"Producer/User Water Recycling Requirements and Monitoring and Reporting Program for the Orange County Water District Interim Water Factory 21 and Groundwater Replenishment System Groundwater Recharge and Reuse at Talbert Gap Seawater Intrusion Barrier and Kraemer/Miller Basins"* adopted as Order No. R8-2004-0002 by the California Regional Water Quality Control Board, Santa Ana Region (RWQCB), on March 12, 2004 (RWQCB, 2004), and four subsequent amendments: (1) Order Nos. R8-2008-0058 on July 18, 2008 (RWQCB, 2008); (2) R8-2014-0054 on December 12, 2014 (RWQCB, 2014a); (3) R8-2016-0051 on July 29, 2016 (RWQCB, 2016); and R8-2019-0007 on March 22, 2019 (RWQCB, 2019). OCWD is the lead agency for the GWRS and responsible for permit compliance. These RWQCB Orders specify permit requirements for the GWRS for purified recycled water for: (1) injection at the Talbert Barrier; (2) spreading at K-M-M-L Basins; (3) injection at the MBI Project; and (4) non-potable uses. One of the permit requirements is submittal of an Annual Report.

This Annual Report serves two overall purposes by providing: (1) an in-depth review and evaluation of the operation of the entire GWRS during 2018 in fulfillment of the permit requirements; and (2) a continuing historical record of the operations of the OCWD water reuse and groundwater recharge facilities.

Information for this report was based on: (1) review of laboratory and on-line water quality data; (2) review of operations reports and groundwater monitoring records compiled by OCWD; and (3) on-site observations by the authors.

1.2 Groundwater Replenishment System

The GWRS produces a reliable, high-quality source of purified recycled water, recharges the Basin, and protects it from further degradation due to seawater intrusion.

The GWRS consisted of the following major components during 2018:

- AWPF, which includes treatment processes and pumping stations;
- Talbert Barrier, featuring injection wells and pipelines;
- K-M-M-L Basins, which are surface percolation basins supplied by the GWR Pipeline;
- DMBI Project, consisting of demonstration well MBI-1 and supplied by the GWR Pipeline; and
- Two non-potable customers: Anaheim Canyon Power Plant (Anaheim CPP) and Anaheim Regional Transportation Intermodal Center (ARTIC), both of which are supplied by the GWR Pipeline.

GWRS purified recycled water production by the AWPF, injection at the Talbert Barrier, and spreading at Kraemer-Miller Basins began in January 2008. Spreading at Miraloma Basin began in July 2012. GWRS purified recycled water injection at the DMBI injection well (MBI-1) began in April 2015. Purified recycled water service for non-potable purposes began at Anaheim CCP in July 2011 and at ARTIC in November 2014. Spreading at La Palma Basin began in November 2016. Four new MBI injection wells were drilled and constructed at Centennial Park in 2018 and are expected to be placed on-line in 2019.

Secondary-treated wastewater is diverted from OCSD Reclamation Plant No. 1 (Plant 1) to the GWRS AWPF, where it is treated to better than drinking water standards using microfiltration (MF), reverse osmosis (RO), an ultraviolet light/advanced oxidation process (UV/AOP), decarbonation, and lime stabilization. Two pumping stations at the AWPF in Fountain Valley deliver the purified recycled water to the: (1) Talbert Barrier in Fountain Valley and Huntington Beach, and (2) K-M-M-L Basins, with service connections to Anaheim CCP and ARTIC in Anaheim, plus the DMBI Project (MBI-1 well) in Fountain Valley. Figure 1-1 schematically shows the location of the GWRS facilities in central Orange County, California.

The AWPF design production capacity is 100 million gallons per day (MGD). Construction of the GWRS Initial Expansion was completed in 2015, increasing the AWPF design production capacity from 70 to 100 MGD and adding flow equalization facilities. AWPF source water flow equalization helped compensate for the diurnal fluctuation in secondary effluent from Plant 1, i.e., higher daytime flows and lower nighttime flows.

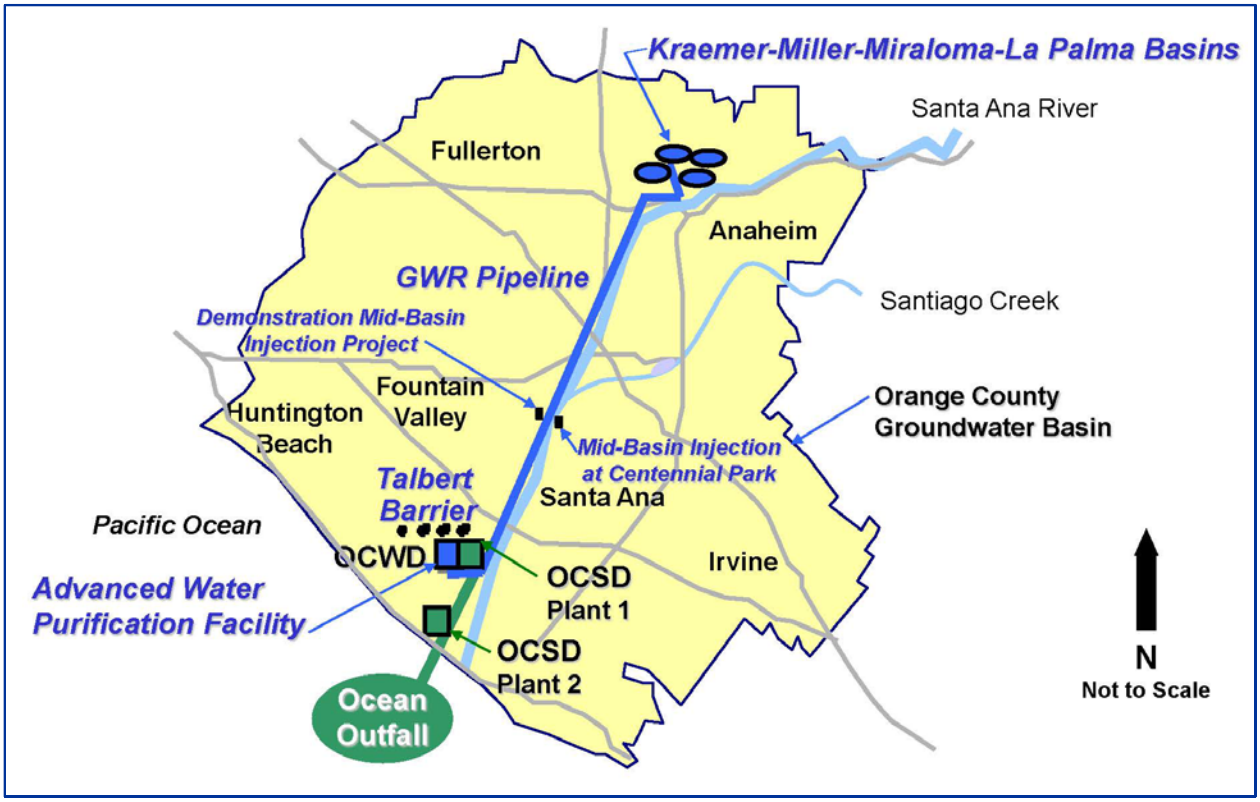


Figure 1-1. Groundwater Replenishment System Location Map

During 2018 the AWPF produced high-quality, purified recycled water averaging a finished water production rate of 86.4 MGD with daily flow rates ranging from 0.0 to 99.6 MGD. As listed in Table 1-1, the purified recycled water flow production in 2018 was discharged to multiple locations, with approximately 26% injected at the Talbert Barrier, 72% pumped to K-M-M-L Basins, nearly 2% injected at the MBI-1 well, and less than 1% used for non-potable purposes. Over half of the purified recycled water produced by the AWPF was recharged at La Palma Basin. Purified recycled water flow rates to the barrier and spreading basins vary seasonally.

Besides water supply, another purpose of the GWRS is to provide peak flow relief for OCSD during emergency, high wet weather flow conditions. During peak wastewater flow events, the AWPF can provide hydraulic relief for the OCSD ocean outfall by discharging up to 100 MGD of microfiltered, ultraviolet (UV)-disinfected, recycled water to the Santa Ana River (SAR) under RWQCB Order No. R8-2014-0069/NPDES 80000408 (RWQCB, 2014b). Alternatively, since the GWRS Initial Expansion was completed in 2015, the AWPF can provide similar hydraulic relief for the OCSD ocean outfall by continuing normal operation and production of up to 100 MGD of purified recycled water for recharge.

Table 1-1. 2018 Summary of Purified Recycled Water Flows and Discharge Points

Purified Recycled Water Discharge Point	Annual Average Daily Flow Rate (Avg. MGD)	Annual Volume		Percent (rounded)
		Million Gallons (MG)	Acre-Feet (AF)	
Talbert Barrier	22.2	8,097	24,848	25.7%
Kraemer Basin	0.6	217	666	0.7%
Miller Basin	0.0	0	0	0.0%
Miraloma Basin	15.0	5,476	16,805	17.4%
La Palma Basin	47.2	17,217	52,836	54.6%
DMBI Project	1.4	496	1,521	1.6%
Anaheim CPP	<0.1	24	75	<0.1%
ARTIC	<0.1	5	18	<0.1%
Total	**86.4**	**31,532**	**96,769**	**100%**

1.2.1 Source Water

Source water for the GWRS is secondary-treated wastewater, or secondary effluent, from the OCSD Plant 1 in Fountain Valley. Located adjacent to the OCWD site, Plant 1 currently has a rated secondary treatment capacity of 170 MGD. Plant 1 also provides secondary effluent for the Green Acres Project (GAP), which is a 7.5 MGD capacity tertiary treatment plant operated by OCWD that produces recycled water for non-potable irrigation and industrial uses. Modification projects at Plant 1 are under construction that will improve its solids thickening and dewatering capability and support its liquid treatment capacity.

OCSD also operates Treatment Plant No. 2 (Plant 2), which is located in Huntington Beach near the coast. Plant 2 does not presently provide source water for the GWRS; secondary effluent from Plant 2 is discharged via an outfall to the Pacific Ocean.

OCSD maintains an industrial pretreatment and source control program to manage contaminants entering the wastewater tributary to Plant 1 which may be harmful to the treatment facilities, environment, or to human health and drinking water supplies. The comprehensive OCSD program fulfills the GWRS permit requirements and final Title 22 Water Recycling Criteria source control requirements for groundwater replenishment with recycled water (CCR, 2014), ultimately helping to protect GWRS purified recycled water quality.

Raw wastewater influent to Plant 1 passes through the metering and diversion structure, mechanical bar screens, and grit chambers, which comprise preliminary treatment. Following screening and grit removal, the wastewater receives advanced primary treatment using ferric chloride and anionic polymer addition and primary sedimentation. Primary effluent is then conveyed to the activated sludge (AS) plants or to trickling filters (TF) for secondary treatment. The existing TF and associated secondary clarifiers were upgraded and began operation in October 2006 with a design treatment capacity of 30 MGD. The older AS plant (OCSD Project No. P1-82 or AS1), which consists of aeration basins and secondary clarifiers, was upgraded in August 2007 to include anoxic and oxic zones and has a design treatment capacity of 80 MGD. Historically, OCSD operated the P1-82 AS plant in the carbonaceous biochemical oxygen demand (CBOD) mode. Since late 2009, the P1-82 AS plant has operated in the biological nitrification/denitrification (NdN) mode achieving partial denitrification. The newer AS plant at Plant 1 (OCSD Project No. P1-102 or AS2) was completed in July 2012 with a design capacity of 60 MGD and has operated in the NdN mode.

Solids handling at Plant 1 consists of dissolved air flotation thickening, anaerobic digestion, holding tanks, belt filter presses for dewatering, and truck loading facilities to haul stabilized solids to disposal. Support facilities include chemical addition, plant and city water systems, odor control, digester gas handling, and on-site power generation. Major upgrades to the biosolids thickening and dewatering facilities (OCSD Project No. P1-101) include two sets of centrifuges for: (1) co-thickening primary sludge and waste activated sludge, and (2) digested biosolids dewatering, which are currently being constructed with completion scheduled in 2019.

In mid-2009, OCSD began operating the Steve Anderson Lift Station (SALS) that conveys up to 50 MGD of additional raw wastewater to Plant 1 to increase the amount of secondary effluent available for the GWRS. The SALS increases the volume of wastewater treated at Plant 1, which in turn, results in more secondary effluent flow being available as source water, thereby enabling the AWPF to perform closer to its full production capacity.

Secondary effluent flows by gravity to the GWRS AWPF, first passing through fine screens which are located at the Plant 1 site. While the ratio is variable, typically three times as much AS effluent as TF effluent is delivered to the AWPF as feedwater.

1.2.2 Advanced Water Purification Facility

The AWPF features MF, RO, and UV/AOP advanced water treatment processes applied to 100% of the influent flow stream, followed by decarbonation and lime stabilization post-treatment processes, with large pumping stations to convey the purified recycled water to the Talbert Barrier, K-M-M-L Basins, DMBI Project, and two non-potable water customers. Figure 1-2 shows the entrance to the AWPF.

Figure 1-2. Groundwater Replenishment System

The AWPF process flow diagram is shown on Figure 1-3, and the site layout is shown on Figure 1-4 on the following pages. Brief descriptions of the processes are also presented.

1.2.3 Secondary Effluent Flow Equalization and Influent Screening

Similar to other wastewater treatment plants, OCSD Plant 1 experiences a daily diurnal flow pattern, peaking in the day and declining to minimal levels in the night. Secondary effluent flow equalization (SEFE) facilities located adjacent to the AWPF store secondary effluent during the day when flows are higher and release it during the night when flows are lower, thereby enabling the AWPF to operate at a more constant flow rate. Pictured on Figure 1-5, the SEFE facilities consist of two 7.5 million gallon (MG) above-ground tanks and a pump station located at the Plant 1 site. During the day, secondary effluent flows exceeding the AWPF production rate setpoint are pumped to the SEFE tanks for storage; at night, SEFE flows are released by gravity to the influent screening facility.

Secondary effluent flows by gravity to the influent screening facility, which consists of five fine screens that remove suspended solids larger than 2 millimeters (mm). Influent screening helps protect and extend the life of the downstream treatment processes at the AWPF. Screened secondary effluent flows from the influent screening facility to the MF system. Solids with screen wash wastewater are returned to Plant 1 for treatment and disposal with other OCSD solids.

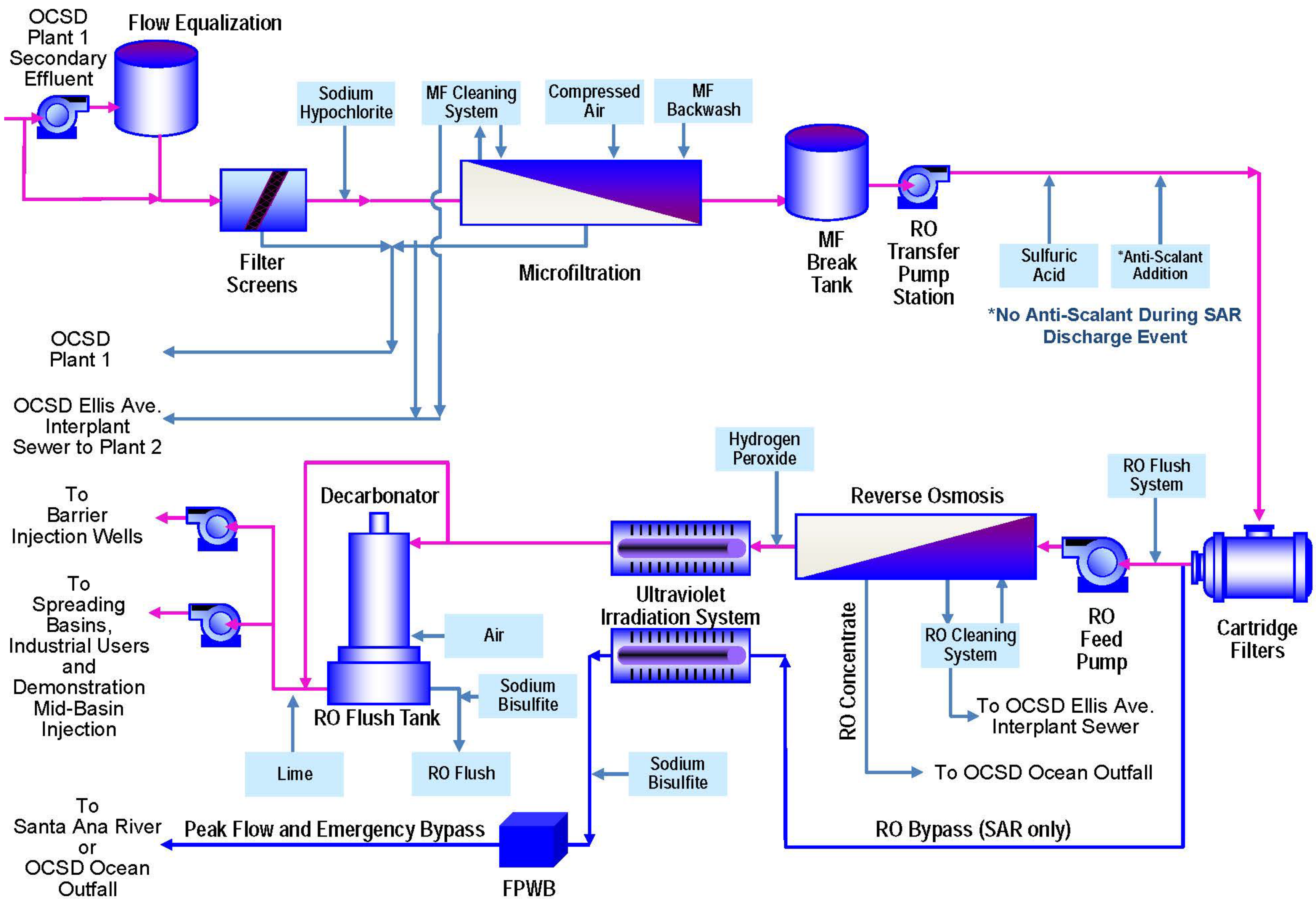


Figure 1-3. GWRS AWPF Process Flow Diagram

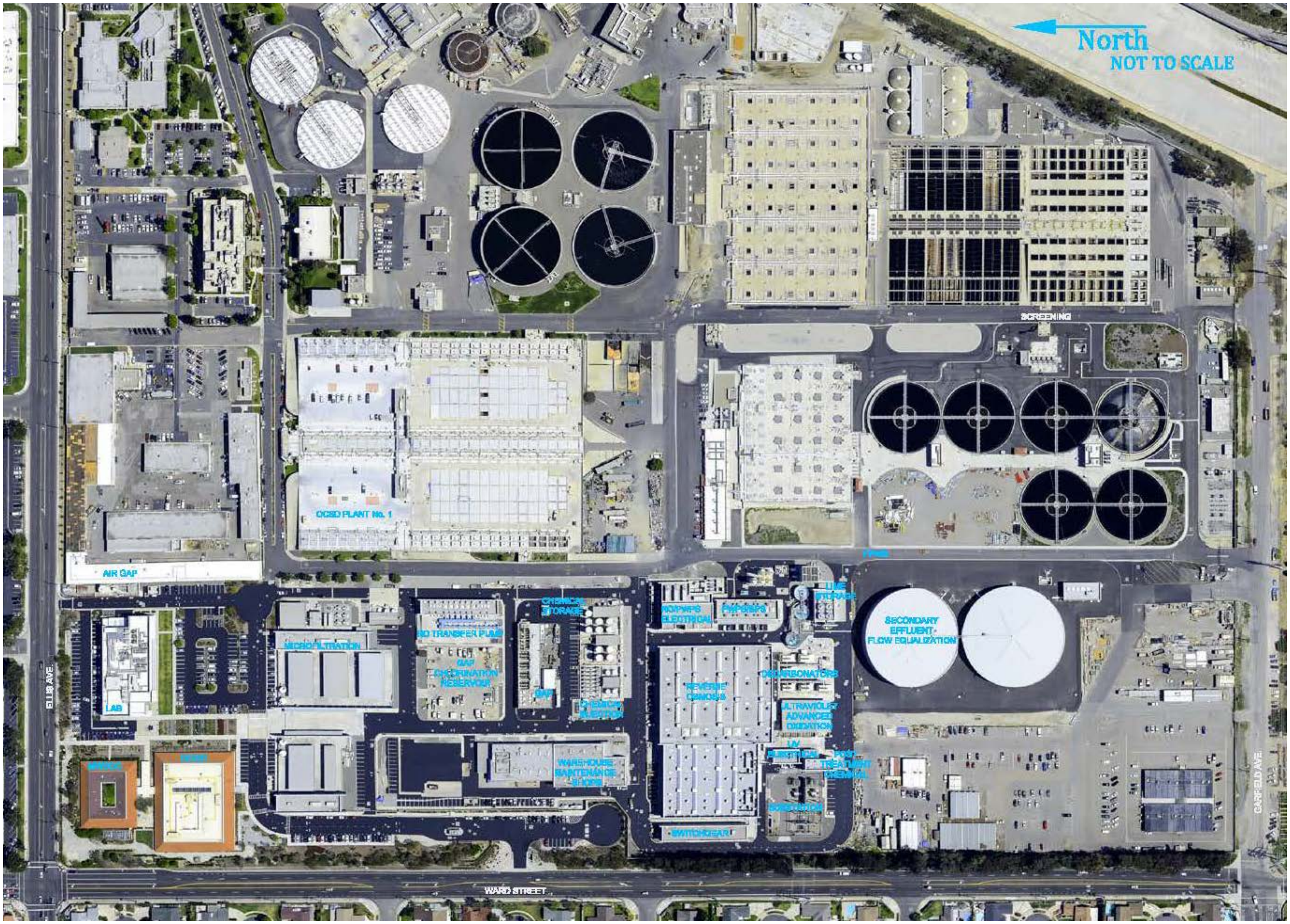


Figure 1-4. AWPF Site Layout

Figure 1-5. Secondary Effluent Flow Equalization (SEFE) Tanks and Pump Station

1.2.4 Microfiltration System

MF removes suspended and colloidal solids, including bacteria and protozoa, using polypropylene hollow-fiber membranes with a nominal pore size of 0.2 micrometers (microns). MF is a pretreatment step before the RO process. Screened secondary effluent flows by gravity to 36 below-grade MF cells, pictured on Figure 1-6. Each MF cell contains 684 in-basin submerged membrane elements. Filtrate pumps, operating in a vacuum mode, continuously pull water through the MF membranes using a piping manifold and discharge the filtrate, or MF effluent, to the MF Break Tank. The maximum rated instantaneous filtrate production capacity of the MF system is 157 MGD with one cell out of service or in backwash. The actual average filtrate production capacity of the MF system 118 MGD based on 90% recovery to account for backwashing and clean-in-place (CIP) cycles. The MF cells are regularly backwashed using filtrate from the MF Break Tank and an air scour. The MF membranes are periodically cleaned-in-place using citric acid and sodium hydroxide with a proprietary chemical to remove foulants and restore membrane performance. Waste backwash is returned to OCSD Plant 1 for treatment. MF CIP spent cleaning solutions are sent to OCSD Plant 2.

Figure 1-6. MF System

1.2.5 Reverse Osmosis System

The RO process demineralizes water and removes inorganics, organics, viruses, and a wide range of other contaminants using spiral-wound, thin-film composite polyamide membranes. MF effluent is pumped from the MF Break Tank to the RO system by the RO Transfer Pump Station. The RO process features pretreatment chemical addition using sulfuric acid and antiscalant (threshold inhibitor), cartridge filtration, and high-pressure feed pumps that supply the pressure vessels containing the RO membranes. Immediately upstream of the RO system are 14 cartridge filters using 10-micron or 20-micron filters. The RO system features 21 units (20 duty units and one standby unit), each rated at 5 MGD permeate capacity.

Shown on Figure 1-7, each RO unit consists of 150 pressure vessels arranged in three banks (stages). The original 15 RO units are configured in a 78:48:24 array; the six GWRS Initial Expansion RO units are configured in a 77:49:24 array with turbocharger energy recovery devices (ERDs) that also provide interstage flux balancing and monitoring capabilities. At a design recovery rate of 85%, the total nominal rated permeate capacity of the RO system is 100 MGD. Concentrate from the RO process is sent to the OCSD ocean outfall for disposal. The RO system can be bypassed during a peak wet weather SAR discharge event.

Figure 1-7. RO System

1.2.6 Ultraviolet/Advanced Oxidation Process System

The UV/AOP system consists of two steps: hydrogen peroxide addition and UV light treatment. UV light exposure is used for primary disinfection and for photolysis of UV light-sensitive contaminants such as N-nitrosodimethylamine (NDMA). Hydrogen peroxide exposed to UV light produces hydroxyl radicals that result in advanced oxidation to destroy UV-resistant contaminants such as 1,4-dioxane. The closed, in-vessel type UV system utilizes low-pressure high-output lamps. The UV system is arranged with 13 trains. Each train contains six reactors and has a rated maximum capacity of 8.75 MGD for a total of 113.75 MGD with all trains in service. Figure 1-8 shows a photo of two UV trains.

Figure 1-8. UV/AOP System

1.2.7 Decarbonation and Lime Stabilization Systems

Figure 1-9. Decarbonation System

Post-treatment consists of decarbonation and lime stabilization. The combination of decarbonation and lime stabilization raises the pH and adds hardness and alkalinity to make the purified recycled water less corrosive and more stable. Following the UV/AOP system, a portion of the excess residual carbon dioxide is removed from the RO permeate by six forced-draft decarbonators in order to raise the pH of the finished product water (FPW). Figure 1-9 shows a decarbonation tower. The decarbonation system has a total design capacity of 72 MGD, allowing for part of the UV-disinfected purified water to be treated by the decarbonators and bypassing the remaining flow. Decarbonated water is blended with the bypassed flow prior to lime stabilization in the FPW channel.

Hydrated lime (calcium hydroxide) is added to neutralize the remaining carbon dioxide, add alkalinity, raise pH, and thereby stabilize the FPW. Figure 1-10 shows a photo of the lime system, which features lime storage silos, slaker mixing tanks, slurry aging tanks, pumps, and saturators that prepare and deliver a saturated lime solution to the FPW channels. The lime system employs gravimetric feeders (based on weight) to control the amount of lime delivered. Anionic polymer is added to the saturators as a coagulant aid to reduce lime particle carryover. Lime sludge is pumped to OCSD's Ellis Avenue Interplant Sewer and conveyed to Plant 2 for treatment and disposal.

Figure 1-10. Lime Post-Treatment System

1.2.8 Purified Recycled Water Pumping

Purified recycled water, or FPW, is conveyed by the Barrier Pump Station to the Talbert Barrier and by the Product Water Pump Station to K-M-M-L Basins, DMBI Project, and non-potable uses. The Barrier Pump Station features four 600-horsepower pumps discharging FPW to the Talbert Barrier injection wells. The Product Water Pump Station features four 2,250-horsepower pumps discharging FPW to K-M-M-L Basins via the 13-mile GWR Pipeline. Laterals from the GWR Pipeline convey purified recycled water to the Anaheim CPP, ARTIC, and the DMBI Project. Both pump stations are housed in the building shown on Figure 1-11. Purified recycled water flows discharged to the Talbert Barrier, K-M-M-L Basins, DMBI Project, and non-potable users are metered, totalized, and recorded.

Figure 1-11. Barrier and Product Water Pump Stations

1.3 Talbert Barrier

The Talbert Gap is one of many geological features along the California coastline where freshwater aquifers are vulnerable to seawater intrusion from the Pacific Ocean. Historically, seawater intrusion has occurred in the Talbert Gap through the Talbert aquifer, which is the shallowest confined potable aquifer in the area and is comprised of sands and gravels deposited by the ancestral SAR. Early seawater intrusion in this area was studied by the California Department of Water Resources (DWR) and documented in *"Bulletin No. 147-1, Ground Water Basin Protection Projects, Santa Ana Gap Salinity Barrier, Orange County"* (DWR, 1966). Increasing freshwater demands and pumping from the Basin in the nearby coastal area accelerated this seawater intrusion condition. To mitigate this problem, OCWD initially constructed a series of 23 injection well sites to form a freshwater mound, or pressure ridge, that helped prevent seawater intrusion in the Talbert Gap area.

OCWD gradually expanded and strengthened the Talbert Barrier, adding more injection well sites to offset increased groundwater production resulting from urbanization of the coastal area. Without the barrier, seawater would migrate inland via the relatively shallow Talbert aquifer and then dive into deeper potable aquifers in areas where they are hydraulically connected or merged with the Talbert aquifer. The brackish degraded groundwater would eventually reach municipal supply wells. By forming an underground hydraulic mound near the coast, the Talbert Barrier helps to prevent seawater intrusion and contamination of the fresh groundwater supply.

Illustrated on Figure 1-12, the current Talbert Barrier consists of a series of 36 injection well sites that are supplied by pipelines that emanate from the AWPF Barrier Pump Station. The injection wells are generally located along Ellis Avenue and also along the SAR just north of Adams Avenue, within the cities of Fountain Valley and Huntington Beach. Of the 36 injection well sites, 23 are the original injection wells (I1 through I23) that were installed between 1968 and 1972 along Ellis Avenue between the Huntington Beach and Newport mesas, herein referred to as the "legacy injection wells." Five additional injection well sites (I24 through I28) were constructed between 1999 and 2004. As part of the GWRS project, eight more injection well sites (I29 through I36) were constructed between 2004 and 2007. Injection well sites I24 through I36 are herein referred to as "modern wells."

Table 1-2 lists the Talbert Barrier injection wells with their associated aquifers and injection depths. Sites I1 through I23 feature nested injection wells with up to four individual casings in one large borehole, each injecting into a different aquifer. These legacy injection wells are nested as illustrated on Figure 1-13. Site I24 is a modern nested injection well. Modern injection well sites I26 through I32 feature clustered injection wells with up to three individual, single-point wells at each site that are spaced approximately 20 feet apart. Modern well sites I33 through I36 are single point wells. Figure 1-14 illustrates these newer cluster-type well sites.

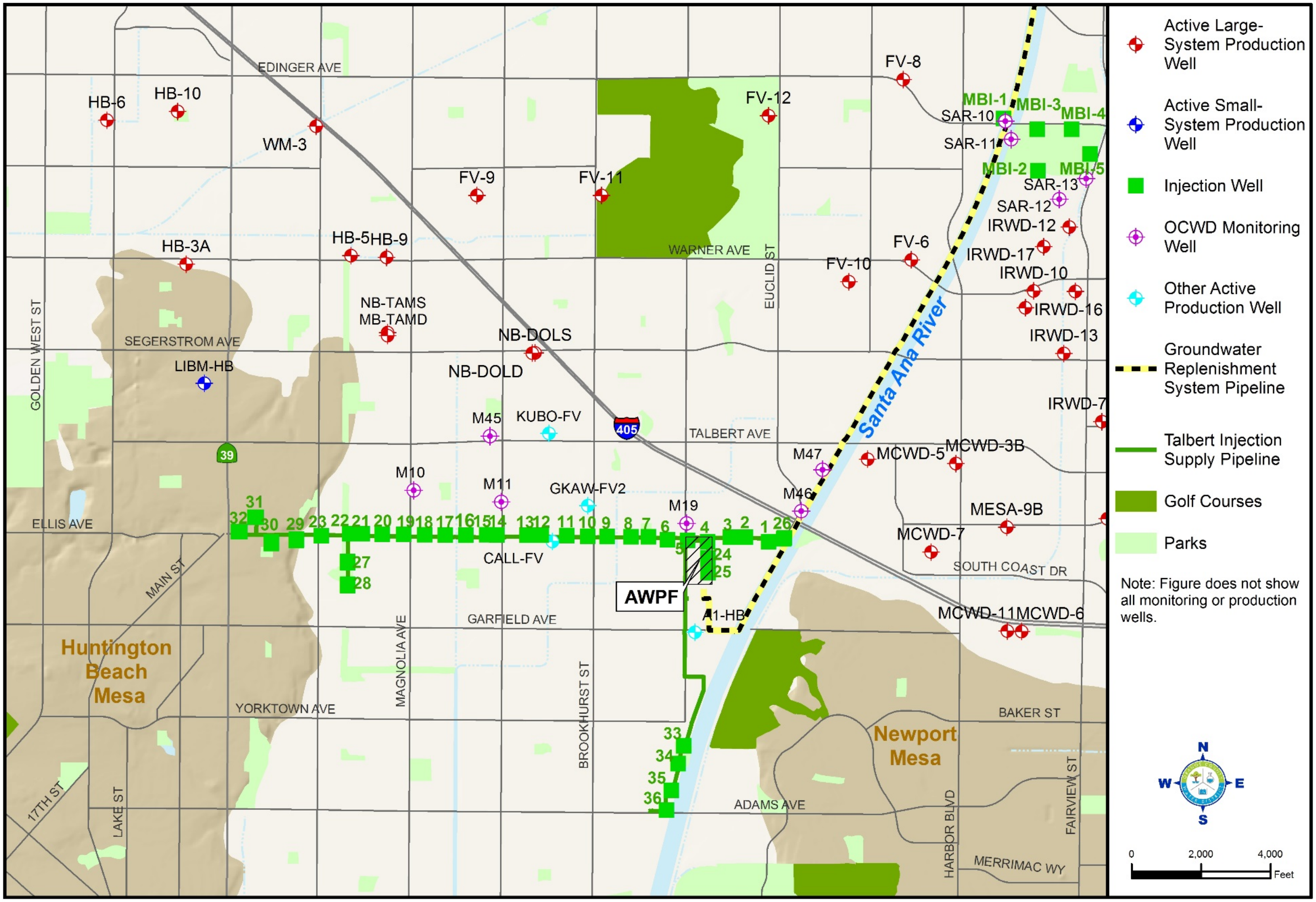


Figure 1-12. GWRS AWPF, Talbert Barrier and DMBI Project Location Map

Table 1-2. Talbert Barrier Injection Well Design Criteria

Aquifers and Perforated Intervals At Talbert Barrier						
Injection Well No.	No. of Casings	Aquifers and Perforated Interval Depth in feet below ground surface (ft bgs)				
		Talbert	Alpha	Beta	Lambda	Main
I1	4	65-100	150-200	235-350	365-400	---
I2	4	64-96	147-210	225-325	350-390	---
I3	4	65-96	145-200	225-325	340-380	---
I4	4	65-95	120-190	215-310	330-355	---
I5	4	70-90	115-180	210-265	320-245	---
I6	4	70-100	120-175	195-250	315-335	---
I7	4	70-95	110-150	165-250	315-336	---
I8	4	60-95	110-165	180-240	300-325	---
I9	4	65-90	110-150	175-235	300-330	---
I10	4	60-90	105-185	205-290	305-330	---
I11	3	65-95	115-180	200-225	---	---
I12	4	60-95	110-165	180-260	290-310	---
I13	4	77-100	120-160	175-250	280-305	---
I14	4	70-95	115-150	175-250	265-300	---
I15	4	70-93	115-145	70-235	262-285	---
I16	3	63-120	---	145-210	245-285	---
I17	3	62-130	---	150-215	250-275	---
I18	3	57-125	---	150-210	260-275	---
I19	3	57-127	---	145-200	235-270	---
I20	3	90-125	---	140-170	230-250	---
I21	3	55-125	---	150-170	230-250	---
I22	2	60-160	---	---	250-275	---
I23	2	70-155	---	---	215-252	---
I24	2	---	120-330			420-605
I25	1	---	120-320			---
I26	3	56-195		271-400		476-660
I27	3	78-148		210-260		355-420
I28	3	80-140		185-235		360-460
I29	3	---	90-120	200-250		365-475
I30	3	---	95-160	230-295		425-650
I31	3	---	90-165	235-295		440-590
I32	3	---	90-155	226-295		425-670
I33	1	61-156	---	See Note 1		---
I34	1	60-135	---	See Note 1		---
I35	1	60-115	---	See Note 1		---
I36	1	60-110	---	See Note 1		---

[1] I33 through I36 each has one casing perforated in the merged Talbert/Beta/Lambda Aquifers

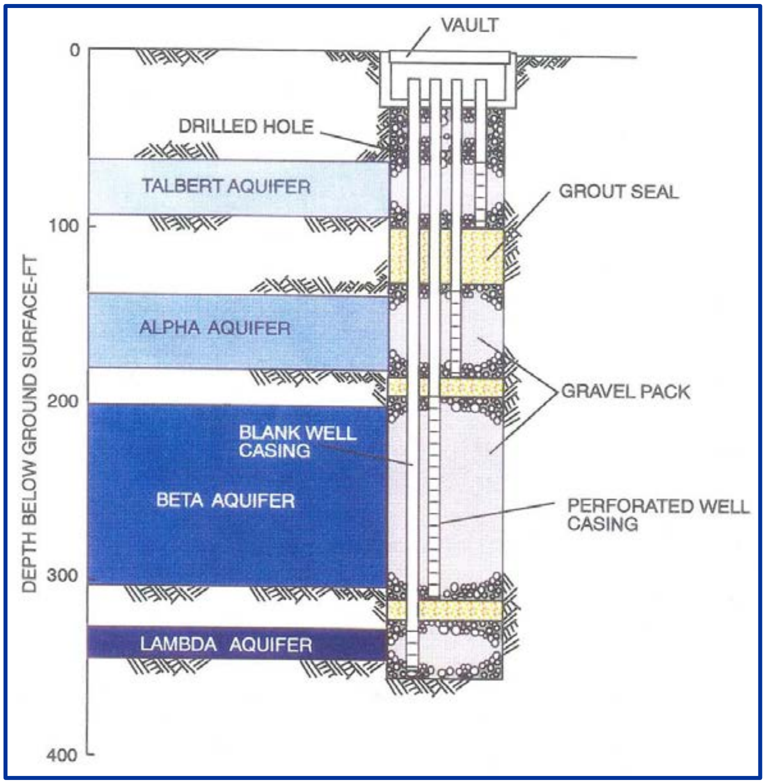


Figure 1-13. Typical Legacy Injection Well

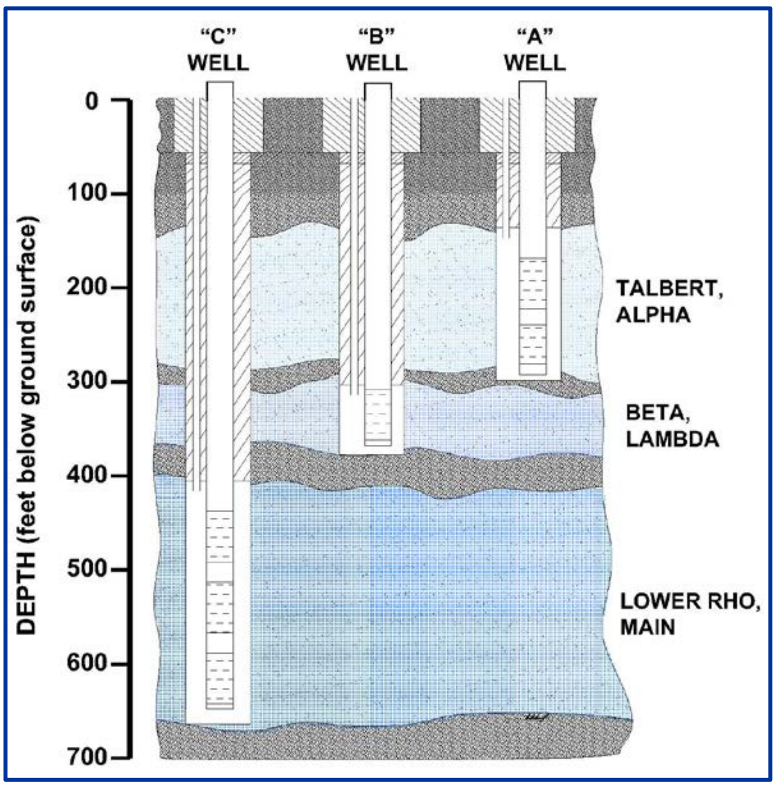


Figure 1-14. Typical Modern Cluster-Type Injection Well

Eight of the injection well sites (I24 and I26 through I32) each have a deeper Main aquifer injection zone primarily for replenishing the groundwater basin, in addition to injection zones in shallower aquifers susceptible to seawater intrusion. One of the clustered injection well sites (I26) is pictured on Figure 1-15.

Figure 1-15. Modern Injection Well Site I26

The closest active municipal public water supply well to the Talbert Barrier is Mesa Water District (Mesa Water) Well MCWD-5. Well MCWD-5 is located approximately 3,300 feet northeast of injection well site I26, which is at the far easterly end of the barrier. The underground retention time prior to extracting water of recycled origin at this domestic drinking water well is estimated at three to eight years.

In 2012, OCWD became aware of an existing private well near the Talbert Barrier, GKAW-FV2/1, being used to supply water to an occupied residence in Fountain Valley. Historically, this well had been used only for irrigation purposes. Inquiries with the owner have revealed that the well water is also being used for drinking purposes. Well GKAW-FV2/1 is located approximately 700 feet north of injection well site I10 and is perforated from 120 to 125 ft bgs in the Alpha aquifer. The underground retention time prior to extracting water of recycled origin at this private drinking water well has been observed to be more than ten years, on the basis of groundwater samples taken from this well since GWRS began operation in 2008 which indicate that GWRS purified recycled water has not yet reached Well GKAW-FV2/1 despite its relatively close proximity to the barrier. The groundwater flow direction in the Alpha aquifer at Well GKAW-FV2/1 is likely seaward towards the barrier. OCWD has contacted the State Water Resources

Control Board (SWRCB) Division of Drinking Water (DDW) and the RWQCB regarding Well GKAW-FV2/1.

The amended permit requires a primary boundary of 12 months underground travel time from the injection operation at the Talbert Barrier. Any new drinking water wells are to be constructed outside this primary boundary. The secondary boundary is defined as the area less than 12 months underground travel time from the Talbert Barrier injection operations. Any new drinking water wells proposed to be constructed near the secondary boundary must be evaluated to assess any potential impact that the proposed well may have on the primary boundary, potentially changing the boundaries.

The Talbert Barrier injection operation complies with the amended permit requirements for underground retention time. The primary boundary is supported by Resolution No. 05-4-40 adopted by the OCWD Board of Directors on April 20, 2005 (OCWD, 2005). OCWD has notified the Orange County Health Care Agency (OCHCA), Orange County Well Standards Advisory Board, and the City of Fountain Valley, which are the well permitting agencies in this area, of this buffer zone requirement. No new drinking water wells have been installed in the 12-month underground retention area.

1.3.1 Monitoring Wells near the Talbert Barrier

OCWD has an extensive monitoring well network in the Talbert Gap, especially in the vicinity of the Talbert Barrier. These wells are monitored for both groundwater levels and groundwater quality to: (1) evaluate barrier effectiveness; (2) characterize seawater intrusion; and (3) track effects of the injection water on groundwater quality. Data from these monitoring wells and nearby drinking water production wells are also analyzed to estimate groundwater travel times along flow paths emanating from the barrier.

Three historic monitoring well sites, M10, M11, and M19, and three newer monitoring well sites, M45, M46, and M47, are monitored for various water quality parameters specified in the permit (RWQCB, 2004). Each site has three to five depth-specific casings for monitoring individual aquifer zones. Overall, a total of 23 distinct points at five of these monitoring well sites (M10, M11, M45, M46, and M47) are routinely sampled and tested for the full comprehensive test suite of analytes. At the sixth monitoring well site (M19), only Zone 3 (M19/3) is tested quarterly like GWRS compliance monitoring wells and annually for the full comprehensive suite of analytes; Zones 1 and 2 (M19/1 and M19/2) are tested twice a year for a reduced set of analytes for the assessment of seawater intrusion. As shown on Figure 1-12 presented earlier, these six sites are strategically located as follows:

- Monitoring well sites M46 and M47 (compliance wells) are between the easterly end of the barrier and the nearest domestic drinking water production well MCWD-5, which is owned and operated by Mesa Water;

- Monitoring well sites M10, M11, and M45 (compliance wells) are located north of the barrier between the barrier and the four City of Newport Beach domestic drinking water production wells (NB-TAMD, NB-TAMS, NB-DOLD, and NB-DOLS); and
- Monitoring well site M19 (non-compliance well) is located approximately 500 ft north of the barrier.

The permit requires that quarterly water quality sampling and analyses for each aquifer receiving injection water be conducted at five monitoring well sites near the barrier: M10, M11, M45, M46, and M47. Monitoring at well site M19 is not required under the current permit. However, since monitoring well site M19 has a long history of data as an original Water Factory 21 (WF-21) compliance monitoring well and is strategically located within 500 feet of the barrier, data continue to be collected at M19. The RWQCB and DDW approved a revised monitoring frequency in 2011 that allows for selected analytes with no detections to be monitored on an annual basis in lieu of quarterly (RWQCB, 2011 and CDPH, 2010a). Since 2012, OCWD reduced the quarterly voluntary groundwater monitoring of chemicals of emerging concern (CECs) to semi-annually, annually, or discontinued at some monitoring wells based on review of the groundwater quality data and assessing the arrival of purified recycled water using its low chloride concentration as an intrinsic tracer. At several monitoring wells, arrival of purified recycled water has not been observed based on chloride concentrations that have remained at levels consistent with pre-GWRS ambient conditions since 2008, which justifies the reduced monitoring frequency at some sites.

1.4 Kraemer-Miller-Miraloma-La Palma Basins

K-M-M-L Basins in Anaheim are components of the GWRS that are used to percolate purified recycled water, along with other waters to recharge the Basin. Figure 1-16 shows the location of these four recharge basins, which are located north of the SAR, near the Carbon Creek Diversion Channel, along with OCWD's other surface water recharge facilities. OCWD manages and operates a surface water recharge system located near the SAR and Santiago Creek comprised of 24 recharge facilities that cover nearly 1,100 wetted acres and have a total storage volume of more than 26,000 acre-feet (AF).

Earlier studies (DWR, 1934; DWR, 1967) have described the Forebay area of the Basin as an area characterized by highly permeable sands and gravels with relatively few discontinuous clay and silt deposits. The majority of recharge in the Basin occurs in the Forebay, primarily by percolation of SAR flows, GWRS purified recycled water, and purchased imported water.

Seven adjacent spreading basins form the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L Basins/La Jolla Basins recharge system. K-M-M-L Basins are components of the GWRS. Kraemer and Miller Basins began spreading purified recycled water in January 2008. Miraloma Basin began spreading

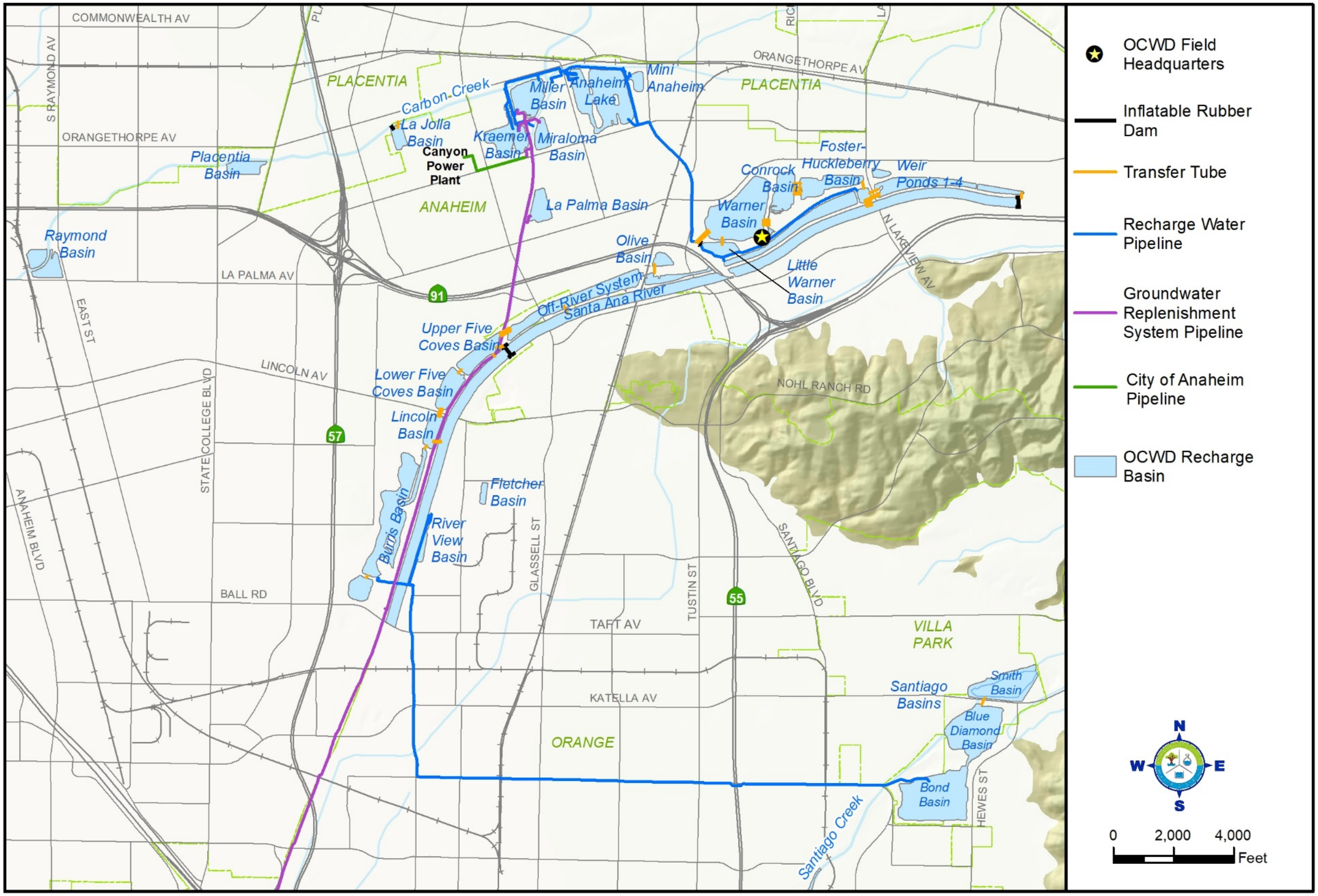


Figure 1-16. Surface Water Recharge Facilities

purified recycled water in July 2012. La Palma Basin began spreading purified recycled water in November 2016. Anaheim Lake and Mini-Anaheim Lake are adjacent to and upgradient of K-M-M-L Basins. La Jolla Basin is close to and downgradient of K-M-M-L Basins.

Table 1-3 summarizes the area, storage capacity and potential recharge water source(s) for each recharge facility. K-M-M-L Basins are the only spreading basins that receive GWRS purified recycled water.

Table 1-3. Area and Storage Capacities of Recharge Facilities

Facility	Wetted Area (acres)	Maximum Storage Capacity (AF)	Possible Recharge Sources			
			GWRS Purified Recycled Water	Captured Storm Water	Imported Water	SAR Base Flow
Anaheim Lake	72	2,260		✓	✓	✓
Kraemer Basin	31	1,170	✓	✓	✓	✓
La Jolla Basin	6.5	26		✓	✓	✓
Miller Basin	25	300	✓	✓	✓	✓
Mini-Anaheim Lake	5	13		✓	✓	✓
Miraloma Basin	11	110	✓	✓	✓	✓
La Palma Basin[1]	14	140	✓	✓	✓	✓
Other Basins[2]	935	22,446		✓	✓	✓

[1] La Palma Basin continues to be dedicated for only GWRS purified recycled water recharge since coming on-line in 2016 to minimize basin clogging and maintain high percolation rates.

[2] OCWD owns and/or operates a total of 24 surface water recharge basins near the SAR and Santiago Creek. These other basins are outside the influence of the current GWRS recharge system operation.

Kraemer Basin is one of eleven deep basins used for percolation. Kraemer Basin covers an area of approximately 31 acres and has a maximum storage capacity of about 1,170 AF. Based on percolation tests with low turbidity water, its maximum percolation rate is estimated at 65 MGD (100 cubic feet per second [CFS]).

Miller Basin is a flood control basin owned by the County of Orange and conjunctively used by OCWD as a recharge basin through a cooperative agreement. Miller Basin covers an area of approximately 25 acres and has a maximum storage capacity of about 300 AF. In winter its usable storage capacity is reduced for flood control purposes. More storage capacity is available at Miller Basin in the summer. Its estimated maximum percolation rate is 29 MGD (45 CFS), assuming percolation of low turbidity GWRS and/or imported water. Shown on Figure 1-17, GWRS purified recycled water recharge first began at Miller Basin on January 17, 2008.

Figure 1-17. Miller Basin with GWRS Purified Recycled Water in 2008

Miraloma Basin is located immediately southeast of Kraemer-Miller Basins and along Carbon Creek Diversion Channel. Pictured on Figure 1-18, Miraloma Basin covers an area of approximately 11 acres and has a maximum storage capacity of about 110 AF. Based on the observed percolation of GWRS purified recycled water, its maximum percolation rate is estimated at 30 MGD (46 CFS). GWRS purified recycled water recharge first began at Miraloma Basin on July 26, 2012. Since then, OCWD has predominately recharged purified recycled water at Miraloma Basin, though the recharge was supplemented with a small amount of non-GWRS water in 2017. Non-GWRS water may be recharged at Miraloma Basin in future years.

Figure 1-18. Miraloma Basin with GWRS Purified Recycled Water in 2012

La Palma Basin is the newest spreading basin located south of Kraemer and Miraloma Basins along Carbon Canyon Diversion Channel as shown on Figure 1-19. La Palma Basin covers an area of approximately 14 acres and has demonstrated exceptional percolation capabilities, achieving an estimated maximum percolation rate of 65 MGD (100 CFS). GWRS purified recycled water spreading first began at La Palma Basin on November 9, 2016. Since then, La Palma Basin has been dedicated to recharging purified recycled water and recharged more than half of all GWRS production during 2018.

Figure 1-19. La Palma Basin in 2016

Three sources of water may be recharged at K-M-M-L Basins:

1. **Purified recycled water** – advanced treated recycled water treated by MF, RO, UV/AOP, decarbonation and lime stabilization by the GWRS AWPF (FPW);
2. **SAR water** – storm water and base flow captured and diverted from the SAR and local tributaries to the spreading basins (base flow is principally comprised of disinfected tertiary-treated wastewater effluent from upstream dischargers); and
3. **Imported water** – raw, untreated surface water from the State Water Project or Colorado River Aqueduct purchased from Metropolitan Water District of Southern California (MWD).

Purified recycled water is conveyed from the AWPF to K-M-M-L Basins by the GWR Pipeline. This 13-mile transmission pipeline traverses an alignment along the west levee of the SAR through the cities of Fountain Valley, Santa Ana, Orange, and Anaheim, and then continues north along the Carbon Creek Diversion Channel to these four spreading basins. The GWR Pipeline is 78 inches in diameter near the AWPF and gradually reduces in size to 60 inches in diameter as it reaches K-M-M-L Basins.

In order to understand how SAR water reaches Kraemer-Miller-Miraloma Basins, it is necessary to review the river diversion system that conveys water to Anaheim Lake and nearby facilities (Figure 1-16). The main source of inflow to the OCWD surface water recharge system is the SAR. SAR flows are divided into two streams upon reaching the Imperial Rubber Dam located just downstream of Imperial Highway. The first stream is diverted from the SAR to Weir Ponds 1-4 (Desilting System). The second stream is the remaining flow which is bypassed around the Imperial Rubber Dam back into the SAR channel. The maximum flow that can be diverted to the Desilting System is 500 CFS. Up to 500 CFS can also be bypassed around the rubber dam.

Flows that pass through the Desilting System are split at Weir Pond 4 with up to 400 CFS being conveyed to Foster-Huckleberry, Conrock, Warner, and Little Warner Basins; flows can also be diverted at Weir Pond 4 to the Off-River System leading to Upper and Lower Five Coves, Lincoln, Burris, and Santiago Basins. At Little Warner Basin, water is conveyed via gravity through the 66-inch diameter Warner Transmission Pipeline to Anaheim Lake. Water reaching Anaheim Lake can also be conveyed via a pipeline around the north side of Anaheim Lake to downgradient basins, including Kraemer, Miller, Miraloma, La Jolla, Placentia and Raymond Basins.

Imported water can be delivered directly to Anaheim Lake and Mini-Anaheim Lake, which can then be directed to the downgradient K-M-M-L Basins and/or La Jolla Basin. Imported water may also be delivered from other nearby MWD turnouts to the SAR and diverted to the Anaheim Lake/K-M-M-L/La Jolla Basins.

While Anaheim Lake, Mini-Anaheim Lake, and La Jolla Basin are part of the Anaheim Lake/K-M-M-L/La Jolla Basins recharge system, it should be noted that GWRS purified recycled water is not recharged at Anaheim Lake, Mini-Anaheim Lake, or La Jolla Basin. GWRS purified recycled water is only recharged at K-M-M-L Basins. Only SAR water and imported water are recharged at Anaheim Lake, Mini-Anaheim Lake and La Jolla Basin. These other water sources (SAR water and imported water) at Anaheim Lake, Mini-Anaheim Lake and La Jolla Basin supplement and blend (once percolated) with the purified recycled water recharged at K-M-M-L Basins. Historically, SAR captured storm flow component of the SAR water (i.e., excluding SAR base flow) and imported water percolated at Anaheim Lake, Mini-Anaheim Lake and La Jolla Basin were included in the previously required recycled water contribution (RWC) determination for the GWRS spreading basins.

The closest downgradient domestic drinking water well to K-M-M-L Basins is Well SCWC-PLJ2 (La Jolla Well), which is owned and operated by the Golden State Water Company (GSWC), formerly Southern California Water Company (SCWC). Well SCWC-PLJ2 is located approximately 5,300 feet downgradient from Kraemer Basin, the closest of the GWRS recharge basins. The underground retention time prior to extracting water of recycled origin at this domestic well is greater than six months (Clark, 2009).

The spreading operation complies with the amended permit requirements which specify that a primary boundary area be established to achieve four months of underground retention time downgradient of the K-M-M-L Basins for inactivation of microorganisms. Any new drinking water wells proposed to be established at the leading edge of the secondary boundary defined by the area with less than four months underground travel time must be evaluated to assess any potential impact that the proposed well may have on the primary boundary.

In compliance with the amended permit, no domestic drinking water supply wells are located within this 4-month underground retention primary/secondary boundary area. With the addition of La Palma Basin, the OCWD Board of Directors adopted Resolution No. 16-7-98 on July 20, 2016, establishing the boundary area for K-M-M-L Basins (OCWD, 2016). OCWD has notified the OCHCA as well as the Orange County Well Standards Advisory Board and the City of Anaheim, which are the well permitting agencies in this area, of this boundary requirement.

1.4.1 Monitoring Wells near Kraemer-Miller-Miraloma-La Palma Basins

OCWD has numerous monitoring wells in the vicinity of K-M-M-L Basins. These monitoring wells are used to observe groundwater levels and examine water quality and associated impacts of the recharge water on groundwater quality. Data from these monitoring wells and nearby domestic drinking water production wells are also analyzed to estimate groundwater travel times along flow paths emanating from the spreading basins.

Five monitoring well sites downgradient of K-M-M-L Basins are monitored for various water quality parameters specified in the permit (RWQCB, 2004, 2008, 2014, 2016) and based on DDW's approval (CDPH, 2014) of the Title 22 Engineering Report Supplement (OCWD and DDB Engineering, Inc., 2014): AM-7, AM-8, AM-10, AMD-10, and AMD-12.

Three of the sites, AM-7, AM-8, and AM-10 feature single-depth casings for monitoring one aquifer zone. The other sites, AMD-10 and AMD-12, each feature five depth-specific casings for monitoring five individual aquifer zones. A total of 13 distinct monitoring points at these five locations are sampled and tested in accordance with the permit and in accordance with the approved reduced monitoring frequency. The RWQCB and DDW allowed for a reduced monitoring frequency from quarterly to an annual basis for selected analytes with no detections (RWQCB, 2011 and CDPH, 2010a).

Listed below, these monitoring well sites are located west-southwest of K-M-M-L Basins as shown on Figure 1-20 on a flow path towards the nearest domestic drinking water Well SCWC-PLJ2.

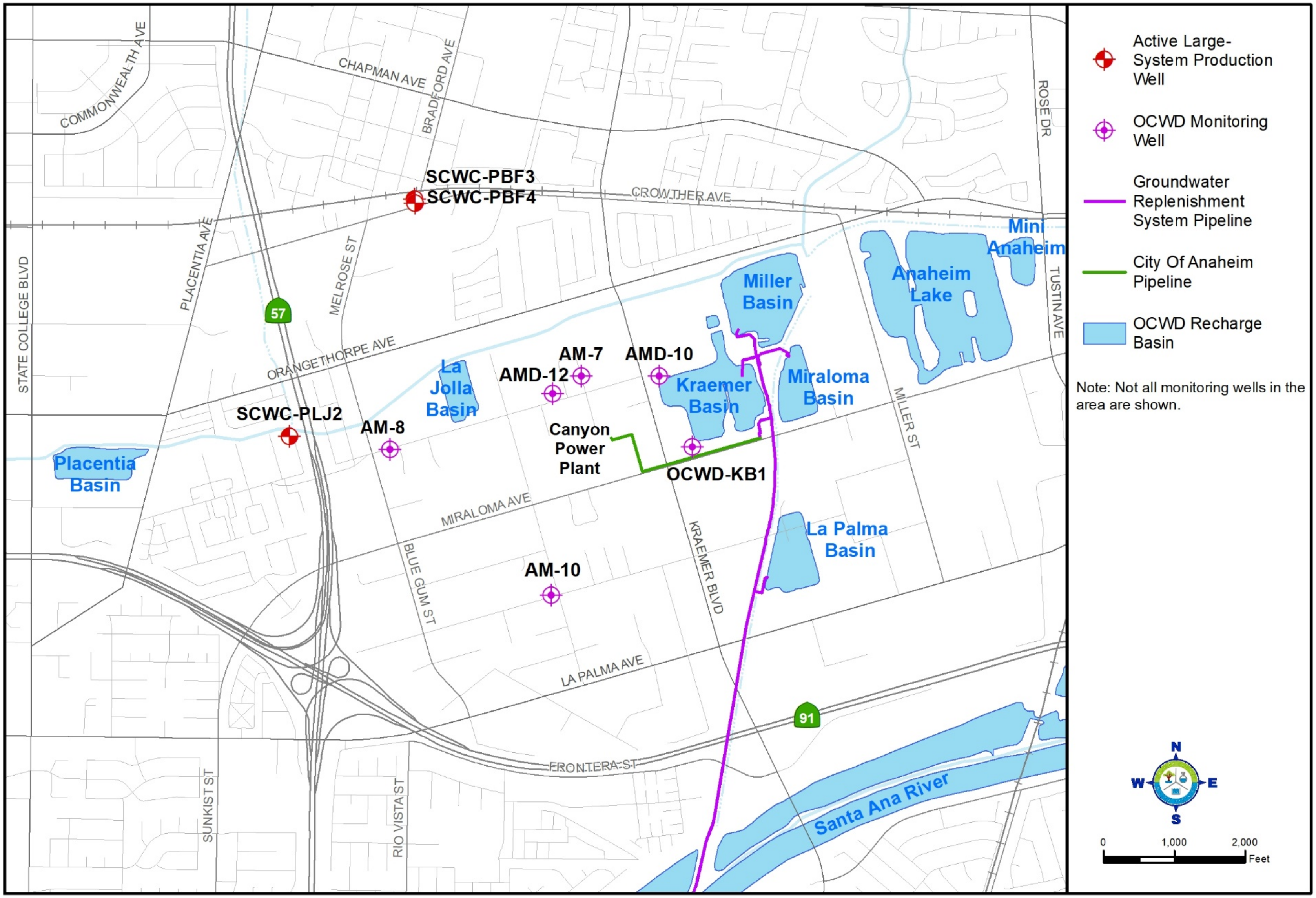


Figure 1-20. Selected Forebay Monitoring and Production Well Locations

Underground travel times were estimated based on tracer studies (LLNL, 2004; Clark, 2009) and confirmed primarily by analyzing chloride concentration trends since the onset of GWRS operations. Groundwater flow paths and elevation contours in this area are discussed in Section 6.

- Monitoring well AM-7/1 is approximately 1,100 ft west of Kraemer Basin and has an approximate 2.5-month underground travel time from Kraemer Basin;
- Monitoring well AM-8/1 is approximately 3,900 ft west of Kraemer Basin and has an approximate 4.5-month underground travel time from Kraemer Basin.
- Monitoring well AM-10/1 is approximately 3,000 ft southwest of Kraemer Basin and 3,000 ft west of La Palma Basin. Monitoring well AM-10/1 previously had an approximate 2-month underground travel time from Kraemer Basin but now likely receives water primarily from La Palma Basin with a similar travel time.
- Monitoring well site AMD-10 is screened at five depths and is located approximately 55 ft west of Kraemer Basin. Monitoring well AMD-10/1, the shallowest zone, has an approximate one-month underground travel time from Kraemer Basin and an approximate three-month underground travel time from Miller Basin. Four deeper zones with longer underground travel times also exist at monitoring well site AMD-10; and
- Monitoring well site AMD-12 is screened at five depths and is located about 1,600 ft west of Kraemer Basin. Monitoring well AMD-12/1, the shallowest zone, has an approximate four-month underground travel time from Kraemer Basin. Four deeper zones with longer underground travel times also exist at monitoring well site AMD-12.

In addition to the above compliance wells, OCWD regularly samples one non-compliance monitoring well that is near the GWRS spreading basins: OCWD-KB1/1. Monitoring well OCWD-KB1/1 is located approximately 100 ft southwest of Kraemer Basin and has an approximate three-week underground travel time from Kraemer Basin. While the GWRS permit does not require monitoring at this monitoring well, OCWD uses OCWD-KB1/1 to collect water level and quality data from the shallowest, upper aquifer that is not captured by deeper monitoring wells. OCWD-KB1/1 also has the benefit of having a relatively long historical record.

1.5 Demonstration Mid-Basin Injection Project

OCWD is operating the DMBI Project to investigate the feasibility of injecting GWRS purified recycled water directly into the Principal aquifer in the central portion of the Orange County Groundwater Basin. The goals of the DMBI Project have been achieved in collecting engineering, hydrogeological, water quality, and injection well operational data for designing the new MBI well field in Centennial Park which is scheduled to be place on-line during 2019.

Located in the central area of the Basin in the cities of Fountain Valley and Santa Ana as shown on Figure 1-21, the DMBI Project consists of the following key components:

- One test injection well, MBI-1; and
- Two downgradient monitoring wells, SAR-10 and SAR-11.

Injection at MBI-1 began on April 15, 2015, replenishing the Principal aquifer at depths between approximately 500 and 1,200 ft bgs with approximately 1.5 MGD of GWRS purified recycled water supplied via a lateral off the GWR Pipeline. During late 2018 following completion of the GWR Pipeline Rehabilitation Project, a higher injection rate of 2 MGD was able to be maintained at MBI-1 due to a reduction in clogging material that had been coming from the interior mortar lining of the pipeline. The downgradient multi-depth monitoring wells, SAR-10 and SAR-11, are sampled to track the underground travel of the injected water. The two monitoring wells are located downgradient of MBI-1 along the groundwater flow path toward the closest municipal production wells, IRWD-12 and IRWD-17, which are owned and operated by Irvine Ranch Water District (IRWD).

Operational data gained from the successful operation of the DMBI Project was used to support the design of four additional MBI wells that were constructed in Centennial Park in 2018-2019 just to the southeast of the DMBI Project (Figure 1-21). DMBI Project operating data were used to support the permitting of the MBI Centennial Park Project. Two new monitoring wells were constructed just south of Centennial Park in late 2017 to support the four MBI wells. These two monitoring wells are strategically located downgradient of the four MBI wells along a flow path towards IRWD-12 and IRWD-17 (Figure 1-21).

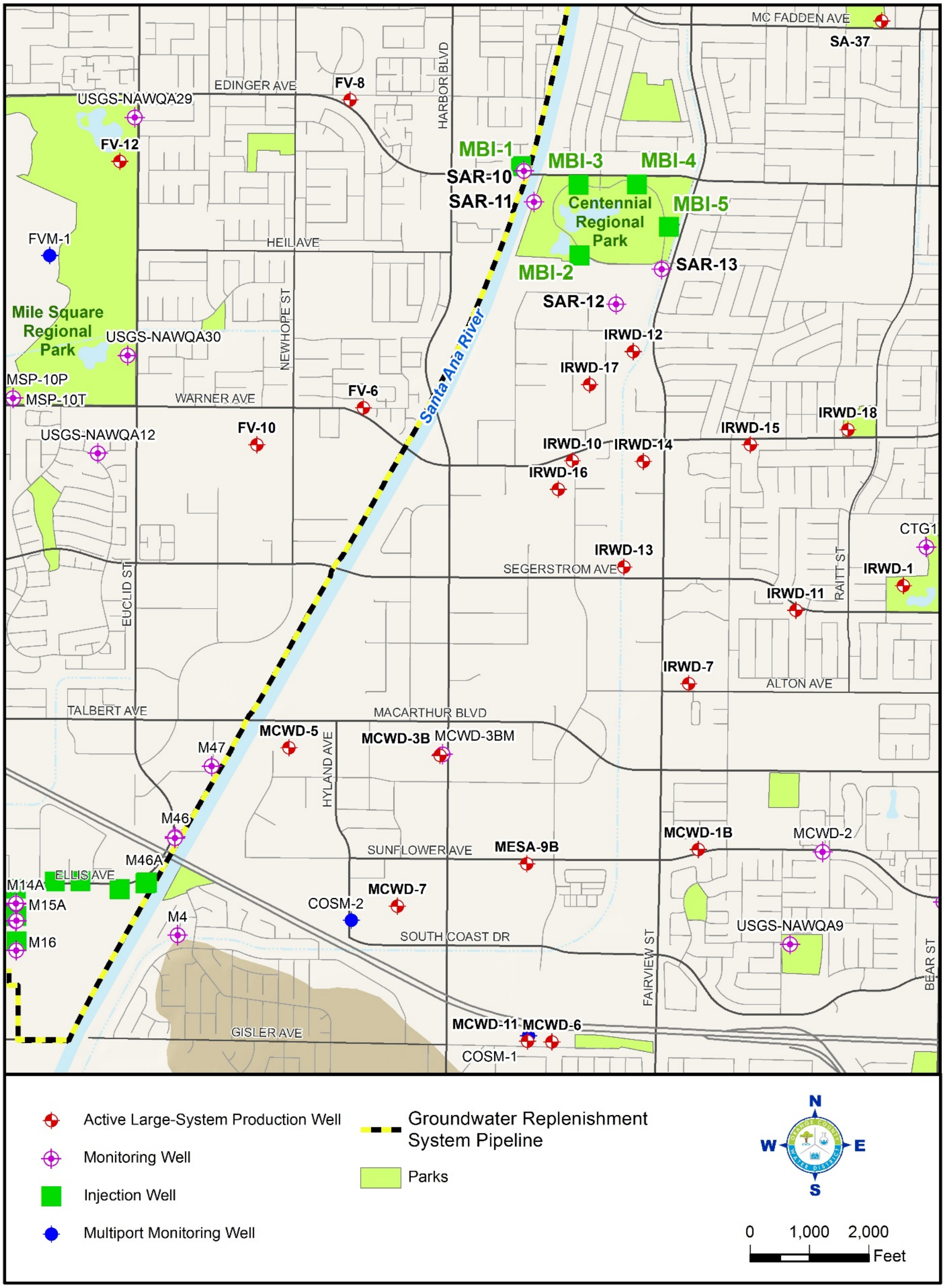


Figure 1-21. DMBI Project Location Map

1.6 History of OCWD Water Recycling Facilities

OCWD has a long history of water recycling for potable reuse, comprised of three recycled water groundwater recharge "eras", which can generally be identified by the water reclamation facilities in service at the time:

- Water Factory 21 (WF-21) — October 1976 to January 2004
- Interim Water Factory 21 (IWF-21) — June 2004 to August 2006
- GWRS AWPF — January 2008 to present

These OCWD water recycling facilities have produced highly treated recycled water for groundwater recharge at the Talbert Barrier. During two transitional periods, roughly from February to May 2004, and again from September 2006 until January 2008, OCWD had no operational facilities producing recycled water for groundwater recharge due to construction at the site.

Presently, the GWRS AWPF produces purified recycled water for injection and recharge at the Talbert Barrier and DMBI Project and for recharge at K-M-M-L Basins to replenish the Orange County Groundwater Basin, plus limited non-potable uses.

1.6.1 Water Factory 21

OCWD operated WF-21 from October 1976 until January 2004 to produce recycled water for injection at the Talbert Barrier to help prevent the inflow of seawater into the Basin. Shown on Figure 1-22, WF-21 was originally designed as a 15-MGD capacity advanced water treatment (AWT) facility to reclaim secondary treated waste-water from OCSD Plant 1.

Over this initial era of recycled water recharge, which spanned nearly three decades, the WF-21 facilities and operations were periodically modified and adjusted. The original WF-21 AWT system consisted of lime clarification, ammonia stripping, recarbonation, filtration, granular activated carbon (GAC), chlorination, blending reservoir, and pumping station. In September 1977, a 5-MGD capacity RO system with cellulose acetate membranes was added to demineralize part of the recycled water flow stream. Later, when it was found that ammonia was removed by nitrification at the OCSD plant and by the RO process, the ammonia stripping towers were taken out of service in 1987 and demolished in 1998. Lastly, a UV/AOP unit consisting of UV light exposure with hydrogen peroxide addition was added in 2001 to remove low molecular weight organic contaminants (e.g., NDMA and 1,4-dioxane).

Figure 1-22. Water Factory 21 in 1976

Two types of recycled water produced by WF-21, AWT water and RO product water, were blended with deep well water and pumped to the Talbert Barrier injection wells until 2000. After that, only RO product was recharged, blending with groundwater from deep wells and potable water from the City of Fountain Valley and the OC-44 turnout (treated potable water from MWD).

Operation of WF-21 ceased on January 15, 2004 for construction of IWF-21 and the GWRS. Portions of WF-21, specifically the RO and UV/AOP processes as well as the blending reservoir and barrier pump station, were maintained for use in IWF-21. Other WF-21 facilities were demolished.

1.6.2 Interim Water Factory 21

Operation of IWF-21 began on June 21, 2004 and ceased on August 8, 2006, for relocation of portions of its equipment to the GWRS AWPF. Although this second era of water recycling for groundwater recharge was relatively brief, the purpose of IWF-21 was twofold: (1) produce up to 5 MGD of recycled water for the Talbert Barrier to help prevent seawater intrusion; and (2) serve as a training facility to allow operations and maintenance staff to gain experience with the same treatment train as that planned for the larger GWRS AWPF. Figure 1-23 shows the IWF-21 facilities.

Figure 1-23. Interim Water Factory 21 in 2006

Utilizing new treatment processes along with modified WF-21 facilities, IWF-21 featured MF, RO, decarbonation, and UV/AOP to treat secondary effluent from OCSD's Plant 1. Recycled water was blended with diluent water, chlorinated, and pumped to the Talbert Barrier injection wells.

The RO system removed minerals, organics, viruses, and other contaminants. The original WF-21 RO System was retrofitted with new thin-film composite polyamide membranes in 2004, which offered improved mineral and contaminant rejection rates and operated at lower pressure, thereby conserving energy. The IWF-21 RO process followed MF and consisted of three steps: chemical pretreatment and cartridge filtration, RO membrane treatment, and post-treatment. Following RO, treatment included decarbonation for product water degasification and removal of carbon dioxide. The nominal rated permeate capacity of the IWF-21 RO system was 5 MGD. Concentrate from the RO process was discharged via a brine pipeline to the OCSD ocean outfall for disposal.

The IWF-21 UV/AOP facilities provided photolysis, advanced oxidation, and disinfection using hydrogen peroxide and UV exposure. Hydrogen peroxide was added to the decarbonated RO permeate upstream of the UV light treatment. UV exposure was used for disinfection and destruction of UV-sensitive contaminants (e.g., NDMA). Hydrogen peroxide exposed to UV light produces hydroxyl radicals that result in advanced oxidation to destroy UV-resistant contaminants (e.g., 1,4-dioxane). The UV/AOP featured a closed, in-vessel type UV system with low-pressure high-output lamps. The UV unit's nominal rated capacity of 8.75 MGD was oversized for IWF-21 because it was designed to be relocated to the GWRS AWPF.

IWF-21 utilized the original WF-21 chlorination system to help prevent biofouling of the injection wells. The blending reservoir combined water from three sources (purified recycled water, potable water from the City of Fountain Valley, and deep well water) for injection and in-plant use. The barrier pump station conveyed water from the blending reservoir to the Talbert Barrier.

After IWF-21 was taken out of service in August 2006 until construction of the full-scale GWRS was completed in January 2008, only potable water from MWD via the OC-44 turnout and from the City of Fountain Valley was available for injection at the Talbert Barrier.

1.6.3 Groundwater Replenishment System

The third and most recent era of OCWD water reclamation for groundwater recharge is the GWRS. Described earlier in this section in detail, the GWRS is a significant achievement and sets OCWD apart as a world leader in water recycling and groundwater management. The GWRS is the largest potable reuse facility in the world.

The original purified recycled water production capacity of the GWRS was 70 MGD. Injection of purified recycled water produced by the AWPF at the Talbert Barrier began on January 10, 2008. Recharge of purified recycled water produced by the AWPF at Miller Basin began on January 17, 2008. Purified recycled water recharge at Kraemer Basin began on February 19, 2008.

Miraloma Basin was constructed in 2011-2012 and began recharging purified recycled water on July 26, 2012. Deliveries from the GWR Pipeline to the Anaheim CCP for cooling water began on July 1, 2011. A second non-potable customer, ARTIC, started receiving purified recycled water for cooling purposes on November 21, 2014.

Injection of purified recycled water began at the DMBI Project (MBI-1) on April 15, 2015. Based on the successful operation of the DMBI Project, four additional MBI wells (MBI-2, MBI-3, MBI-4, and MBI-5) were constructed during 2018 in Centennial Park just to the southeast of the existing DMBI Project and are expected to be placed on-line during 2019.

The GWRS Initial Expansion began operation, increasing the AWPF purified recycled water production capacity up to 100 MGD, on May 21, 2015. By adding 30 MGD of capacity, the GWRS Initial Expansion significantly enhanced the local water supply reliability within the Basin.

La Palma Basin was constructed in 2015-2016 and began recharging purified recycled water on November 9, 2016.

The GWRS Final Expansion design was completed in 2019. When construction is completed in 2023, the GWRS Final Expansion will increase the AWPF purified recycled water production capacity to 130 MGD.

1.7 Water Recycling Permit Requirements

During 2018 OCWD operated the Talbert Barrier and Kraemer-Miller-Miraloma Basins under the requirements of the *"Producer/User Water Recycling Requirements and Monitoring and Reporting Program for the Orange County Water District Interim Water Factory 21 and Groundwater Replenishment System Groundwater Recharge and Reuse at Talbert Gap Seawater Intrusion Barrier and Kraemer/Miller Basins"* adopted by the RWQCB as Order No. R8-2004-0002 (RWQCB, 2004), and four subsequent amendments: RWQCB Order No. R8-2008-0058 (RWQCB, 2008); RWQCB Order No. R8-2014-0054 (RWQCB, 2014a); RWQCB Order No. R8-2016-0051 (RWQCB, 2016); and RWQCB Order No. R8-2019-0007 (RWQCB, 2019). Collectively, these RWQCB Orders comprise the permit for the GWRS. The permit incorporates groundwater recharge criteria, findings and conditions, and recommendations from DDW.

The original permit specified requirements for blending purified recycled water with diluent water. For the blend, the 2004 permit specified an initial maximum RWC of up to 75% recycled water and 25% diluent water at each recharge location. Compliance with this initial maximum RWC limit was determined monthly based on the running average over the prior 60-month period. Diluent water was defined as water of non-wastewater origin.

The permit also contained requirements that, when met, allowed the RWC limit to be increased at each location. Following these requirements, OCWD conducted an RWC Ramp-Up Demonstration to support increasing the RWC to 100% at the Talbert Barrier. The demonstration began in January 2008 and concluded in April 2009. The "RWC Ramp-Up Demonstration Report" (DDB Engineering, Inc., 2009a) was submitted to DDW and the RWQCB for review and approval of the increased RWC at the barrier. A similar demonstration was submitted to DDW and the RWQCB for review and approval of an increased RWC at Kraemer-Miller-Miraloma Basins in 2014 (OCWD and DDB Engineering, Inc., 2014)

In November 2009, DDW approved injection of purified recycled water without blending at the Talbert Barrier (CDPH, 2009). The RWQCB confirmed the maximum 100% RWC limit at the barrier in December 2009 (RWQCB, 2009). Blending at the Talbert Barrier is still allowed, but no longer required.

In 2010 DDW and the RWQCB issued "no-objection" letters for the DMBI Project and established the same 100% RWC limit for injection of unblended GWRS purified recycled water at MBI-1 (CDPH 2010b and RWQCB 2010).

The RWQCB approved purified recycled water recharge at Miraloma Basin via letter in 2012 (RWQCB, 2012). The formal permit amendment allowing recharge at Miraloma Basin and increasing GWRS' rated production capacity from 70 to 100 MGD was adopted in 2014 (RWQCB 2014a).

In June 2014, DDW approved the Title 22 Engineering Report Supplement (OCWD and DDB Engineering, Inc., 2014) and spreading of purified recycled water at Kraemer-Miller-Miraloma Basins without blending (CDPH, 2014). This DDW approval also supported implementation of La Palma Basin. Blending at K-M-M-L Basins with other waters is allowed, but no longer required as the maximum RWC is set at 100%.

In 2016, the RWQCB adopted an amendment to the GWRS permit that added purified recycled water recharge at La Palma Basin and modified the buffer area at the Anaheim Forebay spreading basins (RWQCB, 2016). Groundwater quality downgradient of La Palma Basin at monitoring well AM-10/1 reporting began in compliance with the DDW's approval of the Title 22 Engineering Report Supplement (DDW, 2014).

The most recent permit amendment was adopted by the RWQCB in March 2019 primarily for the MBI Centennial Park Project that is scheduled to begin injection in 2019 (RWQCB, 2019). This fourth permit amendment also updates the buffer areas for GWRS to comply with groundwater recharge regulations for pathogen reduction.

In summary, the permit includes:

- Purified recycled water quality specifications;
- Compliance determinations;
- Requirements for 100% RWC (at Talbert Barrier, DMBI Project, and K-M-M-L Basins);
- Groundwater monitoring requirements;
- Buffer zone specifications near recharge areas;
- Operation, maintenance and monitoring/reporting requirements;
- General requirements for injection and spreading of purified recycled water;
- Required notices and reports; and
- Provisions, which include requirements to comply with the Monitoring and Reporting Program, prepare an Operation, Maintenance and Monitoring Plan (OMMP) (now called an Operation Optimization Plan [OOP]), various prohibitions, and other obligations.

Water quality sampling, analyses, and reporting requirements are specified in the *Monitoring and Reporting Program*, which accompanies and is made part of the RWQCB Order (RWQCB, 2004), and revised in accordance with the amendments (RWQCB, 2008, 2014a, 2016, and 2019). Beginning in 2011, the RWQCB and DDW approved a revised groundwater monitoring frequency allowing for selected analytes with no detections to be monitored annually in lieu of quarterly (RWQCB 2011 and CDPH 2010a).

Table 1-4 on the following pages summarizes the water quality limits and monitoring and reporting requirements of the permit. A complete detailed list of water quality permit requirements and purified recycled water quality during 2018 can be found in Appendix A. Appendices B and C contain laboratory analysis methods used for water quality monitoring. All water quality analyses are performed by state-certified laboratories that operate in accordance with quality assurance plans. OCWD's state-certified water quality laboratory is pictured on Figure 1-24.

Figure 1-24. Philip L. Anthony Water Quality Laboratory

Table 1-4. Summary of GWRS Purified Recycled Water Quality and Monitoring Requirements

Parameter	Sample Flow Stream	Sample Location	Permit Requirement [1]
UV%T-254	GWRS-ROP	RO Permeate	>90%
Turbidity	GWRS-ROP	RO Permeate	<0.2 / 0.5 NTU
Total Recycled Water Flow	GWRS-FPW	Final Product [2]	$\leq$100 MGD
Total Nitrogen	GWRS-FPW	Final Product	5 mg/L [3]
Total Organic Carbon	GWRS-FPW	Final Product	0.5 mg/L [4]
Total Coliform	GWRS-FPW	Final Product	2.2 MPN / 100 mL
pH	GWRS-FPW	Final Product	6 - 9
INORGANIC CHEMICALS			
Aluminum	GWRS-FPW	Final Product	200 ug/L [5]
Antimony	GWRS-FPW	Final Product	6 ug/L
Arsenic	GWRS-FPW	Final Product	10 ug/L
Asbestos (fibers >10 um in length)	GWRS-FPW	Final Product	7 MFL
Barium	GWRS-FPW	Final Product	1,000 ug/L
Beryllium	GWRS-FPW	Final Product	4 ug/L
Cadmium	GWRS-FPW	Final Product	5 ug/L
Chromium	GWRS-FPW	Final Product	50 ug/L
Cyanide	GWRS-FPW	Final Product	150 ug/L
Fluoride	GWRS-FPW	Final Product	2 mg/L
Hexavalent Chromium (dissolved)	GWRS-FPW	Final Product	10 ug/L
Mercury	GWRS-FPW	Final Product	2 ug/L
Nickel	GWRS-FPW	Final Product	100 ug/L
Nitrate (as NO_3)	GWRS-FPW	Final Product	45 mg/L [6]
Nitrate + Nitrite (as Nitrogen)	GWRS-FPW	Final Product	10 mg/L [6]
Nitrite (as NO_2)	GWRS-FPW	Final Product	3.3 mg/L
Nitrite (as Nitrogen)	GWRS-FPW	Final Product	1 mg/L
Perchlorate	GWRS-FPW	Final Product	6 ug/L
Selenium	GWRS-FPW	Final Product	50 ug/L
Thallium	GWRS-FPW	Final Product	2 ug/L
VOLATILE ORGANIC CHEMICALS (VOCs)			
All VOCs (See Appendix A for list)	GWRS-FPW	Final Product	Drinking Water
NON-VOLATILE SYNTHETIC ORGANIC CHEMICALS (SOCs)			
All SOCs (See Appendix A for list)	GWRS-FPW	Final Product	Drinking Water
DISINFECTION BYPRODUCTS			
Total THMs	GWRS-FPW	Final Product	80 ug/L
Monochloroacetic Acid	GWRS-FPW	Final Product	60 ug/L, total HAA5
Dichloroacetic Acid	GWRS-FPW	Final Product	60 ug/L, total HAA5
Trichloroacetic Acid	GWRS-FPW	Final Product	60 ug/L, total HAA5
Monobromoacetic Acid	GWRS-FPW	Final Product	60 ug/L, total HAA5
Dibromoacetic Acid	GWRS-FPW	Final Product	60 ug/L, total HAA5
Bromate	GWRS-FPW	Final Product	10 ug/L
Chlorite	GWRS-FPW	Final Product	1,000 ug/L

Table 1-4. Summary of GWRS Recycled Water Quality and Monitoring Requirements (continued)

Parameter	Sample Flow Stream	Sample Location	Permit Requirement [1]
ACTION LEVELS			
Copper	GWRS-FPW	Final Product	1,000 ug/L [7]
Lead	GWRS-FPW	Final Product	15 ug/L
UNREGULATED CHEMICALS			
Boron	GWRS-FPW	Final Product	N/A
Vanadium	GWRS-FPW	Final Product	N/A
Dichlorodifluoromethane	GWRS-FPW	Final Product	N/A
Ethyl tert-butyl ether	GWRS-FPW	Final Product	N/A
Tertiary-amyl methyl ether	GWRS-FPW	Final Product	N/A
Tert-butyl alcohol	GWRS-FPW	Final Product	N/A
1,2,3-Trichloropropane	GWRS-FPW	Final Product	N/A
n-Nitrosodimethylamine (NDMA)	GWRS-FPW	Final Product	N/A
1,4-Dioxane	GWRS-FPW	Final Product	N/A
Perfluorooctane Sulfonate (PFOS)	GWRS-FPW	Final Product	N/A
Perfluorooctanoic Acid (PFOA)	GWRS-FPW	Final Product	N/A
Remaining Priority Pollutants	GWRS-FPW	Final Product	See Appendix A
Endocrine disrupting chemicals & pharmaceuticals	GWRS-FPW	Final Product	See Appendix A
RADIONUCLIDES			
All Radionuclides (See Appendix A for list)	GWRS-FPW	Final Product	See Appendix A
Combined Radium-226 and Radium -228	GWRS-FPW	Final Product	5 pCi/l
Gross Alpha (excluding uranium)	GWRS-FPW	Final Product	15 pCi/l
Tritium	GWRS-FPW	Final Product	20,000 pCi/l
Strontium-90	GWRS-FPW	Final Product	8 pCi/l
Gross Beta particle activity	GWRS-FPW	Final Product	50 pCi/l
Uranium	GWRS-FPW	Final Product	20 pCi/l
TABLE II			
Aluminum	GWRS-FPW	Final Product	200 ug/L [5]
Color	GWRS-FPW	Final Product	15 Units
Copper	GWRS-FPW	Final Product	1,000 ug/L [7]
Corrosivity	GWRS-FPW	Final Product	Non-corrosive
Foaming Agents (MBAS)	GWRS-FPW	Final Product	0.5 mg/L
Iron	GWRS-FPW	Final Product	300 ug/L
Manganese	GWRS-FPW	Final Product	50 ug/L [8]
Methyl-tert-butyl ether (MTBE)	GWRS-FPW	Final Product	5 ug/L [9]
Odor Range Low	GWRS-FPW	Final Product	N/A
Odor Range High	GWRS-FPW	Final Product	N/A
Threshold Odor Number - Median	GWRS-FPW	Final Product	3 TON
Silver	GWRS-FPW	Final Product	100 ug/L
Thiobencarb	GWRS-FPW	Final Product	1 ug/L [10]
Zinc	GWRS-FPW	Final Product	5,000 ug/L

Table 1-4. Summary of GWRS Recycled Water Quality and Monitoring Requirements (continued)

Parameter	Sample Flow Stream	Sample Location	Permit Requirement [1]
TABLE III [11]			
Total Dissolved Solids	GWRS-FPW	Final Product	500 mg/L
Nitrate nitrogen	GWRS-FPW	Final Product	3 mg/L [6]
Total Hardness (as CaCO3)	GWRS-FPW	Final Product	240 mg/L
Sodium	GWRS-FPW	Final Product	45 mg/L
Chloride	GWRS-FPW	Final Product	55 mg/L
Sulfate	GWRS-FPW	Final Product	100 mg/L

[1] RWQCB Order Nos. R8-2004-0002, R8-2008-0058, R8-2014-0054, R8-2016-0051, and R8-2019-0007 requirements. See Appendix A for a complete itemized list of permit requirements. See Appendices B & C for a list of laboratory methods of analysis.

[2] Final Product is also called Finished Product Water (FPW) and is the final purified recycled water flow stream.

[3] Total nitrogen compliance is based on the running average of all samples collected during the past 20 weeks.

[4] TOC limit is based on recycled water contribution of 100% at all recharge sites.

[5] The permit requirement for aluminum is the lesser of the primary MCL (1,000 ug/L) and the secondary MCL (200 ug/L).

[6] The permit requirement for nitrate-nitrogen is a 12-month running average concentration limit of 3 mg/L based on the RWQCB Basin Plan.

[7] The permit requirement for copper is the lesser of the Action Level (1,300 ug/L) and the secondary MCL (1,000 ug/L).

[8] The permit requirement for manganese is the lesser of the secondary MCL (50 ug/L) and the Notification Level (500 ug/L).

[9] The permit requirement for MTBE is the lesser of the primary MCL (13 ug/L) and the secondary MCL (5 ug/L).

[10] The permit requirement for thiobencarb is the lesser of the primary MCL (70 ug/L) and the secondary MCL (1 ug/L).

[11] Table III parameters are based on the RWQCB Basin Plan Water Quality Objectives.

One of the provisions of the permit requires that an Independent Advisory Panel (the Panel) provide on-going periodic scientific peer review of the GWRS. The permit specifies minimum qualifications for the Panel members and requires that the Panel meet at least annually during the first five years, and then every two years thereafter. The Panel is charged with reviewing the prior Annual Report(s) of plant operations, the OOP, purified recycled water and groundwater quality monitoring reports, and associated groundwater recharge issues. Based on its review, the Panel must issue a report with its recommendations at least every two years.

The Panel last met in 2017; the next meeting is planned in 2019. The Panel was appointed and is administered by the National Water Research Institute (NWRI). Panel members and their respective areas of expertise are listed in Table 1-5.

Table 1-5. GWRS Independent Advisory Panel

Panel Member[1]	Area of Expertise
James Crook, Ph.D., P.E. (Panel Chair)	Water/Wastewater Engineering
Richard Bull, Ph.D.	Toxicology
Amy Childress, Ph.D.	Water/Wastewater Engineering
Joseph A. Cotruvo, Ph.D.	Chemistry
Larry Honeybourne	OCHCA (Retired), Water Quality
Reed M. Maxwell, Ph.D.	Hydrogeology
Joan B. Rose, Ph.D.[2]	Microbiology
George Tchobanoglous, Ph.D., P.E.	Water/Wastewater Engineering
Rhodes Trussell, Ph.D., P.E.	Environmental Engineering/Water Quality

[1] Panel members as of August 2017.
[2] Did not attend the August 28-29, 2017 meeting.

1.8 Operation Optimization Plan Overview

The GWRS OOP describes the operating parameters, critical control points, maintenance schedules, and troubleshooting guides for the AWPF, injection barrier and spreading basins. The permit requires that the OOP be reviewed by the Independent Advisory Panel, updated annually or as necessary, and submitted to DDW and the RWQCB.

The full OOP was revised and updated in 2015 to include Miraloma Basin and the GWRS Initial Expansion (OCWD and DDB Engineering, Inc., 2015). In April 2018, an updated OOP reflecting procedures to demonstrate compliance with pathogenic microorganism control regulations (CCR, 2014) was submitted to DDW and the RWQCB (OCWD, 2018).

The OOP will be updated in the future to reflect the GWRS Final Expansion, changes in GWRS facilities, and any permit revisions.

2. ADVANCED WATER PURIFICATION FACILITY PERFORMANCE

The GWRS AWPF continued to optimize performance and increase production during its tenth year of operation. This section summarizes the performance of the AWPF during 2018:

- Purified recycled water volume;
- Purified recycled water quality;
- Performance and compliance record; and
- Anticipated changes.

2.1 Purified Recycled Water Volume and Flows

During 2018 the AWPF produced a total of approximately 31,532 MG, or 96,769 AF, of purified recycled water to help prevent seawater intrusion and replenish the Basin. On an annual average basis, the AWPF produced approximately 86.4 MGD of purified recycled water for injection, recharge, and industrial uses in 2018. As shown on Figure 2-1, over 72% of GWRS purified recycled water was pumped to the Anaheim Forebay, the majority of which was recharged at La Palma and Miraloma Basins. Nearly 26% of the AWPF production was injected at the Talbert Barrier. Less than 2% of the purified recycled water was injected at the DMBI Project. A small amount of purified recycled water (<0.1%) was used for non-potable purposes at the Anaheim CPP and ARTIC.

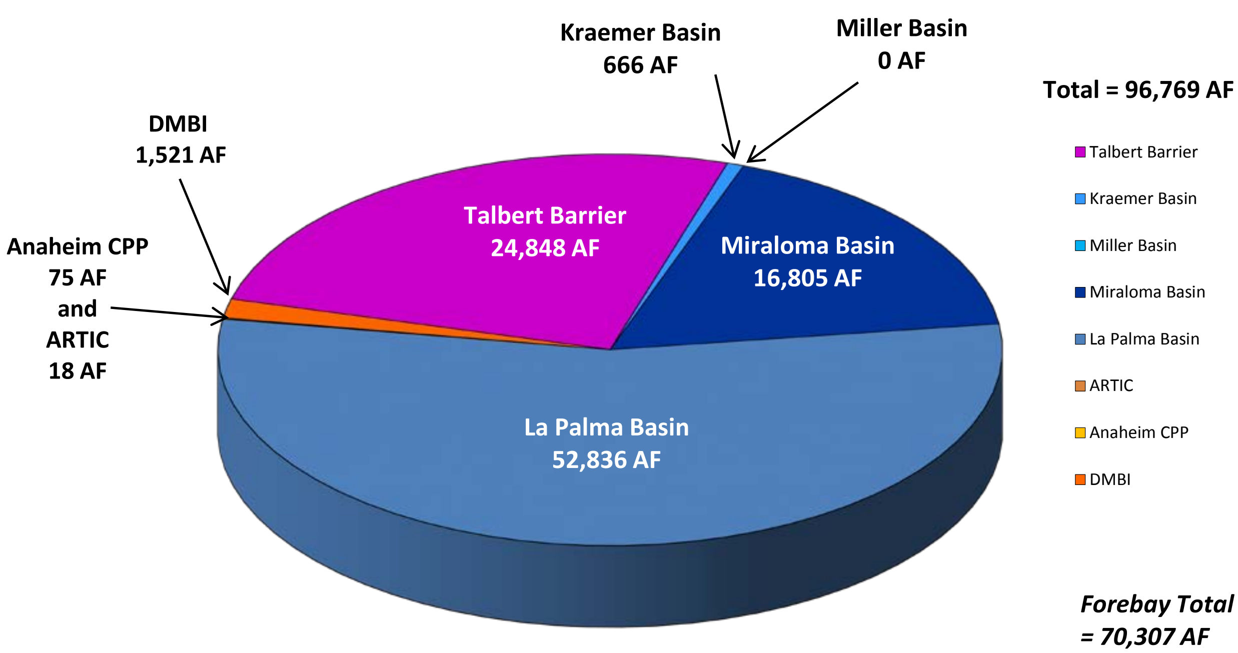


Figure 2-1. 2018 Purified Recycled Water Volume

Figure 2-2 illustrates the average daily AWPF production by month with the reuse location. The average daily purified recycled water production was below average in August and September due to the six-week GWR Pipeline Rehabilitation Project in which the interior mortar lining of Reach 1 was coated with epoxy, limiting AWPF flows to only the Talbert Barrier during that time. Production was lowest in September with an average of only 20.0 MGD, resulting from approximately 30 MGD daily injection at the Talbert Barrier in conjunction with a one-week AWPF shutdown in late September. The GWR Pipeline Rehabilitation Project began on August 23 and concluded on October 2, restricting production and overlapping with the one-week AWPF shutdown (September 18-24).

Overall during 2018, the AWPF was on-line 96.6% of the time with daily average purified recycled water production ranging from 0.0 MGD (on April 10 and from September 18-24 due to planned plant outages for maintenance activities) up to 99.6 MGD (on January 9) compared with its design production capacity of 100 MGD. AWPF shutdowns are discussed in more detail in Section 2.3.1.

2.2 Purified Recycled Water Quality

Water quality is monitored throughout the AWPF treatment train in order to measure and optimize process performance. The AWPF process schematic and sampling locations are illustrated on Figure 2-3. Water quality results are reported to the RWQCB in conformance with the permit requirements on a quarterly basis. Appendix A summarizes all available water quality data for the AWPF purified recycled water during 2018.

AWPF influent (Q1) flow is metered and its quality is monitored for selected constituents in order to control and optimize the operation of the treatment processes. The Q1 sampling point is at the screening facility influent chamber immediately upstream of the fine screens; this location provides a representative sample of the Q1 source water because it is downstream of the SEFE tanks and upstream of the sodium hypochlorite injection prior to the MF system. The AWPF influent is secondary effluent from OCSD's Plant No. 1, which is a combination of clarified AS and TF effluents. The ratio of AS to TF effluent flows in the Q1 supply is variable, as described in detail in Section 2.2.1.

The performance of the MF system is monitored by comparing upstream water quality in the MF feed (MFF) after sodium hypochlorite addition with downstream water quality in the MF effluent (MFE). MFE turbidity is measured on-line directly downstream of the MF cells. Similarly, the performance of the RO system is monitored upstream at the RO feed (ROF), after acid and threshold inhibitor (antiscalant) are added, and then downstream where the RO product (ROP) leaves the process. On-line total organic carbon (TOC) and electrical conductivity (EC) analyzers monitor the ROF and ROP flow streams and provide continuous indication of the RO process performance. Monitoring the UV/AOP process feed (UVF) and product (UVP) streams are indicators of its disinfection and organics degradation performance.

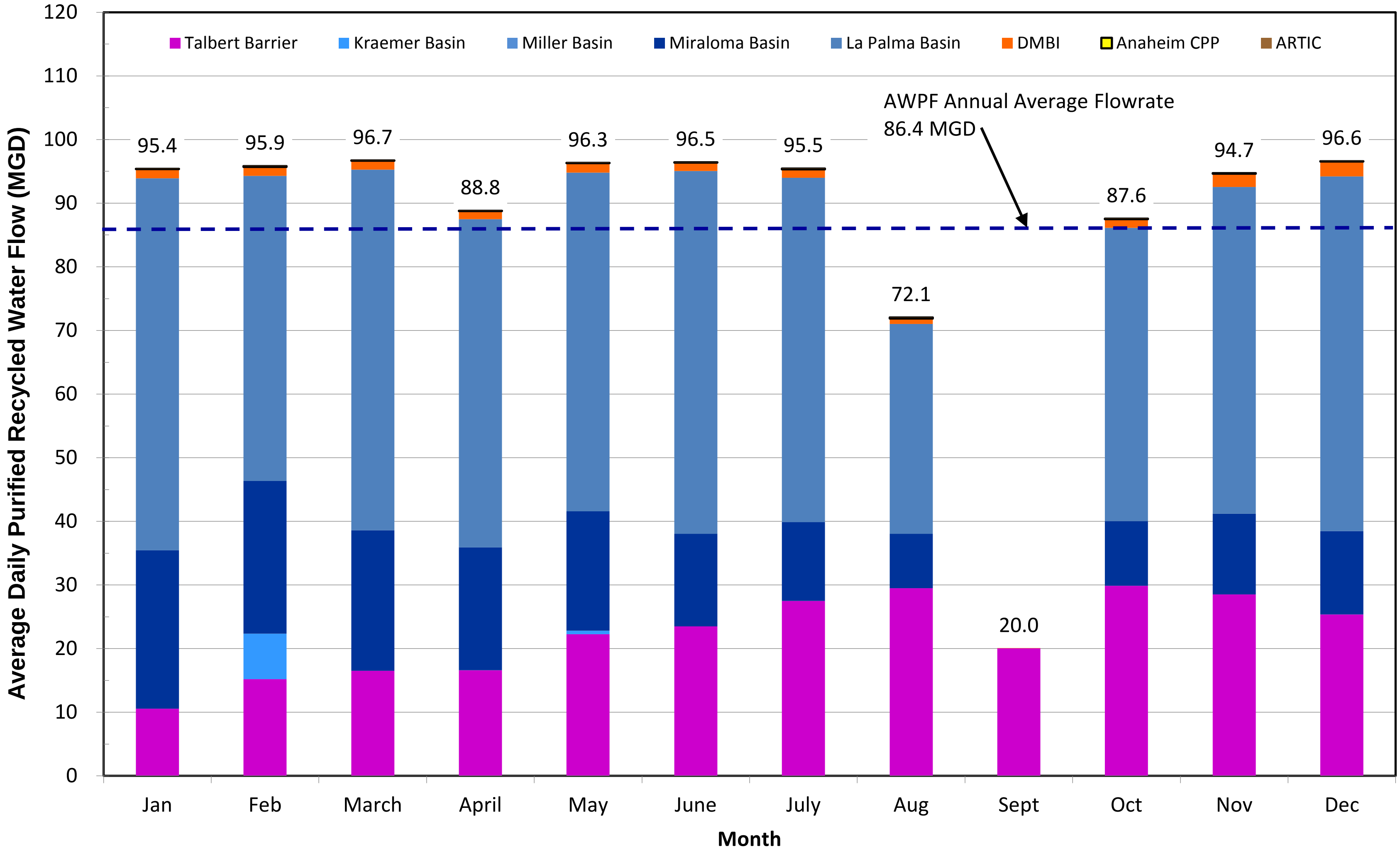


Figure 2-2. 2018 Average Daily Purified Recycled Water Flow by Month

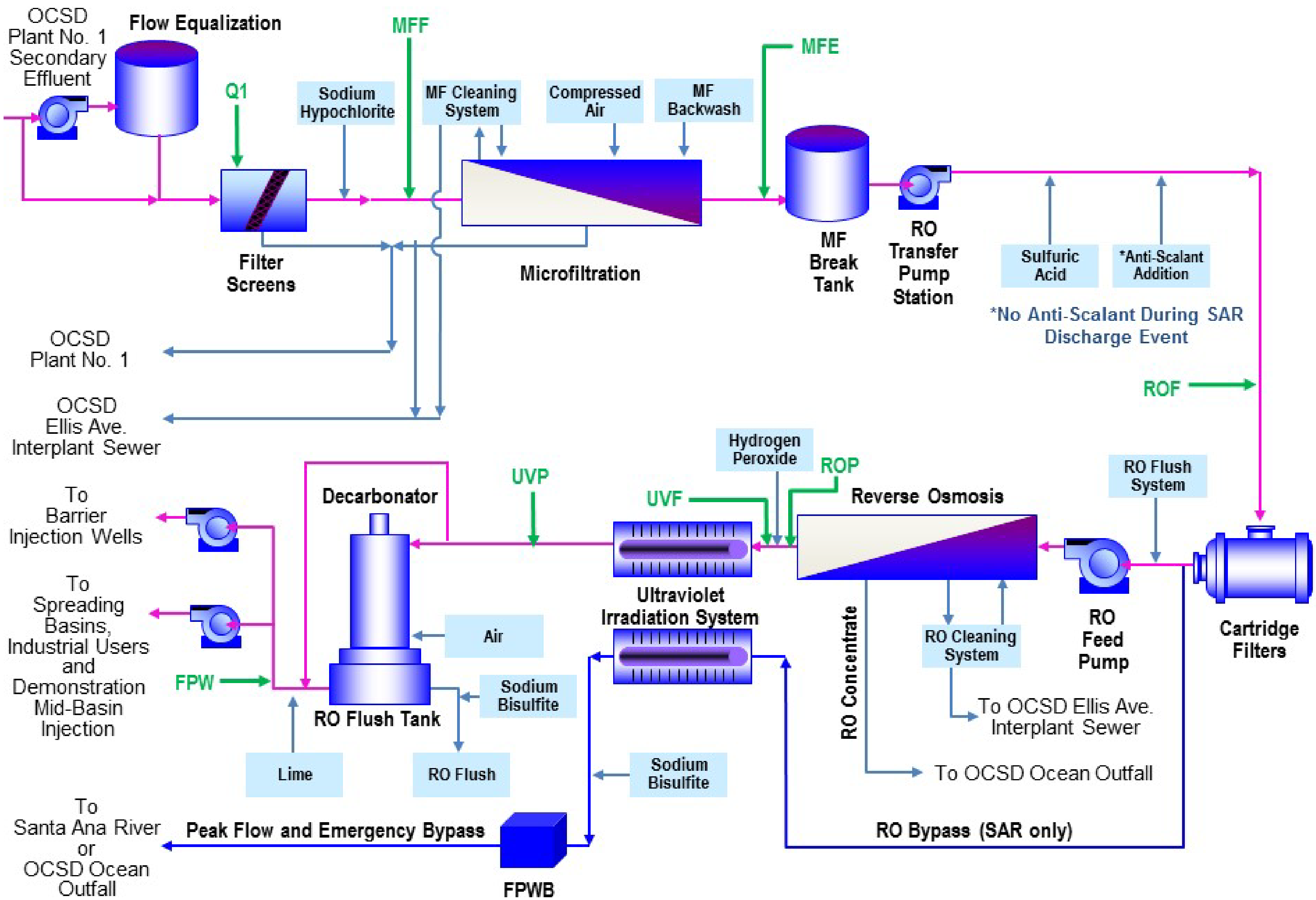


Figure 2-3. AWPF Process Sampling Locations Diagram

Except for turbidity and transmittance, all required final purified recycled water monitoring was performed on finished product water (FPW), also referred to as final product water, following post-treatment and just prior to pumping to the barrier, recharge basins, DMBI, and/or industrial customers. Turbidity is monitored continuously on the ROP flow stream. Transmittance is measured continuously on the UVF flow stream (UVF is immediately downstream of the hydrogen peroxide addition to the ROP). As a backup for the on-line analyzer, daily composite sampling for transmittance is also conducted at the UVF station.

Table 2-1 summarizes the average purified recycled water quality for selected constituents during 2018 at various points in the AWPF treatment process. Drinking water standards as well as the GWRS permit requirements are shown for comparison. For other parameters, Appendix A contains the quarterly monitoring results for 2018. The performance of individual treatment processes measured by water quality is discussed later in this section.

It is interesting to compare 2018 average Q1 and FPW quality for selected constituents with average values in 2017 to monitor for any trends. Table 2-2 compares these two years' results and shows that some changes occurred in the average water quality of Q1 and FPW in 2018 as compared to the previous year.

An increase in the average Q1 total dissolved solids (TDS) concentration was observed from 2017 (957 mg/L) to 2018 (989 mg/L). The average Q1 chloride levels also increased from 2017 (272 mg/L) to 2018 (298 mg/L). For the FPW quality, average TDS levels increased slightly from 2017 (50 mg/L) to 2018 (53 mg/L). FPW chloride concentrations also slightly increased from 2017 (5.1 mg/L) to 2018 (5.3 mg/L).

Average Q1 total suspended solids levels increased somewhat from 2017 (4.9 mg/L) to 2018 (6.4 mg/L). However, average Q1 turbidity slightly decreased from 2017 (1.9 Nephlometric Turbidity Units (NTU)) to 2018 (1.5 NTU).

Table 2-1. 2018 Average Water Quality[1]

Parameter Name	Units	Q1	MFF	MFE	ROF	ROP	UVP	FPW	Permit Limit
Electrical Conductivity	umhos/cm	1,709	1,726[2]	1,680	1,725[2]	35[2]	39	100[2]	900
Total Dissolved Solids	mg/L	989	na	na	1,018	19	na	53	500[3]
Suspended Solids	mg/L	6.4	4.8	<1	na	na	na	na	N/A
Turbidity	NTU	1.5	2.73[2]	0.09[2]	0.10[2]	0.05[4]	na	0.08[2]	≤0.2 / ≤0.5
Ultraviolet percent transmittance (%UVT) @254nm	%	na	na	66.4	na	97.47[4]	na	na	>90
pH	UNITS	7.3	7.2[2]	7.3	6.90[2]	5.48[2]	5.7	8.47[2]	6 - 9
Total Hardness (as CaCO3)	mg/L	297	na	na	296	<1	na	34.1	240[3]
Calcium	mg/L	76.4	na	na	76.4	<0.5	na	13.7	N/A
Magnesium	mg/L	25.9	na	na	25.6	<0.5	na	<0.5	N/A
Sodium	mg/L	223	na	na	222	6.0	na	6.1	45
Potassium	mg/L	19.2	na	na	19.2	0.1	na	0.2	N/A
Bromide	mg/L	na	na	na	na	na	na	<0.1	N/A
Chloride	mg/L	298	na	na	294	4.8	na	5.3	55
Sulfate	mg/L	178	na	na	190	0.3	na	0.3	100
Hydrogen Peroxide	mg/L	na	na	na	na	na	2.3	2.1	N/A
Bicarbonate (as CaCO3)	mg/L	na	na	na	175	8.0	na	38.1	N/A
Nitrate Nitrogen	mg/L	8.81	na	na	na	0.84	na	0.81	3[3]
Nitrite Nitrogen	mg/L	0.844	na	na	na	<0.002	na	0.042	1[3]
Ammonia Nitrogen	mg/L	2.0	na	na	na	0.3	na	0.2	N/A
Organic Nitrogen	mg/L	1.3	na	na	na	0.06	na	0.02	N/A
Total Nitrogen	mg/L	12.9	na	na	na	na	na	1.0	5
Phosphate Phosphorus	mg/L	0.36	na	na	na	na	na	<0.01	N/A
Iron	ug/L	368	na	na	126	<5	na	<5	300
Manganese	ug/L	70.5	na	na	60.1	0.2	na	<1	50
Aluminum	ug/L	7.8	na	na	3.8	0.5	na	1.2	200[3]
Arsenic	ug/L	0.2	na	na	0.2	<1	na	<1	10
Barium	ug/L	33.7	na	na	33.6	<1	na	<1	1,000
Boron	mg/L	0.39	na	na	0.38	0.25	na	0.24	N/A
Cadmium	ug/L	<1	na	na	<1	<1	na	<1	5
Chromium	ug/L	<1	na	na	<1	<1	na	<1	50
Copper	ug/L	6.2	na	na	13.1	0.4	na	<1	1,000[3]
Cyanide	ug/L	<5	na	na	2.3	<5	na	<5	150
Fluoride	mg/L	0.91	na	na	na	na	na	<0.1	2
Lead	ug/L	<1	na	na	6.1	<1	na	<1	15
Mercury	ug/L	<1	na	na	<1	<1	na	<1	2
Nickel	ug/L	4.9	na	na	5.0	<1	na	<1	100
Perchlorate	ug/L	na	na	na	na	na	na	<2.5	6
Selenium	ug/L	0.5	na	na	0.7	<1	na	<1	50
Silica	mg/L	20.6	na	na	20.4	<1	na	0.4	N/A
Silver	ug/L	<1	na	na	<1	<1	na	<1	100
Zinc	ug/L	15.5	na	na	41.5	0.3	na	0.6	5,000
1,2,3-Trichloropropane	ug/L	<0.005	na	na	<0.005	<0.005	<0.005	<0.005	0.005
N-nitrosodimethylamine	ng/L	27.7	na	na	27.9	16.3	<2	1.6	N/A
1,4-Dioxane	ug/L	1.8	na	na	1.9	<1	<1	<1	N/A
Perfluorooctanoic Acid	ng/L	9.5	na	na	na	na	na	<4	N/A
Perfluorooctane Sulfonic Acid	ng/L	14.5	na	na	na	na	na	<4	N/A
Total Trihalomethanes	ug/L	0.3	na	na	12.7	4.0	4.0	3.0	80
Dibromoacetic Acid	ug/L	na	na	na	na	na	na	<1	60,total HAA5
Dichloroacetic Acid	ug/L	na	na	na	na	na	na	<1	60,total HAA5
Monobromoacetic Acid	ug/L	na	na	na	na	na	na	<1	60,total HAA5
Monochloroacetic Acid	ug/L	na	na	na	na	na	na	<1	60,total HAA5
Trichloroacetic Acid	ug/L	na	na	na	na	na	na	<1	60,total HAA5
Apparent Color (unfiltered)	UNITS	na	na	na	55	<3	na	<3	15
Total Organic Carbon (unfiltered)	mg/L	9.53	9.61	na	7.82	0.11	0.25	0.10	0.5[3]
Surfactants (MBAS)	mg/L	0.17	na	na	0.19	<0.02	na	<0.02	0.5
Total Coliform	MPN/100 mL	796,310	36,644	<1	na	<1	<1	0.3	2.2
Fecal Coliform	MPN/100 mL	224,940	2,324	<1	na	<1	<1	<1	N/A

Q1 Secondary Effluent (AWPF Influent)
MFF Microfiltration Feed
MFE Microfiltration Effluent
ROF Reverse Osmosis Feed
ROP Reverse Osmosis Product
UVF Ultraviolet UV/AOP Feed
UVP Ultraviolet UV/AOP Product
FPW Finished Product Water
na Not analyzed
N/A Not applicable

[1] For purposes of calculating annual averages, 10% of the Reportable Detection Limit (RDL) was used for all non-detect (ND) values. If all data for the period were ND, then the average is shown as "<RDL". Number of significant digits shown match those in raw data.
[2] On-line average
[3] See Appendix A for more information
[4] On-line average shown for UVF, which is effectively ROP downstream of hydrogen peroxide addition.

Table 2-2. Comparison Between 2017 and 2018 Average Water Quality[1]

Parameter Name	Units	2017 Q1	2018 Q1	2017 FPW	2018 FPW	Permit Limit
Electrical Conductivity	umhos/cm	1,610	1,709	108[2]	100[2]	900
Total Dissolved Solids	mg/L	957	989	50	53	500[3]
Suspended Solids	mg/L	4.9	6.4	na	na	N/A
Turbidity	NTU	1.9	1.5	0.04[2]	0.08[2]	≤0.2 / ≤0.5
Ultraviolet percent transmittance (%UVT) @254nm	%	63.7	na	na	na	>90
pH	UNITS	7.2	7.3	8.37[2]	8.47[2]	6 - 9
Total Hardness (as CaCO3)	mg/L	292	297	33.3	34.1	240[3]
Calcium	mg/L	74.4	76.4	13.2	13.7	N/A
Magnesium	mg/L	25.8	25.9	<0.5	<0.5	N/A
Sodium	mg/L	213	223	5.8	6.1	45
Potassium	mg/L	18.6	19.2	0.1	0.2	N/A
Bromide	mg/L	na	na	0.01	<0.1	N/A
Chloride	mg/L	272	298	5.1	5.3	55
Sulfate	mg/L	189	178	0.5	0.3	100
Hydrogen Peroxide	mg/L	na	na	2.2	2.1	N/A
Bicarbonate (as CaCO3)	mg/L	na	na	35.5	38.1	N/A
Nitrate Nitrogen	mg/L	11.37	8.81	0.96	0.81	3[3]
Nitrite Nitrogen	mg/L	0.516	0.844	0.037	0.042	1[3]
Ammonia Nitrogen	mg/L	1.7	2.0	0.2	0.2	N/A
Organic Nitrogen	mg/L	1.0	1.3	0.01	0.02	N/A
Total Nitrogen	mg/L	13.8	12.9	1.1	1.0	5
Phosphate Phosphorus	mg/L	0.40	0.36	<0.01	<0.01	N/A
Iron	ug/L	339	368	<5	<5	300
Manganese	ug/L	53.1	70.5	0.1	<1	50
Aluminum	ug/L	7.2	7.8	0.4	1.2	200[3]
Arsenic	ug/L	<1	0.2	<1	<1	10
Barium	ug/L	29.7	33.7	<1	<1	1,000
Boron	mg/L	0.40	0.39	0.25	0.24	N/A
Cadmium	ug/L	<1	<1	<1	<1	5
Chromium	ug/L	<1	<1	<1	<1	50
Copper	ug/L	3.9	6.2	<1	<1	1,000[3]
Cyanide	ug/L	0.9	<5	<5	<5	150
Fluoride	mg/L	0.93	0.91	<0.1	<0.1	2
Lead	ug/L	<1	<1	<1	<1	15
Mercury	ug/L	<1	<1	<1	<1	2
Nickel	ug/L	4.9	4.9	<1	<1	100
Perchlorate	ug/L	na	na	<2.5	<2.5	6
Selenium	ug/L	1.4	0.5	<1	<1	50
Silica	mg/L	20.8	20.6	0.3	0.4	N/A
Silver	ug/L	<1	<1	<1	<1	100
Zinc	ug/L	21.1	15.5	0.3	0.6	5,000
1,2,3-Trichloropropane	ug/L	<0.005	<0.005	<0.005	<0.005	0.005
N-nitrosodimethylamine	ng/L	12.7	27.7	0.9	1.6	N/A
1,4-Dioxane	ug/L	2.2	1.8	<1	<1	N/A
Perfluorooctanoic Acid	ng/L	13.4	9.5	<4[4]	<4	N/A
Perfluorooctane Sulfonic Acid	ng/L	24.5	14.5	<4[4]	<4	N/A
Total Trihalomethanes	ug/L	na	0.3	2.7	3.0	80
Dibromoacetic Acid	ug/L	na	na	<1	<1	60,total HAA5
Dichloroacetic Acid	ug/L	na	na	<1	<1	60,total HAA5
Monobromoacetic Acid	ug/L	na	na	<1	<1	60,total HAA5
Monochloroacetic Acid	ug/L	na	na	<1	<1	60,total HAA5
Trichloroacetic Acid	ug/L	na	na	<1	<1	60,total HAA5
Apparent Color (unfiltered)	UNITS	na	na	<3	<3	15
Total Organic Carbon (unfiltered)	mg/L	9.00	9.53	0.10	0.10	0.5[3]
Surfactants (MBAS)	mg/L	0.19	0.17	<0.02	<0.02	0.5
Total Coliform	MPN/100 mL	1,477,240	796,310	<1	0.3	2.2
Fecal Coliform	MPN/100 mL	347,720	224,940	<1	<1	N/A

Q1 Secondary Effluent (AWPF Influent) na Not analyzed

FPW Finished Product Water N/A Not applicable

[1] For purposes of calculating annual averages, 10% of the Reportable Detection Limit (RDL) was used for all non-detect (ND) values. If all data for the period were ND, then the average is shown as "<RDL". Number of significant digits shown match those in raw data.

[2] On-line average

[3] See Appendix A for more information

[4] Result shown for UVP.

The average Q1 total nitrogen concentration decreased from 2017 (13.8 mg/L) to 2018 (12.9 mg/L). The average FPW total nitrogen concentration decreased slightly from 2017 (1.1 mg/L) to 2018 (1.0 mg/L).

The average Q1 TOC concentration increased from 2017 (9.0 mg/L) to 2018 (9.5 mg/L). The average FPW TOC concentration remained the same in 2017 (0.10 mg/L) as in 2018 (0.10 mg/L), as determined by laboratory samples.

The annual average concentration of N-nitrosodimethylamine (NDMA) in the Q1 source water more than doubled from 2017 (12.7 nanograms per liter (ng/L)) to 2018 (27.7 ng/L). The FPW average NDMA concentration also significantly increased from 2017 (0.9 ng/L) to 2018 (1.6 ng/L). Similar to the 58 FPW samples analyzed for NDMA in 2017, none of the 55 FPW samples analyzed for NDMA in 2018 exceeded the DDW Notification Level (NL) of 10 ng/L.

A comparison of the annual average Q1 concentrations of 1,4-dioxane revealed a slight decrease from 2017 (2.2 µg/L) to 2018 (1.8 µg/L). The FPW average 1,4-dioxane concentrations in both 2017 and 2018 were below the reportable detection level (RDL) of 1 µg/L; furthermore, all individual FPW sample results during 2017 and 2018 were below the RDL and DDW NL of 1 µg/L for 1,4-dioxane.

2.2.1 Source Water in 2018

The AWPF feedwater (Q1) was a variable blend of AS and TF effluents from OCSD Plant No. 1. In 2018, source water exhibited consistently low turbidity and nitrogen levels as a result of the NdN operation of the AS facilities.

2.2.1.1 TF Effluent Fraction

The OCSD secondary effluent is typically a blend of AS effluent and TF effluent. The blend is variable, with typically more secondary effluent flow from the AS facilities. During 2018, the Q1 source water to the AWPF consisted of 37,293 MG of AS effluent and 8,628 MG of TF effluent, as illustrated on Figure 2-4, for a total annual influent flow of 45,921 MG. On an annual average daily flow basis, the AWPF had available approximately 102.2 MGD of AS effluent and 23.6 MGD of TF effluent, for a total of 125.8 MGD of available source water. The volume of TF effluent made up 19% of the total influent during 2018; however, the day-to-day operation varied with TF effluent making up from 0.0% (September 18-22) to 26.6% (April 10) of the AWPF source water.

Figure 2-5 shows the average daily flow rate of AS effluent and TF effluent for each month during 2018. Of the influent flow stream, about 3,488 MG, or 9.6 MGD on average, was not recycled and was returned to OCSD via the influent weir overflow at the screening facility. The return flow in 2018 was greater than that in 2017 (924 MG or 2.5 MGD on average) due to the AWPF's limited production during the GWR Pipeline Rehabilitation Project. The net total MFF flow during 2018 was approximately 42,433 MG or an annual average daily flow of 116.2 MGD.

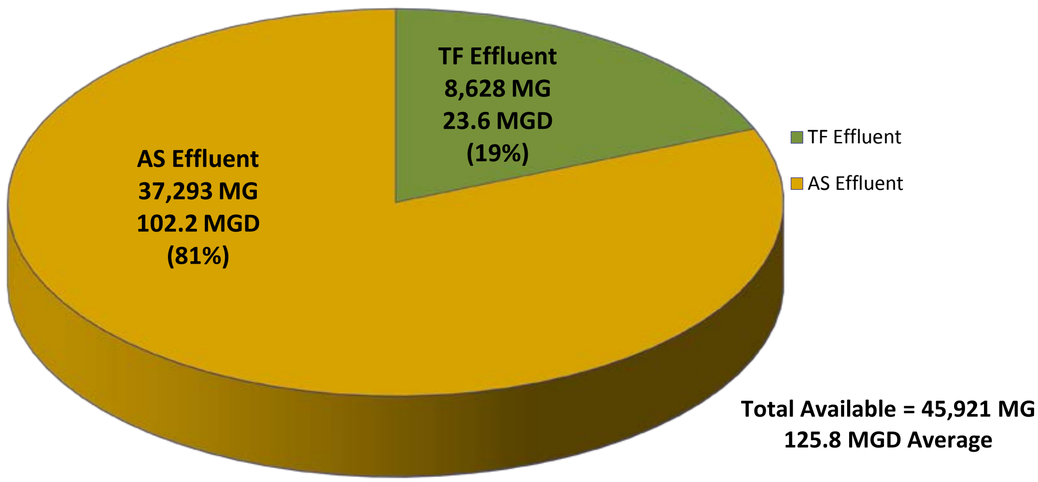


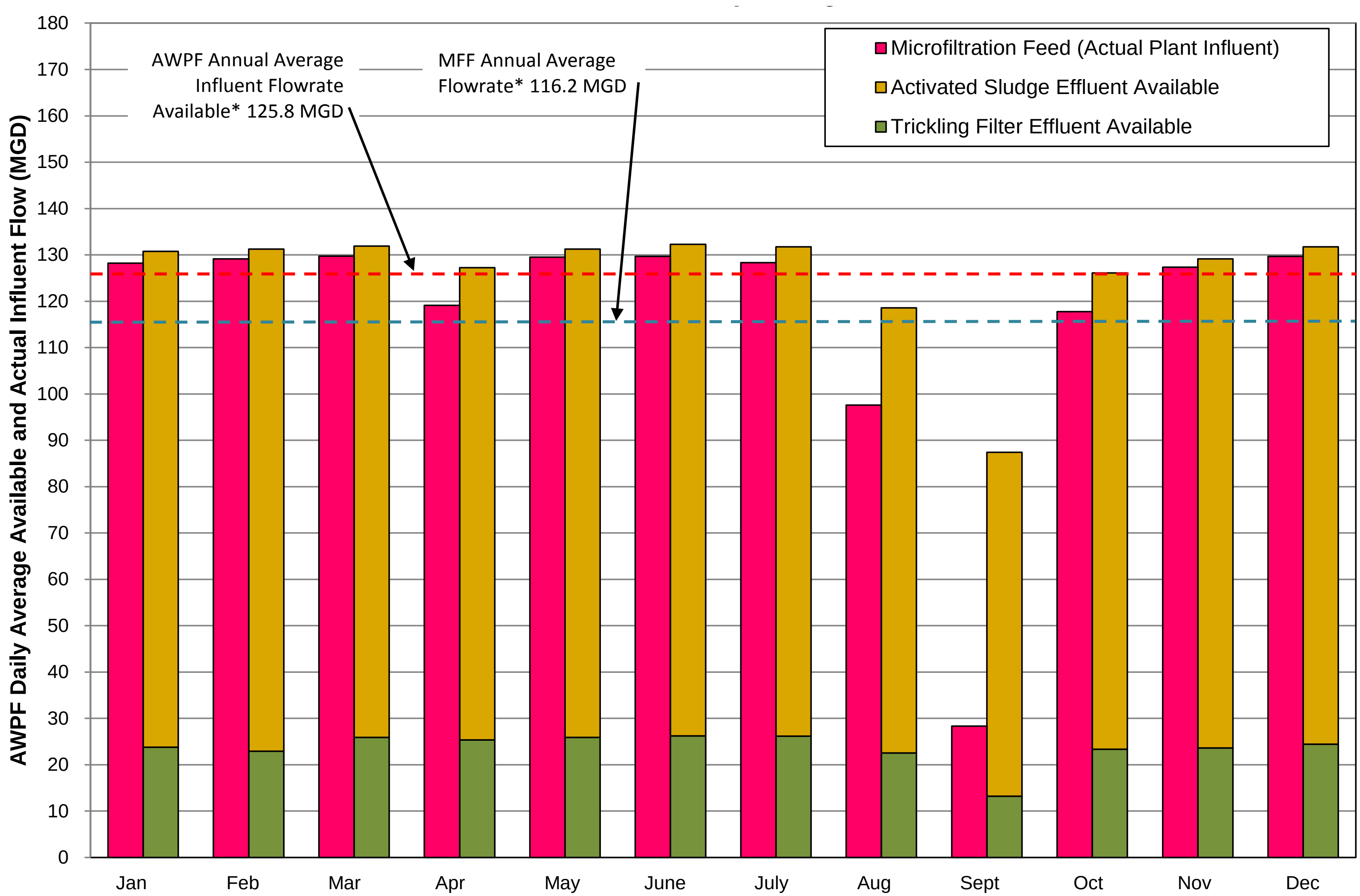
Figure 2-4. 2018 AWPF Average Influent Flow Sources and Volumes

2.2.1.2 Source Water Turbidity and Ammonia-Nitrogen

In 2018 the AWPF feedwater (Q1) turbidity generally ranged between 0.7 and 2.3 NTU (based on grab samples), demonstrating consistently low turbidity. Total suspended solids concentrations in the AWPF feedwater (Q1) ranged from 5.6 to 7.4 mg/L, which is outstanding for secondary effluent.

The average Q1 total nitrogen level remained low (12.9 mg/L) and the corresponding ammonia-nitrogen concentration was 2.0 mg/L due to the blend of TF effluent and AS effluent from the OCSD AS facilities operating in the NdN mode. Ammonia is necessary for formation of chloramine in the MFF (when sodium hypochlorite is added to the Q1 stream). Low ammonia levels increase the potential for free chlorine to be formed, which can damage the MF and RO membranes.

Tests in 2018 showed that a low concentration of ammonia essentially remained in the Q1 source water when TF effluent was included in the AWPF source water, which favored chloramine formation over free chlorine, thereby protecting the membranes. Q1 ammonia-nitrogen concentrations declined to less than 1 mg/L periodically in January and again in late September to early October. In response, the sodium hypochlorite dose in the MFF was adjusted periodically



*Available flow includes weir overflow returned to OCSD. Difference between available flow and MFF flow is weir overflow return.

Figure 2-5. 2018 AWPF Influent Sources and Average Flows by Month

to control the ROF free chlorine residual level. The MFF sodium hypochlorite dose was typically at 9 to 10 mg/L in 2018. The MFF and ROF free chlorine residual concentrations were consistently maintained below the operating target of 0.1 mg/L established to avoid breakpoint chlorination.

2.2.2 MF System Performance in 2018

The MF process provides pretreatment for the RO process. Secondary effluent (Q1) from Plant No. 1 is fine-screened upstream of the MF process.

Table 2-3 summarizes the monthly MF system performance for 2018 in terms of turbidity reduction. The daily average MFF turbidity ranged from 1.32 to 3.97 NTU based on daily averages of on-line turbidimeter readings taken upstream of the MF process. The annual average MFF turbidity was 2.73 NTU. The OCSD Plant No. 1 original AS1 plant (Project P1-82) has operated in the partial NdN mode since 2010, and the newer AS2 plant (Project No. P1-102) has operated in the NdN mode since 2012; as a result of these operational changes at Plant No. 1, low MFF turbidity has been reliably achieved, demonstrating the benefits of NdN.

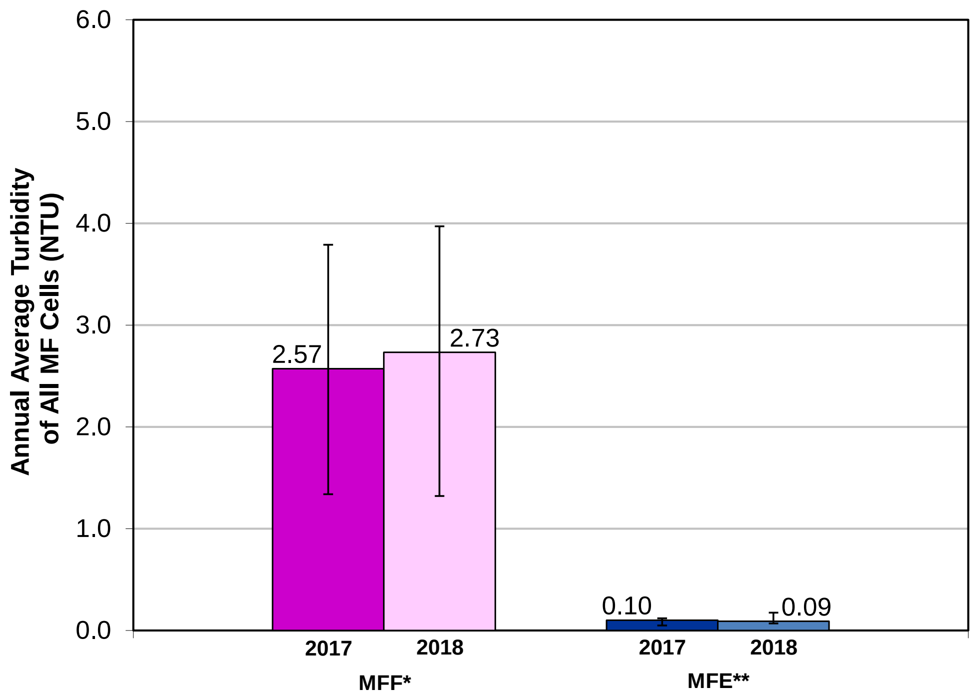
The daily average MFE turbidity during 2018 ranged from 0.07 to 0.17 NTU, with an annual average turbidity of 0.09 NTU based on on-line turbidimeter readings taken immediately downstream of each bank of four MF cells. Continuous readings from nine turbidimeters (one per bank of four MF cells) are averaged to determine the daily average MFE turbidity. This represents an average turbidity removal rate for the MF process of 96.7% during 2018. With the exception of the 0.17 NTU outlier in September, other daily maximum MFE turbidity readings were approximately 0.13 NTU.

Figure 2-6 presents the annual average turbidity reduction achieved by the MF system in 2018 and compares it with the MF system performance during 2017. Overall, the average turbidity removal rate of 96.7% in 2018 was slightly higher than the 96.1% removal rate in 2017. Review of the average monthly performance reveals consistently stable average MFF turbidities with minor seasonal variation throughout 2018. Indicated by the black bars representing the minimum and maximum daily average turbidities by year on Figure 2-6, the range in MFF turbidity was about the same in 2018 (1.32 to 3.97 NTU) as compared with that in 2017 (1.34 to 3.79 NTU).

Table 2-3. 2018 MF Performance

Month	Turbidity			
	MF Feed MFF[1]		MF Effluent MFE[1]	
	Avg. (NTU)	Max (NTU)	Avg. (NTU)	Max (NTU)
January	2.88	3.61	0.09	0.10
February	2.89	3.97	0.09	0.11
March	3.03	3.52	0.08	0.10
April	3.28	3.94	0.09	0.13
May	2.81	3.69	0.09	0.10
June	2.54	3.06	0.09	0.11
July	2.61	3.19	0.09	0.11
August	2.34	3.31	0.09	0.10
September	2.03	2.90	0.10	0.17
October	2.64	2.99	0.10	0.13
November	2.63	3.08	0.09	0.10
December	3.02	3.72	0.09	0.10
Annual Average	2.73	---	0.09	---
Maximum	---	3.97	---	0.17
Average % Removal	96.7%			

[1] Based on daily average turbidity readings from MFF and MFE on-line turbidimeters. Values shown represent the monthly average for all MF cells. Daily average MFE turbidity readings from individual MF banks (4 cells/bank) are available upon request.



* MFF on-line turbidimeter results
**MFE on-line turbidimeter results
Note: Black bars represent the range in daily average turbidity for the years shown.

Figure 2-6. 2018 MF Turbidity Removal Performance

2.2.3 RO System Performance in 2018

The RO process is designed to remove inorganic and organic compounds as well as bacteria and viruses, producing up to 100 MGD of product water at a recovery rate of approximately 85%. Monthly performance data for the RO process in 2018 for key constituents, EC and TOC, are summarized in Table 2-4. With regard to salinity removal in 2018, the ROF EC averaged 1,742 µmhos/cm, and the ROP EC averaged 36 µmhos/cm based on semi-weekly grab samples. This represents an average salinity removal rate for the RO process of 97.9% during 2018. Figure 2-7 presents the 2018 annual average EC reduction performance of the RO system and compares it with the RO system's average EC reduction the previous year. The EC reduction was the same in 2017 and 2018 at 97.9%.

Table 2-4. 2018 RO Performance

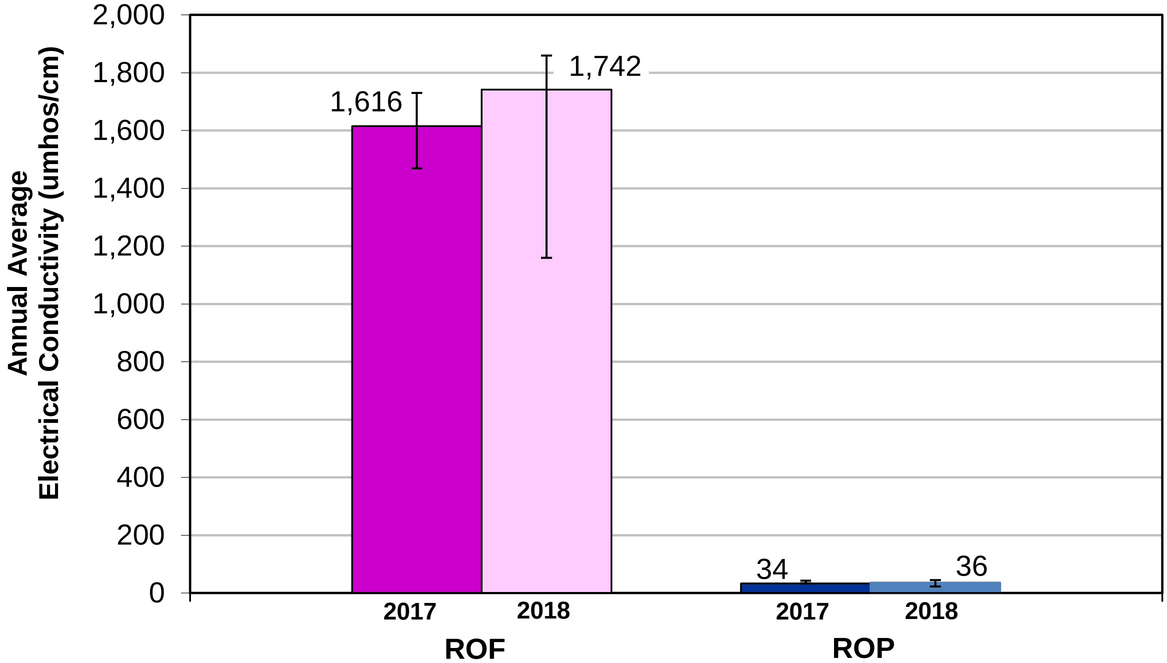
Month	Electrical Conductivity[1,2]				Total Organic Carbon[3]			
	RO Feed ROF		RO Product ROP		RO Feed ROF		RO Product ROP	
	Avg. (umhos/cm)	Max. (umhos/cm)	Avg. (umhos/cm)	Max. (umhos/cm)	Avg. (mg/L)	Max. (mg/L)	Avg. (mg/L)	Max. (mg/L)
January	1618	1800	28	31	7.90	8.48	0.14	1.91
February	1718	1750	29	30	7.95	8.81	0.11	0.25
March	1800	1860	34	36	7.92	8.64	0.11	0.33
April	1795	1810	35	37	8.12	8.53	0.11	0.25
May	1806	1860	39	42	8.02	8.47	0.12	0.26
June	1803	1810	41	41	7.73	8.47	0.10	0.18
July	1740	1780	41	42	7.89	8.33	0.11	0.23
August	1728	1780	43	45	7.69	8.43	0.18	1.14
September	1713	1730	38	40	7.45	7.91	0.12	0.40
October	1744	1790	36	39	7.84	9.05	0.11	0.30
November	1750	1790	36	38	7.59	8.33	0.09	0.12
December	1695	1740	33	35	7.63	7.91	0.08	0.14
Annual Average	1742	---	36	---	7.82	---	0.11	---
Maximum	---	1860	---	45	---	9.05	---	1.91
Average % Removal	97.9%				98.5%			

[1] Electrical Conductivity (EC) data for RO are not normalized with respect to ROF pressure or temperature

[2] EC semi-weekly grab sample results

[3] TOC daily grab sample results

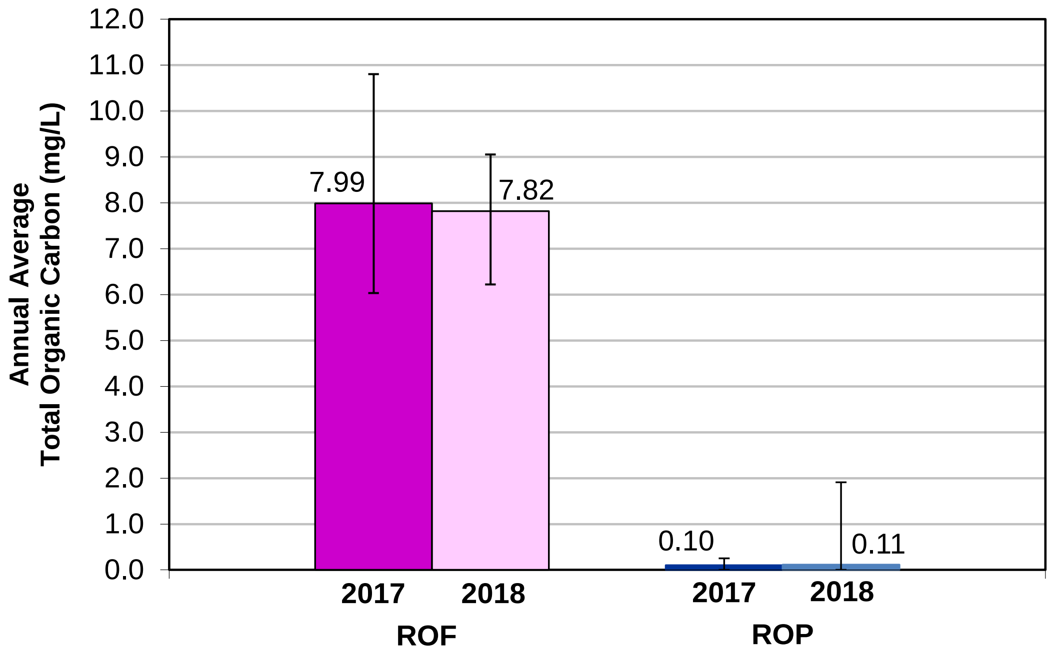
Figure 2-8 presents the annual average TOC removal performance of the RO system, comparing 2017 and 2018 results. The average TOC removal of 98.5% in 2018 was effectively the same as the prior year. In general, this TOC removal performance indicates rejection rates remained fairly constant over this period.



2018 Average Percent Removal = 97.9%

Note: Black bars represent the range in individual grab samples for the years shown.

Figure 2-7. 2018 RO Electrical Conductivity Removal Performance



2018 Average Percent Removal = 98.5%

Note: Black bars represent the range in individual grab samples for the years shown.

Figure 2-8. 2018 RO Total Organic Carbon Removal Performance

The TOC concentration in the ROF based on daily grab samples averaged 7.82 mg/L in 2018, which is nearly the same as the 7.99 mg/L average observed in 2017. The ROF TOC concentration range in 2018 was narrower than in the prior year, from 6.22 to 9.05 mg/L as shown by the vertical black bars on Figure 2-8, and likely due to the lesser variability in the proportion of TF effluent in the Q1 feedwater. The TOC concentration in the ROP based on daily grab samples averaged 0.11 mg/L during 2018, ranging from non-detectable (less than the RDL of 0.05 mg/L) to 1.91 mg/L. Two ROP TOC results were significantly higher than the other 2018 values (1.91 mg/L on January 5 and 1.14 mg/L on August 20). Sample contamination is suspected for these two ROP TOC outliers because the corresponding FPW TOC results were unremarkable (0.12 mg/L on January 5 and 0.13 mg/L on August 20).

2.2.4 UV / AOP Performance in 2018

The UV/AOP (hydrogen peroxide advanced oxidation and UV light exposure) system performance is demonstrated by the UVP results as compared with those in the UV/AOP influent, or feed water stream (UVF).

2.2.4.1 Disinfection

With regard to disinfection through the entire AWPF in 2018, total coliform levels in the Q1 averaged approximately 796,310 MPN/100 mL. (See Table 2-1 presented earlier.) Sodium hypochlorite addition upstream of MF reduced the total coliform levels in the MFF to an average of 36,640 MPN/100 mL, representing an average total coliform removal of 1.3 log achieved by disinfection. MF treatment further reduced the average total coliform levels to less than 1 MPN/100 mL in the MFE. Total coliform levels remained less than 1 MPN/100 mL through the RO and UV/AOP processes. The FPW complied at all times with the permit limit for total coliform, which requires that the FPW shall not exceed 240 MPN/100 mL in any single sample, 23 MPN/100 mL in more than one sample in any 30-day period, and the 7-day median shall not exceed 2.2 MPN/100 mL.

Over a five-day period in late September, elevated FPW total coliform results ranging from 2 to 9.8 MPN/100 mL were discovered and thought to be caused by bacterial growth in the decarbonation towers while they were off-line during a week-long AWPF shutdown and/or the six-week low-flow operations for the GWR Pipeline Rehabilitation Project. To correct the problem, the AWPF was operated at only 15 MGD for about 8 hours with sodium hypochlorite added to the UVP and circulated through the decarbonation towers, piping, RO flush tanks and FPW channels (no lime); the chlorinated product water was discharged to the OCSD outfall and the post-treatment facilities were flushed before returning to normal service. Despite the brief period of elevated total coliform results, corrective actions taken by OCWD operations staff enabled the FPW to comply with the total coliform 7-day median limit of 2.2 MPN/100 mL.

2.2.4.2 NDMA Removal

Besides disinfection, a key performance criterion for the UV/AOP system relates to destruction of NDMA as shown in Table 2-5. The 2018 average concentration of NDMA in the UVF was approximately 17.1 ng/L, based on weekly grab samples ranging from 6.3 to 46.0 ng/L (using a laboratory method with an RDL of 2 ng/L). For comparison purposes, the average concentration of NDMA in the Q1 stream during 2018 was approximately 27.7 ng/L, ranging from 11.6 to 24.7 ng/L.

All UVP NDMA results in 2018 were non-detect (using a laboratory method with an RDL of 2 ng/L). Overall in 2018, comparison of the average UVF and UVP NDMA concentrations, the UV/AOP system attained an average NDMA removal rate of 98.8%, or a 1.9 log reduction if 10% of the detection limit is assigned to the non-detect values. Figure 2-9 illustrates the UV/AOP system performance with regard to NDMA destruction.

It is interesting to note that the addition of sodium hypochlorite in the MFF stream creates NDMA. Comparison between the Q1 and UVF NDMA concentrations reveals that the average UVF NDMA concentration is sometimes higher than that in the average Q1; for example, in August 2018, the average UVF NDMA concentration was 26.2 ng/L as compared with the average Q1 NDMA concentration of 18.6 ng/L. As presented in Section 2.3.10, the ROF NDMA concentration is higher than that in the UVF because the RO process removes a portion of the NDMA. Allowing for NDMA formation in the MF process and subsequent partial removal by the RO system prior to UV/AOP treatment helps explain the fate of this contaminant through the AWPF. Following UV/AOP treatment, the average NDMA concentration in the UVP was non-detect (less than 2 ng/L) in all samples.

In 2018, all FPW NDMA results were below the DDW notification level for NDMA (10 ng/L). The highest NDMA concentration in the Q1 stream, 100 ng/L, occurred on November 30, 2018. The NDMA concentration in the FPW on that date was 3 ng/L. The UVP NDMA concentration on that day was non-detect (less than 2 ng/L), demonstrating the efficacy of the UV/AOP process. While the Q1 NDMA concentration on that day was elevated and the corresponding UVP NDMA concentration was non-detect, it is suspected that the FPW value was due to NDMA rebound occurring after UV treatment in the post-treatment FPW stabilization processes.

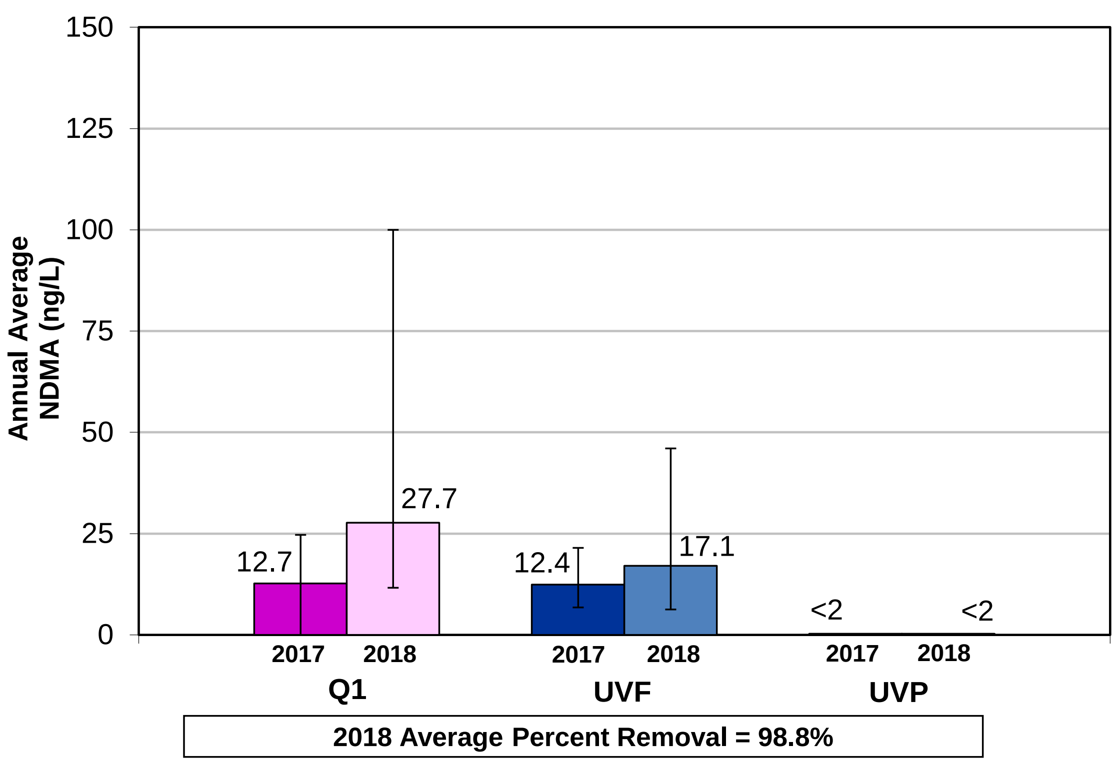
Comparing the available raw data for NDMA concentrations in FPW and UVP revealed that detectable levels were found more frequently in FPW than in UVP. Low concentrations of NDMA in the FPW, below the DDW notification level (10 ng/L), were detected periodically throughout 2018, whereas UVP NDMA concentrations were consistently non-detect throughout the year.

Table 2-5. 2018 UV/AOP NDMA Removal Performance

Month	NDMA					
	Secondary Effluent Q1		UV Influent UVF [1]		UV Effluent UVP	
	Avg. [2] (ng/L)	Max. (ng/L)	Avg. [2] (ng/L)	Max. (ng/L)	Avg. [2] (ng/L)	Max. (ng/L)
January	23.7	31.9	12.7	15.7	<2	<2
February	21.5	25.6	12.4	16.3	<2	<2
March	24.5	31.9	18.3	23.1	<2	<2
April	31.2	38.8	19.6	21.6	<2	<2
May	24.1	27.7	19.5	23.9	<2	<2
June	16.4	19.7	14.6	16.1	<2	<2
July	18.7	26.4	17.7	22.2	<2	<2
August	18.6	24.3	26.2	46.0	<2	<2
September	18.9	23.1	31.1	39.5	<2	<2
October	17.5	19.0	13.6	16.2	<2	<2
November	51.6	100.0	12.5	18.7	<2	<2
December	63.2	93.1	9.1	12.0	<2	<2
Annual Average	27.7	---	17.1	---	<2	---
Maximum	---	100.0	---	46.0	---	<2
Average % Removal (by UV/AOP)	98.8%					
Average Log Removal (by UV/AOP)	1.9					

[1] Average hydrogen peroxide dose was 3 mg/L.

[2] Average of weekly grab samples. For purposes of calculating monthly averages, 10% of the Reportable Detection Limit (RDL) was used for all non-detect (ND) values. If all data for the month were ND, then the average is shown as "< RDL".



Note: Black bars represent the range in individual weekly grab samples for the years shown.

Figure 2-9. 2018 UV/AOP NDMA Removal Performance

Potential causes include reformation of NDMA from previously photolyzed NDMA and/or formation of “new” NDMA from precursors, both of which are likely dependent on the combined chlorine (chloramine) concentration. Investigations by OCWD into this NDMA rebound have revealed that the lime used during post-treatment is not a likely source of NDMA or precursor material, but the increase in pH caused by the lime allows for greater formation of NDMA in the presence of combined chlorine. Accordingly, the post-treatment pH target of 8.5 attempts to limit NDMA formation while also managing cement mortar-lined distribution pipeline stability and aquifer metals mobilization.

2.2.4.3 1,4-Dioxane Removal

Performance of the UV/AOP system, as well as that of the RO system, can also be measured based on removal of 1,4-dioxane. Table 2-6 and Figure 2-10 show how well 1,4-dioxane was removed by both the RO and UV/AOP processes.

Following UV/AOP treatment with the addition of hydrogen peroxide, the 1,4-dioxane concentration in the UVP was consistently non-detect (<1 µg/L). The UVF 1,4-dioxane concentrations were also non-detect (<1 µg/L). The Q1 concentrations of 1,4-dioxane averaged 1.8 µg/L, ranging from non-detect (< 1 µg/L) to 5.8 µg/L.

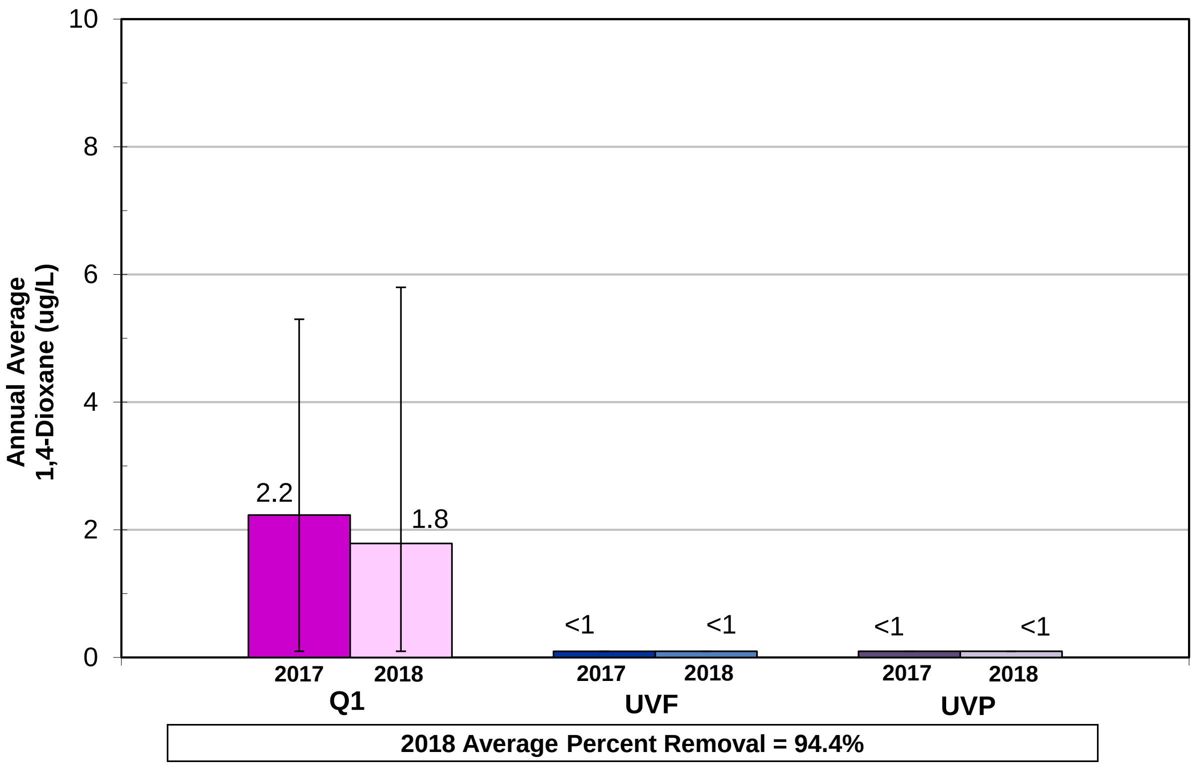
As illustrated by the black vertical bars on Figure 2-10, the 2018 maximum of 5.8 µg/L from all weekly Q1 grab samples was marginally higher than the corresponding maximum of 5.3 µg/L in 2017. The FPW 1,4-dioxane concentrations during 2017 and 2018 were consistently non-detect (<1 µg/L). Overall, the RO/UV/AOP processes achieved an average 94.4% removal of 1,4-dioxane during 2018 (Q1 through UVP streams) when assigning 10% of the RDL to the non-detect values. Given that all UVF 1,4-dioxane concentrations were non-detect (<1 µg/L), it appears that the RO process effectively removed 1,4-dioxane in 2018. The overall percent removal was lower in 2018 (94.4%) in comparison with that in 2017 (95.5%) because the Q1 average 1,4-dioxane concentration was lower in 2018 (1.8 µg/L) than in 2017 (2.2 µg/L), and the UVP 1,4-dioxane concentrations were non-detect (<1 µg/L). This decreased the percent removal for 2018, when in effect, the level of treatment remained outstanding. The RO/UV/AOP processes achieved a 1.3 log removal of 1,4-dioxane during 2018.

Table 2-6. 2018 RO/UV/AOP 1,4-Dioxane Removal Performance

Month	1,4 Dioxane					
	Secondary Effluent Q1		UV Influent UVF		UV Effluent UVP	
	Avg. [1] (µg/L)	Max. (µg/L)	Avg. [1] (µg/L)	Max. (µg/L)	Avg. [1] (µg/L)	Max. (µg/L)
January	2.4	2.7	<1	<1	<1	<1
February	2.3	2.7	<1	<1	<1	<1
March	2.7	3.8	<1	<1	<1	<1
April	3.2	5.8	<1	<1	<1	<1
May	2.4	3.5	<1	<1	<1	<1
June	1.0	1.4	<1	<1	<1	<1
July	1.1	1.6	<1	<1	<1	<1
August	1.3	1.9	<1	<1	<1	<1
September	1.3	1.4	<1	<1	<1	<1
October	1.1	1.8	<1	<1	<1	<1
November	1.3	1.5	<1	<1	<1	<1
December	1.6	1.8	<1	<1	<1	<1
Annual Average	1.8	---	<1	---	<1	---
Maximum	---	5.8	---	<1	---	<1
Average % Removal (RO/UV/AOP System) [2]	94.4%					
Average Log Removal (RO/UV/AOP System) [2]	1.3					

[1] Average of weekly grab samples. For purposes of calculating monthly averages, 10% of the Reportable Detection Limit (RDL) was used for all non-detect (ND) values. If all data for the month were ND, then the average is shown as "<RDL".

[2] Average % removal and log removal calculated based on non-detect (ND) = 10% of RDL of 1 µg/L.



Note: Black bars represent the range in individual weekly grab samples for the years shown.

Figure 2-10. 2018 RO/UV/AOP 1,4-Dioxane Removal Performance

2.2.5 Total Nitrogen Removal in 2018

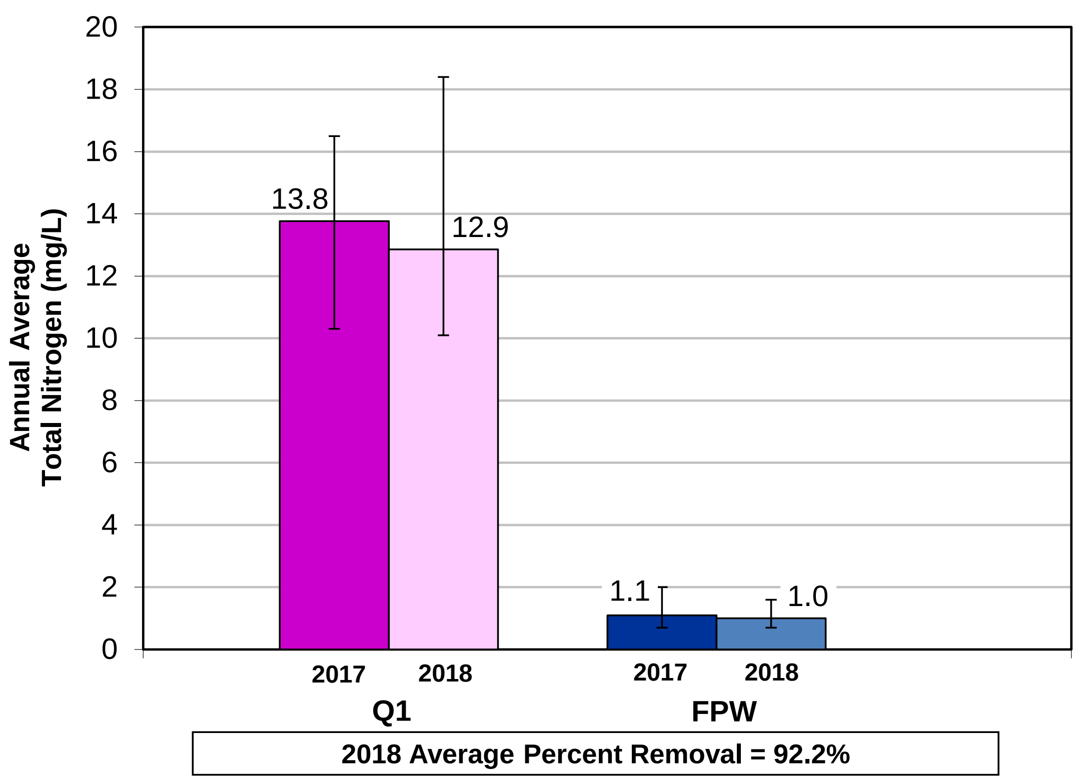
Monthly performance data for AWPF total nitrogen removal are summarized in Table 2-7 and Figure 2-11. On an annual basis, the Q1 total nitrogen concentration (sum of ammonia, nitrite, nitrate, and organic nitrogen, all expressed as nitrogen) averaged approximately 12.9 mg/L during 2018. Low total nitrogen concentrations in the Q1 flow stream were an indication of OCSD's NdN operation of the AS facilities at Plant No. 1. Comparison of the pre-NdN operation (before late 2009) with the post-NdN operation (after 2010-2011) reveals that secondary effluent total nitrogen concentrations decreased by about 50% in recent years as compared with average Q1 total nitrogen levels in 2008-2009 of approximately 26 to 28 mg/L. In 2018, this lower influent total nitrogen concentration helped the AWPF to achieve consistently low concentrations of total nitrogen levels in the FPW, ranging from approximately 0.7 to 1.6 mg/L based on individual samples. Overall, the annual average FPW total nitrogen concentration remained consistently low over the past two years, 1.1 mg/L in 2017 and 1.0 mg/L in 2018. In comparison, before OCSD switched the AS Plant to the NdN mode of operation in late 2009, the annual average FPW total nitrogen concentration was generally above 2 mg/L. Additionally, the nitrogen species comprising the FPW total nitrogen has changed from being predominately ammonia (pre-NdN) to being mostly nitrate (post-NdN). Figure 2-11 presents the 2018 annual average total nitrogen reduction performance of the AWPF and compares it with that achieved in the previous year.

Figure 2-12 illustrates the FPW total nitrogen concentration during 2018, showing it was typically about 1.0 mg/L, which was well below the total nitrogen permit limit of 5 mg/L. The FPW sampling frequency for total nitrogen analyses is semi-weekly, generally about three days apart.

Table 2-7. 2018 AWPF Total Nitrogen Removal Performance

Month	Total Nitrogen[1] Secondary Effluent Q1 Avg. (mg/L)	Total Nitrogen[1] Secondary Effluent Q1 Max. (mg/L)	Total Nitrogen[1] AWPF Effluent FPW Avg. (mg/L)	Total Nitrogen[1] AWPF Effluent FPW Max. (mg/L)
January	12.6	13.2	0.8	0.9
February	11.7	12.2	0.8	0.9
March	13.6	14.8	0.8	1.0
April	13.4	16.0	0.9	1.2
May	16.4	18.4	1.3	1.6
June	13.3	13.7	1.2	1.4
July	13.4	14.8	1.2	1.4
August	13.2	14.6	1.2	1.3
September	11.8	12.2	1.2	1.5
October	11.5	12.1	0.9	1.2
November	11.0	11.6	0.8	0.9
December	12.6	14.8	0.8	1.0
Annual Average	12.9	---	1.0	---
Maximum	---	18.4	---	1.6
Average % Removal	92.2%			

[1] Total nitrogen data based on weekly Q1 and semi-weekly FPW individual grab sample results.



Note: Black bars represent the range in individual grab samples for the years shown.

Figure 2-11. 2018 AWPF Total Nitrogen Removal Performance

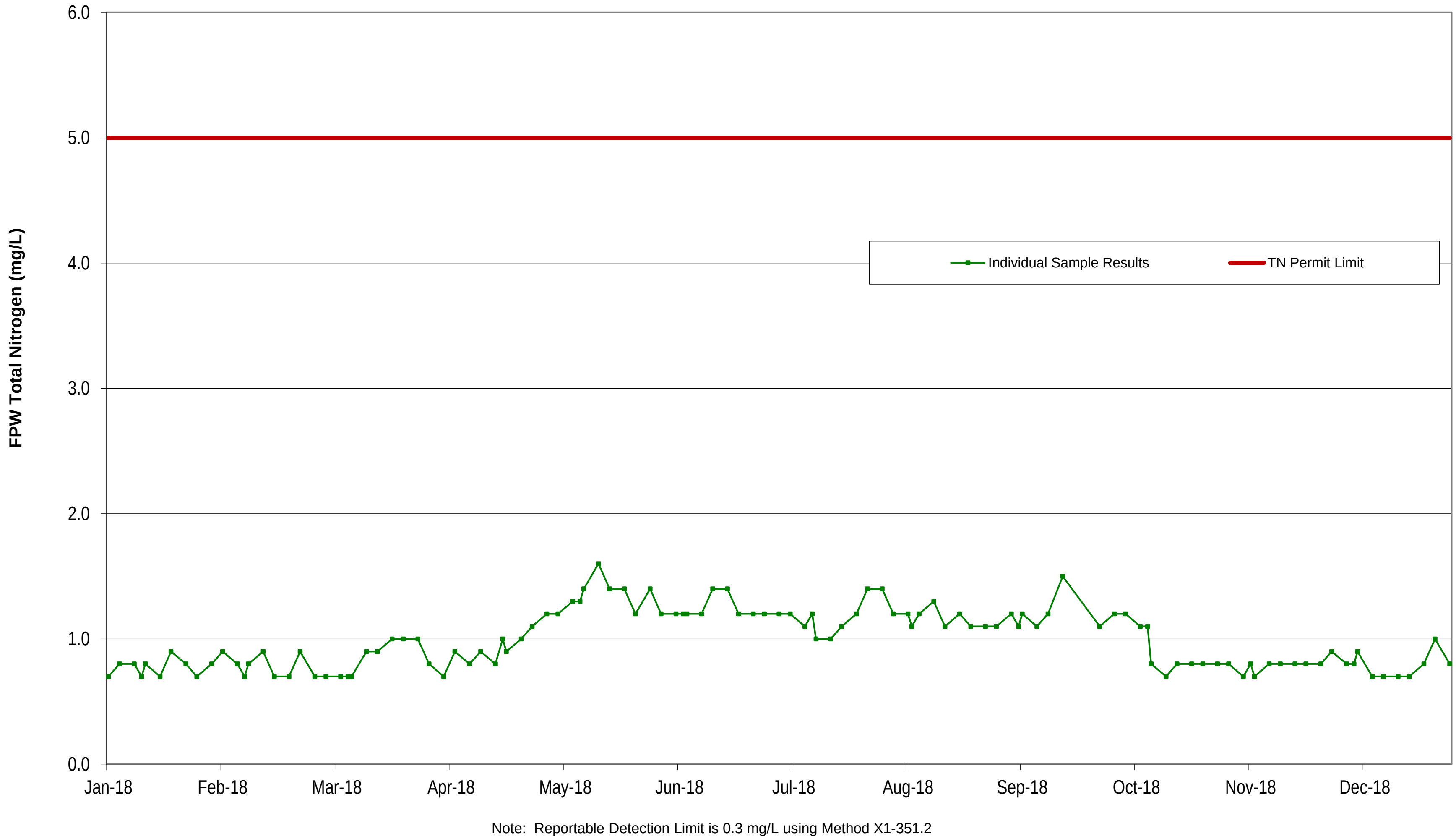


Figure 2-12. 2018 Purified Recycled Water Total Nitrogen

2.2.6 Total Organic Carbon Removal in 2018

Figure 2-13 shows the TOC concentration in the FPW during 2018 based on daily 24-hour composite samples. A few individual TOC results were non-detect (< 0.05 mg/L) and were assigned 10% of the RDL for the purpose of calculating averages. The running 20-sample average TOC concentration in the FPW was generally about 0.10 mg/L. The running 4-sample average TOC concentration in the FPW was also approximately 0.10 mg/L.

Compliance with the permit TOC limit is determined monthly based on the running average TOC concentration in the most recent 20 composite samples of FPW. The TOC limit is calculated based on the DDW-specified maximum RWC at each recharge location. The TOC limit for all recharge sites (Talbert Barrier, K-M-M-L Basins, and DMBI) is 0.5 mg/L (determined by dividing 0.5 mg/L by the DDW-specified maximum allowable RWC at that location, which is 100% for all sites).

During 2018, the running 20-sample average FPW TOC was consistently well below 0.5 mg/L and in compliance with the permit requirements.

2.3 Performance and Compliance Record

The overall performance and compliance record of the AWPF are summarized below in terms of general operating records, including start/restart issues, downtimes, operator certifications, compliance with critical control points, and focused studies to optimize performance and increase water production.

2.3.1 General Operational Performance

The AWPF continued to successfully operate and produce purified recycled water for groundwater recharge through 2018. The original AWPF began operation on January 10, 2008, with a 70 MGD design production capacity, following a rigorous commissioning and acceptance testing period. The GWRS Initial Expansion began operation on May 21, 2015, first enabling the AWPF to produce up to 85 MGD and later up to 100 MGD of purified recycled water; final acceptance and completion of the GWRS Initial Expansion construction project followed on July 31, 2015.

The AWPF was on-line approximately 353 days in 2018 (about 96.6% of the year). Appendix D contains descriptions of all plant shutdowns during the year. The majority of the AWPF shutdowns were scheduled in coordination with preventive maintenance on equipment, meters, piping, and valves, inspection of electrical equipment, and software upgrades. The AWPF was completely off-line for one full day in April and seven consecutive days in September for preventive maintenance activities (April 10 and September 18-24).

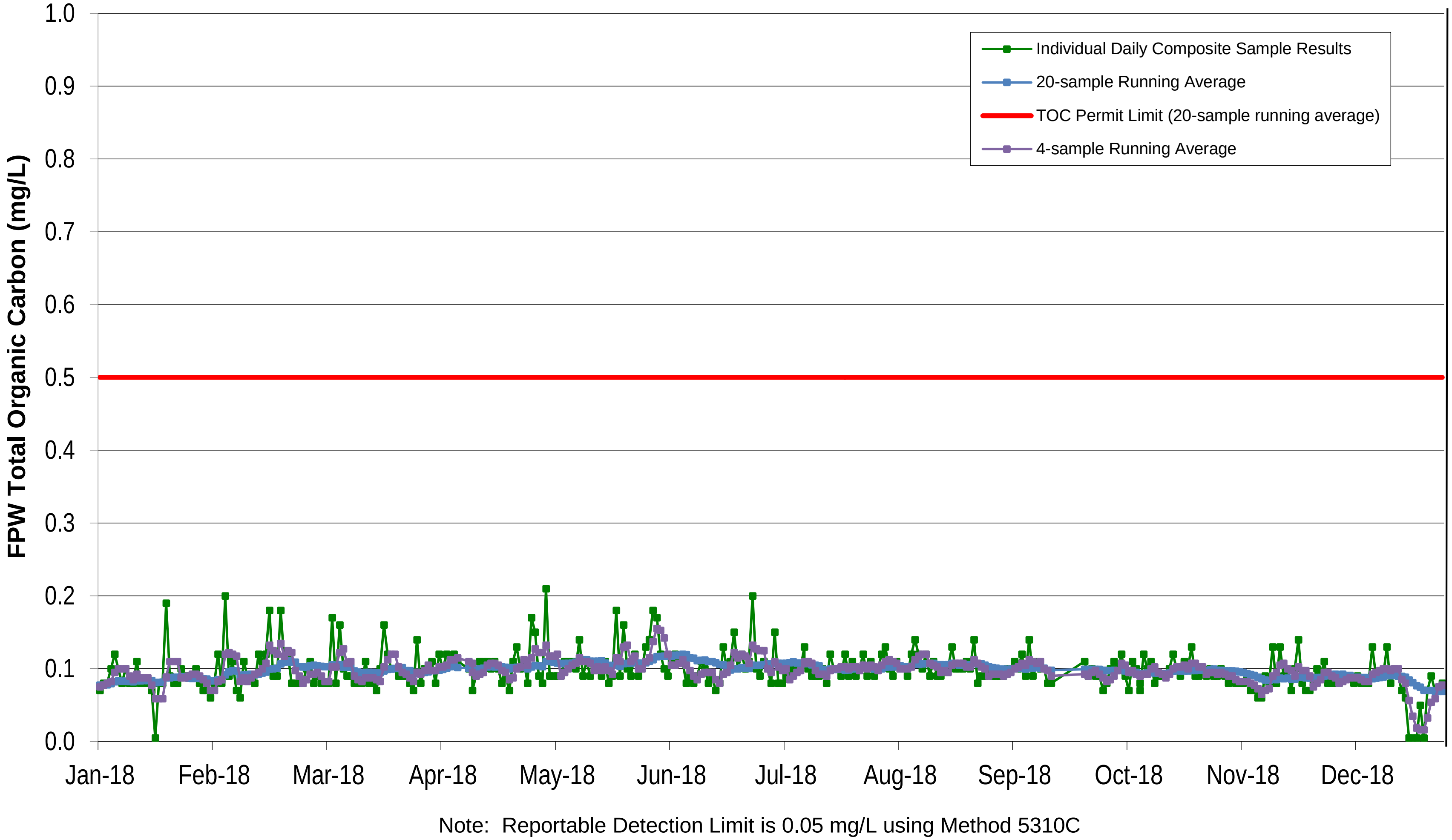


Figure 2-13. 2018 Purified Recycled Water Total Organic Carbon

The AWPF was operated at a reduced production capacity of approximately 30 MGD from August 22 to October 3 of 2018, supplying only the Talbert Barrier. During that six-week period, the GWR Pipeline was drained, and no purified recycled water was delivered to the K-M-M-L Basins, DMBI Project, Anaheim CPP, or ARTIC. The GWR Pipeline follows the west side of the SAR and Carbon Creek Diversion Channel from Fountain Valley to Anaheim for a total length of approximately 13 miles, varying in diameter from 78 inches at the AWPF to 60 inches at the spreading basins. The six-week GWR Pipeline Rehabilitation Project involved application of an epoxy coating to the interior mortar lining of Reach 1 of the 78-inch and 72-inch diameter pipeline, from the AWPF to the DMBI turnout just north of Edinger Avenue in Santa Ana.

The AWPF experienced nine unexpected power outages in 2018 with durations ranging from approximately one to ten hours each. The longest outage of seven hours occurred during the night on July 31-August 1. It appears that the unplanned outages were caused by maintenance activities from the regional electrical power utility Southern California Edison (SCE).

A 9.5-hour AWPF shutdown was scheduled in early October for preventive maintenance activities involving repair of a flow meter on the waste sump flows discharged to Plant No. 2. During this outage, annual valve exercises were conducted at multiple processes.

On September 27, the AWPF reduced production to 15 MGD but did not completely shut down for three hours for a mandatory load reduction event conducted by SCE as part of the Enel X Demand Response Program which allows SCE to request periodic reductions in electrical power consumption during peak demand periods. OCWD's agreement with Enel X (formerly known as EnerNOC), the regional Demand Response Program provider, requires a load reduction of 11 Megawatts based on the original AWPF production capacity of 70 MGD. After completion of the GWRS Initial Expansion, the AWPF can maintain production at a low level (15-20 MGD) during these periods, while still delivering the required power reduction for the Enel X program. OCWD receives financial compensation for participating in this program.

The AWPF was briefly off-line due to unexpected issues from time to time during 2018. The AWPF experienced no shutdowns or process interruptions for four months of 2018: March, May, November, and December. Overall, the AWPF operated well during 2018, albeit sometimes at reduced production rates. Major operational performance issues are discussed later in this section.

Appendix D includes a list of OCWD operations personnel with their grades of certification as well as summaries of equipment calibration records for 2018. OCWD has a total of 22 operations staff, of which all 22 are certified operators and six who have the highest Level V certification. The AWPF control room is staffed 24 hours per day, 7 days per week.

2.3.2 Critical Control Points

Operation of the AWPF involves performance monitoring at multiple points or steps along the entire treatment process. This performance monitoring enables the operators to track how the system is doing at each step and gives them ample time to take corrective actions if necessary. Such performance monitoring ensures that the purified recycled water is safe, complies with regulatory requirements, and may be recharged and/or reused.

Critical control points and critical limits are shown in Table 2-8, as well as important process monitoring and control criteria used to operate the AWPF. Developed over time, the critical control points and critical limits were originally identified in the OOP (OCWD and DDB Engineering, Inc., 2015) and later modified in 2015-2016 with review and oversight by the Panel (NWRI, 2017). At the request of the Panel and in compliance with the groundwater recharge regulations (CCR, 2014), pressure decay test (PDT) results were added as an indicator of MF membrane integrity. Since February 2017 and in response to comments from DDW (DDW, 2017), the critical control points and critical limits have been used to demonstrate pathogen log reduction values for compliance with the groundwater recharge regulations (CCR, 2014). OCWD submitted an updated OOP to DDW in 2018 (OCWD, 2018) documenting the criteria for pathogen log reduction values and adding electrical energy dose (EED) as an indicator of UV/AOP performance. Evaluation of operating records for each critical control point with respect to the associated critical limit provides an indication of performance during the year.

Appendix E contains plots of data from the AWPF PCS showing how the AWPF operation compared with the critical limits listed above during 2018. Except for PDT monitoring, the critical control point readings are from continuous on-line analyzers rather than sampling and laboratory analyses. The critical control points trigger alarms in the AWPF PCS for the operators to take corrective actions if a limit is exceeded. The critical control points and corresponding critical limits are used for operating the AWPF and were not historically used for permit compliance. However, in order to comply with updated DDW regulations, some of the critical control points have been adopted for the demonstration of pathogen log removals by each unit process; this is described in Sections 2.3.5.2 (MF), 2.3.6.5 (RO), and 2.3.7.2 (UV/AOP).

Table 2-8. Summary of Critical Control Points and Critical Limits

Parameter		Flow Stream or Process	Target Operating Range
1.	Combined Chlorine Residual	MFF	3 to 5 mg/L
2.	Combined Chlorine Residual	ROF	< 5 mg/L
3.	Turbidity	MFF	< 5 NTU optimum ≤ 20 NTU for membrane warranty > 20 NTU for no more than 4 hours < 50 NTU at all times
4.	Turbidity	MFE	< 0.15 NTU optimum > 0.20 NTU for no more than 4 hours ≤ 0.5 NTU at all times
5.	Turbidity	ROP	0.1 to 0.15 NTU
6.	Transmembrane Pressure (TMP)	MF	3 to 12.5 psi
7.	Pressure Decay Test (PDT) based on daily testing	MF	> 0.25 psi/min triggers work order < 0.5 psi/minute at all times
8.	Electrical Conductivity	ROP	< 60 µmhos/cm (< 110 µmhos/cm for individual units)
9.	Total Organic Carbon	ROP	≤ 0.1 mg/L
10.	UV Transmittance	UV/AOP	95% minimum (at 254 nanometers)
11.	Electrical Energy Dose (EED)	UV/AOP	0.23 kWh/kgal minimum[1]
12.	Average UV Train Power	UV/AOP	74 kW per train minimum
13.	Calculated UV Dose per Train	UV/AOP	111 mJ/cm^2 minimum[2]
14.	pH	FPW	< 9 units

[1] EED is used to demonstrate compliance with 6-log virus reduction.

[2] Calculated UV dose per train is significantly greater than the minimum and is based on the equation shown below in performance paragraph #13.

Performance evaluation of the 2018 AWPF operations with respect to critical control points yields the following observations:

1. **MFF chlorine residual** (as chloramine) averaged 4.1 mg/L during 2018 (See Appendix E, Figure E-1). Many readings were below the 3 mg/L target (lowest was 2.2 mg/L). Several of the MFF chlorine residual readings were above the 5 mg/L upper target, sporadically reaching 6.0 mg/L. The MFF chlorine residual generally increased during 2018. With some periodic high and low values, MFF chlorine residual readings primarily held steady within the target range between 3 and 5 mg/L to maintain chloramination and minimize the risk of breakpoint chlorination which can damage the membranes. The sodium hypochlorite dose was adjusted from time to time and spike doses were periodically applied to control rapid MF membrane fouling.

2. **ROF chlorine residual** (as chloramine) was less than the 5 mg/L maximum target with two exceptions (See Appendix E, Figure E-2). The 2018 average chlorine residual was 3.1 mg/L. The maximum ROF chlorine residual was approximately 5.3 mg/L in early June, just slightly above the maximum target. The minimum ROF chlorine residual was 1.4 mg/L in late September when the AWPF was restarted following a week-long shutdown. In general, the ROF chlorine residual trended slightly upwards during 2018.

3. **MFF turbidity** was consistently well below the operating target maximum of 20 NTU on a daily average basis; in fact, the daily average MFF turbidity was always less than 4 NTU (See Appendix E, Figure E-3). The MFF turbidity averaged 2.7 NTU and ranged from 1.3 to 4.0 NTU, indicative of the superior AWPF feedwater quality received from OCSD's Plant No. 1 during 2018.

4. **MFE turbidity** was at or below the target of 0.15 NTU, except on one occasion (See Appendix E, Figure E-4). The MFE turbidity was 0.17 NTU on September 25 following the week-long AWPF shutdown. The MFE turbidity of all MF trains ranged between 0.07 and 0.17 NTU and averaged 0.09 NTU for 2018.

5. **ROP turbidity** was consistently well below the target operating range of 0.1 to 0.15 NTU (See Appendix E, Figure E-5). The ROP turbidity averaged 0.05 NTU and ranged between 0.02 and 0.09 NTU during 2018.

6. **MF TMP** readings were within the target operating range of 3 to 12.5 pounds per square inch (psi) for the majority of 2018, except for numerous readings that fell below the minimum range in late August through September (See Appendix E, Figure E-6). During that period, only six to eight MF cells were in service because the AWPF operated at a reduced production rate supplying approximately 30 MGD to the barrier. The lowest daily average TMP reading (average for all operational MF cells) was approximately 1.4 psi in late September. The highest daily average TMP reading (average for all operational MF cells) was approximately 5.5 psi at the end of December. The annual average TMP for all operational MF cells in 2018 was 4.4 psi. The MF TMP readings were above the 3 psi target prior to late August and after September. In general, average TMP readings during 2018 primarily remained steady from about 3.5 to 5.5 psi from January through mid-August. After the AWPF resumed full production, from October through December, the average TMP readings ranged from approximately 3.0 to 5.5 psi. Overall for 2018 the daily average TMP readings of individual operating MF cells ranged from a minimum of 0.6 psi to a maximum of 10.2 psi.

7. **Daily average MF PDT** results were at or below the targeted optimum level of 0.25 psi/minute throughout the year (See Appendix E, Figure E-7). Daily average MF PDT results (average of all MF cells) ranged from 0.11 to 0.20 psi/minute during 2018. A steady gradual increasing trend was observed during 2018 following the MF membrane replacements that were completed the previous year. Section 2.3.5.2 discusses MF PDT readings as they pertain to pathogen log reduction value (LRV) calculations.

8. **ROP electrical conductivity** (EC) was fairly consistent with only minor seasonal changes during 2018 with all of the readings below the maximum 95 µmhos/cm target (See Appendix E, Figure E-8). Replacement of membranes in six of the original RO trains (Trains A-F) during Fiscal Year 2016-2017 helped maintain the ROP EC below the operational target. During 2018 the ROP EC varied from a low of 23 µmhos/cm in January to a high of 50 µmhos/cm in May, and then decreasing to 26 µmhos/cm at the end of December. On an annual average basis, the ROP EC was 35 µmhos/cm in 2018.

9. **ROP TOC** daily average levels were all consistently well below the maximum target of 0.1 mg/L (See Appendix E, Figure E-9) throughout 2018. The ROP TOC concentration ranged from 0.01 to 0.08 mg/L based on on-line readings. The annual average ROP TOC concentration was 0.04 mg/L in 2018. Section 2.3.6.5 discusses on-line ROP TOC monitoring for purposes of pathogen LRV calculations.

10. **UV transmittance** was greater than the minimum 95% (at 254 nanometers) target throughout 2018, except for one outlier of 90% that occurred on September 24 (See Appendix E, Figure E-10). Records for that day showed that the average %UVT was 77% for approximately three hours when the AWPF conducted a test of the emergency peak flow/rain event system (bypassing RO). The average %UVT improved to 98.5% following the test when the AWPF returned to normal production mode. Other than that single outlier, on-line %UVT values in 2018 ranged between 96.3% and 99.4%. The overall average %UVT in 2018 (including all readings) was 97.5%.

11. **UV EED** was consistently greater than the minimum target of 0.23 kWh/kgal established for the UV/AOP system (See Appendix E, Figure E-11). During 2018 the UV system EED varied from a low of 0.234 kWh/kgal to a high of 1.000 kWh/kgal. The highest UV EED reading occurred during the emergency peak flow/rain event test on September 24. UV EED readings were generally elevated (0.308 to 0.393 kWh/kgal) when the AWPF operated at reduced production rates between mid-August and late September while the GWR Pipeline Rehabilitation Project was underway. The overall annual average EED was 0.265 kWh/kgal in 2018.

12. **Average UV train power levels** were above the minimum 74 kW consumption level for all trains (A through M) throughout 2018 (See Appendix E, Figure E-12). The individual UV trains generally operated at average power levels between 79 and 84 kW.

13. **Calculated UV dose per train** was significantly above the minimum 111 millijoules per square centimeter (mJ/cm^2) target (See Appendix E, Figure E-13). The lowest calculated UV dose of 233 mJ/cm^2 occurred in early October; the highest calculated UV dose of 559 mJ/cm^2 occurred on September 24 during the emergency peak flow/storm event test. The calculated UV dose was generally elevated (310 to 455 mJ/cm^2) between mid-August and early October when the AWPF operated at reduced production rates to supply only the barrier. The average calculated UV dose during 2018 was 283 mJ/cm^2. The UV dose per train is calculated using the following equation:

    Calculated Dosage per UV Train = (R * LP * 111 mJ/cm^2 * 5 MGD) / (100 * Q)

    Where:

R	=	Number of reactors in service for a UV train
LP	=	Reactor Lamp Output is a function of the Reactor Ballast Power Level (BPL) as indicated in the SCADA system (values range from 60% to 100%) according to the relation LP = (-1.0674) + (0.0358 * BPL) – (0.000172 * BPL) and assumes lamps are at the end of their life
Q	=	Flow in MGD to a UV train

    UV/AOP critical control points applied for determining pathogen LRVs are discussed in Section 2.3.7.2.

14. **FPW pH** was within the allowable range of 6 to 9 on a daily average basis, except for a single outlier day (See Appendix E, Figure E-14). The daily average FPW pH on February 21 was 9.9 (based on on-line readings); that same day an AWPF PCS issue caused a false low pressure alarm and the PWPS suddenly shut down. Operations staff reduced the lime dose to control the FPW pH. The daily average FPW pH measured on-line ranged from approximately 7.1 to 9.9; the annual average FPW pH was 8.5.

2.3.3 Source Water Availability

The availability of source water from OCSD Plant No. 1 supplied as feedwater to the AWPF has largely supported purified recycled water production close to its 100 MGD design production capacity since 2015. Two factors were responsible for improving source water availability: (1) the GWRS Initial Expansion SEFE facilities has managed the diurnal flow pattern of Plant No. 1 secondary effluent, delivering a more constant feedwater flow rate to the AWPF; and (2) OCSD has operated the SALS nearly continuously to convey more wastewater to Plant No. 1 for treatment. Operational challenges with the SALS however have periodically restricted the wastewater flow diversion and limited source water for GWRS.

By late 2017, OCSD had completed repairs at the SALS and was able to manage the pump vibration and high temperature issues by operating three pumps and intermittently cycling individual pumps (on/off) for brief periods (15-30 minutes). This approach continued successfully until July 2018 when one pump failed and the output of a second pump was limited to approximately 75% of capacity due to excessive vibration. With only two of the four SALS pumps on-line, plus the restricted pump, less wastewater could be diverted to Plant No. 1 and the secondary effluent flow delivered to the AWPF was reduced by 5 to 8 MGD. By October and continuing through the end of 2018, the SALS operated with three of the four pumps in service enabling Plant No. 1 to produce an ample supply of secondary effluent for the AWPF to regain close to its full purified recycled water production.

The Plant No. 1 Primary Effluent Pump Station (PEPS) normally returns reclaimable sidestreams to the secondary treatment processes; however, beginning in early August 2018 OCSD had to divert the sidestreams to Plant No. 2 while repairs were done at PEPS. This loss of reclaimable sidestreams decreased the secondary effluent flow by approximately 3 MGD. OCSD completed the PEPS repairs in September and regained the 3 MGD of AWPF source water.

On August 8 OCWD coordinated GWRS operation with OCSD's brief shutdown of Plant No. 1 that lasted about seven hours. The shutdown was scheduled to remove a stuck headworks slide gate. In preparation for the event, OCWD stored secondary effluent in the SEFE facilities to supply the AWPF. During the event, the AWPF reduced purified recycled water production to only 15 MGD. The AWPF returned to full production within about four hours after Plant No. 1 resumed operation.

In order to conduct inspections of the Plant No. 1 headworks gates, OCSD temporarily treated wastewater from the SARI at Plant No. 1 on September 17; OCSD resumed the normal SARI diversion to Plant No. 2 beginning September 18. OCSD coordinated this gate inspection work with OCWD's scheduled AWPF shutdown (September 18-24) to preclude SARI wastewater from being recycled as required by the GWRS permit.

2.3.4 Source Water Quality

Source water quality was satisfactory in 2018, although increased ammonia and turbidity levels were experienced as described in Section 2.2. Typically, the Plant No. 1 AS process produces secondary effluent with low nitrogen and turbidity levels as a result of the NdN operation. Between mid-January and late-May the AS process experienced filamentous growth problems; OCSD chlorinated the return activated sludge (RAS) and reduced the peak flow to combat the bulking sludge in the AS clarifiers. OCSD believed the AS process upset was caused by high grease loads following their releases of caustic into the collection system. While the AS/NdN process upset adversely impacted source water quality, the AWPF was able to control potential MF membrane fouling by adjusting the sodium hypochlorite dosage.

OCSD continued conducting TF clarifier cleanings at night up to three times per month throughout 2018. Since 2016 the practice of caustic treatments to control odors, snails, and birds at the TFs proved successful, and the timing of the events diluted the slug of caustic TF effluent with stored secondary effluent being released from the SEFE tanks during the night. Little or no change in the source water TOC concentration was observed at the AWPF during OCSD's TF clarifier cleaning events. The corresponding ROP TOC concentration was essentially unaffected by the TF clarifier cleaning events.

2.3.5 MF System Operation and Performance

2.3.5.1 MF System Operation

The MF System operated well during 2018 with notable activities that included sodium hypochlorite dosage adjustments, valve replacements to correct elevated PDTs, and installation of polyvinylidene difluoride (PVDF) membranes in one MF cell for demonstration purposes.

Adjustments in the sodium hypochlorite dosage to the MFF stream were made frequently to maintain chloramination in response to variable ammonia levels and manage the ROF free chlorine residual concentration at or below 0.1 mg/L to protect the RO membranes from damage. The sodium hypochlorite dosage was adjusted to control MF membrane fouling while also maintaining the %UVT above 95%. As discussed in the previous section, the source water ammonia concentration increased because of AS process upsets; in response, OCWD increased the sodium hypochlorite dosage (generally between 9-10 mg/L, and sometimes higher for brief periods) to reduce the potential for MF membrane biofouling. The on-line ammonia analyzer that was installed in 2017 on the MFF helped OCWD manage the sodium hypochlorite dose.

In March a pinhole leak was discovered in the MF backwash supply line and a temporary patch was installed. A permanent repair was made to the MF backwash supply line while the AWPF was off-line in April. During the shutdown several valve air leaks were discovered and repaired and more were found that required repairs in May.

Elevated PDTs were experienced periodically in some cells and investigations led to corrective actions and repairs. For example, MF Train B was taken out of service in June to replace vacuum valves on two cells that were experiencing high PDTs; the new vacuum valves resolved the PDT issue in one cell, but not the other. Investigations continued and in September, after replacing the air test valve twice, the PDT result was corrected and the cell was returned to service. Similar elevated PDT issues were experienced at MF Train C; a variety of valve problems were corrected in July by replacing pneumatic control blocks and rebuilding valve actuators. In November MF Train C experienced vacuum pump issues caused by a pinhole leak and other backwash supply valve problems that were corrected in December. Elevated PDT readings at a Train B cell in December triggered investigations that discovered a loose retaining clip; after securing the clip, the cell passed the PDT and was returned to service. At no time during 2018 was a cell allowed to remain in service if the PDT value resulted in an LRV calculation of less than 4.0 log for *Giardia* cysts or *Cryptosporidium* oocysts.

OCWD is considering installation of PVDF membranes in the GWRS Final Expansion. On August 9, OCWD removed the Evoqua polypropylene membranes in MF Cell E04 and replaced them with Scinor PVDF membranes to conduct a full scale demonstration of the PVDF membranes. (The polypropylene membranes, which had been installed in 2014 with the GWRS Initial Expansion, were cleaned and stored for later use as replacements in other MF cells.) The full scale demonstration will assess the PVDF membrane ability to operate at higher filtration rates and longer runtimes between cleanings. The performance comparison test of polypropylene membranes in MF Cell E01 and PVDF membranes in MF Cell E04, both operating at a fixed filtration rate began in late September.

From August 22 until September 24 while the GWR Pipeline Rehabilitation Project was under way, only six to eight MF cells were needed for the AWPF to produce approximately 30 MGD of purified recycled water for the barrier. Consequently, OCWD rotated the MF trains that were on-line, using all trains in a cyclical manner. To prepare for the week-long AWPF maintenance shutdown (September 18-24), all 36 MF cells were cleaned. To avoid having all the MF cells come due for their subsequent scheduled 21-day runtime CIPs, some MF cells were cleaned early to return to the normal staggered schedule.

2.3.5.2 MF System Pathogen Log Reduction Monitoring

The MF process receives pathogen log reduction credits for *Giardia* cysts and *Cryptosporidium* oocysts in accordance with the updated OOP (OCWD, 2018). No credit for reduction of enteric virus is attributed to the MF process. A combination of on-line turbidimeters and daily PDT results are used to show compliance with pathogen removal requirements. The critical control points and critical limits designated for MFE turbidity and MF PDT (Table 2-8) establish the criteria that enable the MF process to demonstrate at least 4-log reduction of *Giardia* cysts and *Cryptosporidium* oocysts.

Continuous MFF and MFE turbidity readings, plus daily MF PDT results are critical control points and compliance with those critical limits supports the pathogen reduction by the MF process. (See Appendix E, Figures E-3, E-4, and E-7, respectively.) The MFE turbidity and MF PDT results are recorded and used to calculate the pathogen log removal credit achieved by the MF process in accordance with the *Standard Practice for Integrity Testing of Water Filtration Membrane Systems* (ASTM D6908-06) (ASTM, 2017). The calculated pathogen log removal is automatically displayed in the GWRS PCS and recorded as explained in the OOP (OCWD, 2018). If a log removal result based on the PDT calculation for an individual cell is less than 4-log, the affected cell is taken out of service until the cell can comply with the 4-log reduction requirement. A PDT value of 0.5 psi/minute or less will ensure that the pathogen reduction achieved is at least 4-log. OCWD's critical limit for the PDT critical control point is 0.25 psi/minute for each MF cell, i.e., any daily PDT result above 0.25 psi/minute triggers a work order to investigate the issue at the affected cell.

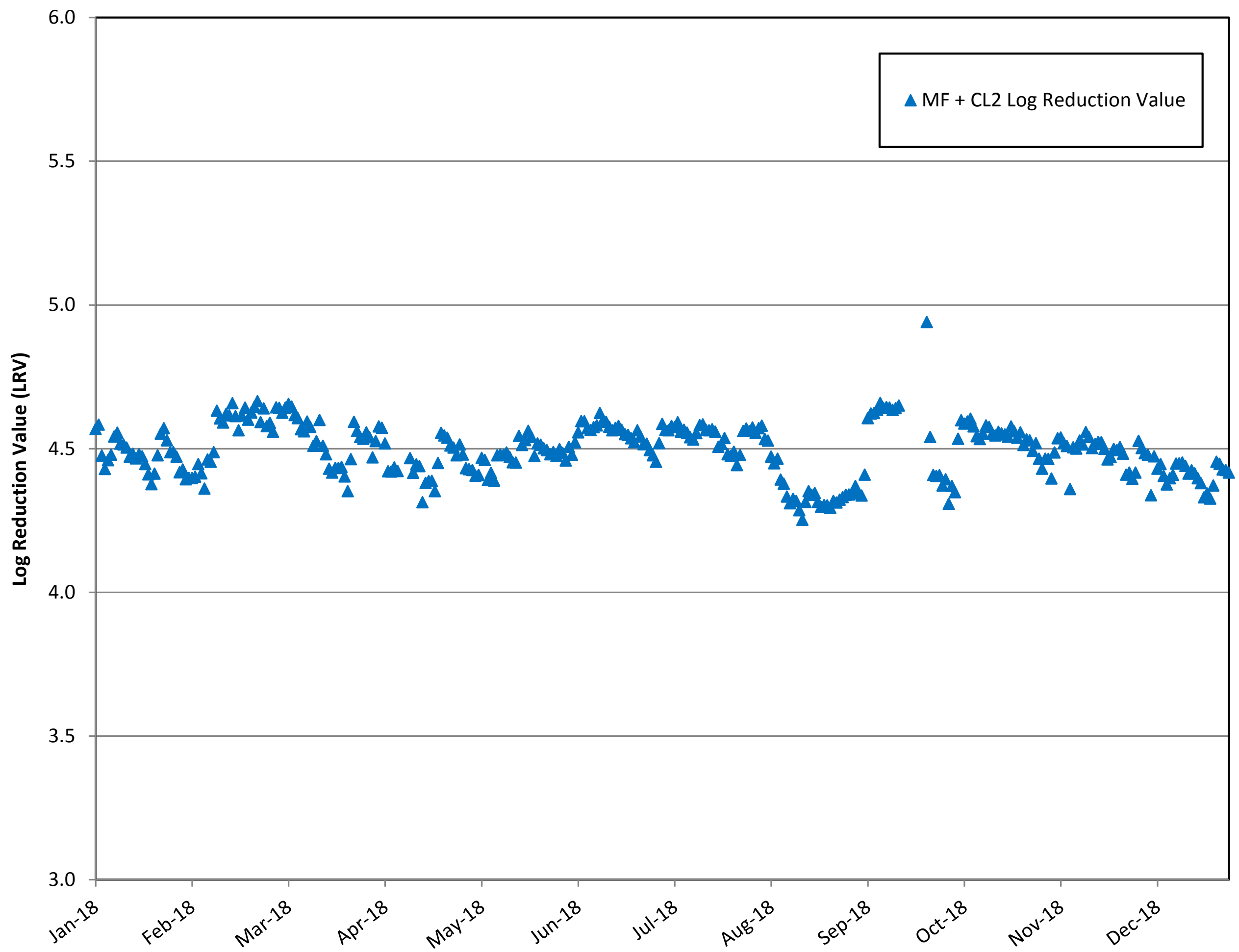
Monthly reports are submitted to DDW documenting the daily pathogen log reduction values achieved by the MF process. Appendix F contains copies of the 2018 monthly reports submitted to DDW and the RWQCB documenting pathogenic microorganism control achieved by GWRS.

MF membrane integrity is monitored continuously with on-line turbidimeters on the MFF and MFE flow streams. The MFE turbidity is continuously measured using nine individual turbidimeters, each assigned to a group of four MF cells. In addition, one bulk MFE turbidimeter continuously tracks the combined MFE flow stream. The MFE turbidity must be 0.2 NTU or less in order to receive pathogen log reduction credits. If the MFE turbidity is maintained above 0.2 NTU for more than four hours, an investigation is triggered, possibly taking the affected cells out of service. As noted in Table 2-8, OCWD's critical limit for MFE turbidity as a critical control point for optimum MF performance is 0.15 NTU.

On an annual average basis, the MFF turbidity of 2.73 NTU was consistently reduced through the MF process to an MFE turbidity of 0.09 NTU, which is equivalent to a 96.7% reduction (See Table 2-3, Figure 2-6, and Appendix F). The maximum MFE turbidity reading was 0.17 NTU, which demonstrated membrane integrity, i.e., the MFE turbidity was consistently equal to or less than 0.2 NTU (0.0% of the time greater than 0.2 NTU).

Corresponding daily average PDT results for all cells confirm MF membrane integrity based on pressure decay results at or below the target minimums throughout 2018 (See Appendix E, Figure E-7). A detailed review of the MF operating records shows that three cells in Trains B and C exhibited PDT values above the target level (0.25 psi/minute). As discussed in the previous section, the affected cells (B02, B07, and C06) were taken out of service for investigation. Replacing vacuum valves and air test valves resolved the issues and the PDT results returned to acceptable levels below the operational target maximum. OCWD tracks the daily PDT results for each MF cell to recognize trends and confirm membrane integrity.

Figure 2-14 summarizes the 2018 monthly reports for daily log reduction values for *Giardia* cysts and *Cryptosporidium* oocysts achieved by the MF process (See Appendix F for monthly reports). The minimum daily log reduction value achieved in 2018 for these pathogens by the MF process was 4.2-log; the average log reduction value achieved in 2018 was 4.5-log. Collectively, the MFE turbidity and PDT data demonstrate that the MF process consistently achieved greater than the target of 4-log reduction for both *Giardia* cysts and *Cryptosporidium* oocysts during 2018.



Giardia cysts and *Cryptosporidium* oocysts LRV based on USEPA Membrane Filtration Guidance Manual (USEPA, 2005) and sensitive at less than 3 microns.

Figure 2-14. MF Log Reduction Values in 2018: *Giardia* Cysts and *Cryptosporidium* Oocysts

2.3.6 RO System Operation and Performance

The RO system performed well during 2018, and highlights are described below.

2.3.6.1 RO System Operation

Beginning in mid-2015 and continuing through 2018, the RO system operated at an ROF pH of 6.9 and recovery rate of 85%.

The 10-micron cartridge filters on the ROF stream that had been installed in April 2017 experienced increasing differential pressures apparently caused by biofouling in 2018. To alleviate the pressure increases, the cartridge filters were systematically soaked with sodium hypochlorite solution for periods ranging from two to 15 hours and then flushed to control biofouling. Unfortunately, this cleaning regime yielded minimal improvement in the rising differential pressures in the cartridge filters. At the end of May 2018 OCWD replaced all of the cartridge filters.

In mid-September 2018 as a preventive measure for the AWPF week-long shutdown, seven of the cartridge filters were taken out of service and soaked in sodium hypochlorite solution for about seven hours. After flushing, the first seven were returned to service and the soaking procedure was repeated on the remaining seven cartridge filters. While the AWPF was off-line (September 18-24), more sodium hypochlorite was added to all of the cartridge filters and allowed to soak for the entire week.

New RO membranes were installed in Train A in mid-October 2018. Table 2-9 summarizes the membrane types and installation dates in the RO System.

Table 2-9. RO System Membranes

RO Train[1]	RO Unit	Membrane Type[2]	Installation Date
A	A01	LG Chemical	October 2018
	A02	LG Chemical	October 2018
	A03	LG Chemical	October 2018
B	B01	Hydranautics ESPA2-LD	March 2016
	B02	Hydranautics ESPA2-LD	February 2016
	B03	Hydranautics ESPA2-LD	January 2017
C	C01	Hydranautics ESPA2-LD	January 2016
	C02	Hydranautics ESPA2-LD	February 2016
	C03	Hydranautics ESPA2-LD	January 2017
D	D01	Hydranautics ESPA2-LD	December 2015
	D02	Hydranautics ESPA2-LD	January 2016
	D03	Hydranautics ESPA2-LD	February 2017
E	E01	Hydranautics ESPA2-LD	March 2017

RO Train[1]	RO Unit	Membrane Type[2]	Installation Date
E	E02	Hydranautics ESPA2-LD	March 2017
	E03	Hydranautics ESPA2-LD	March 2017
F	F01	DOW/Filmtec XLE-440	April 2015
	F02	DOW/Filmtec XLE-440	April 2015
	F03	DOW/Filmtec XLE-440	April 2015
G	G01	DOW/Filmtec XLE-440	May 2015
	G02	DOW/Filmtec XLE-440	May 2015
	G03	DOW/Filmtec XLE-440	May 2015

[1] Trains F and G have ERDs. Trains A through E do not have ERDs.
[2] Thin Film Composite Polyamide RO Membranes.

2.3.6.2 RO System Third-Stage Fouling

The third-stage of units in Train F and Train G were cleaned in May 2018 using a high pH generic cleaning chemical that yielded less than satisfactory results to control biological fouling. Another cleaning of these units' third-stages was performed in June using a high pH proprietary surfactant cleaning chemical. The proprietary cleaning chemical performed well on Trains F and G, restoring the third-stage flux rate with minimal impact to EC rejection. These six units in Trains F and G are unique in that they use ERDs to increase the flow to their third stages, which increases their loading rates. Similar benefits have not been observed for the proprietary cleaning chemical when used for other non-ERD units in Trains A through E.

The antiscalant (AWC-A110) that had been used since mid-2014 was replaced with a new antiscalant (AWC-A108) in March 2018. Units B01, B02, and A01 are currently being closely monitored for third-stage fouling to assess the performance of this new antiscalant. OCWD continues to evaluate other antiscalants at the AWPF Engineering/Research Center's pilot testing facility.

2.3.6.3 RO System Energy Recovery Devices

All Train F and Train G units were operated with their ERDs on-line at the design set points from January until mid-December 2018 when Unit G03's ERD began leaking at its pump shaft mechanical seal and was taken out of service. OCWD investigated further and found other issues that require repairs by the manufacturer.

2.3.6.4 RO System TOC Analyzers

The ROF on-line TOC analyzer instability issues that began in August 2017 continued in 2018. Despite being recalibrated, the ROF TOC analyzer showed intermittent spikes and false TOC readings that are commonly found with dosing syringe alarm indications. In comparison, the ROP on-line analyzer was more stable and rarely experienced erratic readings or unusual alarm conditions. OCWD installed redundant ROF and ROP on-line TOC analyzers in early 2018.

OCWD contacted the TOC analyzer supplier, who updated the firmware for the original ROF TOC analyzer in July 2018; however, the TOC analyzer continued to exhibit unstable readings. In September the supplier replaced the dosing syringe assembly on the original ROF TOC analyzer. The newer ROF TOC analyzer was left unchanged for comparison. During this trial, the original analyzer had few spiked readings, while the newer one continued to have frequent false readings. It was concluded that replacing the dosing syringe assemblies on the remaining three TOC analyzers (new ROF and both ROP) would resolve the instability issues. During the investigations, it was also observed that the ROP TOC analyzers' magnetic flow sensors required repairs. As late as December, after the dosing syringe assemblies were replaced and flow sensors repaired, the ROF TOC analyzers continued to experience intermittent false high and low readings; the ROP TOC analyzers experienced similar, albeit infrequent, false spikes. Investigations into the false spikes shall continue into 2019.

An on-line ROP TOC spike above the 0.10 mg/L target occurred in early October 2018 and lasted approximately seven hours. The on-line ROP TOC gradually rose to 0.23 mg/L and then slowly declined to below 0.10 mg/L. An ROP sample was collected during the event that confirmed the elevated TOC; however, the sample volume was insufficient to determine the contributing compound(s). OCWD contacted OCSD to investigate potential causes, however, findings were inconclusive.

A second ROP TOC spike event above 0.10 mg/L occurred in late October 2018. Similar to the prior event, the ROP TPC gradually peaked at 0.21 mg/L and lasted over four hours. ROP sampling was conducted and more extensive TOC and VOC analyses confirmed the spike and revealed acetone was present in the ROP. Acetone is poorly removed by RO due to its low molecular weight. OCSD investigated and found the likely source was a food manufacturer's discharge of isopropyl alcohol (acetone is an impurity of isopropyl alcohol).

Fortunately, neither of the ROP TOC spike events in October 2018 resulted in a GWRS permit exceedance.

2.3.6.5 RO System Pathogen Log Reduction Monitoring

The RO process receives a pathogen log reduction credit of 2-log each for *Giardia* cysts, *Cryptosporidium* oocysts, and enteric virus, and monitoring is conducted in accordance with the updated OOP (OCWD, 2018). Two on-line TOC analyzers (one duty and one standby) continuously monitor the bulk (common header) ROF flow stream, providing full redundancy; likewise, two on-line TOC analyzers continuously monitor the bulk (common header) ROP flow stream, providing full redundancy. The standby on-line TOC analyzers on the ROF and ROP pipelines were installed and began operation in April 2018. Minimum, maximum, and average results are recorded daily along with the calculated average percent daily TOC removal. Monthly reports are submitted to DDW documenting the daily pathogen log reduction values achieved by the RO process.

The RO process performance for pathogen reduction is measured using TOC removal (OCWD and DDB Engineering, Inc., 2014). DDW has approved this methodology that uses on-line TOC as a surrogate for RO membrane integrity and pathogen reduction (CDPH, 2014). TOC removal as a continuous indicator of membrane integrity compared on-line ROF and ROP TOC data. (See also critical control points discussion in Section 2.3.2 and Appendix E, Figure E-9 for ROP TOC results.)

Figure 2-15 shows the on-line ROF and ROP TOC results and the corresponding pathogen log reduction achieved by the RO process in 2018. The documented TOC removal was consistently equal to or greater than 2.0-log based on on-line TOC readings. The average TOC removal in 2018 was 2.3-log, with the range of daily values between 2.0 and 2.8. The minimum daily log reduction value achieved in 2018, 2.0-log, occurred on October 9 when an elevated acetone concentration was detected in the ROP stream (215 µg/L). Acetone is poorly removed by RO and contributes to TOC levels. For reference, the on-line TOC results on October 9 showed the ROF TOC was 8.50 µg/L and the ROP TOC was 0.080 µg/L. OCWD contacted OCSD to investigate the potential source of the acetone in the sewershed.

In summary, these pathogen reduction values are confirmed by the monthly reports submitted to DDW and the RWQCB as shown in Appendix F and illustrated on Figure 2-16. This performance confirmed the ability of the RO process to consistently achieve 2-log or more of pathogen reduction throughout 2018.

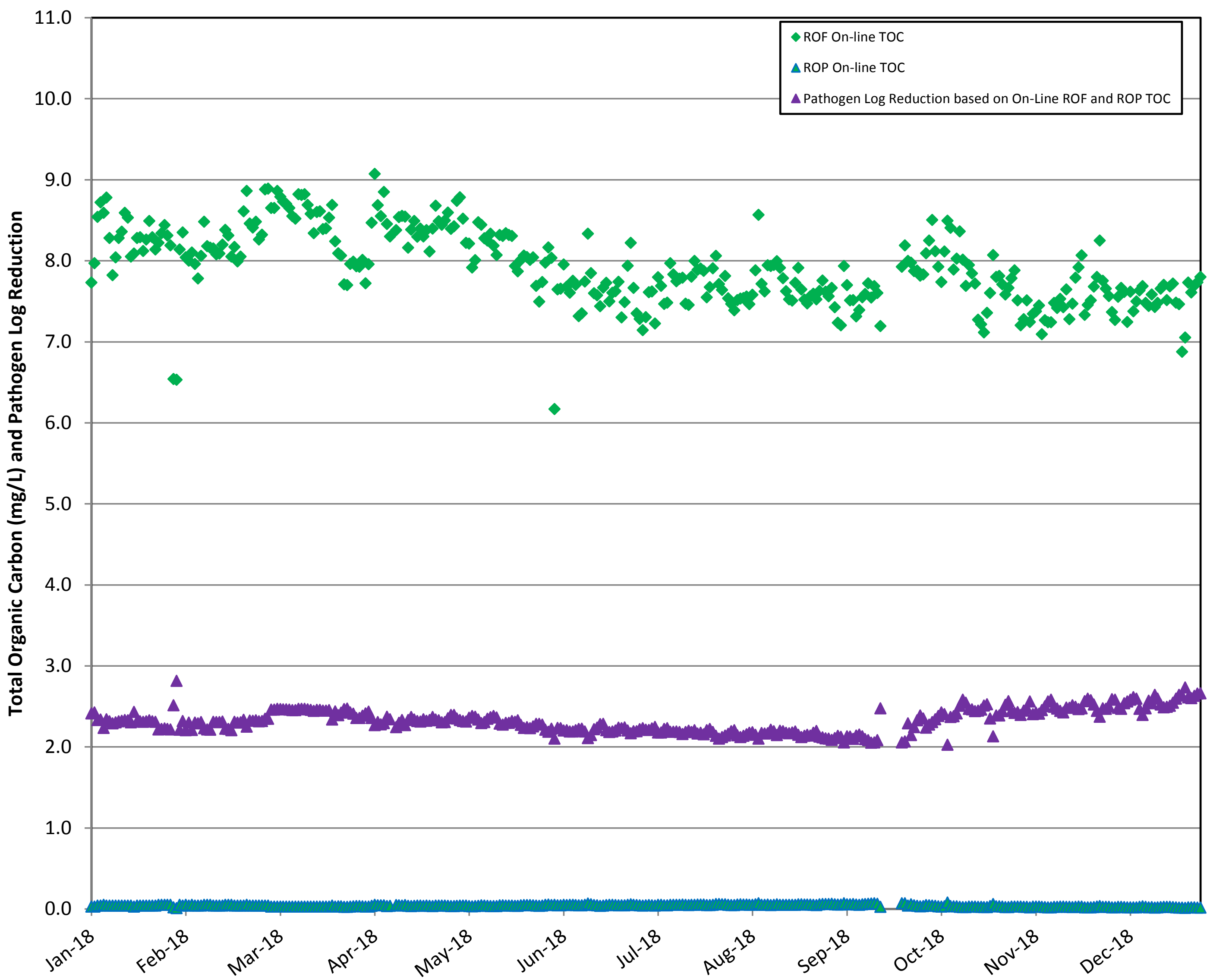


Figure 2-15. TOC and Pathogen Log Reduction Achieved by the RO Process in 2018

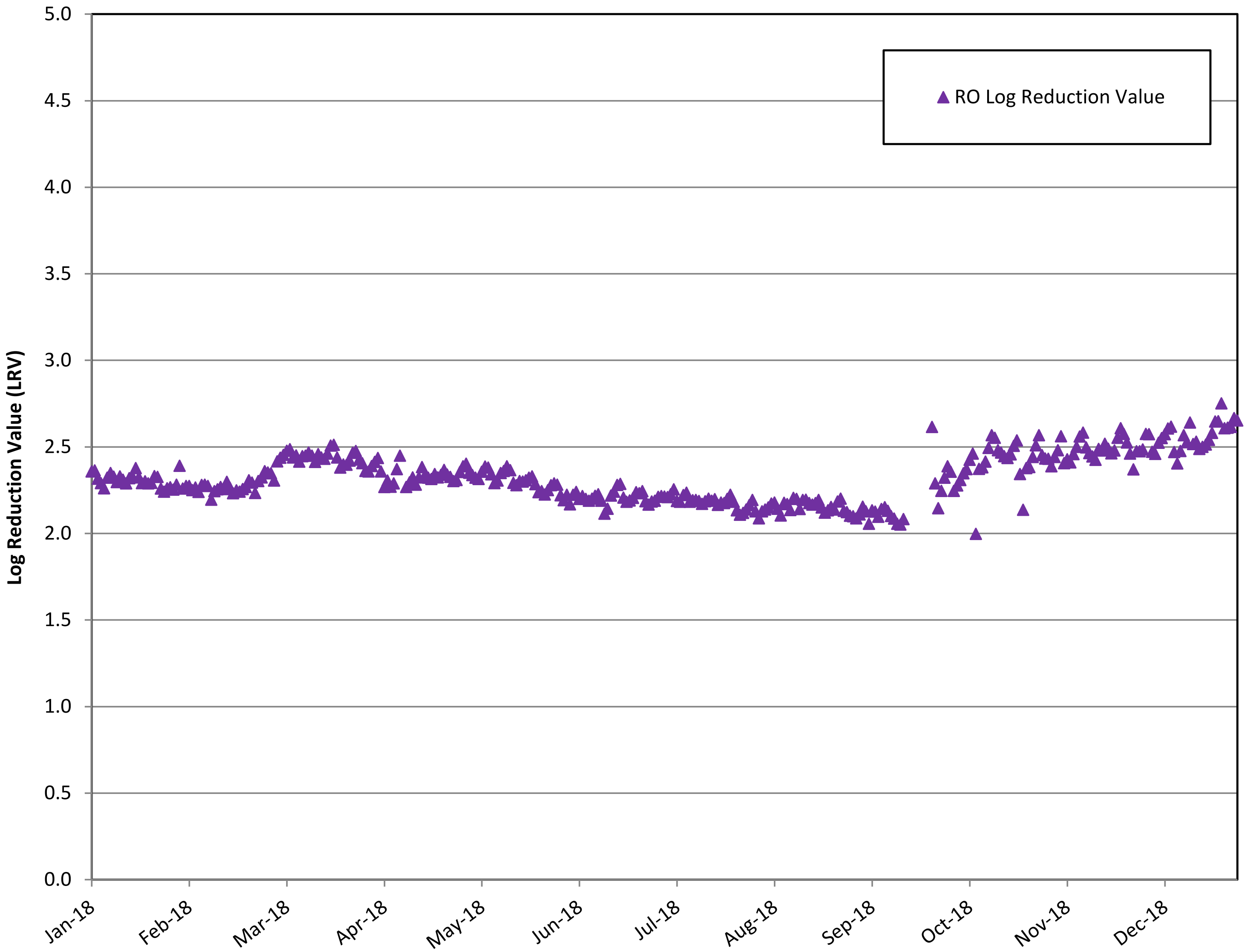


Figure 2-16. RO Log Reduction Values in 2018: *Giardia* Cysts, *Cryptosporidium* Oocysts, and Virus

2.3.7 Ultraviolet/Advanced Oxidation Process Operation and Performance

2.3.7.1 UV/AOP System Operation

The AWPF typically operated with 13 UV trains and with five to six reactors each on-line during 2018, except during low production periods (See Section 2.3.1) when an average of five UV trains with five to six reactors each were in service.

The UV/AOP system operated well and few operational challenges were experienced in 2018. OCWD maintenance staff continued to replace lamps approaching the end of their 12,000-hour guaranteed life, which complied with DDW's mandated limit for each lamp's operational life.

Multiple UV intensity issues were addressed when probes in various reactors periodically indicated low UV intensity readings. Investigations identified four probable causes for the UV intensity issues:

(1) UV lamp #1 outage (lamp #1 is monitored by the UV intensity probe to represent the reactor's overall intensity);
(2) UV intensity probe failure;
(3) UV intensity probe's cover has developed a haze and requires replacement; and
(4) UV intensity probe's viewing window has become dirty or stained and requires replacement.

In March the UV transmittance analyzer reading suddenly rose to 99.9% and then dropped to 70%, which caused all UV trains and reactors to come on-line in the "safe mode" at 100% power. The cause was found to be a failed light bulb in the analyzer, which was replaced and the UV system returned to the normal mode of operation. A new, redundant on-line UVF %UVT analyzer was installed and placed in service on April 11. Following a power outage, when the AWPF was restarted on April 14, the %UVT was less than 95% for approximately 2 hours.

The targeted hydrogen peroxide dose was 3 mg/L until September 29 when it was increased to 4.5 mg/L due to total coliform detections in grab samples of FPW (1 to 9.8 MPN/100 mL). The UVF and UVP hydrogen peroxide residuals were monitored. The FPW continued to have positive coliform results until October 1, despite the higher hydrogen peroxide dosage. Investigations into the FPW positive total coliform results indicated that the source may have been related to the decarbonation system operation and flow balancing while the AWPF production was limited by the GWR Pipeline Rehabilitation Project. The corrective action to disinfect the decarbonation system and downstream post-treatment process resolved the coliform detection issue. After the AWPF's full production rate was resumed, the FPW total coliform counts declined to less than 1 MPN/100 mL.

2.3.7.2 UV/AOP Pathogen Log Reduction Monitoring

The UV/AOP system receives up to 6-log pathogen log reduction credit each for *Giardia* cysts, *Cryptosporidium* oocysts, and enteric virus in accordance with the updated OOP (OCWD, 2018). The on-line UV transmittance analyzer and ballast power level are used to verify the 6-log pathogen removal. By continuously monitoring critical control points, a UV transmittance of at least 95% combined with a minimum UV power level of 74 kW per train ensure that a minimum EED of 0.23 kWh/kgal achieves the required 6-log pathogen reduction.

The UV/AOP system continuously monitors UV transmittance, UV train power levels, calculated UV dose, and EED, which are all critical control points (See Appendix E, Figures E-10, E-11, E-12, and E-13). The pathogen reduction credits achieved by the UV/AOP process are based on these critical control points (OCWD and DDB Engineering, Inc. 2014) with the approval of DDW (CDPH, 2014).

Quarterly reports submitted to DDW in 2018 show that the monthly average calculated EED ranged from 0.25 to 0.29 kWh/kgal, which is greater than the minimum EED of 0.23 kWh/kgal approved by DDW for the UV system.

The on-line UV transmittance during 2018 was above the minimum 95% target, except for two hours on April 14 as noted above. The on-line UV train power was greater than the minimum critical limits for each UV train; the calculated UV dose was always more than two times the minimum UV dose of 111 mJ/cm^2 required for disinfection; and the EED was consistently greater than the minimum 0.23 kWh/kgal for virus reduction. The EED on April 14 was 0.25 kWh/kgal. Furthermore, the log reduction of 1,4-dioxane (Table 2-6) was consistently well above the minimum 0.5-log requirement.

On this basis, the UV/AOP system can be credited for 6-log reduction of *Giardia cysts*, *Cryptosporidium oocysts*, and *viruses* during 2018. Figure 2-17 illustrates the daily LRV credits achieved by the UV/AOP system in 2018.

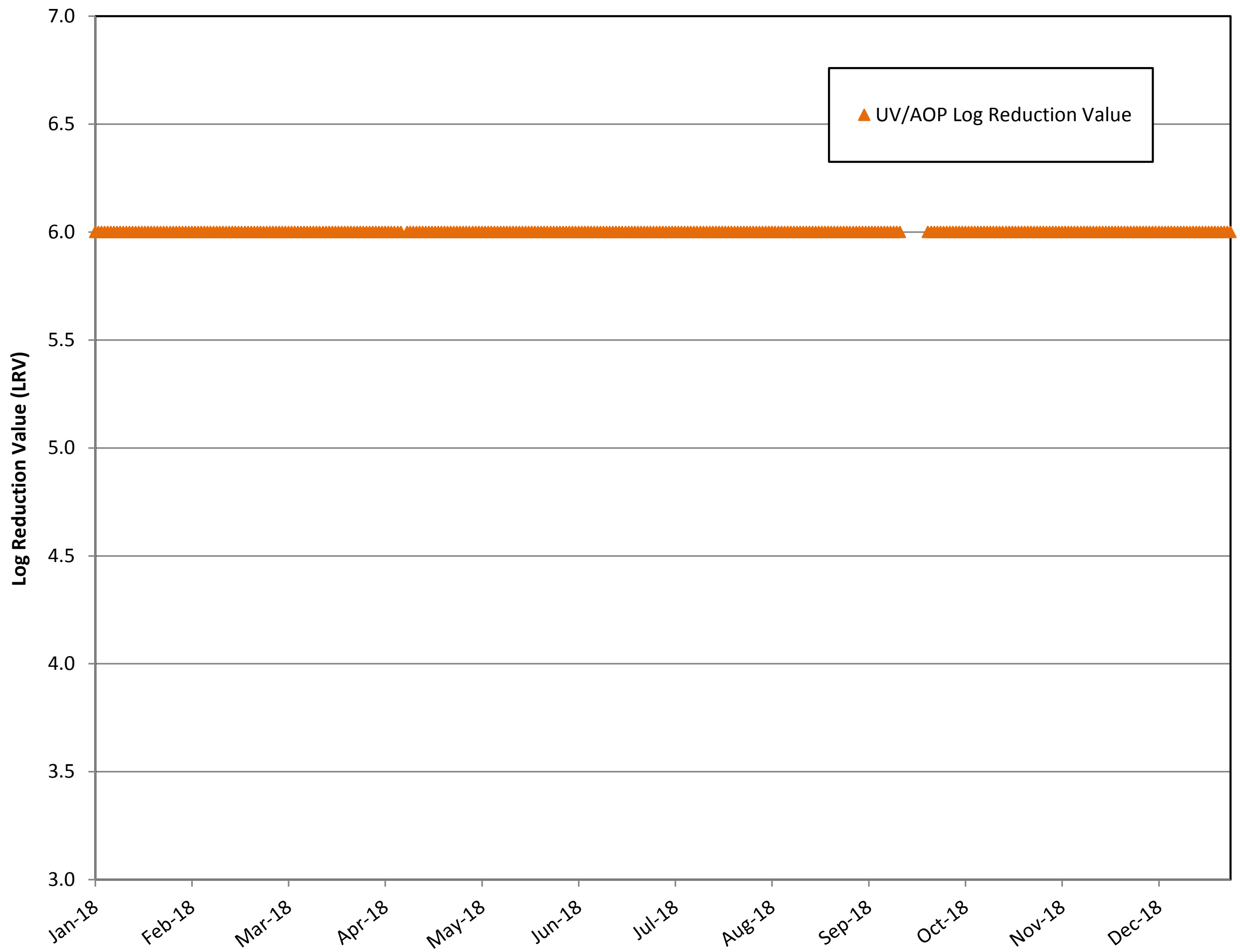


Figure 2-17. UV/AOP Log Reduction Values in 2018: *Giardia* Cysts, *Cryptosporidium* Oocysts and Virus

2.3.8 Decarbonation and Lime System Operation and Performance

Post-treatment systems include decarbonation and lime addition for pH adjustment and corrosivity control prior to recharging the finished product water. Post-treatment is required to stabilize the ROP stream because excess carbon dioxide builds up through the RO system as a result of the lower ROF pH. The excess carbon dioxide drives down the pH of the ROP water. In order to remove excess carbon dioxide, which remains through the closed UV/AOP process, a portion of UVP is sent to decarbonation towers. These towers are filled with plastic media and the water being treated is trickled down over the media while a counter-current fan blows air onto the water, off-gassing, or releasing, the excess carbon dioxide and yielding decarbonated product water (DPW). To ensure that not all of the acidity is removed, a portion of the UVP is bypassed around the decarbonation process and then mixed with the DPW. Adjusting the percentage of UVP that is bypassed around the decarbonation process helps to control the FPW pH and alkalinity.

Lime addition is the final post-treatment step, adding minerals back into the RO/UV/AOP-treated water in the form of calcium and alkalinity to help stabilize the water and reduce its corrosivity.

The Tekkem lime system, which began operation in late 2014, is gravimetric, meaning that it uses weight to ensure the correct lime slurry concentration is maintained. The lime system consists of several components including: bulk storage of hydrated lime in silos; screw feeders moving dry lime to slaker tanks where it is mixed with water before being transferred; slurry aging tanks with loop pumps that convey slurry to a dosing assembly that feeds the saturators; polymer feed system to control lime particle carryover; and saturators acting as solids contact clarifiers to feed saturated lime solution to the FPW channel.

OCWD continued to optimize flow patterns through the decarbonation towers and RO flush supply tanks to stabilize the DPW prior to introducing DPW to the lime stabilization process. Operation of the lime saturators is enhanced by using fully decarbonated DPW because decarbonation expels carbon dioxide which can cause excess calcium carbonate precipitation in the saturators. One RO flush supply tank (A01) receives fully decarbonated DPW; the other RO flush supply tank (A02) receives a blend of decarbonated and bypassed flow. The RO flush tanks discharge to segregated, parallel FPW channels where their respective amounts of lime saturated water are added and mixed. These streams are then blended in the common FPW channel.

The decarbonation bypass flow rate is adjusted for continuous management of the FPW pH (i.e., more bypass decreases the FPW pH; less bypass increases the FPW pH). The lime dose is also reduced to control high FPW pH periods when the decarbonation bypass flow rate cannot be further decreased. The partially decarbonated bypass flow (from RO flush tank A02) is the primary variable used to maintain FPW pH stability; the majority of the lime saturated water is added to the partially decarbonated bypass stream under normal operating conditions.

Adjustments to the ROP/decarbonation bypass flow were made from time to time during 2018 by changing the decarbonation tower feed valve settings; the purpose of these adjustments was to limit back pressure on the UV and RO processes while maintaining the FPW pH in the range of 8.0 to 9.0 (target pH is 8.5). The decarbonation bypass ranged from 60% to 90% in 2018, with the majority of the bypass flow rate falling between 70% and 85% of the AWPF production.

When the AWPF was returned to full production in October 2018, total coliform were detected in the FPW stream as discussed earlier in this section. Investigations found that the likely source was one of the decarbonation towers that had limited flow during the GWR Pipeline Rehabilitation Project. Disinfection and flushing of the decarbonation system resolved the total coliform issues.

The lime dose varied between 20 and 26 mg/L early in 2018; beginning in May and continuing through the end of the year the lime dose was generally kept at 26 mg/L, except for intermittent reductions to 23 to 24 mg/L for FPW pH control. The FPW pH was maintained between 7.3 and 9.0, with an average of 8.0 based on grab samples in 2018.

2.3.9 Summary of GWRS Pathogen Log Reduction Monitoring in 2018

GWRS complies with pathogen reduction requirements using the MF, RO, and UV/AOP processes at the AWPF as discussed above plus underground retention as an environmental barrier. Although allowed by the regulations (CCR, 2014), no credit is taken for secondary treatment.

In addition to the pathogen log reduction achieved by the MF, RO, and UV/AOP systems, GWRS provides a minimum underground retention time prior to withdrawal at the nearest drinking water well of four months via established primary and secondary buffer areas at the Talbert Barrier and Anaheim Forebay that were confirmed by tracer studies; currently all drinking water wells are located outside these buffer areas with four months or more (typically many years) of subsurface travel prior to the extraction of GWRS water recharge or injection. Based on the 1-log virus reduction credit per month of underground retention time allowed by the Title 22 Water Recycling Criteria for groundwater recharge (CCR, 2014), GWRS therefore provides at least 4-log reduction of viruses after surface spreading and direct injection.

Table 2-10 summarizes the minimum daily total pathogen log reduction credits achieved by GWRS in 2018, demonstrating compliance with the Title 22 Water Recycling Regulations (CCR, 2014). Figure 2-18 illustrates the total pathogen log reduction values.

Table 2-10. Summary of GWRS Minimum Pathogen Log Reduction Credits Achieved in 2018

Pathogen	Minimum Log Reduction Requirements[1]	Minimum Daily Pathogen Log Reduction Value Achieved in 2018[2]					
		OCSD Plant 1	MF and Cl_2	RO	UV/AOP	Underground Retention Time	Total[3]
Giardia cysts	10	0	4.2	2.0	6.0	0	12.4
Cryptosporidium oocysts	10	0	4.2	2.0	6.0	0	12.4
Viruses	12	0	0	2.0	6.0	4	12.0

[1] Per Title 22 Water Recycling Criteria (CCR, 2014).

[2] Minimum daily log reduction value achieved by each process in 2018. Daily minimums are not additive. Daily minimums for each process may occur on different dates such that the sum of the daily minimums does not reflect the total daily minimum. (e.g., MF+Cl_2 minimum LRV (4.2-log) occurred on 8/16/18. RO LRV was 2.19-log on 8/16/18.) See Appendix F for details.

[3] Total daily minimum for all processes in 2018. See Appendix F for details.

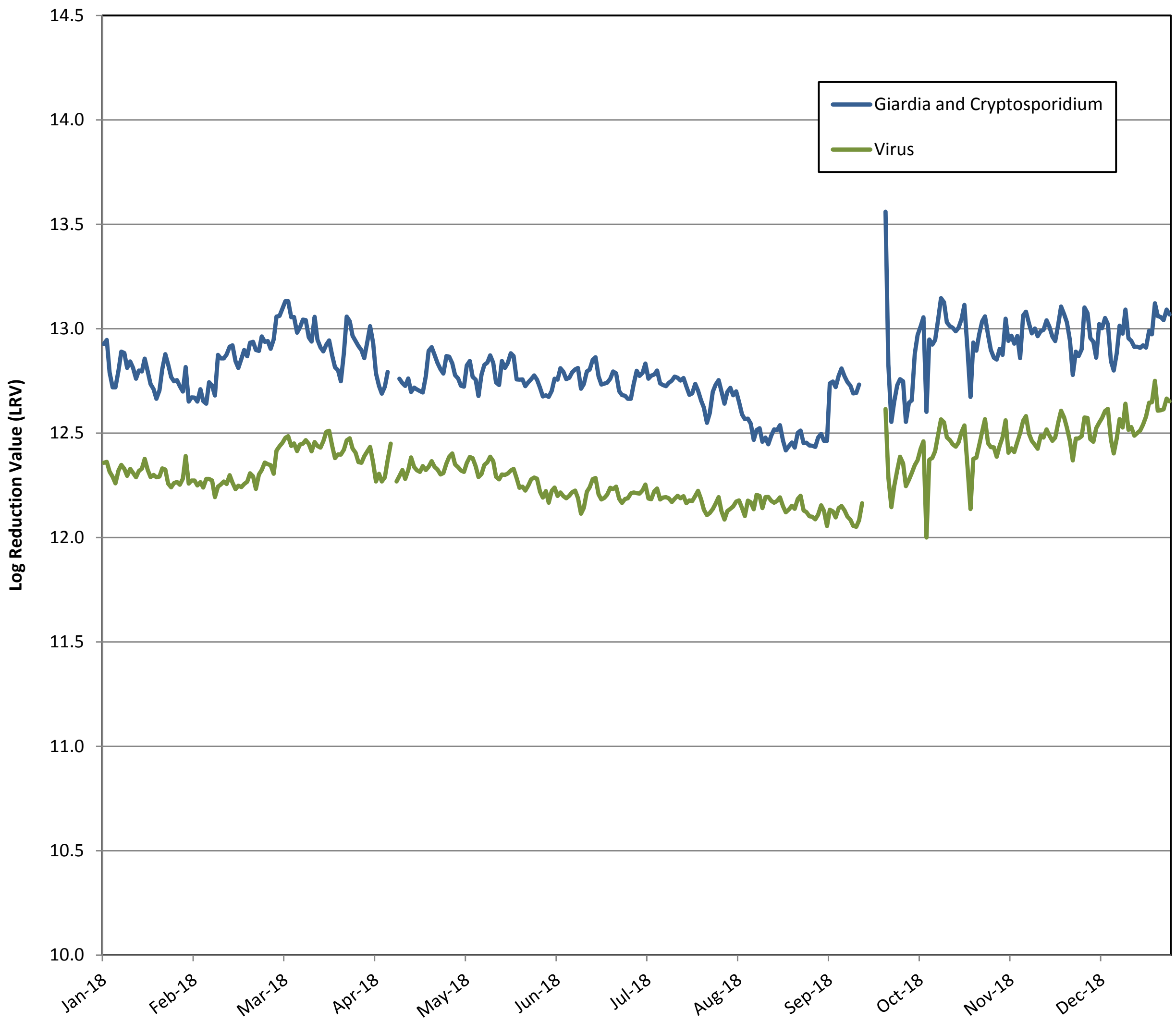


Figure 2-18. Summary of Minimum GWRS Pathogen Log Reduction Credits Achieved in 2018

2.3.10 CEC Monitoring and Compliance with Amended SWRCB Recycled Water Policy

In compliance with the SWRCB amended Recycled Water Policy (SWRCB, 2013), OCWD continued its CEC and surrogate monitoring program during 2018. In December 2018, the SWRCB adopted a new Water Quality Control Policy for Recycled Water (SWRCB, 2018) that will become effective in 2019. In the future, OCWD will modify the GWRS monitoring and reporting program to comply with the new Recycled Water Policy.

Table 2-11 summarizes the monitoring requirements for groundwater recharge projects and presents the results for GWRS. Monitoring of CECs and surrogates must be conducted as follows:

- Health-Based CECs: Monitor at least annually following treatment and prior to release to the aquifer;
- Performance-Indicator CECs: Monitor at least annually prior to RO and following treatment prior to release to the aquifer; and
- Surrogates: Monitor both EC and TOC continuously before and after the RO process.

2.4 Santa Ana River Discharges

The AWPF did not discharge to the Santa Ana River to provide peak flow relief for OCSD at any time during 2018. The emergency peak flow/rain event system was tested on September 24, 2018. During the test the AWPF discharged microfiltered, disinfected effluent (bypassing RO) to the OCSD 66-inch diameter Interplant Line, which conveyed the treated wastewater to the OCSD ocean outfall. No purified recycled water was produced for recharge during the test.

Discharges to the Santa Ana River are covered by a separate permit, RWQCB Order No. R8-2014-0069 NPDES No. CA8000408, entitled *"Waste Discharge Requirements for the Orange County Water District Groundwater Replenishment System Advanced Water Treatment Facility Emergency Discharge to Reach 1 of the Santa Ana River*,*"* which was adopted by the RWQCB on December 12, 2014 (RWQCB, 2014b).

Since completion of the GWRS Initial Expansion in 2015, the AWPF is capable of producing up to 100 MGD of purified recycled water. It is feasible for the AWPF to continue normal purified recycled water production and provide similar emergency peak flow relief for the OCSD ocean outfall without having to discharge to the Santa Ana River. Confirming that capability, the maximum daily purified recycled water production by the AWPF during 2018 reached 100 MGD in January and was greater than 98 MGD in all but one month (September) when the AWPF operated at a reduced production rate for the GWR Pipeline Rehabilitation Project.

Table 2-11. Summary of CEC and Surrogate Monitoring for GWRS in 2018

Constituent	Constituent Group	Relevance/Indicator Type		Required Reporting Limit	OCWD RDL	Units	ROF		ROP		UVP		FPW		Removal Percentages (%) (Between ROF and FPW)			
		Health	Performance[1]				No. Of Samples	Average[2]	No. Of Samples	Average[2]	No. Of Samples	Average[2]	No. Of Samples	Average[2]	Average	Minimum	Maximum	Target[3]
CECs to be monitored[3]																		
Groundwater Recharge Reuse - Subsurface Applications																		
17β-estradiol	Steroid hormones	✓		1	2	ng/L	3	2.2	4	<2	na	na	5	<2	91.0%	0.0%	95.5%	N/A
Caffeine	Stimulant	✓	✓	50	3[4]	ng/L	3	950	4	2.1	na	na	5	1.6	99.8%	98.7%	100.0%	>90%
NDMA	Disinfection byproduct	✓	✓	2	2	ng/L	55	27.9	55	16.3	51	<2	55	<2	94.3%	75.0%	99.7%	>80%
Triclosan	Antimicrobial	✓		50	1	ng/L	3	57.6	4	3.7	na	na	5	<1	99.8%	99.8%	99.9%	N/A
DEET	Personal care product		✓	50	1	ng/L	3	240	4	<1 - <5[5]	na	na	5	<1 - <5[5]	99.9%	99.7%	100.0%	>90%
Sucralose	Food additive		✓	100	100	ng/L	3	35,300	4	<100	na	na	5	<100	100.0%	100.0%	100.0%	>90%
Surrogates to be monitored[3]																		
Groundwater Recharge Reuse - Subsurface Applications																		
Electrical Conductivity[6]				N/A	1	µm/cm	51	1,742	51	36	1	39	355	98	94.3%	91.4%	95.8%	>90%
TOC[6]				N/A	0.05	mg/L	357	7.82	360	0.11	2	0.25	358	0.10	98.8%	96.6%	99.9%	>90%

[1] Performance-indicator CECs are shown for the initial assessment monitoring phase and may be refined for subsequent monitoring phases.
[2] Average of all available 2018 data based on using 10% of the RDL for non-detectable readings unless noted otherwise.
[3] GWRS compliance with the 2013 Recycled Water Policy is based on CEC and surrogate monitoring for subsurface application of RO + AOP treated recycled water. Targets are from Amended Recycled Water Policy, SWRCB Resolution No. 2013-0003, Table 6 (SRWCB, 2013).
[4] All results shown for caffeine analyses used OCWD's CEC Method with an RDL of 3 ng/L.
[5] Two RDLs were used for DEET: OCWD's CEC Method with an RDL of 5 ng/L was used in January 2018. OCWD's CEC Method with an RDL of 1 ng/L was used for all other analyses.
[6] Based on grab sample results. On-line measurements are also taken and available results are reported in Appendix E.
na = Not analyzed
N/A = Not applicable

2.5 Anticipated Changes

Engineering design of the GWRS Final Expansion that will increase the AWPF purified recycled water production capacity from 100 to 130 MGD was completed in late February 2019. The proposed project schedule calls for construction of facilities to begin in fall 2019 and be completed by early 2023.

In order to produce 130 MGD of purified recycled water, the AWPF will require more source water (secondary effluent) from OCSD. Currently, the AWPF effectively receives all of the available secondary effluent from Plant No. 1. To supplement the existing Plant No. 1 source water supply, secondary effluent from OCSD's Plant No. 2 in Huntington Beach will be conveyed to the AWPF. Plant No. 2 treats raw wastewater as well as flows from the Santa Ana Regional Interceptor (SARI). The SARI flows are comprised of comingled raw wastewater, desalter brines, concentrated waste streams, and effluent from the Stringfellow Hazardous Waste Treatment Facility in Riverside County. The GWRS permit precludes flows from the SARI from being used as source water for the AWPF. For this reason, SARI flows will be segregated at Plant No. 2. Plant No. 2's treatment systems will be split into a reclaimable train and a non-reclaimable train. Only reclaimable treated wastewater (non-SARI) will be used as source water for the GWRS Final Expansion. Plant No. 2 reclaimable secondary effluent will be flow-equalized and pumped to the expanded AWPF.

The GWRS Final Expansion will consist of the following components:

- AWPF expansion;
- Plant No. 2 effluent pump station;
- Plant No. 2 flow equalization tank;
- Rehabilitated conveyance pipeline; and
- Plant No. 2 headworks modification to segregate SARI flows.

3. TALBERT BARRIER OPERATIONS

In 2018, Talbert Barrier operations focused on optimizing injection of the purified recycled water supply both for preventing seawater intrusion and replenishing the basin. Operation of the barrier injection facilities is presented in this section:

- Injection water sources;
- Injection water volumes; and
- Barrier operations.

3.1 Injection Water Sources

Two types of water were injected at the Talbert Barrier during 2018:

1. Purified recycled water produced by the AWPF; and
2. Imported potable water from the MWD OC-44 turnout delivered via the City of Huntington Beach.

A third source, potable water comprised of a blend of groundwater and imported water from the City of Fountain Valley (FV), was available but not used. The injection supply was predominately purified recycled water produced by the AWPF. Negligible volumes of potable water were used periodically during AWPF shutdowns.

OC-44 potable water was supplied via a reduced pressure principle backflow prevention device and a pressure reducing valve into the barrier pipeline supplying the injection wells. Limited amounts of OC-44 potable water were used on 23 days in 2018, primarily to keep the barrier pipeline pressurized and to trickle a small amount of injection into selected wells for operational purposes. OC-44 potable water was used as summarized below and detailed in Appendix D:

January	2 days	Power outage
February	1 day	Process interruption
March	1 day	Minor use
April	6 days	Power outage, AWPF maintenance, and OCSD operations
May	--	--
June	2 days	Power outage and minor use
July	4 days	Power outage
August	3 days	Power outage
September	2 days	OCSD operations and AWPF maintenance
October	2 days	AWPF post-treatment chlorination project and power outage
November	--	--
December	--	--

The highest daily usage of OC-44 potable water was 1.27 MG on August 1 due to an unexpected SCE power outage, which caused the AWPF to cease production.

3.2 Injection Water Flow Rates and Volumes

The volume of water injected at the Talbert Barrier in 2018 is presented below and compared with historical barrier injection.

3.2.1 2018 Injection Water Flow Rates and Volumes

The total annual average daily flow rate of all sources (purified recycled water, OC-44 potable water and FV potable water) injected at the Talbert Barrier in 2018 was 22.2 MGD. On a volumetric basis, a total volume of approximately 8,104 MG (24,870 AF) of purified recycled water and OC-44 potable water was injected at the Talbert Barrier during 2018.

Figure 3-1 illustrates the flow rates and volumes of each of the water sources injected at the Talbert Barrier during 2018. As noted above, the vast majority (99.91%) of barrier injection, approximately 22.18 MGD on average (rounded to 8,097 MG or 24,848 AF), was GWRS purified recycled water. Only 0.02 MGD on average (rounded to 7.4 MG or 22.6 AF) of OC-44 potable water was injected at the barrier during 2018. No FV potable water was injected during the year.

Table 3-1 summarizes the monthly average daily flow rates and quantities of purified recycled water and potable water injected at the barrier, and Figure 3-2 illustrates the monthly 2018 injection water supply average daily flow rates and volumes. As discussed above, potable water was used when the AWPF was temporarily off-line due to brief shutdowns to keep the barrier pipeline pressurized until purified recycled water production resumed.

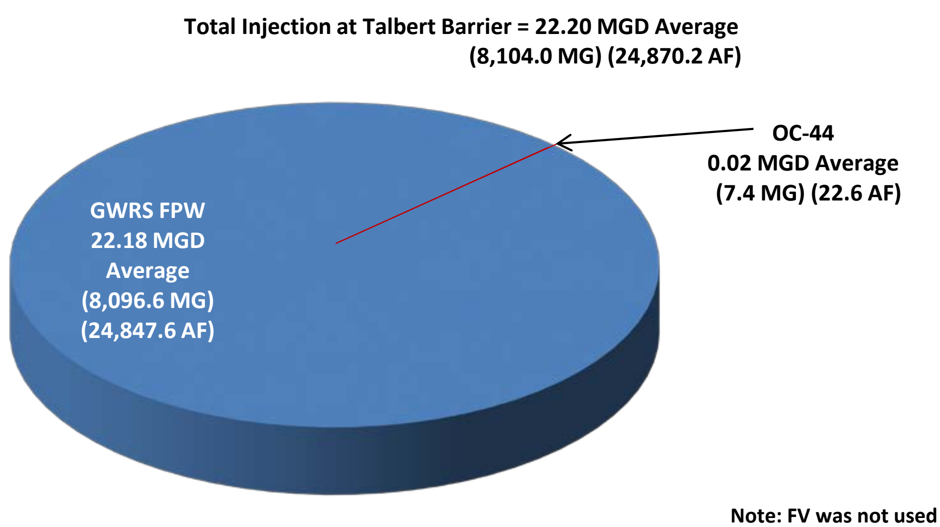


Figure 3-1. 2018 Talbert Barrier Injection Water Sources: Flow Rates and Volumes

Table 3-1. 2018 Monthly Injection Water Quantity at Talbert Barrier

Month	GWRS FPW		OC-44		FV		Total Injection Flow Rate and Volume			
	(Avg. MGD)	(MG)	(Avg. MGD)	(MG)	(Avg. MGD)	(MG)	(Avg. MGD)	(MG)	(AF)	(m^3)
January	10.55	327.06	0.01	0.32	0.00	0.00	10.56	327.38	1,004.70	1,239,275
February	15.20	425.55	0.00	0.03	0.00	0.00	15.20	425.58	1,306.05	1,610,985
March	16.53	512.40	0.00	0.00	0.00	0.00	16.53	512.40	1,572.51	1,939,658
April	16.61	498.36	0.06	1.76	0.00	0.00	16.67	500.11	1,534.80	1,893,142
May	22.29	690.85	0.00	0.00	0.00	0.00	22.29	690.85	2,120.15	2,615,170
June	23.51	705.43	0.01	0.22	0.00	0.00	23.52	705.65	2,165.55	2,671,171
July	27.50	852.46	0.04	1.23	0.00	0.00	27.54	853.69	2,619.87	3,231,558
August	29.49	914.09	0.09	2.65	0.00	0.00	29.57	916.74	2,813.38	3,470,247
September	20.05	601.39	0.03	0.88	0.00	0.00	20.08	602.27	1,848.29	2,279,827
October	29.88	926.42	0.01	0.31	0.00	0.00	29.89	926.73	2,844.02	3,508,049
November	28.54	856.18	0.00	0.00	0.00	0.00	28.54	856.18	2,627.52	3,241,002
December	25.37	786.42	0.00	0.00	0.00	0.00	25.37	786.42	2,413.43	2,976,920
Total	**22.13**	**8,096.61**	**0.02**	**7.38**	**0.00**	**0.00**	**22.15**	**8,103.99**	**24,870.25**	**30,677,004**

Abbreviations:

GWRS FPW	Groundwater Replenishment System Finished Product Water (Purified Recycled Water)
OC-44	MWD Turnout OC-44 via Huntington Beach (Imported Potable Water)
FV	City of Fountain Valley (Potable Water - groundwater and imported water)
MGD	Million Gallons per Day shown as an average (avg.) flow rate
MG	Million Gallons
AF	Acre-feet
m^3	Cubic Meters

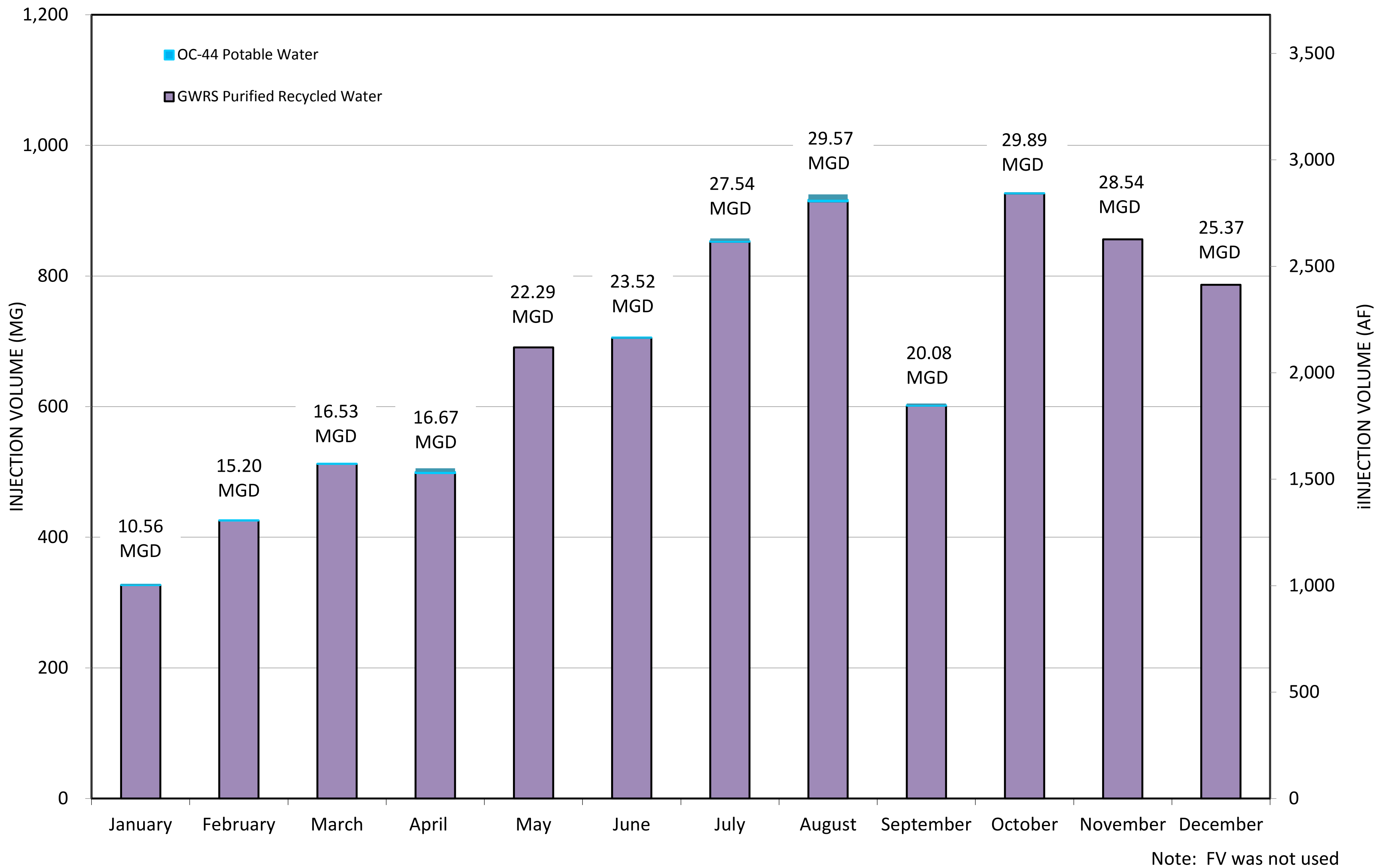


Figure 3-2. 2018 Monthly Injection Water Quantity at Talbert Barrier

3.2.2 Historical Injection Water Quantity

OCWD has operated the Talbert Barrier, injecting recycled water and potable water, since 1976. As discussed in Section 1, OCWD has historically injected water from six sources at the Talbert Barrier. Recycled water produced by WF-21, IWF-21, and the GWRS AWPF has been injected at the barrier. Diluents injected at the barrier have included deep well groundwater, potable water from the City of Fountain Valley, and imported potable water from the MWD OC-44 turnout.

Table 3-2 and Figure 3-3 summarize the history of annual quantities of water from the six available sources that have been injected at the Talbert Barrier since the OCWD water reclamation projects began operation. In the 11 years since GWRS has been in operation, the 24,489 AF of total injection for 2012 represented the lowest annual volume injected into the Talbert Barrier; in comparison, the 24,870 AF of total injection in 2018 was only slightly greater than the 2012 minimum (24,489 AF) and significantly less than the highest annual total injection in 2010 (38,531 AF). The maintenance of protective groundwater elevations against seawater intrusion drives the demand for injection water at the Talbert Barrier, and these demands can vary seasonally and annually based on both the Basin overdraft condition and local groundwater pumping demands. Overall, the annual injection volumes from 2008 through 2018 were significantly greater than pre-GWRS injection volumes.

The injection wells were supplied high quality recycled water by WF-21 from 1976 to 2004. Purified recycled water from IWF-21 was injected at the Talbert Barrier from 2004 to 2006. Injection of GWRS purified recycled water began in January 2008. The specific treatment processes of these water reclamation facilities differed as follows:

1. **AWT water** – recycled water consisting of secondary effluent treated by lime clarification, ammonia stripping, recarbonation, filtration, GAC, and chlorination (all WF-21 treatment processes except RO); AWT water produced by WF-21 was injected from 1976 to 2000.

2. **RO product water** – recycled water consisting of AWT product water that bypassed GAC and was treated instead by RO at WF-21 from 1977 until 2004, and later recycled water produced by IWF-21 from 2004 to 2006. After mid-1981, GAC was not used for RO pretreatment because the fine carbon particles clogged the RO membranes and RO demonstrated superior organics removal compared to GAC. From 1981 until 2001, the WF-21 RO treatment train was comprised of lime clarification, recarbonation, chlorination, filtration, and RO. In 2001, a UV/AOP unit was added downstream of the RO process, replacing chlorination for disinfection and adding treatment for the removal

Table 3-2. Historical Injection Water Quantity at Talbert Barrier

Year	Injection Quantity								Q-10 [1] or GWRS Average Quality [4] (mg/L)		OC-44 [2] Average Quality [4] (mg/L)		FV [3] Average Quality [4] (mg/L)		Total Flow-Weighted Average Quality [4] (mg/L)	
	AWT (MG)	RO (MG)	GWRS (MG)	Well (MG)	FV (MG)	OC-44 (MG)	Total (MG)	Total (AF)	Cl⁻	TDS	Cl⁻	TDS	Cl⁻	TDS	Cl⁻	TDS
1976	290.15	0.00		542.80			832.95	2,556.06								
1977	1,192.30	235.30		2,875.30			4,302.90	13,204.25	80	415					80	415
1978	1,760.60	1,368.20		1,575.40			4,704.20	14,435.71	103	442					103	442
1979	1,695.20	1,338.50		1,487.00			4,520.70	13,872.61	78	400					78	400
1980	258.50	1,311.00		1,054.30			2,623.80	8,051.62	57	231					57	231
1981	90.60	1,107.30		1,344.30			2,542.20	7,801.21	50	204					50	204
1982	4.60	1,179.90		1,166.90			2,351.40	7,215.71	47	174					47	174
1983	0.00	1,220.56		1,173.21			2,393.77	7,345.73	37	154					37	154
1984	231.71	313.22		488.40			1,033.33	3,170.97	79	339					79	339
1985	476.18	568.12		577.26			1,621.56	4,976.06	103	389					103	389
1986	630.73	519.38		772.42			1,922.53	5,899.64	102	379					102	379
1987	408.50	469.46		590.04			1,468.00	4,504.83	93	366					93	366
1988	968.37	1,187.03		1,213.41			3,368.81	10,337.82	89	319					89	319
1989	949.27	1,098.75		1,814.02			3,862.04	11,851.39	87	342					87	342
1990	785.13	1,267.19		1,837.44			3,889.76	11,936.45	90	320					90	320
1991	1,084.19	1,226.75		2,967.16			5,278.10	16,196.83	109	380					109	380
1992	1,257.92	1,338.84		2,413.57			5,010.33	15,375.13	89	336					89	336
1993	860.11	1,494.87		2,026.14			4,381.12	13,444.28	85	328					85	328
1994	157.31	947.22		896.85			2,001.38	6,141.61	50	248					50	248
1995	203.47	655.98		740.20			1,599.65	4,908.82	49	243					49	243
1996	56.73	741.22		521.84			1,319.79	4,050.02	26	151					26	151
1997	16.40	690.27		545.54			1,252.21	3,842.64	22	129					22	129
1998	5.44	776.08		578.51			1,360.03	4,173.51	23	127					23	127
1999	450.08	1,327.24		1,191.98			2,969.30	9,111.85	57	239					57	239
2000	207.50	771.75		1,863.75			2,843.00	8,724.27	37	233					37	233
2001		1,071.62		2,166.06	1,350.83		4,588.51	14,080.70	33	252					33	252
2002		1,367.55		1,180.56	1,576.61		4,124.72	12,657.47	34	226					34	226
2003		1,053.38		751.59	1,591.85	33.73	3,430.55	10,527.28	38	237	98	374			39	238
2004 [5]		935.30		421.22	1,321.64	2,559.46	5,237.62	16,072.61	32	230	93	390			62	308
2005		1,238.02		4.84	953.44	2,703.43	4,899.73	15,035.73	24	177	78	464			54	336
2006 [6]		663.01			551.37	1,658.75	2,873.13	8,816.73	19	127	67	386			47	276
2007					0.00	2,245.52	2,245.52	6,890.80			89	474			89	474
2008 [7]			7,247.08		0.00	1,712.25	8,959.33	27,493.37	4	40	97	560			21	140
2009			11,011.23		0.00	55.21	11,066.44	33,959.43	5	46	97	653			5	49
2010			12,465.25		0.00	44.62	12,509.86	38,393.98	4	43	89	532			5	45
2011			8,384.84		0.15	2.27	8,387.26	25,741.30	5	43	83	539	54	391	5	44
2012			7,978.15		0.09	0.97	7,979.21	24,488.96	7	45	83	479	67	410	7	45
2013			9,804.46		0.00	1.83	9,806.30	30,096.46	7	50	84	559			7	50
2014 [8]			10,734.25		0.00	2.46	10,736.71	32,949.80	7	54	na	na			7	54
2015			11,820.22		0.00	5.52	11,825.74	36,291.90	11	64	na	na			11	64
2016			11,288.83		0.36	2.39	11,291.58	34,652.64	7	57	na	na	na	na	7	57
2017			8,554.73		0.00	5.06	8,559.78	26,269.04	5	50	na	na			5	50
2018			8,096.61		0.00	7.38	8,103.99	24,870.25	5	53	na	na			5	53
TOTALS	**14,040.99**	**29,483.01**	**99,289.03**	**36,782.01**	**7,346.34**	**11,033.46**	**197,974.85**	**607,522.68**								

Abbreviations:

- AWT - Granular Activated Carbon Effluent disinfected using chlorine (Recycled Water)
- RO - RO Effluent disinfected using chlorine prior to March 2001 and using UV/AOP from March 2001 until January 2004
- GWRS - Groundwater Replenishment System Finished Product Water (Recycled Water)
- Well - Deep Well Water (Colored Groundwater)
- FV - City of Fountain Valley Potable (Domestic) Water (groundwater and potable water)
- OC-44 - MWD Turnout OC-44 Potable Imported Water (via City of Huntington Beach and Southeast Barrier Pipeline)
- Cl⁻ - Chloride
- TDS - Total Dissolved Solids
- mg/L - milligrams per liter
- MG - million gallons
- AF - acre-feet
- na - not analyzed (because blending is no longer required)

Notes:

1 Q-10 water was mixed in the WF-21 and IWF-21 blending reservoir from multiple sources prior to injection into the barrier: AWT, RO, Well and FV.

2 OC-44 water is provided directly into the barrier (via backflow prevention and pressure reduction devices).

3 FV water is provided directly into the barrier (via backflow prevention device and a pressure reduction valve).

4 Chloride and TDS concentrations shown for each year are based on a 12-month flow-average of available samples.

5 WF-21 ceased operation on January 15, 2004.

6 IWF-21 ceased operation on August 8, 2006.

7 GWRS began operation on January 10, 2008.

8 Starting in 2014, injection water quality was effectively the same as GWRS water because only limited volumes of OC-44 and FV water were used.

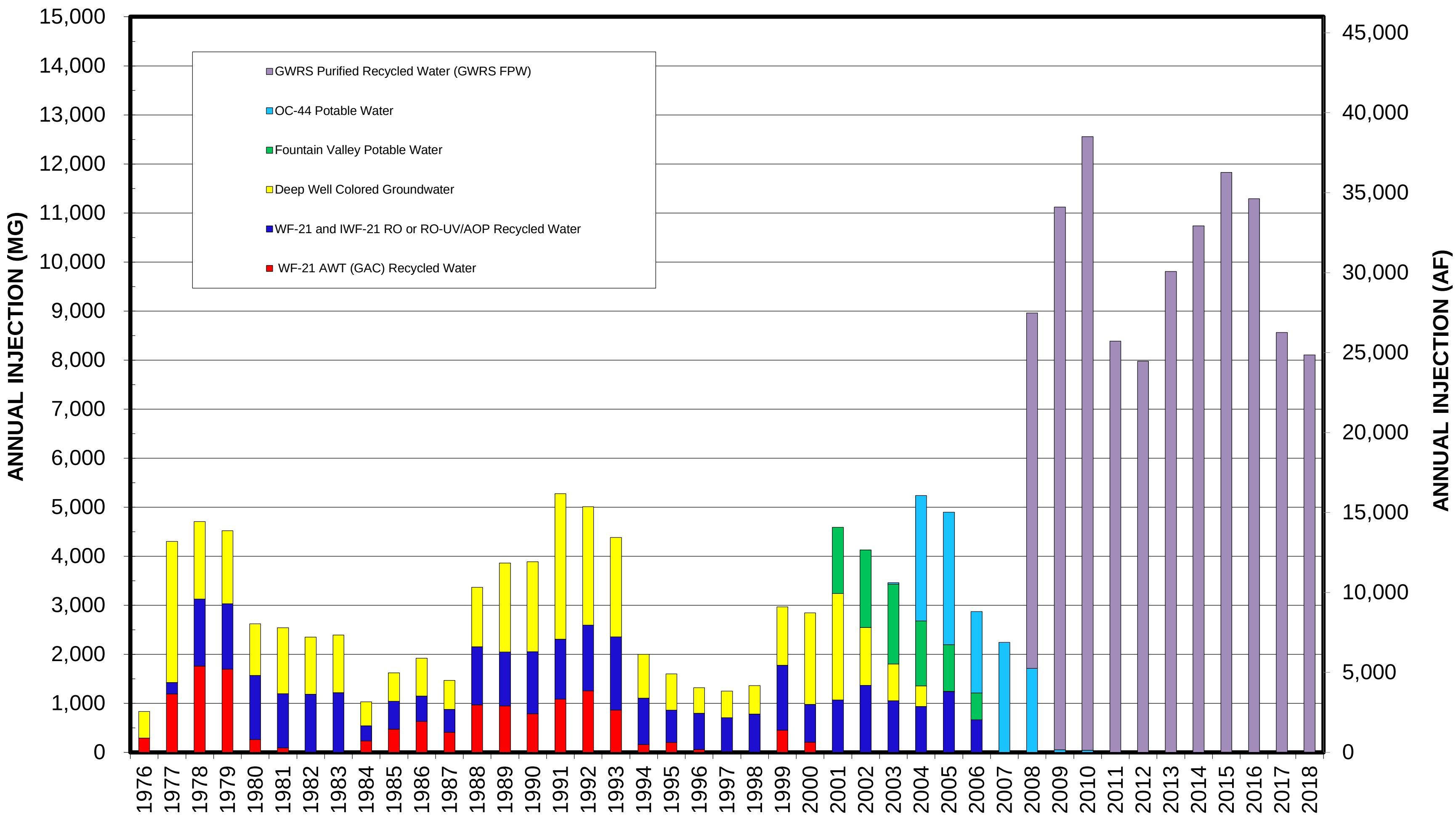


Figure 3-3. Historical Injection Water Quantity at Talbert Barrier

of low molecular weight organics. From 2004 until 2006, MF replaced the pretreatment train upstream of RO when the IWF-21 RO product water was supplied to the barrier.

3. **GWRS water** – purified recycled water consisting of secondary effluent treated by MF, RO, UV/AOP, decarbonation and lime stabilization (GWRS AWPF FPW, or purified recycled water); injection of GWRS water produced by the AWPF began in January 2008.

The three diluent water sources that have been historically injected at the barrier are listed below:

1. **Deep Well water** – groundwater that is low in salts but high in color and TOC and produced from deep aquifers that are not susceptible to seawater intrusion; deep well water was injected from 1976 to 2005.

2. **Potable water from the City of Fountain Valley** – variable blend of groundwater and potable imported water that was injected primarily from 2001 to 2006. Since then, small amounts of potable water from the City of Fountain Valley have been sporadically used to maintain pressure in the injection conveyance system when purified recycled water was unavailable during brief periods when the AWPF was off-line. A negligible volume of this water source was used during 2011, 2012, and 2016. None was used in 2018.

3. **Potable water from the MWD OC-44 turnout** – imported water from the MWD OC-44 turnout delivered via the City of Huntington Beach that was injected from late 2003 through 2018. As shown in Table 3-2, only minor amounts of MWD OC-44 water (less than 8 MG/year) have been used over the last eight years, primarily for maintaining pressure in the barrier pipeline during AWPF shutdowns. In general, this supplemental source has been preferred over using the City of Fountain Valley potable connection.

3.3 Barrier Operations

Injection of purified recycled water produced by the AWPF began on January 10, 2008. During 2018, AWPF purified recycled water was the primary injection water source, comprising 99.91% of the water injected. Potable imported water from the MWD OC-44 connection was used as back-up injection supplies during AWPF and Barrier Pump Station (BPS) shutdowns and for refilling and pressurizing the barrier distribution system just prior to plant startup after such shutdowns. During calendar year 2018, the MWD OC-44 connection was used for brief periods on 23 different days during or immediately following AWPF shutdowns, which were primarily related to preventive maintenance activities, SCE power interruptions, and other brief events. For both the OC-44 and FV connections over the last ten years, insignificantly small amounts of water have been used for filling and pressurizing the barrier pipeline, as shown by the small annual totals discussed in Section 3.2.2.

Since the GWRS came on-line in 2008, barrier injection was at its lowest in 2012 (Figure 3-3) due to relatively high groundwater conditions throughout the Basin, as well as in the Talbert Gap area where groundwater levels were effectively maintained at or above protective elevations without becoming overly high or above ground surface during that year. Annual barrier injection was steadily increased from 2012 through 2015 because of increasingly lower Basin groundwater level conditions (increased accumulated overdraft) during that time. Barrier injection decreased slightly in 2016 but remained relatively high, after which barrier injection in 2017 decreased significantly due to higher Basin conditions resulting from above average rainfall in 2016-17 and a basin-wide In-Lieu Program from July 2017 through January 2018. During an In-Lieu Program, local retail water agencies take MWD water in place of groundwater production, thereby increasing groundwater stored in the Basin. Barrier injection in 2018 decreased by 5.3% from the prior year to 24,870 AF. This decrease in barrier injection was primarily due to a planned one-week AWPF shutdown in September 2018 and continued high groundwater conditions directly following injection adjustments: (1) reduced injection during the winter and spring months on the west end of the barrier to prevent groundwater levels from increasing unnecessarily above protective elevations so as to prevent shallow groundwater issues, and (2) reduced injection during November and December in response to reduced Basin pumping demands resulting from colder weather and early season rainfall.

From June 2017 to June 2018, groundwater storage increased by 51,000 AF despite below-average rainfall during that period. The increased groundwater storage primarily resulted from participation in the In-Lieu Program from July 2017 through January 2018, in which 73,109 AF of potable imported water was purchased by Basin producers instead of pumping that amount of water from the Basin. This resulted in a significant rise in groundwater levels throughout the Basin in the Principal aquifer and a milder rise in the Shallow aquifer. In response to the higher groundwater levels near the coast, Talbert Barrier injection into the Shallow aquifer and uppermost Principal aquifer zones was reduced during the winter and spring months of 2018 by placing most of the wells along the western half of the barrier off-line during that time so as to maintain protective elevations seaward of the barrier while preventing any shallow groundwater issues, especially in the low-lying coastal area of Huntington Beach near Central Park where ground surface is at or slightly below sea level. In the Talbert Barrier area, Principal aquifer groundwater levels rose 10 to 20 feet from June 2017 to June 2018, whereas Shallow aquifer WLs remained relatively stable at protective elevations.

During the second half of 2018, groundwater levels experienced some decline as pumping increased throughout the summer months of July through September, allowing an increase in barrier injection during that time but still with some injection wells off-line on stand-by since they were not needed to maintain protective elevations. A planned one-week AWPF shutdown in September reduced the overall injection for that month (Figure 3-2). Overall, due to the relatively high Basin storage conditions, a relatively low amount of annual barrier injection was required during 2018 to maintain protective elevations seaward of the barrier, as discussed in Section 4.

Operation of the barrier was consistent and stable during 2018 due to a constant, reliable AWPF water supply and on-going rehabilitation and backwashing of the injection wells. As discussed in the previous section, there were 21 days in which an insignificant amount of potable water from the MWD OC-44 connection was used due to brief AWPF shutdowns. During 2018, there were only two AWPF shutdowns that lasted longer than one day: a planned 58-hour shutdown on April 9-11 and a planned one-week shutdown on September 18-25, both of which were for scheduled maintenance activities and repairs. Potable OC-44 water was used to keep the barrier pipeline full and pressurized during this time (with barrier injection wells off-line), so that this potable water was the first water injected when the AWPF and barrier injection wells came back on-line.

As shown in Table 3-1 and on Figure 3-2, monthly injection flow rates during 2018 ranged from a low daily average flow rate in January of 10.56 MGD (annual low January volume of 327.38 MG or 1,004.70 AF) to a high daily average flow rate in October of 29.89 MGD (annual high October volume of 926.73 MG or 2,844.02 AF). Typically, the amount of injection required to achieve and maintain protective groundwater elevations is greater in the summer months and lesser in the winter months when municipal pumping is considerably less. This was generally the case during 2018, except for September in which the monthly injection volume was less due to the one-week AWPF and barrier shutdown.

Operationally, injection was intermittently maintained at relatively high rates at most of the Talbert Barrier injection wells during 2018. Many of the injection wells were taken off-line and placed on stand-by for several months during 2018 because those wells were not needed to maintain protective elevations for seawater intrusion control and to prevent shallow groundwater issues. Taking injection wells off-line for these reasons usually occurs in the winter and early spring months when groundwater levels are typically higher, and such was the case during 2018, with several wells remaining off-line January through June. A few injection wells remained off-line on stand-by even during the summer months, and finally some injection wells were also taken off-line in November and December in response to reduced pumping demands as the season cooled along with early rainfall during that time.

In some years when injection requirements are greater due to lower groundwater levels, a few injection wells must be taken off-line during the peak injection summer months because of hydraulic restrictions or bottlenecks in the barrier pipeline. During 2018 however, no injection wells were taken off-line due to hydraulic restrictions or pipeline bottlenecks. When Talbert Barrier injection is reduced due to high groundwater elevations, the surplus GWRS water can generally be pumped up to K-M-M-L Basins for surface recharge to maintain the AWPF operating at or near full capacity. From August 23 to October 2 of 2018, Reach I of the GWR Pipeline was shut down for epoxy lining the interior of the mortar-lined pipe. Therefore, AWPF flows were reduced during this time with GWRS flows only going to the Talbert Barrier.

3.3.1 Vertical Distribution of Injection

Figure 3-4 shows the monthly amount of injection into each aquifer zone. For operational reasons related to the hydrogeology of the area, the aquifer zones that receive injection have been grouped into three major categories:

- Shallow Zone: Talbert and Alpha aquifers;
- Intermediate Zone: Beta, Lambda, Omicron, and Upper Rho aquifers; and
- Deep Zone: Lower Rho and Main aquifers.

These aquifers are described in more detail in Section 4 – Groundwater Monitoring at the Talbert Barrier. The shallow and intermediate zones are both susceptible to seawater intrusion. The 23 legacy injection well sites only inject into the shallow and intermediate zones. The majority of the modern injection well sites constructed since 2000 inject into all three zones, with deep zone injection being primarily intended for replenishing the Basin rather than for seawater intrusion control. Therefore, injection into the deep zone is operationally considered to be lowest priority for when surplus injection supply and pipeline capacity are available over and above what is needed for seawater intrusion control in the shallow and intermediate zones.

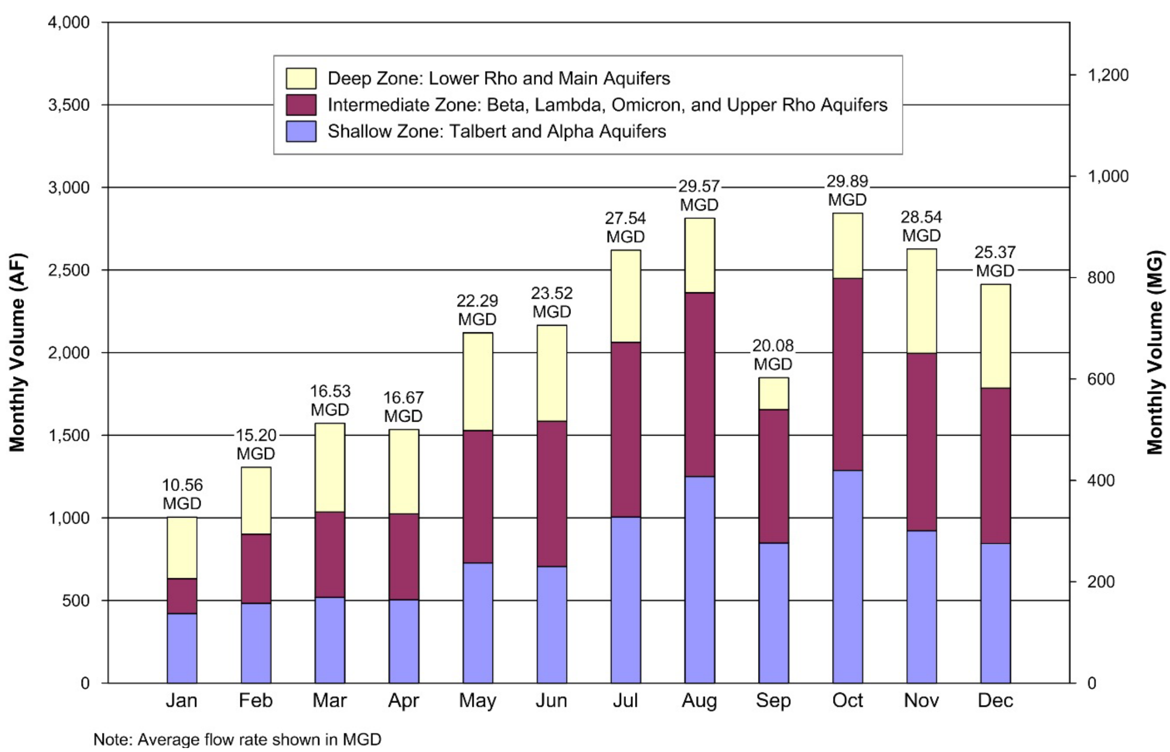


Figure 3-4. 2018 Talbert Barrier Monthly Injection Quantity by Aquifer Zone

As shown on Figure 3-4, 2018 monthly injection into the combined shallow and intermediate zones steadily increased from a low of approximately 200 MG (700 AF) in January to approximately 750 MG (2,350 AF) in August. September injection was much lower due to the planned one-week AWPF and barrier shutdown. Injection into the shallow and intermediate zones reached a maximum of approximately 800 MG (2,450 AF) in October before steadily declining in November and December. The lower injection amounts during both the January through April and November through December periods were attributable to higher groundwater elevations in the shallow and intermediate zones during those months in which several shallow zone modern injection wells and legacy wells were kept off-line since they were not needed to maintain protective elevations seaward of the barrier for seawater intrusion control. These wells were also kept off-line to prevent groundwater elevations from becoming excessively high in low-lying areas historically subject to shallow groundwater conditions. During the May through October period, more of the injection wells were on-line and injection into the combined shallow and intermediate zones was increased to keep pace with lower or falling groundwater levels as pumping increased during these warmer months.

As shown on Figure 3-4, injection into the deep zone for Basin replenishment remained somewhat constant from month to month during 2018 as ample pipeline capacity existed most months to maximize the lower priority deep zone injection wells due to the lower shallow and intermediate zone injection totals. Deep zone groundwater elevations are typically lower than in the shallow and intermediate zones, and therefore, deep zone injection rates can often be maintained year-round. Deep zone injection was less during September due to the planned one-week AWPF and barrier shutdown.

During 2018, approximately 38% of all injection was into the shallow zone, 38% into the intermediate zone, and 24% into the deep zone, as shown on Figure 3-5. Therefore, approximately 76% of barrier injection during 2018 was collectively into the shallow and intermediate zones for the primary purpose of seawater intrusion control, slightly reduced from the 78% the prior year. Therefore, deep zone injection was 2% greater than the prior year. During the first half of 2018, over 20 shallow and intermediate zone injection wells were off-line due to the unusually high winter and spring groundwater levels following the In-Lieu Program, while all deep zone injection wells were on-line during that time. As mentioned previously, deep zone injection can typically be maintained year-round during relatively high groundwater conditions due to its groundwater levels being generally lower than in both the shallow and intermediate zones.

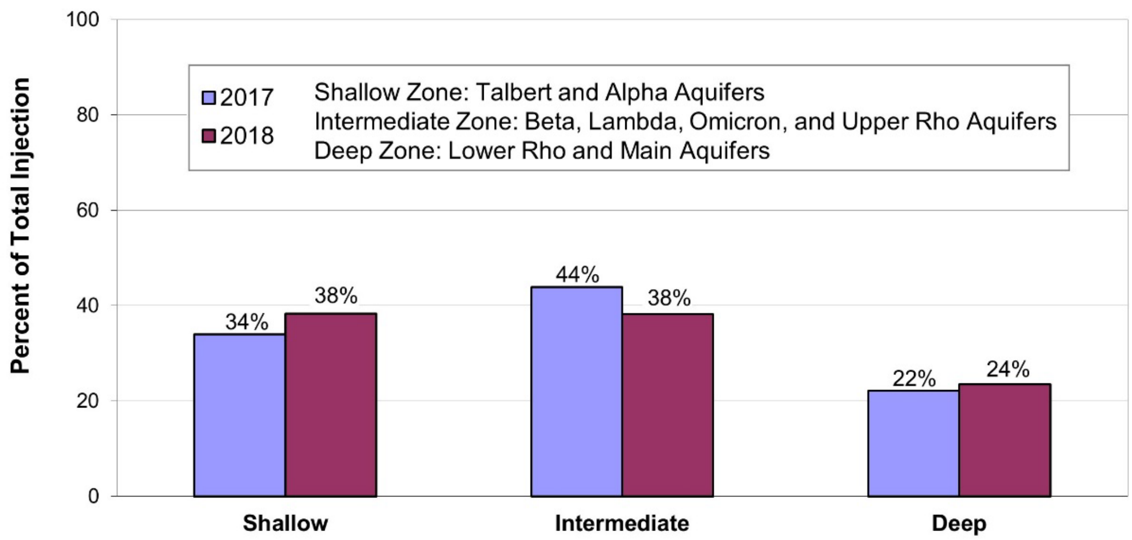


Figure 3-5. 2017 and 2018 Annual Average Injection Percentages for Each Depth Zone

3.3.2 Spatial Distribution of Injection along the Barrier

Injection rates and daily injection volumes at every injection point are measured using the process control system (PCS) that was installed as part of the GWRS. Flow is continuously monitored for each injection well so that precise daily and monthly injection volumes are directly obtained for each injection well casing. The monthly volumes for each injection well casing are then downloaded to spreadsheets, checked, adjusted to match reported total barrier injection, and uploaded to the OCWD Water Resources Management System (WRMS) database.

Table 3-3 shows the annual volume injected into each of the 36 injection well sites during 2018. Each well site consists of one to four discretely measured injection casings (installed at different depth zones). Table 3-3 is a summary of the total injection at each site but is divided into the three different aquifer zones that were previously described above (shallow, intermediate, and deep). The flow volumes in Table 3-3 represent adjusted values. The measured monthly per well casing flow volumes were adjusted so that the sum of all individual wells for each month exactly equals the total barrier injection reported in Table 3-1 for that month (recorded from the AWPF Barrier Pump Station flow meter). For all injection well points, the raw transmitter injection measurements were multiplied by a small correction factor each month to obtain the values shown in Table 3-3. For a given month, all well points were adjusted by the same factor. During 2018, the monthly adjustments ranged from approximately 1.3% to 1.7% and were acceptably small and within expected standards for comparing the Barrier Pump Station flow meter totals with the sum of all individual injection well transmitter readings over the course of each month. To keep the discrepancy acceptably small, OCWD staff frequently run diagnostic checks on flow meters and transmitters and re-calibrate them as necessary.

Table 3-3. 2018 Injection Quantity at Talbert Barrier Well Sites

	Well Site	Shallow Zone [1] (AF)	Intermediate Zone [2] (AF)	Deep Zone [3] (AF)	Total [4] (AF)	Total [4] (MG)
West	I32	886.67	168.93	920.94	1,976.53	644.05
	I31	739.09	365.09	1,073.16	2,177.34	709.49
	I30	744.88	304.34	1,008.40	2,057.62	670.48
	I29	134.95	434.88	418.84	988.67	322.16
	I23	120.10	127.92	–	248.02	80.82
	I28	305.09	256.87	658.93	1,220.89	397.83
	I27	306.70	472.54	645.00	1,424.25	464.09
	I22	267.39	192.41	–	459.80	149.83
	I21	–	223.31	–	223.31	72.76
	I20	229.69	378.54	–	608.22	198.19
	I19	–	147.90	–	147.90	48.19
	I18	6.31	48.90	–	55.21	17.99
	I17	315.18	416.62	–	731.81	238.46
	I16	0.00	29.84	–	29.84	9.72
	I15	139.56	221.84	–	361.40	117.76
	I14	282.90	71.18	–	354.08	115.38
	I13	186.30	214.53	–	400.82	130.61
	I12	274.80	161.72	–	436.52	142.24
	I11	339.76	130.92	–	470.68	153.37
	I10	223.49	144.88	–	368.37	120.03
	I9	195.17	172.79	–	367.96	119.90
	I8	0.00	0.00	–	0.00	0.00
	I7	721.30	226.63	–	947.93	308.88
	I6	0.00	0.00	–	0.00	0.00
	I5	294.60	502.44	–	797.04	259.72
	I25	–	1,002.09	–	1,002.09	326.53
	I24	–	989.42	500.62	1,490.05	485.53
	I4	505.33	823.96	–	1,329.28	433.15
	I3	33.51	48.33	–	81.84	26.67
	I2	0.00	219.25	–	219.25	71.44
	I1	285.31	355.29	–	640.60	208.74
East	I26	626.15	646.47	625.78	1,898.40	618.60
Southeast Barrier	I33	293.81	–	–	293.81	95.74
	I34	216.64	–	–	216.64	70.59
	I35	411.16	–	–	411.16	133.98
	I36	432.98	–	–	432.98	141.09
	Total:	9,518.80	9,499.83	5,851.69	24,870.31	8,104.00
	Percent:	38.27%	38.20%	23.53%		

1. Shallow Zone: Talbert and Alpha aquifers.
2. Intermediate Zone: Beta, Lambda, Omicron, and Upper Rho aquifers.
3. Deep Zone: Lower Rho and Main aquifers
4. Per well injection totals above represent adjusted values (by month) to reconcile with the reported total barrier injection in Table 3-1.

Figure 3-6 graphically depicts the annual volume injected into each of the 36 injection well sites during 2018. The injection volumes are divided into the same three depth zones described above: shallow, intermediate, and deep. The 36 well sites on Figure 3-6 are generally ordered geographically from west to east (left to right) on the bar graph (rather than by well number) so as to give a visual sense of how the injection is spatially distributed along the barrier alignment. Notice the relatively large annual injection amounts for the west-end modern well sites I27, I28, I29, I30, I31, and I32, as is characteristic every year. East-side modern wells I24 and I26 also had large annual injection amounts due to the deep zone contribution at those sites.

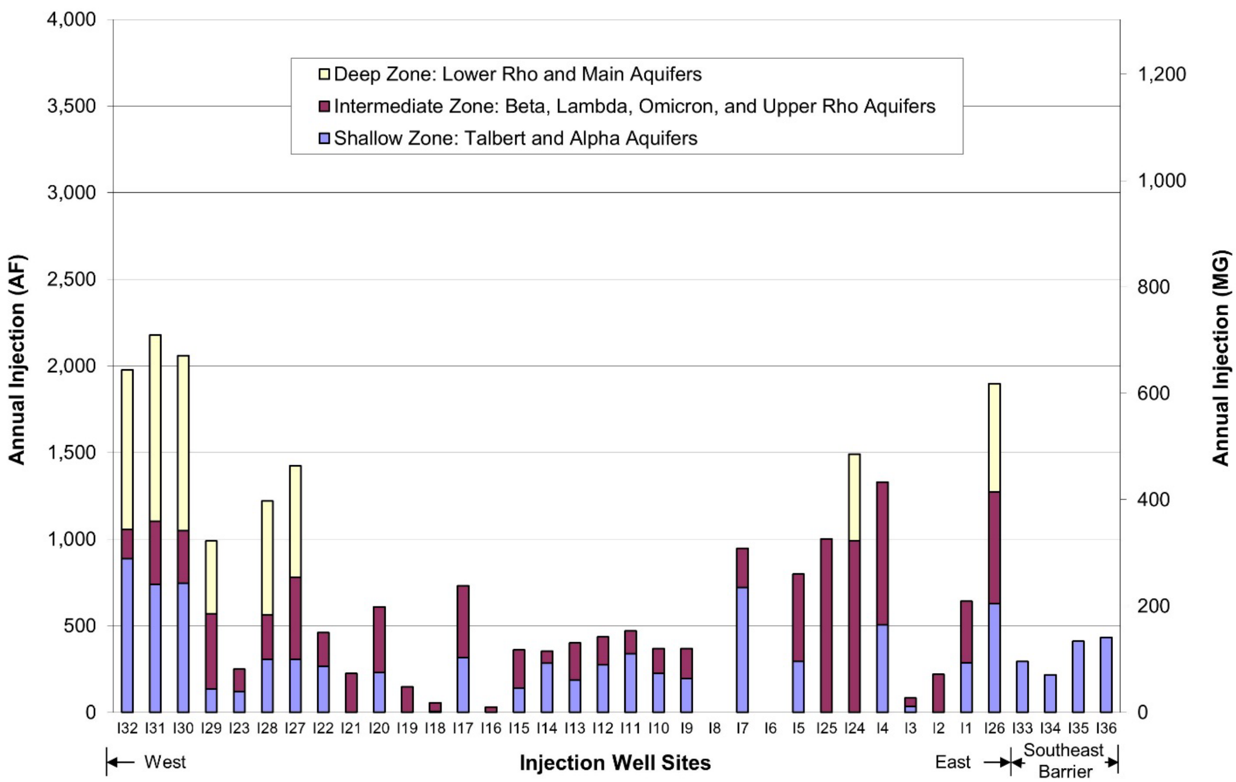


Figure 3-6. 2018 Talbert Barrier Injection Quantity at Each Well Site

At all six west-end modern injection wells I27 through I32, intermediate zone annual injection was reduced during 2018 due to being off-line from January through May/June because they were not needed to maintain groundwater levels above protective elevations and to prevent groundwater levels from becoming too high in the low-lying area farther to the west near Huntington Lake. For the same reasons, west-end modern injection wells I27, I28, and I29 had reduced shallow zone annual injection due to being off-line for the first half of 2018. Similarly, southeast barrier modern injection wells I33A, I34A, and I35A had reduced annual injection during 2018 because they were off-line from January through April/May, as they were not needed during that time to maintain protective elevations.

The older legacy well sites (I1 through I23) tend to have lower injection capacities than the modern wells. However, the intermediate zones at I4, I5, and I17 performed comparably with the equivalent modern wells during 2018. Also, I4 and I7 had relatively high shallow zone annual injection comparable to shallow zone modern wells during 2018. Legacy well I4 was on-line all year and had combined shallow and intermediate zone annual injection of over 1,300 AF during 2018 (1.2 MGD daily average), on par with shallow and intermediate zone injection at modern injection well I26 which was also on-line all year. During 2018, many of the other legacy injection wells had relatively low combined shallow and intermediate zone annual injection volumes ranging from zero to 900 AF, with the lower end of this range mostly due to legacy wells being off-line for several months or for the entire year.

During 2018, three legacy wells (I2, I3, and I21) had very low annual injection of approximately 100 to 200 AF because they consistently are poor performers and have lost capacity over the years due to leaky well seals or irreversible clogging, or both. These three wells are planned to be replaced within the next few years. Lastly, both I6 and I8 had no injection during 2018 because they were off-line the entire year and were not needed to maintain protective elevations. In the case of I8, it is typically not used since its access hatch is in the traffic lane on Ellis Avenue, making access both difficult and unsafe for barrier operations staff.

Table 3-4 shows which wells were off or on-line on a weekly basis during 2018, including an explanation for inactive status. An injection well site is only shown to be off-line if it was secured for the majority of the specified week (4 days or more). Since the legacy wells are each typically operated with all zones at that site being on or all zones off, Table 3-4 only shows a status entry for each entire legacy site. For the modern injection well sites I26 through I32 featuring a cluster of three separate injection wells (shallow "A", intermediate "B", and deep "C"), each individual injection zone is operated independently. Modern well I24 features I24/1 for the upper casing (intermediate zone) and I24/2 for the lower casing (deep zone) due to its nested well construction with two casings in the same borehole. Modern well I25 is a single-point well screened primarily in the intermediate zone and is designated I25/1. Therefore, Table 3-4 shows a separate status entry for each individual injection zone for these modern wells. Many injection wells were off-line for a major portion of 2018 due to the higher Basin conditions following the In-Lieu Program in which Basin pumping was reduced from July 2017 through January 2018. Protective elevations were maintained throughout the year with only intermittent use of many of the injection wells.

Table 3-4 shows that the entire injection barrier was off-line during the third week of September (September 18-25). This was due to a scheduled one-week AWPF shutdown that coincided with SARI flows being taken at OCSD Plant 1. OCWD used this time to conduct GWRS maintenance.

Due to the reduced injection into the shallow and intermediate zones during 2018, no deep zone injection wells had to be taken off-line during the peak summer months as is typical due to

Table 3-4. 2018 Injection Wells Operational Status

	Well	JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP				OCT				NOV				DEC			
West	I32A					S										S						S	S						S							Z													
	I32B	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			Z													
	I32C																															S	S			Z													
	I31A	S						S						S				S	S									S								Z													
	I31B	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S						S								Z													
	I31C																															S	S			Z		S			S								
	I30A		S	S		S	S				S	S	S		S					S	S				S	S	S									Z													
	I30B	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S		S	S					Z													
	I30C																																			Z		S			S								
	I29A	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S								Z						S	S	S	S	S	S	S	S
	I29B	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S																Z													
	I29C	S	S	S	S	S	S	S	S																										S	Z		S											
	I23	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S											S	R	R	S					Z						S	S	S	S	S	S	S	S
	I28A	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S											Z						S	S	S	S	S	S	S	S
	I28B	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S													Z													
	I28C																																			Z		S		S									
	I27A	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S											Z						S	S	S	S	S	S	S	S
	I27B	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S																	Z													
	I27C	S	S	S	S	S	S	S																												Z		S											
	I22	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S				R		S														Z							S	S	S	S	S	S	S
	I21	S	S	S	S	S																	R													Z													
	I20	S	S	S	S	S					S	S	S	S	S	S					R	S	S													Z						S	S	S	S	S	S	S	S
	I19	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			R	S	S	S	S	S	S	S	S	S	S	S	S	S	Z	S	S	S	S	S	S	S	S	S	S	S	S	S
	I18	S	S	S	S	S	S	S	S	S	S	S	S										R	R	S	S	S	S	S	S	S	S	S	S	S	Z	S	S	S	S	S	S	S	S	S	S	S	S	S
	I17	S	S	S	S	S																		R	S											Z											S	S	S
	I16	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S						R	S	S	S	S	S	S	S	S	S	S	Z	S	S	S	S	S	S	S	S	S	S	S	S	S
	I15	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S		R	R	S									Z													
	I14	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	R	S	S	R							Z													
	I13	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S					S	R	S				Z						S	S	S	S	S	S	S	S
	I12	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S				R	S	S	S			Z													
	I11	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			R							Z													
	I10																															R	S	S	S	Z	S	S	S	S	S	S	S	S	S	S	S	S	S
	I9																									M	M	M	M	M	M	M	R	S	S	Z	S	S	S				S	S	S	S	S	S	S
	I8	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	Z	S	S	S	S	S	S	S	S	S	S	S	S	S
	I7																																	R	S	Z													
	I6	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	R	Z	S	S	S	S	S	S	S	S	S	S	S	S	S
	I5																																			Z		R	S	S	S	S	S	S	S	S	S	S	S
	I25/1	S	S	S	S	S	S																													Z													
	I24/1	S	S	S	S	S	S																													Z													
	I24/2	S	S	S	S	S	S																													Z		S											
	I4																																			Z			R										
	I3																																			Z					R	S	S	S	S	S	S	S	S
	I2																																			Z													
	I1																																			Z	R	S	S	S									
	I26A																																			Z													
	I26B																																			Z													
East	I26C																																			Z													
Southeast Barrier	I33A	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S																Z												S	S
Southeast Barrier	I34A	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S																Z													S
Southeast Barrier	I35A	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S																				Z											S	S	S
Southeast Barrier	I36A																																			Z													S

☐ Well in Operation: GWRS Recycled Water
☐ Well in Operation: OC-44 Potable Water
M Maintenance Repair
R Redevelopment
Z GWRS off-line
P Pipeline Restriction
C Construction
S Stand-by

Wells were specified as off-line if non-operational for the majority of the specified week or longer. Letters designate the reason for the well being off-line (not all letters are used in every year).

pipeline restrictions, i.e., to maintain acceptably low flow velocities at critical points along the barrier pipeline identified as bottlenecks based on operational data. Barrier pipeline improvements are currently planned to remove these bottlenecks in order to maximize injection during years with lower Basin conditions and higher injection requirements.

3.3.3 Injection Well Repairs and Redevelopment

The Talbert Seawater Intrusion Barrier consists of 100 individual injection well points arranged into 36 injection well sites. During 2018, 34 of the 36 injection well sites were operated over the course of the year, with only I6 and I8 being off-line for the entire year since they were not needed to maintain protective elevations as well as traffic control access issues at I8. In general, various injection wells are typically placed off-line for either brief or extended periods during the course of a year for the following reasons:

- Well redevelopment and backwash pumping to restore and improve injection rates;
- Maintenance repairs (plumbing, electrical, communications, well vaults, pipeline, etc.);
- Availability of injection water supply, including AWPF shutdowns;
- Optimize distribution of injection for controlling seawater intrusion and maintaining protective groundwater elevations;
- Reduce or redistribute injection to avoid overly high groundwater conditions; and
- Hydraulic restrictions on the barrier pipeline and appurtenances (bottlenecks).

OCWD and OCSD construction activities requiring localized dewatering in the vicinity of the injection barrier. Only one injection well, I9, was off-line for maintenance repairs during 2018. As shown in Table 3-4, I9 was off-line for seven weeks in July and August.

All legacy wells except I2 and I8 were redeveloped during 2018. I2 is a perennial poor performer and is planned to be replaced, and I8 is rarely used due to traffic control access issues. Table 3-4 shows when each of the legacy well sites were taken off-line for redevelopment during 2018. Note that each legacy well site was not off-line for more than one week to complete the redevelopment work. Redevelopment of each legacy well typically takes one day per well casing, or less than one week to complete each well site.

Legacy well redevelopment requires disassembly of the injection well header plumbing, followed by air-lift pumping and surging to remove accumulated fine material that causes well clogging near the formation interface with the gravel pack. During the 2018 redevelopment, approximately 15 cubic yards of fine-grained material were removed from the 21 legacy wells.

Results of the 2018 redevelopment were very favorable. The increase in injection capacity at each legacy well site ranged from a low of 18% (I11) to a high of 145% (I1), with an average injection increase of 65% per well site (sum of all injection zones per site). To calculate these percent increases, the injection flow rates were measured just prior to taking each legacy well site off-line for redevelopment and then once again after approximately three weeks of continuous post-redevelopment operation.

The previous round of legacy redevelopment occurred in 2016 and included nine legacy well sites. Since implementing 100% GWRS purified recycled water as the primary injection source, a legacy redevelopment cycle of approximately every 2 to 3 years has been sufficient to maintain injection flow rates without significant reductions in well efficiency and thus maintain overall barrier capacity. There is no legacy well redevelopment planned for 2019.

Three of the modern injection wells (I24/1, I24/2, and I25/1) are equipped with dedicated submersible pumps allowing for regular backwash pumping. The submersible pump backwash frequency is based on the cumulative volume injected similar to the other injection wells. During the first few years of GWRS operations, the volume injected between submersible pump backwash events was only 9 to 10 MG. More recently, the backwash frequency has been extended and now ranges from an injection volume of 20 to 40 MG between backwash events without any detrimental long-term loss of injection capacity. This typically translates to a frequency of approximately every one to two months. Backwash pumping is accomplished by OCWD Operations staff from the AWPF control room. A relatively short duration of only 5 to 15 minutes is typically required for each submersible pump backwash event to restore the well's injection capacity. The submersible pump backwash pumping rate is maintained considerably higher than each well's rate of injection, so as to remove any particulate material that may have been introduced into the gravel pack or out into the formation. During 2018, the submersible backwash pumping rate for these three wells ranged from approximately 1,700 to 2,100 gpm.

The rest of the modern injection wells (sites I26 through I36) are equipped with dedicated air lines and are regularly backwashed using the air-lift pumping method, which requires a portable air compressor to be transported to each site.

Since 2011, OCWD Barrier Operations staff have used a 750 cubic feet per minute (cfm) high-pressure air compressor to regularly air-lift backwash these modern wells lacking dedicated pumps.

The air lift backwash frequency for these modern injection wells is also based on the cumulative volume injected since the previous backwash and varies considerably from well to well. Well performance is monitored closely to determine the optimal time to backwash. The volume injected between modern well air-lift backwash events typically varies from 15 to 40 MG, which usually translates to a frequency ranging from one to two months. Modern wells that are air-lift backwashed require little header plumbing disassembly and typically take one day per injection well site to complete. Therefore, these backwash events are not typically shown on the injection well status table (Table 3-4) since each well site is only off-line for one day.

Historically, there has been some evidence of erosion of Barrier distribution pipeline materials via the presence of measureable amounts of sand found at the pipeline terminus during maintenance blow-off activities and on in-line bypass filters. To help limit potential pipeline erosion, historically the quality of the lime used during post-treatment has been improved and specific post-treatment stability targets have been adjusted. Barrier Operations and AWPF Operations staff continue to investigate and refine the lime post-treatment process in an effort to improve the existing procedures so as to reduce the amount of particulates entering the FPW that could potentially contribute to well clogging.

There were no significant changes to the post-treatment process or the associated operating parameters during 2018. Bypass filter monitoring and periodic pipeline inspections will continue.

4. GROUNDWATER MONITORING AT THE TALBERT BARRIER

OCWD has maintained a comprehensive groundwater monitoring program in the vicinity of the Talbert Barrier for decades as part of the operation of its water reclamation program as well as the assessment of the effectiveness of the barrier in preventing seawater intrusion. This section presents the following for 2018:

- Description of Talbert Gap aquifers;
- Overview of groundwater monitoring program;
- Groundwater elevations and directions of flow; and
- Groundwater quality.

4.1 Talbert Gap Aquifers

Earlier studies (DWR, 1966) delineated numerous discrete aquifer units comprising the Talbert Gap area of the Orange County Groundwater Basin. In general, from shallowest to deepest, these include:

- Talbert aquifer;
- Alpha aquifer;
- Beta aquifer;
- Lambda aquifer;
- Omicron aquifer;
- Upper Rho aquifer;
- Lower Rho aquifer;
- Main aquifer; and
- Lower Main aquifer.

The Talbert aquifer is the primary conduit for inland migration of seawater. Being the shallowest of the potable aquifers listed above, it is also the youngest and therefore has not been appreciably folded or uplifted by the Newport-Inglewood Fault system that runs roughly parallel to the coastline through the Talbert Gap area as shown on Figure 4-1. Therefore, the Talbert aquifer is relatively horizontal, continuous, and in direct hydraulic connection with the Pacific Ocean. The Talbert aquifer is approximately 50 to 80 feet thick within the Talbert Gap area and is comprised of relatively coarse sands and gravels that were deposited by the ancestral SAR. The Talbert Gap was formed by the contemporaneous erosional processes of the ancestral SAR between the uplifted areas now known as the Huntington Beach Mesa and the Newport Mesa. Therefore, the Talbert aquifer is non-existent beneath both of these mesas.

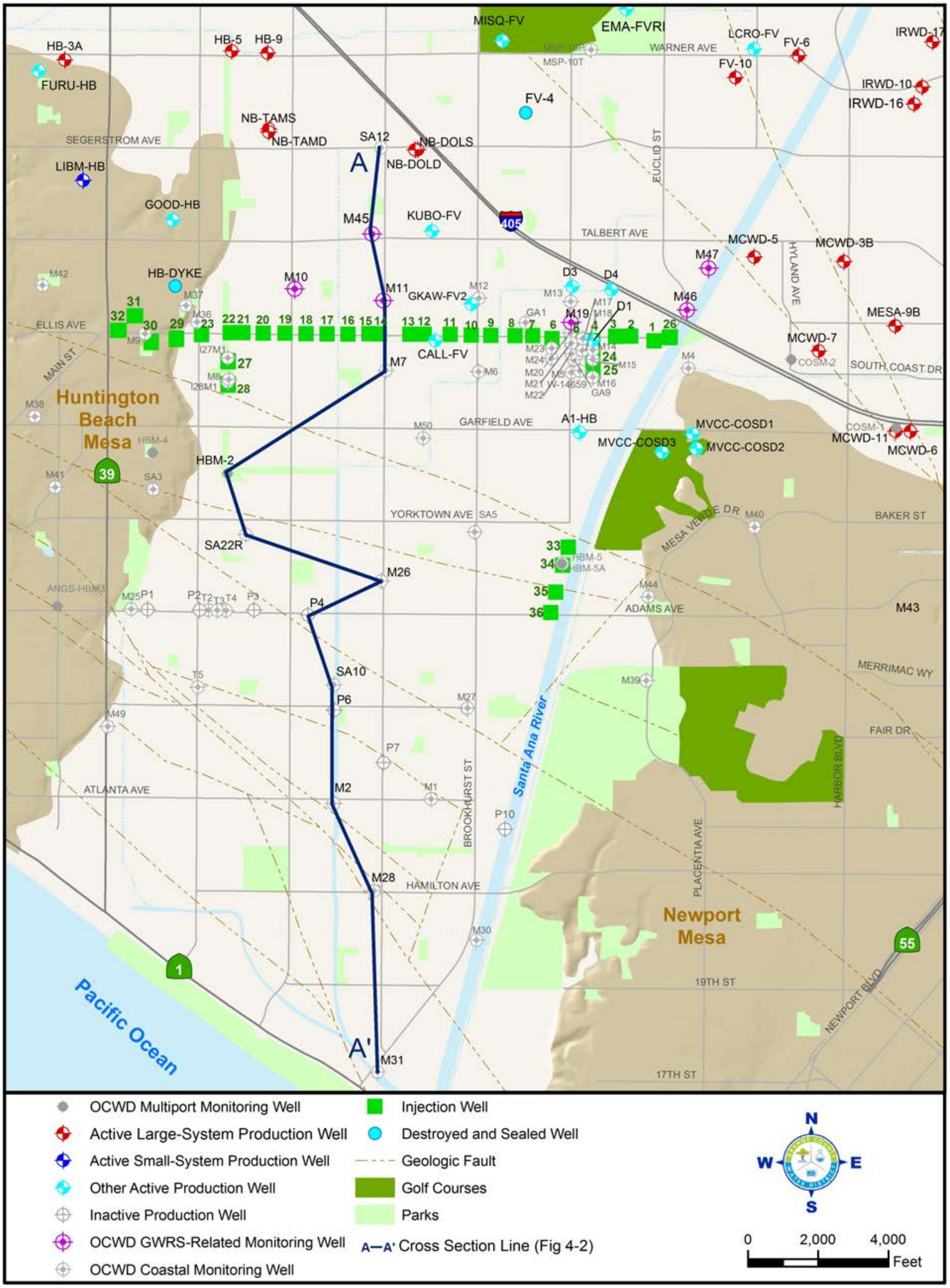


Figure 4-1. Talbert Gap Study Area and Well Location Map

The potable aquifers below the Talbert aquifer are considerably older and have thus been uplifted and offset to varying degrees by the Newport-Inglewood Fault system illustrated on Figure 4-2. Unlike the Talbert aquifer, these deeper aquifers exist not only within the Talbert Gap but also extend beneath the mesas. As discussed later in this section, the Alpha, Beta, Lambda, Omicron, and Upper Rho zones are all susceptible to seawater intrusion via hydraulic connection with the Talbert aquifer. That is, seawater migrating inland within the Talbert aquifer can flow into deeper aquifers via mergence zones where there is no depositional or hydraulic separation between vertically adjacent aquifers.

The Main and Lower Main aquifers were not previously considered to be susceptible to seawater intrusion within the Talbert Gap area due to their considerable depth and vertical isolation from the shallower aquifers (DWR, 1966). Furthermore, due to the higher degree of faulting and offset, the Lower Main aquifer is thought to be non-existent seaward of approximately Yorktown Avenue. The Main aquifer is discontinuous and offset across the Newport-Inglewood Fault system, and thus largely hydraulically isolated from the ocean. Seaward of this fault zone, the Main aquifer is brackish and isolated from the inland portion of the Basin. However, with increased groundwater withdrawals from the Main aquifer in the coastal area over the last 20 to 30 years, lower groundwater elevations in the coastal area could increase the potential for leakage of saline water inland across the Newport-Inglewood Fault system within the Main aquifer (Herndon and Bonsangue, 2006).

Chloride concentration data obtained from OCWD monitoring wells suggest that slightly brackish groundwater exists in the Main aquifer beneath the Newport Mesa inland of the North Branch of the Newport-Inglewood Fault system. It is currently uncertain whether the salinity slowly leaked across the fault system due to inland gradients or represents remnant pockets of older connate water that (1) have never been fully flushed out of these marine deposits due to entrapment by the Newport-Inglewood Fault system and/or (2) resulted from upwelling of connate water from deeper Pliocene deposits below the fresh water base of the Basin. The Main aquifer chloride concentrations in this area have either decreased slightly or have been relatively stable for the last several years, remaining below 400 mg/L inland of the Bolsa-Fairview Fault, which is the inland most branch of the Newport-Inglewood Fault system. Main aquifer chloride concentrations in the Newport Mesa area will continue to be monitored.

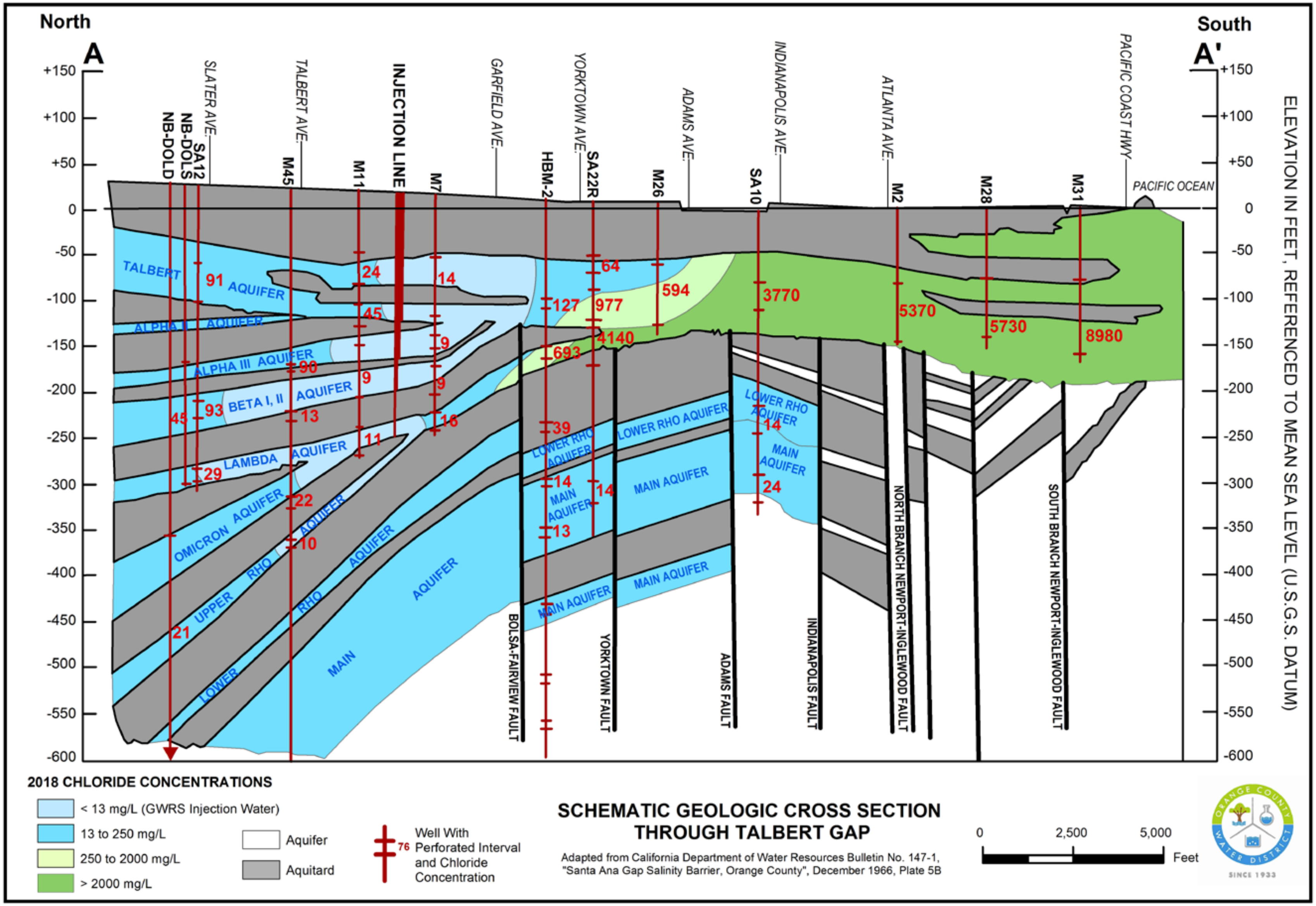


Figure 4-2. Schematic Geological Cross Section Through Talbert Gap

4.2 Groundwater Monitoring Program

As part of the groundwater monitoring program required by the current permit for the GWRS (RWQCB, 2004, 2008, 2014a, and 2016), OCWD-owned monitoring wells and several municipal and private wells in the Talbert Barrier area were sampled in 2018. OCWD performs coastal groundwater monitoring at numerous additional wells on a semi-annual basis for the purposes of monitoring seawater intrusion. The locations of OCWD's GWRS permit compliance wells, other coastal monitoring wells, private wells, and municipal production wells in the Talbert Gap area are shown on Figure 4-1.

Under the previous WF-21 permit, OCWD monitoring well sites M9, M10, and M19 were sampled on a monthly basis. These wells were constructed between 1967-68, prior to injection of WF-21 recycled water. Under the current permit, quarterly compliance monitoring is required from OCWD monitoring well sites M10, M11, M45, M46, and M47. The three newer GWRS compliance monitoring wells M45, M46, and M47 were constructed during 2004-05. The GWRS monitoring program began in mid-2004.

Sampling of monitoring well sites M9 and M19 is not required under the current GWRS permit. However, both monitoring well sites continued to be monitored through 2018, and the associated data for M19 are reported herein because this well is located in a strategic location just north of the Talbert Barrier near the east end. At monitoring well site M19, only Zone 3 (M19/3) is tested quarterly like GWRS compliance wells and annually for the full comprehensive suite of analytes; Zones 1 and 2 (M19/1 and M19/2) are tested twice a year for a reduced set of analytes for the assessment of seawater intrusion.

Monitoring well site M45 is located approximately halfway between the Talbert Barrier Ellis Avenue alignment and the City of Newport Beach municipal wells (NB-TAMS, NB-TAMD, NB-DOLS, and NB-DOLD) located north of the barrier (Figure 4-1). Well sites M46 and M47 are located approximately one-quarter and one-half the distance, respectively, between injection well site I26 and the nearest municipal production well MCWD-5, which is owned and operated by Mesa Water. These three newer compliance monitoring wells were each constructed with five nested casings designed to monitor the individual aquifers tapped by the nearby production wells.

4.3 Groundwater Elevations and Directions of Flow

Groundwater flow directions in the vicinity of the Talbert Barrier vary considerably due to barrier injection and seasonal fluctuations in coastal pumping as well as historical changes in pumping patterns, such as new well fields coming on-line. Also, due to the vertical distribution of coastal pumping, each of the aquifers receiving injection water has a somewhat different flow path.

4.3.1 Talbert and Alpha Aquifers

Figure 4-3 shows interpreted groundwater elevation contours and inferred groundwater flow directions within the shallow Talbert and Alpha aquifers for June 30, 2018 in the Talbert Gap area. The contours not overlying the Huntington Beach and Newport Mesas (i.e., within the Talbert Gap), represent groundwater elevations for the Talbert aquifer. A more-detailed one-foot contour interval was used in the Talbert Barrier area and seaward to better illustrate the groundwater flow patterns. On the mesas, the contours represent Alpha aquifer groundwater elevations since the Talbert aquifer does not exist beneath the mesas as was described earlier in Section 4.1; however, the Talbert aquifer is in hydraulic connection with the Alpha aquifer beneath the Huntington Beach Mesa, such that they behave as one aquifer system. Figure 4-3 also shows the Talbert aquifer mergence zones, which can act as vertical drains transmitting water from the Talbert aquifer down into the deeper Alpha, Beta, and Lambda aquifers due to a typically downward vertical gradient.

As shown on Figure 4-3, groundwater elevations in the Talbert aquifer were at or above mean sea level both along Ellis Avenue near the barrier as well as farther seaward near the southeast portion of the barrier and along Adams Avenue. Groundwater elevations were as high as 4 to 10 feet above mean sea level immediately surrounding the southeast barrier injection wells near the intersection of Adams Avenue and the Santa Ana River, as evidenced by the enclosed mound around these wells shown on Figure 4-3. Seaward of Adams Avenue, Talbert aquifer groundwater elevations within the Talbert Gap were 2 to 3 feet above mean sea level, indicating little or no inland migration of seawater during the June 2018 time frame.

The Shallow aquifer groundwater elevations shown on Figure 4-3 for June 2018 were very similar to the prior year for June 2017 due to similarly sustained barrier injection for the first half of the year.

During both 2017 and 2018, sustained barrier injection resulted in a local hydraulic mound above mean sea level and thus helped to minimize brackish water seaward of Adams Avenue from migrating and draining into the mergence zones, thus preventing it from migrating inland. Without sustained Talbert Barrier injection, a below sea level depression within the Shallow aquifer in the Talbert Gap would occur seaward of Ellis Avenue due to the draining effect of the aforementioned mergence zones, as was evidenced during June 2014 when the barrier was off-line for approximately one month due to GWRS Initial Expansion construction activities (Figure 4-3 of 2014 GWRS Annual Report, DDB Engineering, Inc., 2015). Without the Talbert Barrier, such a depression would be a more permanent condition, thereby drawing inland migrating seawater into potable aquifers tapped by municipal production wells farther inland.

Figure 4-3 also shows groundwater flow directions inferred from the groundwater elevation contours for the shallow Talbert and Alpha aquifers for June 2018. The inferred groundwater

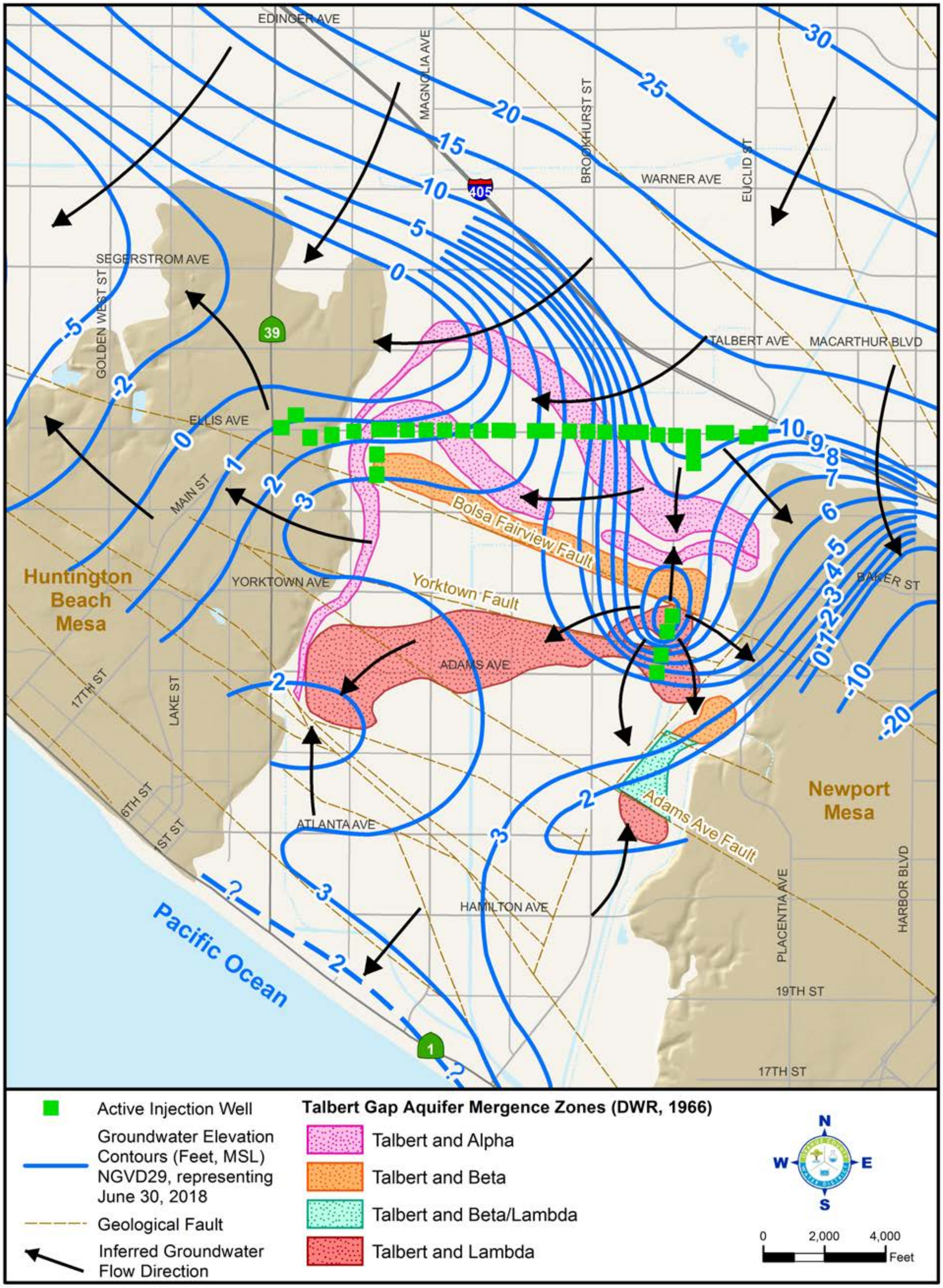


Figure 4-3. Shallow Aquifer Potentiometric Surface with Inferred Groundwater Flow Directions in the Talbert Gap Area During 2018

flow direction was predominantly to the southwest, or seaward, within the Talbert Gap area, except for the area south of the barrier between Ellis and Adams avenues where the gradient was relatively flat with a more westerly flow pattern towards the Huntington Beach Mesa.

In the Huntington Beach Mesa area to the west of the barrier, the Alpha aquifer groundwater flow direction in June 2018 was also westerly, indicating a flow path from the Talbert aquifer within the Talbert Gap migrating westerly into the Alpha aquifer via the Talbert/Alpha mergence zone along the eastern margin of the Huntington Beach Mesa (Figure 4-3). As shown on Figure 4-3, the westerly flow pattern beneath the Huntington Beach Mesa was due to lower groundwater elevations of approximately 5 feet below mean sea level in the Bolsa Gap area to the west/northwest of the Huntington Beach Mesa. Although not shown on Figure 4-3, Bolsa Gap farther to the west also has mergence zones like those in the Talbert Gap where groundwater from the Shallow aquifer can drain down into the Alpha, Beta, and Lambda aquifers, thus causing somewhat lower groundwater levels in that area.

The inferred flow directions shown on Figure 4-3 for the Shallow aquifer during June 2018 were very similar to those the prior year during June 2017 and are representative of normal barrier operating conditions. During June 2014 when the barrier was off-line for approximately one month, the groundwater flow direction in the Huntington Beach Mesa area reversed to eastward from the mesa towards Talbert Gap because of the very low Talbert aquifer groundwater levels in Talbert Gap as was shown in Figure 4-3 of the 2014 GWRS Annual Report (DDB Engineering, Inc., 2015). This implies that during periods of no barrier injection, the dominant flow pattern is from the Huntington Beach Mesa towards the Talbert Gap mergence zones. On Figure 4-3, the Shallow (Alpha) aquifer groundwater elevation contours in the southern end of the Huntington Beach Mesa terminate into the North Branch of the Newport-Inglewood Fault system, which is thought to act as an impermeable barrier to flow in the Alpha aquifer on the Huntington Beach Mesa.

As groundwater flows laterally within the Talbert aquifer to the southwest, groundwater also flows vertically from the Talbert aquifer down into the Alpha, Beta, and Lambda aquifers due to their respective mergence zones as discussed above. As shown on Figure 4-3 for June 2018, a relatively steep and uniform seaward gradient existed in the Talbert aquifer north of the barrier but largely flattened out south of the barrier due to vertical flow losses to the mergence zones. This June 2018 condition represents just enough barrier injection to overcome these vertical losses to the mergence zones while still maintaining a somewhat flat but slight seaward gradient with groundwater levels above mean sea level south of Ellis Avenue. That is, the Talbert aquifer groundwater elevations were at an optimal level in which they were high enough to be protective of seawater intrusion but with only minimal losses to the ocean. A seaward gradient in this area has the added benefit of slowly pushing back existing brackish water past the crucial Talbert-Lambda mergence zone along Adams Avenue.

4.3.1.1 Key Monitoring Well M26

Monitoring well M26 is strategically located seaward of the barrier in the Talbert-Lambda mergence zone in the middle of the Talbert Gap (Figure 4-1) and is screened across both the Talbert and Lambda aquifers. Therefore, M26 is a key monitoring well for evaluating barrier injection requirements versus seawater intrusion potential. M26 is located approximately 1,000 feet north of Adams Avenue, which approximately represents the farthest seaward line at which the goal is to achieve protective groundwater elevations of approximately 3 feet above mean sea level (ft msl). This protective elevation is based on the Ghyben-Herzberg relation (Ghyben, 1888; Herzberg, 1901; Freeze and Cherry, 1979, pp. 375-376), which takes into account the depth of the Talbert aquifer at that location along with the density difference between saline and fresh groundwater. If this protective elevation is achieved along Adams Avenue for at least the majority of each year, then brackish water in the Talbert aquifer would be maintained slightly seaward of the mergence zone and thus prevented from migrating down into the Lambda aquifer that is tapped by inland production wells.

Figure 4-4 shows the historical inter-relationship between coastal groundwater production, Talbert Barrier injection, and groundwater elevations at M26 over the last 11 years. Groundwater elevations at M26 were approximately 15 feet below mean sea level at the beginning of 2008. This represented the lowest conditions at this well over the last 11 years because barrier injection supply was limited to the imported MWD OC-44 connection during 2007 before GWRS startup. Also, basin pumping reached a historical maximum during 2007.

With the commencement of GWRS purified recycled water injection in January 2008 and the contemporaneous startup of several new injection wells, the injection volume was significantly increased from previous years, causing groundwater elevations at M26 to steadily rise over a two-year period to reach protective elevations of approximately 3 feet above mean sea level by the beginning of 2010 (Figure 4-4). Since then, groundwater elevations at M26 have consistently been maintained at or above protective elevations with the exception of brief periods related to AWPF shutdowns.

During 2018, groundwater elevations at M26 started the year at a high of approximately 7 ft above mean sea level due to the basin-wide In-Lieu Program which ended in January 2018 (Figure 4-4). Groundwater levels at M26 gradually declined from January through September down to more typical protective elevations of 3 to 4 ft above mean sea level as injection was ramped up

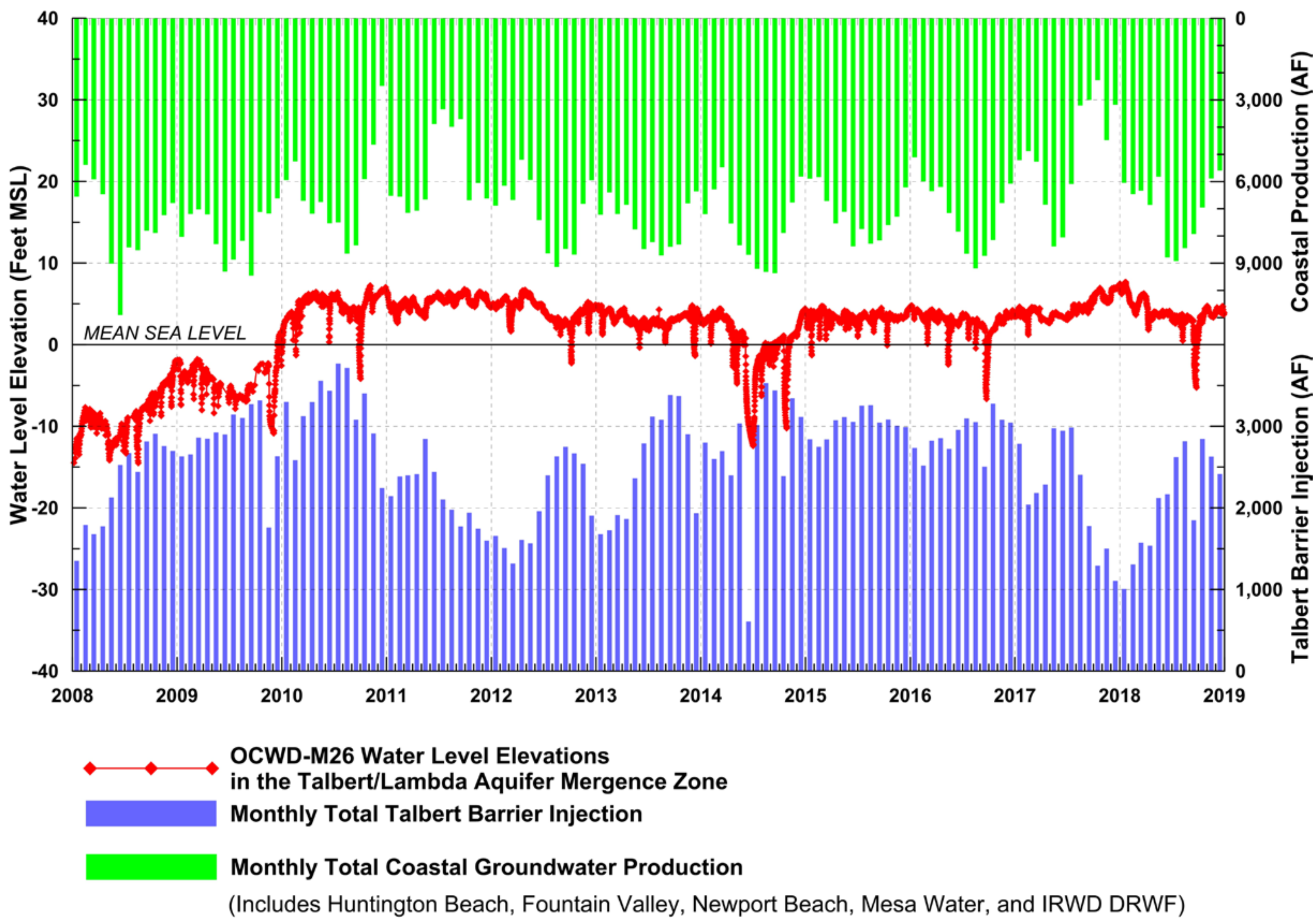


Figure 4-4. Talbert Barrier Injection, Coastal Production, and M26 Groundwater Levels

during this time to keep pace with increased coastal groundwater production. A one-week AWPF and barrier shutdown in September caused groundwater elevations at M26 to briefly drop to approximately 5 ft below mean sea level for a few days but then recovered quickly back up to protective elevations and remained relatively stable during the last quarter of the year at approximately 4 ft above mean sea level. The M26 high groundwater elevation of 7 ft above mean sea level at the beginning of 2018 represented a maximum operational threshold. Optimally, groundwater elevations at M26 are maintained between 3 and 6 feet above mean sea level for seawater intrusion control while minimizing any possibility of shallow groundwater issues.

As shown on Figure 4-4 and discussed previously in Section 3.3, barrier injection in January 2018 was only 1,000 AF and represented a historical monthly low over the 11 years since the inception of GWRS, except for June 2014 when the barrier was off-line for most of that month due to a prolonged AWPF shutdown related to GWRS Initial Expansion construction activities. As mentioned previously, the high groundwater elevations and low injection requirement at the beginning of 2018 stemmed from the basin-wide In-Lieu Program which started in July 2017 and ended in January 2018, during which time Basin pumping was significantly reduced and Basin storage subsequently increased.

Operationally, whenever groundwater elevations at M26 rise above 6 ft msl, barrier injection is incrementally reduced by 1 to 2 MGD at strategic locations to prevent additional groundwater elevation increases. Conversely, when groundwater elevations at M26 drop below 3 ft msl (protective elevation), then barrier injection is incrementally increased by 1 to 2 MGD until groundwater elevations again stabilize within the desired 3 to 6 ft msl range at key well M26. When groundwater levels drop below mean sea level at M26, like after prolonged barrier shutdowns as occurred in June 2014 and briefly in September 2018, subsequent barrier injection is then maximized and prioritized into the shallow and intermediate aquifer zones susceptible to seawater intrusion.

As shown on Figure 4-4, coastal groundwater production during 2018 was lower during the winter/spring months, higher during the summer months, and somewhat reduced during the late fall months as is typical based on seasonal water demands. Coastal production totaled 83,978 AF during 2018 (includes Huntington Beach, Fountain Valley, IRWD well field in Santa Ana, Mesa Water, and Newport Beach), representing an increase of 38% from the prior year since the prior year was abnormally low due to the aforementioned In-Lieu Program.

In response, Figure 4-4 shows that barrier injection at the start of 2018 was very low at approximately 1,000 AF in January (average of 10.6 MGD) but was incrementally increased throughout the first half of the year and into the summer and early fall, with monthly maximum injection of approximately 2,800 AF in October (average of 29.9 MGD). October injection was slightly higher than in the summer months of July and August because of the additional injection required to raise groundwater levels back up to protective elevations immediately following the one-week AWPF and barrier shutdown in late September. The annual barrier injection of 24,870 AF for 2018 was approximately 5% less than the prior year and was only slightly greater than the 11-year low annual injection in 2012 due to similarly high Basin storage conditions. During the low injection months, the surplus AWPF flows were sent to the Forebay spreading basins in Anaheim.

4.3.2 Lambda Aquifer

Figure 4-5 shows interpreted groundwater elevation contours and inferred groundwater flow directions within the intermediate depth Lambda aquifer for June 30, 2018 during a typical on-line barrier condition. The June 2018 Lambda inferred flow directions shown on Figure 4-5 are very similar to those for June 2017 presented in the prior year's annual report.

The June 2018 Lambda groundwater elevations in Figure 4-5 are very similar to those from the prior June except for being approximately 20 ft higher in the inland eastern portion of the study area near the Mesa Water wells and IRWD Dyer Road Well Field (DRWF) in Santa Ana. The higher Lambda groundwater elevations in this pumping area are likely due to the higher overall Basin storage conditions in 2018.

Except for the Mesa Water and IRWD DRWF area, groundwater levels in the Lambda aquifer near the Talbert Barrier and in the mergence zones seaward of the barrier during June 2018 (Figure 4-5) were nearly the same as in June 2017 due to somewhat typical sustained barrier injection and pumping conditions during the first half of 2018.

Newly revised geologic interpretations of the aquifer stratigraphy were used to construct both the June 2017 and June 2018 Lambda groundwater elevation contour maps. These new geologic interpretations primarily focused on the Bolsa Gap and Sunset Gap areas for groundwater modeling work but were extrapolated westward to the area inland of the Talbert Barrier for consistency. The new interpretation has the Lambda aquifer being approximately 150 to 250 feet deeper in this area than previously thought. The deeper geologic correlations moving inland from the coastal area were driven by an improved understanding of the significant folding from the Compton Blind Thrust Fault which trends from the northwest to southeast similar to the Newport-Inglewood Fault but is located farther inland.

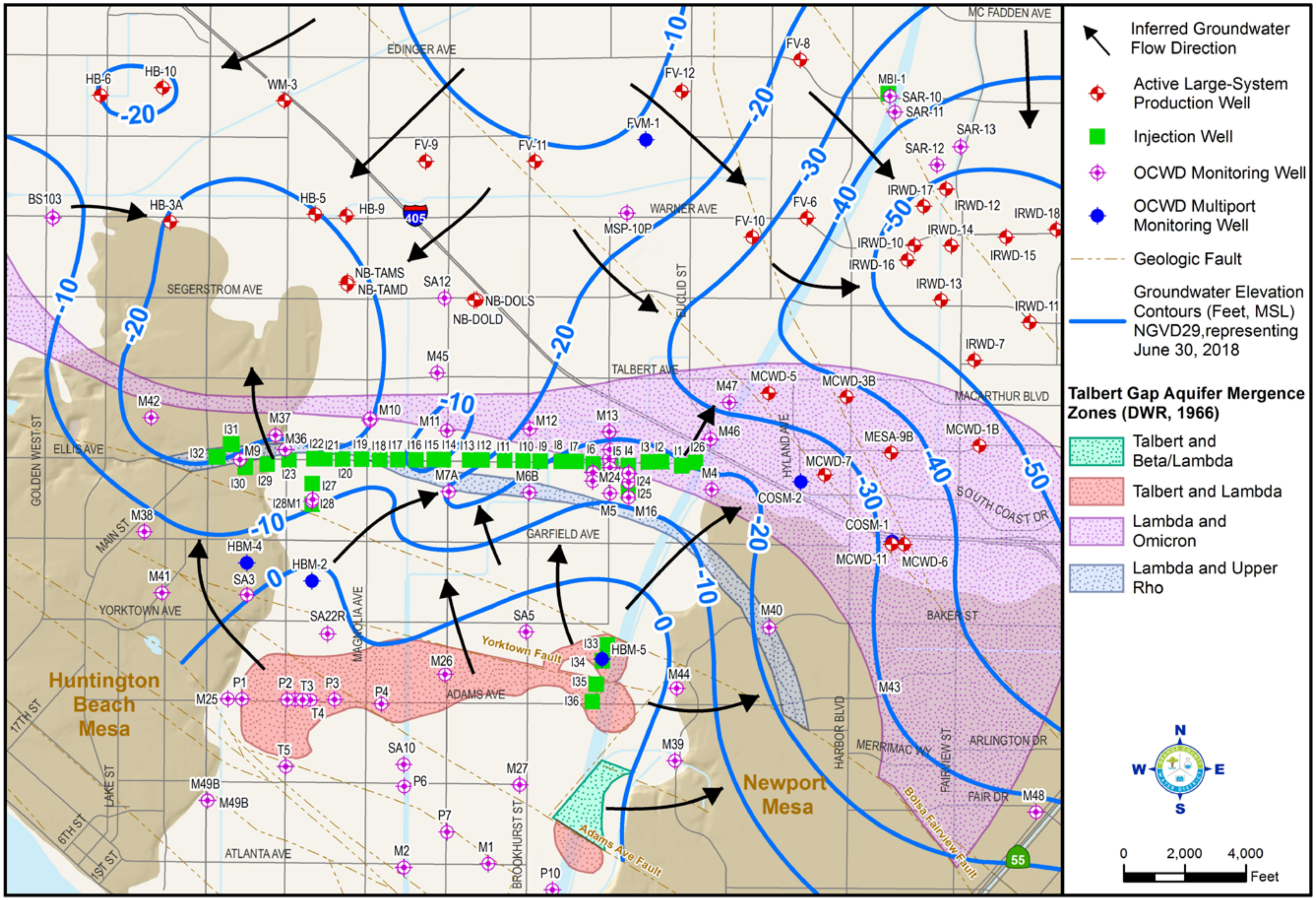


Figure 4-5. Lambda Aquifer Potentiometric Surface with Inferred Groundwater Flow Directions in the Talbert Gap Area

When the barrier is on-line as in June 2018, there is typically a relatively small localized mound of raised groundwater elevations in the Lambda aquifer, albeit below mean sea level, limited to the central portion of the Ellis Avenue barrier alignment. The lack of a more pronounced injection mound along Ellis Avenue is likely due to: (1) the limited amount of injection into the legacy well Lambda zones along Ellis Avenue (previously shown on Figure 3-6), and (2) the presence of mergence zones between the Lambda aquifer and the deeper Omicron and Upper Rho aquifers in the vicinity of the barrier, causing groundwater injected into the Lambda aquifer to quickly drain down into these deeper aquifers due to a downward vertical gradient induced by coastal production wells that tap from these aquifers. In other words, the Lambda-Omicron and Lambda-Upper Rho mergence zones drain the Lambda aquifer, thus preventing Lambda groundwater levels from mounding higher. As such, the groundwater flow arrows shown on Figure 4-5 in this area only depict the inferred lateral flow directions within the Lambda aquifer but do not show the vertical flow lost down into the Omicron and Upper Rho aquifers.

As previously discussed, the Talbert-Lambda mergence zone located approximately 1.5 miles seaward of the barrier acts as a groundwater source for the Lambda aquifer, as groundwater flows from the Talbert aquifer down into the Lambda aquifer, from where it then flows inland within the Lambda aquifer due to groundwater gradients caused by production wells.

Figure 4-5 shows that Lambda aquifer groundwater elevations in the Talbert-Lambda mergence zone along Adams Avenue were at or slightly above mean sea level and have approximately the same levels as the shallower Talbert aquifer in this same area on Figure 4-3. However, Figure 4-5 has a coarser contour interval of 10 ft and therefore does not show the contours in this mergence zone area that are above zero but below 10 ft msl. Lambda groundwater elevations decrease with distance away from the Talbert-Lambda mergence zone moving north towards the barrier and towards production wells. As is typical, Lambda groundwater elevations were lowest to the east of the Talbert Barrier, at approximately -30 to -50 ft msl near the Mesa Water production wells and IRWD DRWF at the end of June 2018. Lambda groundwater elevations were approximately -20 ft msl to the north/northwest of the Talbert Barrier near Huntington Beach and Newport Beach production wells at the end of June 2018.

4.3.3 Main Aquifer

Figure 4-6 shows interpreted groundwater elevation contours and inferred groundwater flow directions within the deeper Principal aquifer system for June 30, 2018. Over 90% of Basin pumping occurs from the Principal aquifer system, which vertically from top to bottom includes the Beta, Lambda, Omicron, Upper Rho, Lower Rho, and Main aquifers. The groundwater elevation contours shown on Figure 4-6 most closely represent the lower portion of the Principal aquifer system and will thus be referred to herein more specifically as Main aquifer groundwater elevations. The Main aquifer typically has the lowest groundwater elevations in the area.

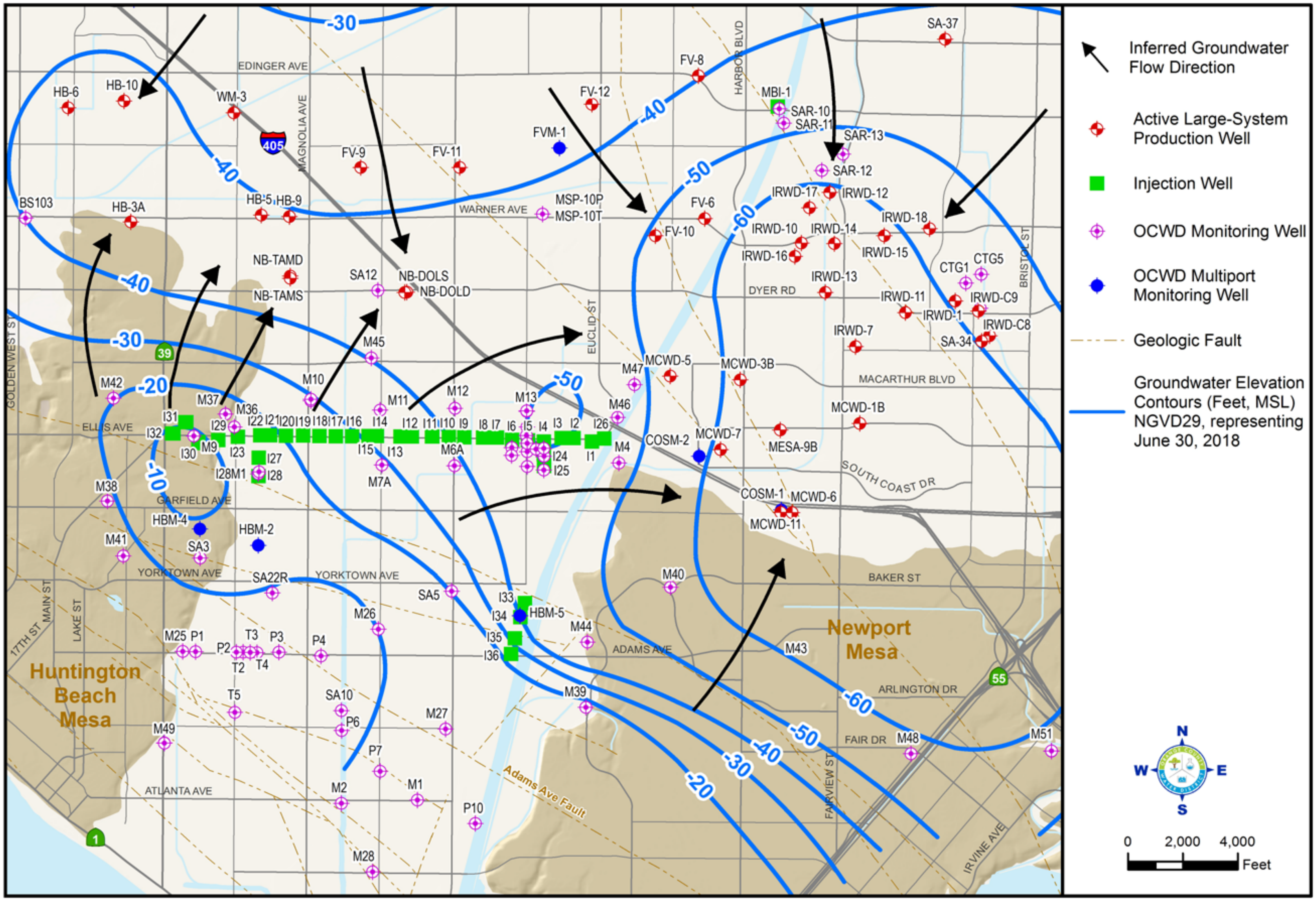


Figure 4-6. Principal Aquifer Potentiometric Surface with Inferred Groundwater Flow Directions in the Talbert Gap Area

As in previous years, the June 2018 Main aquifer groundwater elevations shown on Figure 4-6 indicated a large pumping depression in the area surrounding the Mesa Water production wells and the IRWD DRWF to the east/northeast of the barrier, with Main aquifer groundwater elevations approximately -60 ft msl. North/northwest of the barrier, production wells owned by the cities of Huntington Beach and Newport Beach are relatively fewer and more spread out, and therefore create a less pronounced pumping depression, with Main aquifer groundwater elevations approximately -40 ft msl. Compared to June of the prior year, these groundwater elevations in the Main aquifer for June 2018 were approximately 20 ft higher in the area of the Mesa Water production wells and IRWD DRWF and approximately 10 feet higher in the area surrounding the Huntington Beach and Newport Beach production wells.

Figure 4-6 shows a localized mound of raised Main aquifer groundwater elevations at approximately -10 ft msl surrounding the west end of the Talbert Barrier. All six of the Talbert Barrier west-end deep injection wells were on-line during June 2018. These June 2018 Main aquifer groundwater elevations were approximately 15 to 25 ft higher than the prior June when only four of the six west-end deep injection wells were on-line.

On the east end of the barrier, there are only two Main aquifer injection wells (I24/2 and I26C). Although both were on-line during nearly all of 2018, their combined injection is typically not substantial enough to create a noticeable mound on Figure 4-6. These two deep injection wells are typically kept on-line throughout the year since Main aquifer groundwater levels are much lower on the east end of the barrier than on the west end. Although Main aquifer groundwater elevations shown on Figure 4-6 were well below mean sea level, the Main aquifer is not considered to be directly susceptible to seawater intrusion in this area due to the Newport-Inglewood Fault Zone acting as an effective barrier to inland groundwater flow in the Main aquifer. As mentioned previously in this section, there is an area of slightly elevated salinity within the Main aquifer inland of the fault zone in the Newport Mesa area. Main aquifer chloride concentrations in this area have either decreased slightly or remained stable over the last several years and are continually being monitored as to their nature and extent. All eight Main aquifer injection wells (I24/2, I26C, I27C, I28C, I29C, I30C, I31C, and I32C) were constructed and are primarily used for Basin replenishment, and due to the pumping-induced inland gradient in most years, no Main aquifer injection water is expected to be lost to the ocean, especially considering the barrier effect of the Newport-Inglewood Fault Zone.

4.3.4 Compliance Monitoring Well Trends

Groundwater level hydrographs for the 10-year period 2009-2018 for well sites M10, M11, M19, M45, M46, and M47 are shown on Figure 4-7 through Figure 4-12, respectively. These figures also show chloride concentrations, which are discussed in Section 4.4. The seasonal fluctuations in groundwater levels indicate that the potable aquifers in the Talbert Barrier area – especially

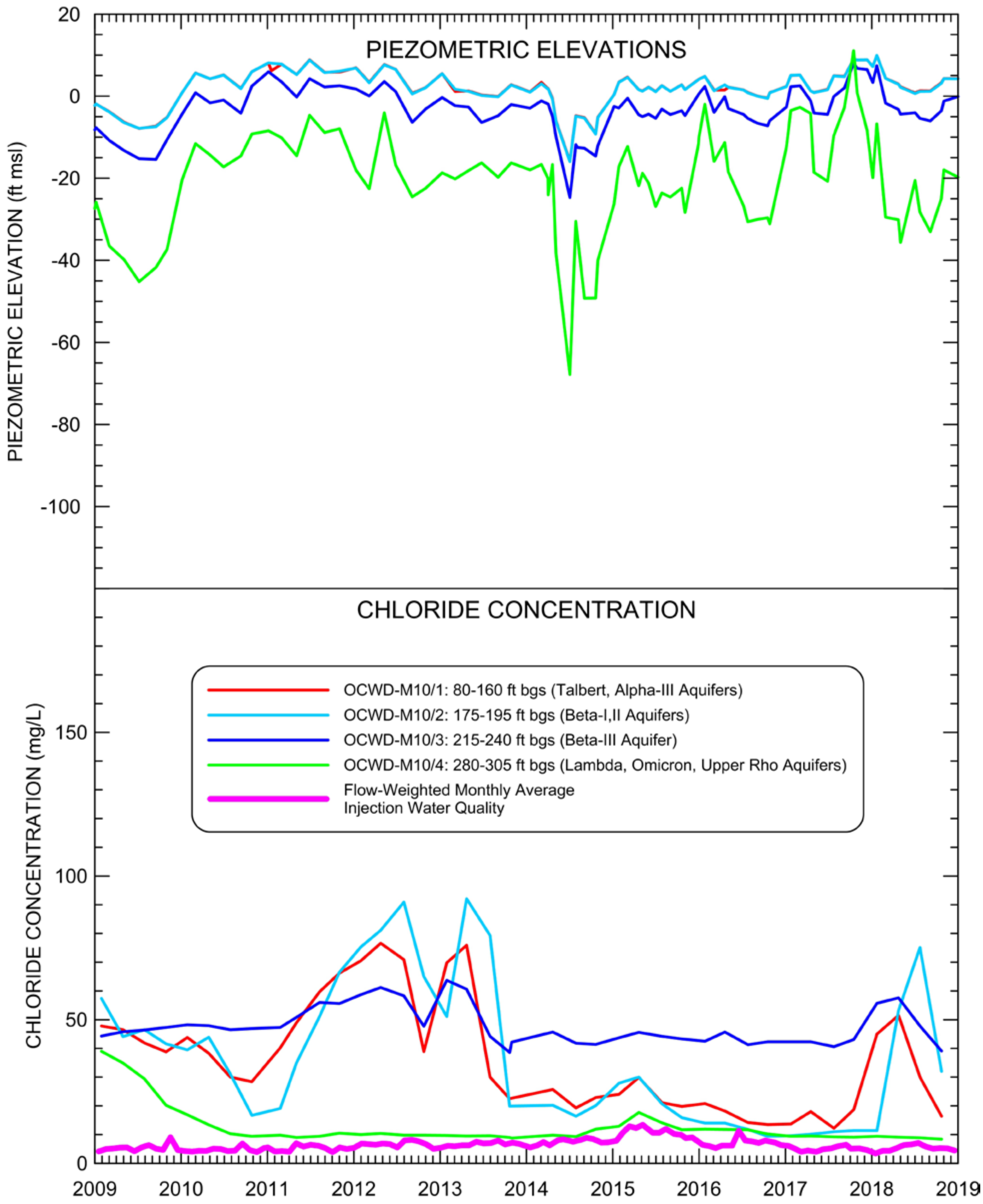


Figure 4-7. Monitoring Well OCWD-M10 Piezometric Elevations and Chloride Concentration

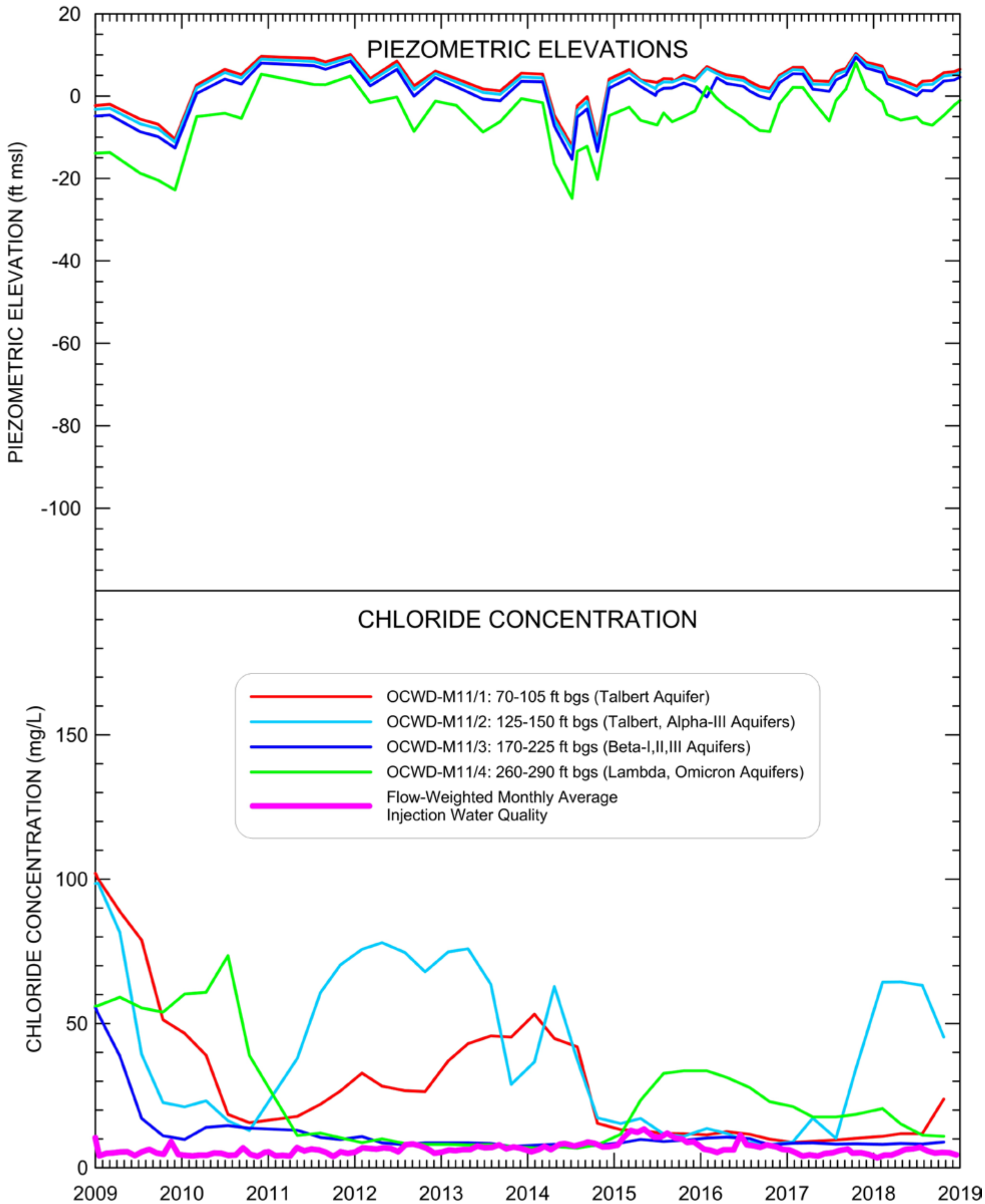


Figure 4-8. Monitoring Well OCWD-M11 Piezometric Elevations and Chloride Concentration

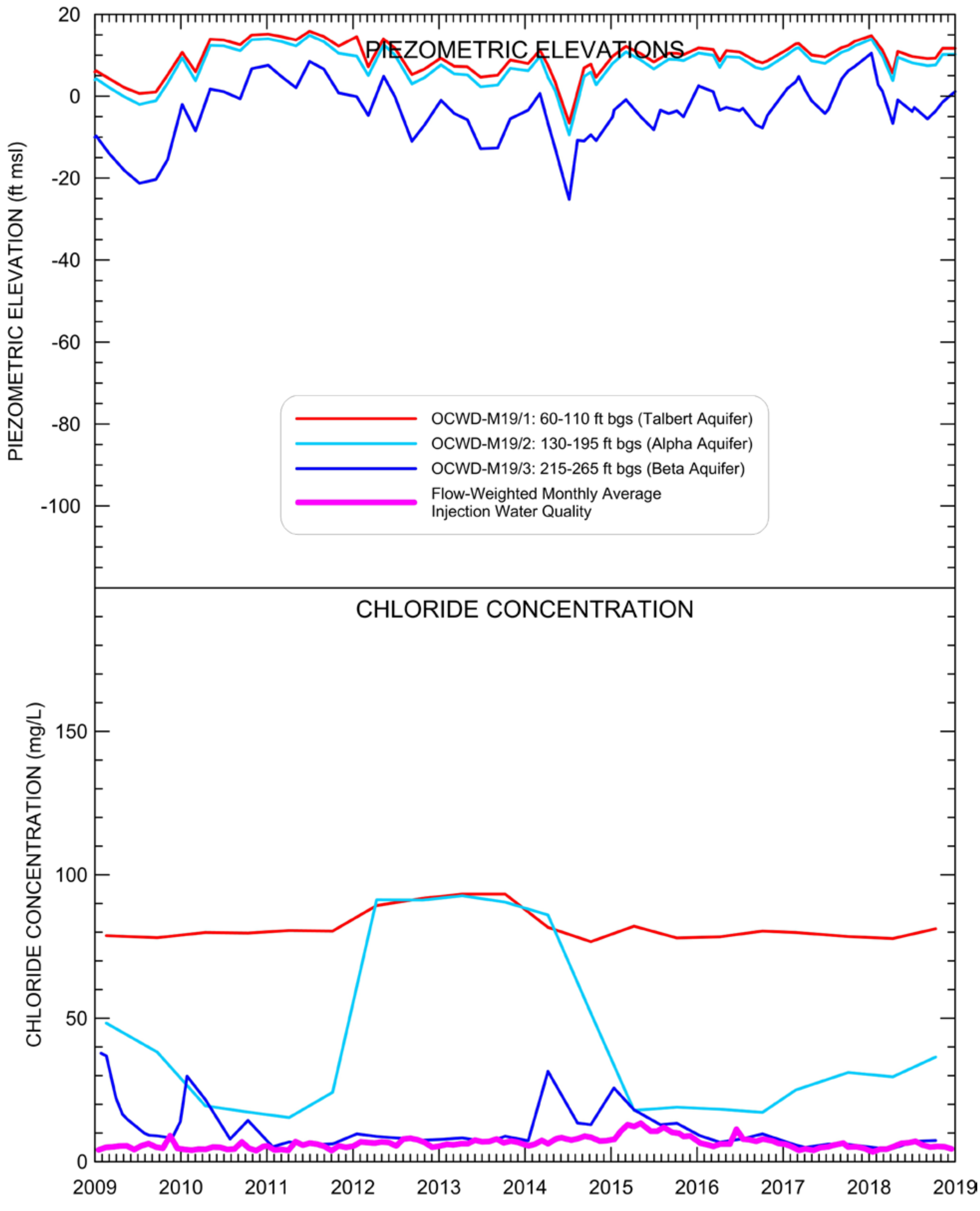


Figure 4-9. Monitoring Well OCWD-M19 Piezometric Elevations and Chloride Concentration

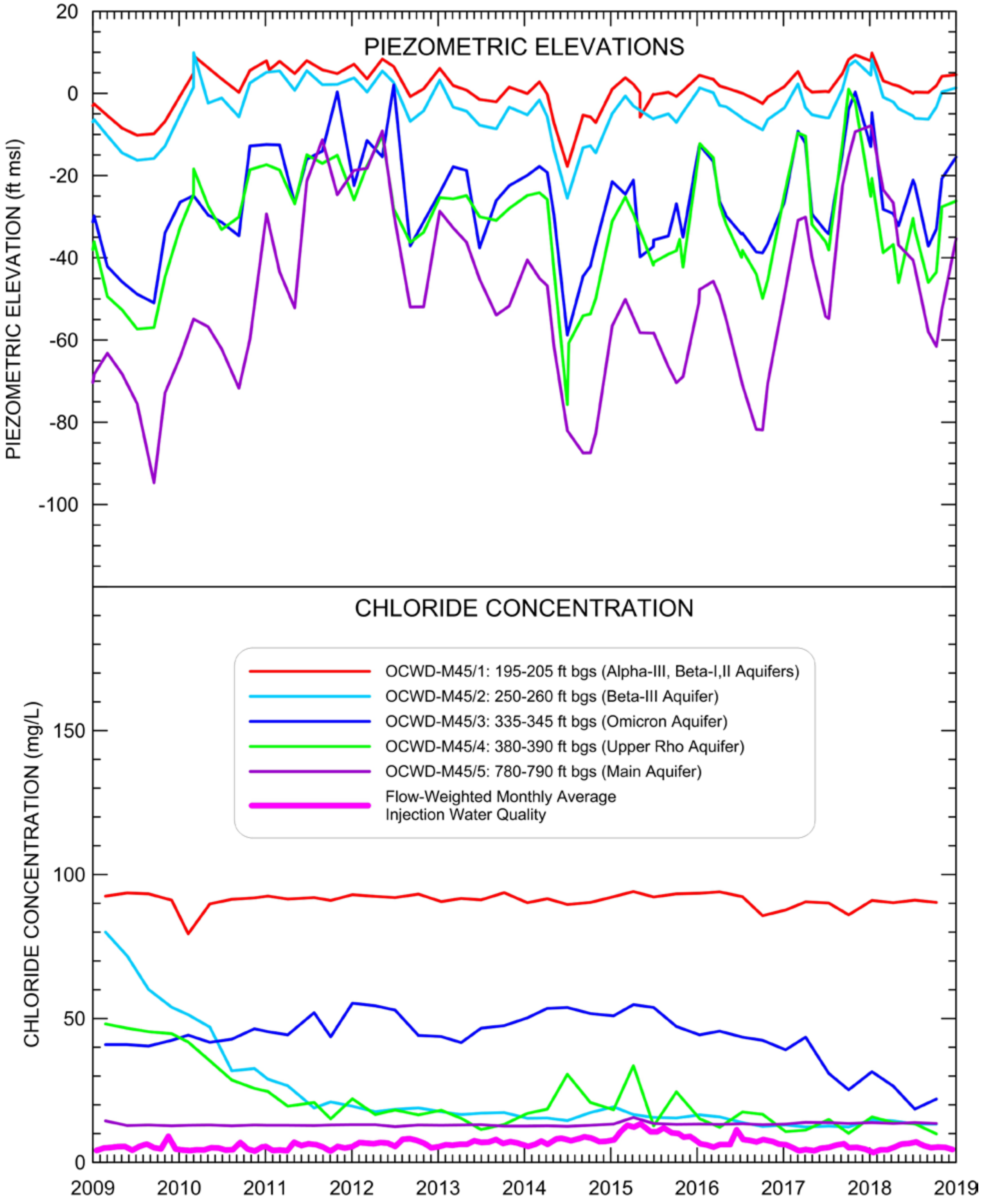


Figure 4-10. Monitoring Well OCWD-M45 Piezometric Elevations and Chloride Concentration

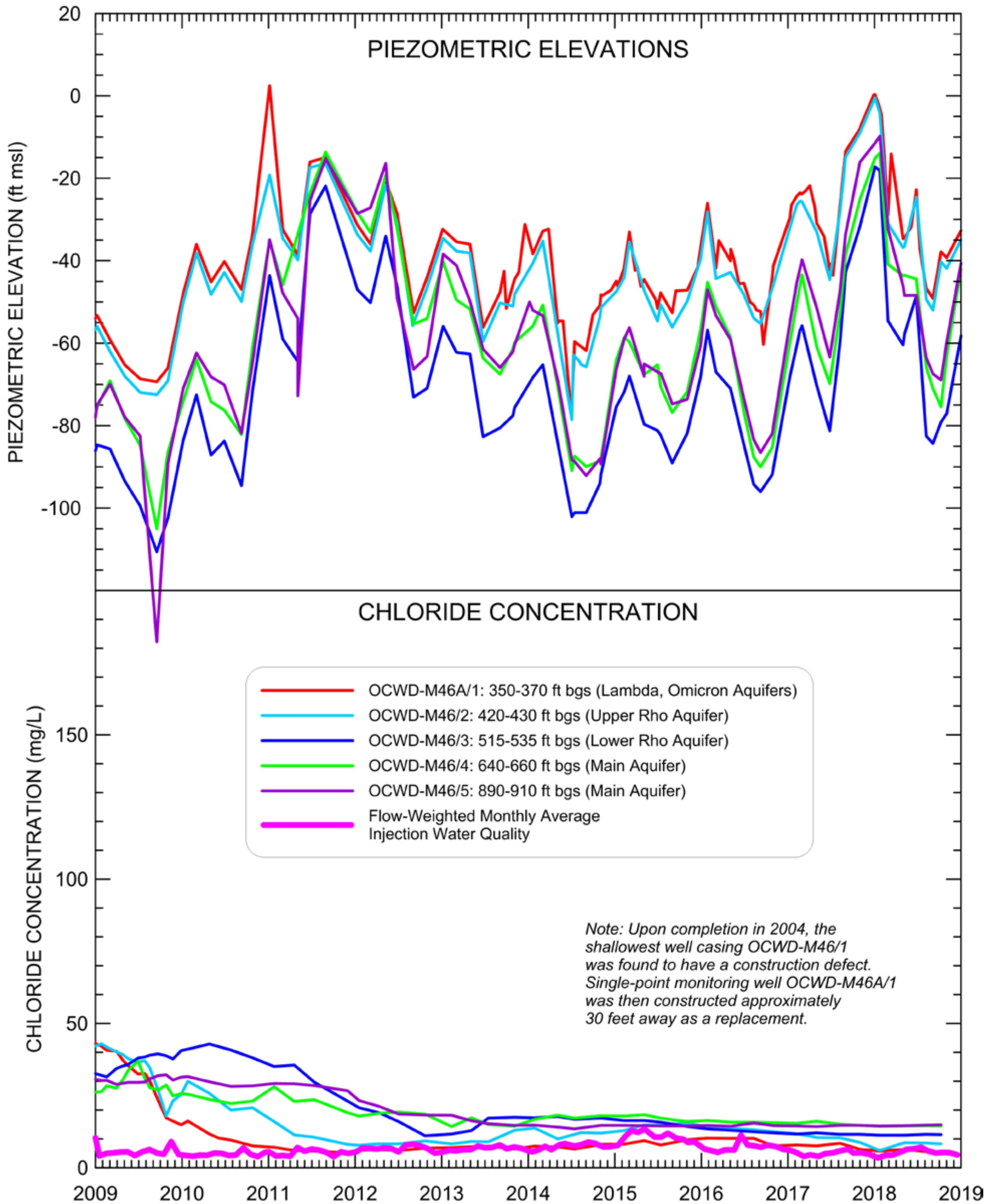


Figure 4-11. Monitoring Well OCWD-M46 and -M46A Piezometric Elevations and Chloride Concentration

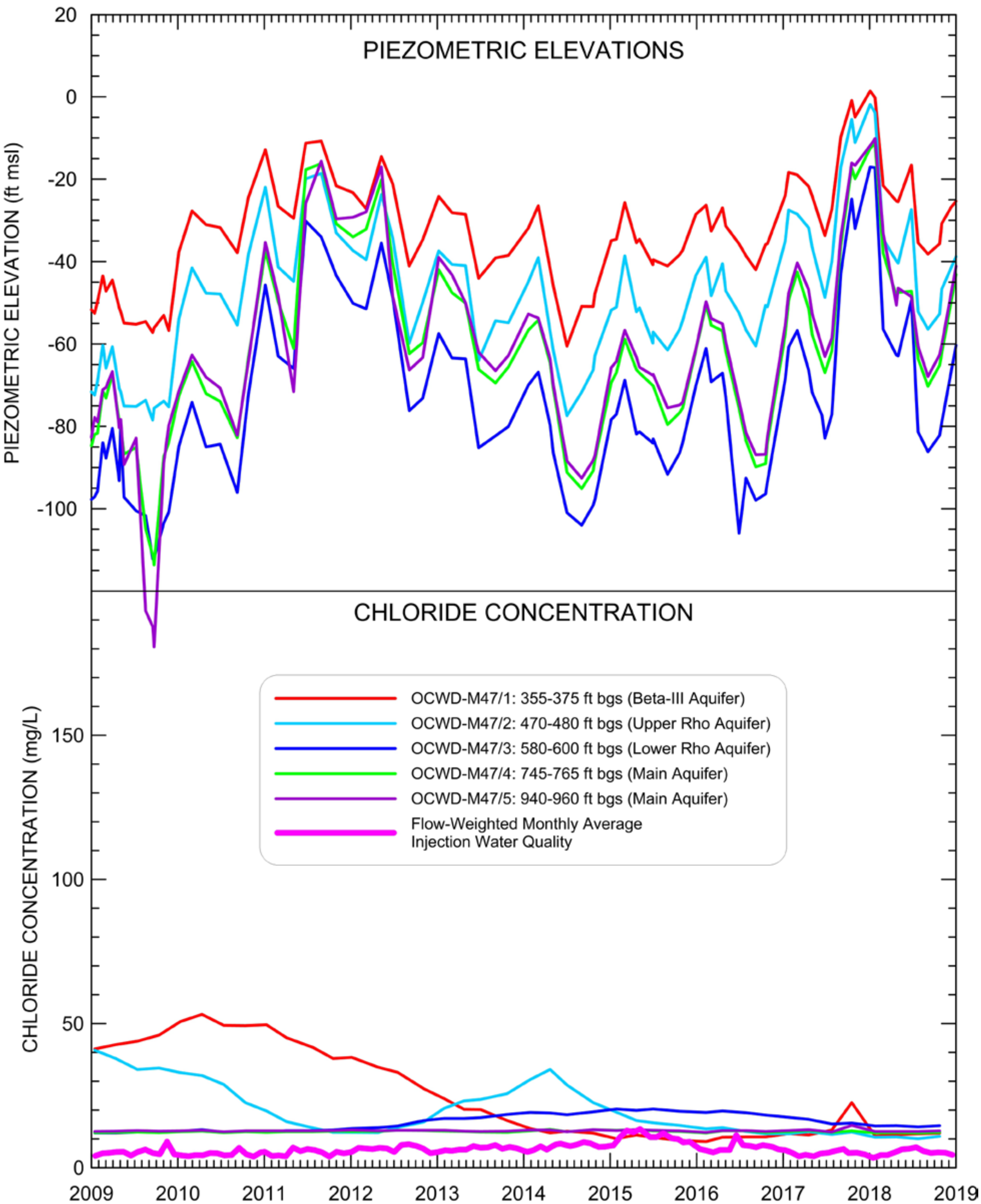


Figure 4-12. Monitoring Well OCWD-M47 Piezometric Elevations and Chloride Concentration

the Principal aquifer system – are influenced heavily by groundwater production, which typically varies considerably from winter to summer based on seasonal water demands.

The discussion that follows describes the seasonal groundwater level trends during 2018 at the barrier compliance monitoring wells for the following three aquifer depth categories: (1) shallow Talbert and Alpha aquifers, (2) intermediate depth Beta, Lambda, Omicron, and Upper Rho aquifers, and (3) deeper Lower Rho and Main aquifers. Only the shallow and intermediate depth aquifers are susceptible to seawater intrusion and have thus historically received injection prior to GWRS.

During the first quarter of 2018, groundwater levels in all barrier compliance wells began the year very high but then declined sharply due to increased groundwater pumping following the end of the Basin-wide In-Lieu Program in January and a very dry 2017-2018 winter. This decline was atypical, as groundwater levels typically rise and reach a peak during the first quarter of most years. This decline was largest in the intermediate and deeper zones most influenced by pumping, i.e., the Lambda, Omicron, Upper Rho, Lower Rho, and Main aquifers. In these aquifers, the decline was 10 to 20 ft at the compliance wells in the west and central portion of the barrier (M10, M11, and M45) and as much as 20 to 40 ft at compliance wells on the east end of the barrier (M46 and M47). In the shallow Talbert and Alpha aquifers, the first quarter decline was much smaller, ranging from 5 to 10 ft.

During the second quarter of 2018, groundwater levels in all compliance monitoring wells were relatively stable and even rose slightly in May and June in the intermediate and deeper zones due to reduced coastal pumping in May. Despite the decline in the first quarter, groundwater levels in the compliance wells at the end of June 2018 were approximately the same or slightly higher than at the end of June 2017 in all aquifer zones.

During the third quarter of 2018, groundwater levels either remained stable or declined slightly in the shallow and intermediate aquifer zones at the compliance monitoring wells in the west and central portions of the barrier (M10, M11, and M45) but declined as much as 20 to 30 ft on the east end of the barrier (M46 and M47) in the intermediate and deeper aquifer zones in response to increased summer pumping and compounded by a planned one-week AWPF and barrier shutdown in September. At the compliance wells, the annual low groundwater levels occurred in September (as is typical) and were just slightly lower than the prior year's annual low that occurred in June 2017 (just prior to commencement of the In-Lieu Program in July 2017).

During the fourth quarter of 2018, groundwater levels in the compliance wells rose (as is typical) due to reduced coastal pumping as the weather cooled along with early season rainfall which led to reduced water demands. The rise was less than 5 ft in the shallow aquifers, 5 to 15 ft in the intermediate aquifers, and 20 to 30 ft in the deeper aquifer zones. Despite the late season rise, groundwater levels at the compliance wells ended the year lower than at the beginning of the year: approximately 5 ft lower in the shallow aquifers, 5 to 10 ft lower in the intermediate aquifers in the west and central portion of the barrier, and 25 to 35 ft lower in the intermediate aquifers at the east end of the barrier (M46 and M47).

Groundwater elevation hydrographs for compliance monitoring wells M46 and M47 (Figure 4-11 and Figure 4-12, respectively) on the east end of the barrier show the large summertime declines within the deeper Lower Rho and Main aquifers, declining to a historical low of more than 120 ft below mean sea level during 2009. During 2018, groundwater elevations in the Lower Rho and Main aquifers declined to a low of approximately 85 ft below mean sea level in September, approximately 5 ft lower than the prior year's summer low. Lower Rho and Main aquifer groundwater elevations at M46 and M47 ended the year approximately 40 feet lower than at the beginning of the year and are primarily influenced by nearby coastal pumping and Basin groundwater storage conditions rather than by barrier injection since the bulk of Main aquifer deep injection occurs on the west end of the barrier.

4.4 Groundwater Quality

This section describes monitoring well groundwater quality for general constituents, 1,4-dioxane, and NDMA in the vicinity of the Talbert Barrier. Groundwater quality for production wells in the vicinity of the Talbert Barrier is also summarized.

4.4.1 Monitoring Wells – General Water Quality

Quarterly compliance groundwater quality data for 2018 are presented in Appendix G for the Talbert Barrier monitoring wells. General groundwater quality data for 2014-18 are summarized in Appendix H for the barrier compliance monitoring wells. Barrier compliance monitoring wells were tested for: (1) an extensive list of inorganic, organic and radiological parameters, (2) the majority of the U.S. Environmental Protection Agency (EPA) Priority Pollutants, and (3) 1,4-dioxane and NDMA. During 2018, arsenic was detected slightly above the Primary Maximum Contaminant Level (MCL) at barrier compliance monitoring well M47/1 in October (10.2 μg/L) but then decreased slightly to just below the MCL by the end of the year. No other constituents were detected above their respective Primary MCL in 2018. During 2012 and the first quarter of 2013, arsenic was similarly detected slightly above the MCL at barrier compliance monitoring well M11/4 but steadily declined below the MCL thereafter down to background levels and remained low during 2018. A few other compliance wells have shown small increases in arsenic that appear to be related to the injection of GWRS water, but their concentrations remain well below the MCL. Section 6.4.2 discusses potential arsenic mobilization resulting from recharge with GWRS purified recycled water at the Anaheim Forebay spreading grounds, as well as OCWD's related studies with Stanford University and recommendations from the NWRI GWRS Independent Advisory Panel.

Lastly, some analyses revealed constituents above the EPA Secondary MCL in 2018 (color and odor), similar to past years and unrelated to purified recycled water injection. No microbial detections were found at the barrier compliance monitoring wells during the first quarter of 2018, which marked the end of the required reporting period for microbial detections as described below.

Historically, relatively few total coliform detections have occurred in GWRS Talbert Barrier compliance monitoring wells. Those that have occurred have been traced back to the infiltration of surface water runoff into well vaults, improper well casing welds, or simply random detections due to the sensitivity of the microbial assay. As such, the monitoring well total coliform results have been found to not always be representative of local groundwater quality. Furthermore, these occasional Talbert Barrier monitoring well total coliform detections have never been traced back to GWRS recycled water quality, as GWRS-FPW is consistently non-detect for total coliforms based on permit-required daily testing (Table 2-1). Therefore, the permit requirement for total coliform monitoring at GWRS groundwater monitoring was rescinded by the RWQCB in February 2018 after review and concurrence by the NWRI GWRS Independent Advisory Panel and DDW.

4.4.2 Monitoring Wells – Intrinsic Chloride Tracer

Dissolved chloride concentrations can be used to trace the subsurface movement of injection water because chloride is relatively unaffected by sorption, chemical, or biological reactions in the aquifer. Thus, chloride is considered to be a relatively good conservative tracer. Groundwater flow paths determined from groundwater level monitoring are also verified by comparing groundwater quality changes at nearby monitoring wells with injection water quality, primarily using chloride concentrations, chloride/bromide ratios, and electrical conductivity. These methods have proven useful for estimating travel times of injection water to reach Talbert Barrier area monitoring wells. These same methods were also used in tracking injected water from the DMBI Project.

Fortunately for tracking purposes, GWRS-FPW has a very low chloride concentration with an annual average ranging from 4 to 11 mg/L since 2008, which is considerably lower than older pre-GWRS injection water which predominantly ranged from approximately 50 to 100 mg/L (with a few sporadic years slightly lower in the 20 to 50 mg/L range) (Table 3-2). Native groundwater inland of the barrier is typically in the range of older pre-GWRS injection water in the shallow zones, less than pre-GWRS injection water but noticeably greater than GWRS water in the intermediate depth zones, and finally just slightly greater than GWRS water in the deep zones.

Observed chloride concentrations for the 10-year period 2009-2018 for barrier monitoring wells M10, M11, M19, M45, M46, and M47 are shown on the lower graph of Figure 4-7 through Figure 4-12, respectively. For comparison, all graphs also show historical flow-weighted monthly average injection water chloride concentrations. Observed chloride concentrations at these compliance wells were influenced by a variety of factors, including: (1) recycled water injection volumes, (2) individual injection well operational status, (3) coastal groundwater production, and (4) overall groundwater storage conditions in the Basin.

Figure 4-9 for monitoring well M19/3 (Beta aquifer) illustrates the efficacy of tracking injection water by using chloride concentrations. With the GWRS coming on-line in January 2008, a subsequent decline in M19/3 chloride concentrations indicated a three-month travel time to that well from the nearest injection well I5. Given a distance of approximately 500 feet from I5 to M19/3, the three-month travel time represented an average groundwater velocity of over 5 feet/day in this vicinity of the barrier in the Beta aquifer. With continued GWRS injection in early 2009, chloride concentrations at M19/3 by mid-2009 were essentially equivalent to those of GWRS water, indicating approximately 100% GWRS purified recycled water at M19/3.

During 2014, Figure 4-9 shows that chloride concentrations at M19/3 experienced a temporary increase from low GWRS levels to 30 mg/L in April 2014 and similar to what occurred in 2010, likely resulting from high groundwater levels causing a temporary shift in the gradient direction or a complete gradient reversal from landward to seaward in which older injection water located inland of M19/3 migrated back to M19/3; this gradient reversal phenomenon has previously been observed during other high groundwater periods at other nearby monitoring wells and is also discussed in the next section (Section 4.4.3) with regards to temporary increases in 1,4-dioxane. By the end of 2015, chloride concentrations at M19/3 decreased back to GWRS levels, indicating a reversal of the gradient back to landward that has persisted through 2018 with chloride concentrations at M19/3 remaining below 10 mg/L.

At M19/2 (Alpha aquifer), chloride concentrations also suggest gradient reversals (Figure 4-9). The decrease in chloride concentrations at M19/2 down to near-GWRS levels from late 2008 to 2011 indicated the sustained arrival of GWRS water during those years, whereas increased chloride concentrations back to pre-GWRS levels from late 2011 through 2013 indicated a three-year seaward gradient reversal due to higher groundwater levels. From 2014 through 2016, chloride concentrations declined back down below 20 mg/L at M19/2, suggesting a landward gradient once again with predominantly GWRS water at this well. Since 2017, chloride concentrations at M19/2 have gradually increased and reached 37 mg/L by the fourth quarter of 2018, indicating a higher percentage of pre-GWRS injection water due to a reversal or partial shift to a mildly seaward gradient because of higher groundwater conditions over the last two years.

At M19/1, chloride concentrations have remained stable at historical background levels of approximately 80 to 100 mg/L (Figure 4-9), significantly higher than GWRS water and thus indicating that no GWRS water has ever reached this well within the shallow Talbert aquifer, consistent with the observed seaward gradient at this location.

At monitoring well site M11, Figure 4-8 shows that chloride concentration decreases at various times after GWRS injection began indicate arrival of GWRS water in all four zones, with arrival being the fastest at M11/3 (Beta aquifer) with an estimated travel time from the barrier of approximately 10 months. Since this well is 1,000 feet north of the barrier, this would imply an average groundwater velocity of approximately 3 feet/day, which is consistent with groundwater velocity estimates for other flow paths emanating from the barrier. During 2018, chloride concentrations remained below 9 mg/L at M11/3, indicating 100% GWRS purified recycled water at this well and indicating that the gradient remained predominantly landward in the Beta aquifer at this location.

Chloride concentrations shown on Figure 4-8 for monitoring well M11/4 (Lambda aquifer) indicate that arrival was slowest in this zone with an estimated travel time from the barrier of approximately 3 years. Possible reasons for the relatively long observed travel time may include: lower permeability in the Lambda aquifer near M11 as compared to the Beta aquifer, little or no injection into the Lambda aquifer legacy injection wells nearest M11, or the injection water flow path to M11 is originating from more distant injection wells. Another complicating factor is that the Lambda-Upper Rho mergence zone is located immediately south of the barrier in this vicinity and could be locally influencing the injection water flow pattern. Chloride concentrations at M11/4 increased from low GWRS levels to 34 mg/L during 2015, likely indicating a gradient reversal or slight shift in gradient direction allowing older pre-GWRS injection water and/or native groundwater to migrate back to this well. Since 2016, chloride concentrations have gradually decreased and were as low as 11 mg/L by the fourth quarter of 2018, indicating nearly 100% GWRS water once again resulting from a landward gradient.

At M11/1 (Talbert aquifer) and M11/2 (Talbert and Alpha aquifers), Figure 4-8 shows that chloride concentrations began 2017 at low GWRS levels at both wells but increased sharply at M11/2 during the second half of 2017 and peaked to over 60 mg/L during the first three quarters of 2018 before declining slightly to 45 mg/L during the fourth quarter of 2018. At M11/1, chloride concentrations also increased in 2017 and 2018 but the trend was subtler and continued to the end of 2018, reaching 24 mg/L. At both wells, the chloride concentration increase indicated a mild seaward gradient reversal during the second half of 2017 and most of 2018 in the Talbert and Alpha aquifers at this location.

At M10/1 (Talbert and Alpha aquifers) and M10/2 (Beta-I and Beta-II aquifers), Figure 4-7 shows that chloride concentrations began 2017 at low GWRS levels at both wells but then rose sharply at M10/1 during the second half of 2017 and first half of 2018, peaking at 52 mg/L during the second quarter of 2018. At M10/2, chloride concentrations also rose sharply but slightly later during the first quarter of 2018 and peaked at 75 mg/L during the third quarter of 2018. In both cases, the chloride concentration increase was likely due to a seaward shift in the gradient, allowing older pre-GWRS injection water to migrate back to these two wells. However, this seaward gradient reversal was short-lived as chloride concentrations declined once again at both M10/1 and M10/2 in the second half of 2018.

Figure 4-7 shows that chloride concentration trends in the Beta-III aquifer at M10/3 were similar to but much more dampened than at M10/1 and M10/2 over the entire period shown. Since 2014, chloride concentrations at M10/3 have remained somewhat high and stable at approximately 40 mg/L, likely indicating a much smaller percentage of GWRS water. Contemporaneous with the chloride increase at M10/1, chloride concentrations experienced a subtle rise at M10/3 in the last half of 2017 and first half of 2018 up to 58 mg/L before dropping back down to approximately 40 mg/L once again by the end of 2018, indicating a short-lived gradient reversal similar to M10/1 but never dropping back down to low GWRS chloride levels. The Beta aquifer at this location may have a much lower permeability and/or the landward gradient from the barrier towards M10 may be flatter or less pronounced than in other portions of the barrier.

At M10/4 (Lambda, Omicron, and Upper Rho aquifers), the first arrival of GWRS purified recycled water occurred during the last quarter of 2008, as evidenced by the steady chloride concentration decrease from October 2008 through 2010 (Figure 4-7). Thus, a travel time of approximately 10 to 12 months is estimated for injection water to reach M10/4 in the Lambda aquifer. Since 2010, chloride concentrations at M10/4 have mostly remained stable and low near GWRS levels, indicating a prolonged predominance of GWRS purified recycled water at this well due to a consistently landward gradient in these aquifers. During 2018, chloride concentrations at M10/4 remained low and stable below 10 mg/L, indicating 100% GWRS water at this well.

The results from barrier compliance monitoring well sites M45, M46, and M47 were also consistent with OCWD's hydrogeological understanding of the area. Similar to the correlation of chloride trends between injected water and monitoring well M19/3, chloride trends at monitoring well M46A/1 (Lambda aquifer) also showed the influence of injection water, albeit in a somewhat slower and more dispersive fashion (Figure 4-11). A travel time of approximately 10 months was observed after GWRS came on-line in January 2008, based on the subsequent drop in chloride concentrations observed at monitoring well M46A/1 during the fourth quarter of 2008. Since 2011, chloride concentrations at M46A/1 have remained low and stable at GWRS levels, indicating the continued presence of 100% GWRS purified recycled water in the Lambda aquifer at this location.

In the four other deeper zones at the M46 monitoring well site, the arrival of GWRS water is indicated by the chloride concentration decline in each well (Figure 4-11). However, the chloride decline becomes more delayed and dampened with depth due to dispersive transport and a weaker GWRS injection signal from only two injection wells (I24/2 and I26C) screened in the Lower Rho and Main aquifers on the east end of the barrier. Therefore, reliable travel times could not be discerned for these deeper zones at the M46 site. During 2018, chloride concentrations remained relatively low and stable ranging from approximately 6 to 15 mg/L in the four deeper zones (M46/2, M46/3, M46/4, and M46/5), just slightly higher than at M46A/1, thus indicating a predominance of GWRS water but slightly less than 100% at those four wells.

At M47/1 (Beta-III aquifer), Figure 4-12 shows that chloride concentrations were low and stable at approximately 12 mg/L during the first half of 2017, indicating nearly 100% GWRS purified recycled water at this well, but then experienced a brief increase to 23 mg/L during the fourth quarter of 2017, likely indicating a temporary gradient shift or reversal due to higher groundwater levels. During 2018, chloride concentrations were low and stable at approximately 12 mg/L, indicating a shift back to a landward gradient from the barrier and nearly 100% GWRS water at this well once again. Due to the gradual dampened nature of the chloride concentration declines, an accurate GWRS arrival time cannot be calculated but is likely greater than three years.

At M47/2 (Upper Rho aquifer), Figure 4-12 shows that chloride concentrations first began to gradually decline in late 2008 much sooner than at the shallower M47/1, likely indicating that the GWRS arrival time to M47/2 is faster than M47/1 but once again is not readily discernable due to the dampened trends. During 2018, chloride concentrations at M47/2 were low and stable at 10 to 11 mg/L, indicating a predominance of GWRS water. At the three deeper zones M47/3, M47/4, and M47/5 screened in the Lower Rho and Main aquifers, GWRS arrival is inconclusive based on the low and stable chloride concentrations since prior to the commencement of GWRS injection.

As shown on Figure 4-10, chloride concentrations at M45/2 (Beta aquifer) and M45/4 (Upper Rho aquifer) gradually declined since 2008, indicating the arrival of GWRS water in these two zones but reliable travel time estimates were not discernable due to the dampened trends. During 2018, chloride concentrations were low and stable in both wells, ranging from 10 to 16 mg/L and indicating a predominance of GWRS water slightly less than 100%.

At M45/3 (Omicron aquifer), Figure 4-10 shows that chloride concentrations remained relatively high within a range of approximately 40 to 50 mg/L until finally beginning to decline for the first time during 2017 with a continued decline for the first three quarters of 2018 to a historical low of 19 mg/L before a slight uptick to 22 mg/L during the fourth quarter of 2018. These lower chloride concentrations since the beginning of 2017 likely indicate some proportion of GWRS water arriving at this well in the Omicron aquifer.

In the intermediate depth aquifers (Beta, Lambda, Omicron, and Upper Rho) landward of the Talbert Barrier near monitoring well site M45 (and also M11) exists a seasonally variable east-west groundwater flow divide due to being near the geometric center of the Ellis Avenue injection barrier alignment as well as being flanked to the northwest by the Huntington Beach and Newport Beach production wells and to the east/northeast by the Mesa Water wells and the

IRWD DRWF. This groundwater flow divide was again evident in the Lambda aquifer based on the June 2018 groundwater elevation contours shown on Figure 4-5. Therefore, the direction of groundwater flow at monitoring well site M45 in the Lambda aquifer and the other intermediate depth aquifers may vary both seasonally and from year to year and depend largely on the timing and amount of municipal well production and to a lesser extent on the distribution and amount of barrier injection.

Finally, at M45/5 (Main aquifer), GWRS arrival is inconclusive based on the low and stable chloride concentrations (Figure 4-10) since prior to the commencement of GWRS injection. This well is located over a mile downgradient to the northeast from the nearest Main aquifer deep injection wells on the west end of the barrier.

4.4.3 Monitoring Wells – 1,4-Dioxane and NDMA

In 2000-01, OCWD discovered elevated levels of 1,4-dioxane and NDMA present in injection water produced by WF-21. Subsequently, OCWD began frequent monitoring for 1,4-dioxane and NDMA at several locations: in the WF-21 source water, intermediate treatment steps, final product water, and both monitoring and production wells located near the Talbert Barrier. By 2001, OCSD and OCWD implemented additional source control measures and installed a UV/AOP treatment process as part of WF-21 in order to produce injection water in compliance with drinking water guidance levels for 1,4-dioxane and NDMA. Figure 4-13 shows the 1,4-dioxane and NDMA concentrations in injection water since 2000; GWRS-FPW has been tested for NDMA and 1,4-dioxane at least weekly since 2008. In March 2002, DDW reduced the Notification Level (known as the Action Level prior to January 1, 2005) for NDMA to the current level of 10 ng/L. The Notification Level (NL) for 1,4-dioxane was originally set at 3 μg/L but was subsequently reduced to 1 μg/L in November 2010. DDW recommends that a drinking water production well be taken out of service if the Response Levels (RL) of 300 ng/L for NDMA or 35 μg/L for 1,4-dioxane are exceeded. While these NLs are not formal permit limits for GWRS, OCWD consistently produces purified recycled water for injection and recharge with concentrations below detection and/or below these NLs (Figure 4-13). No drinking water production wells in the vicinity of the Talbert Barrier have NDMA or 1,4-dioxane concentrations even remotely approaching their respective RL.

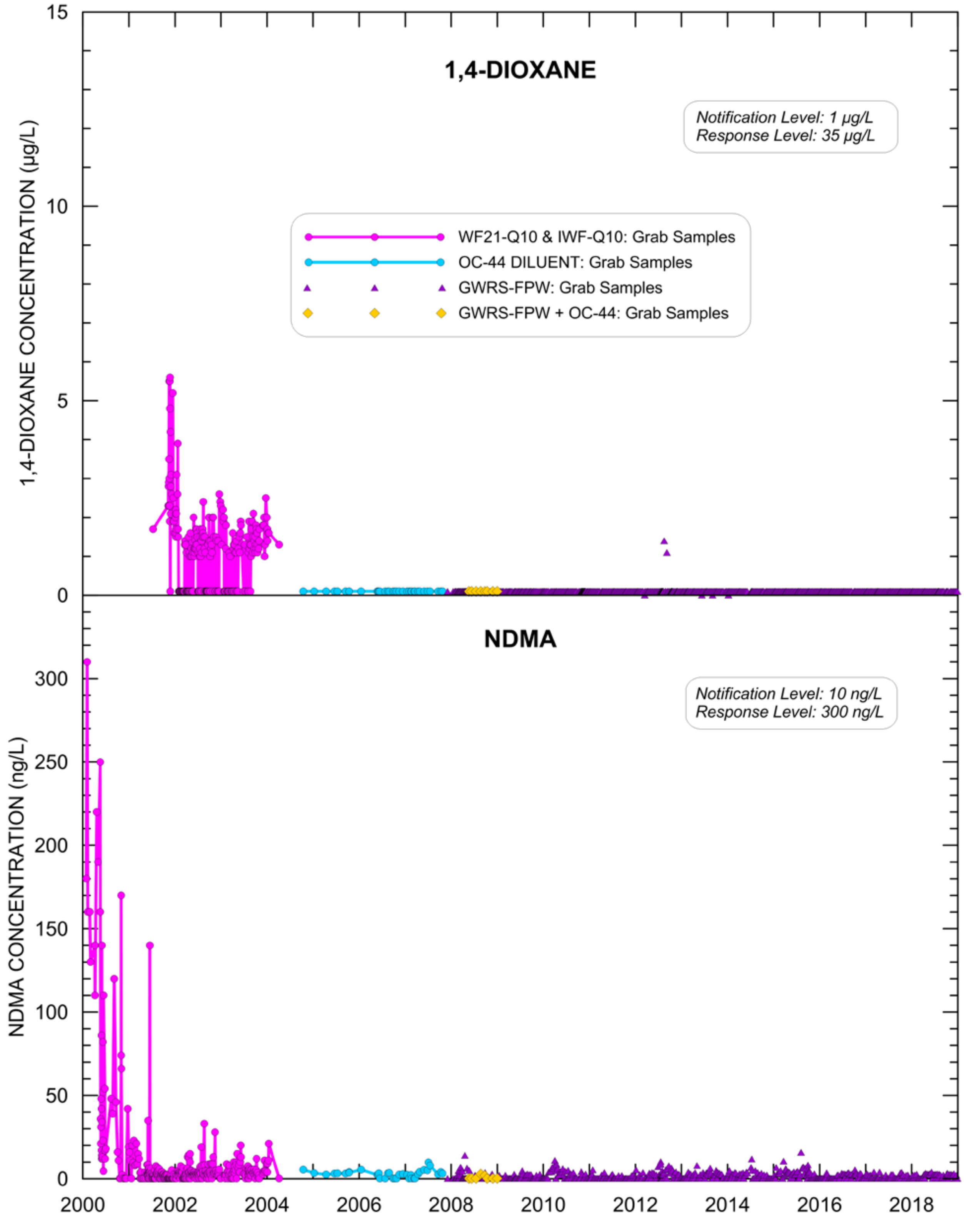


Figure 4-13. Talbert Barrier Injection Water 1,4-Dioxane and NDMA Concentrations

Testing for NDMA and 1,4-dioxane at monitoring wells and production wells near the Talbert Barrier continued during 2018. Data from the monitoring wells are illustrated on Figure 4-14 through Figure 4-19 and are presented in Appendix H. During 2018, all barrier compliance monitoring wells except M19 and M47 had one or more aquifer zones with 1,4-dioxane concentrations that were above the DDW NL of 1 μg/L during at least a portion of the year, but all samples at all six monitoring wells were significantly below the DDW RL for drinking water systems; these detections are a legacy of WF-21 injection. In contrast, NDMA was only detected in one monitoring well during 2018 at M46A/1, and it was well below the DDW NL of 10 ng/L. In general, OCWD has observed 1,4-dioxane to be more persistent than NDMA in groundwater in the vicinity of the Talbert Barrier.

The 1,4-dioxane results for monitoring well site M10 (Figure 4-14) in 2018 continued to show the highest concentrations in M10/3 (Beta aquifer) and much lower or ND in the other three aquifer zones. Concentrations of 1,4-dioxane at M10/3 increased gradually throughout 2018 from 4.7 μg/L in January to 6.5 μg/L in October. The slight increase in 1,4-dioxane concentrations at M10/3 is consistent with the increase in chloride concentrations at this well in the first half of 2018 which indicated a short-term seaward gradient shift or reversal, causing a higher percentage of older (pre-GWRS) WF-21 injection water to migrate back to this well.

Concentrations of 1,4-dioxane at M10/4 (Lambda, Omicron, and Upper Rho aquifers) experienced a slight increase during the first half of 2015 (Figure 4-14) consistent with the contemporaneous small increase in chloride concentrations at this well (Figure 4-7) that indicated a temporary shift or reversal in the gradient within the Lambda aquifer at this location. The subsequent decline in both chloride concentrations and 1,4-dioxane concentrations below the reportable detection limit (RDL) of 1 μg/L during the second half of 2015 and continuing below the RDL through 2018 indicated the return of a more typical sustained landward gradient from the barrier to this well and a predominance of GWRS water.

At M10/2 (Beta-I and Beta-II aquifers), Figure 4-14 shows that concentrations of 1,4-dioxane increased during the second half of 2014 and first half of 2015 once again consistent with the contemporaneous small increase in chloride concentrations at this well (Figure 4-7). Like M10/4, this short-term subtle increase was likely due to a short-term gradient shift or reversal from landward to seaward.

Concentrations of 1,4-dioxane at M10/2 subsequently decreased back down to 1 μg/L by the end of 2015, had one minor detection in 2016, and remained below the RDL through 2018, consistent with the contemporaneous low chloride concentrations at this well indicating a landward gradient and predominance of GWRS water.

At M10/1 (Talbert and Alpha aquifers), Figure 4-14 shows that concentrations of 1,4-dioxane at M10/1 gradually declined from 2015-2017 and dropped below the RDL during the fourth quarter

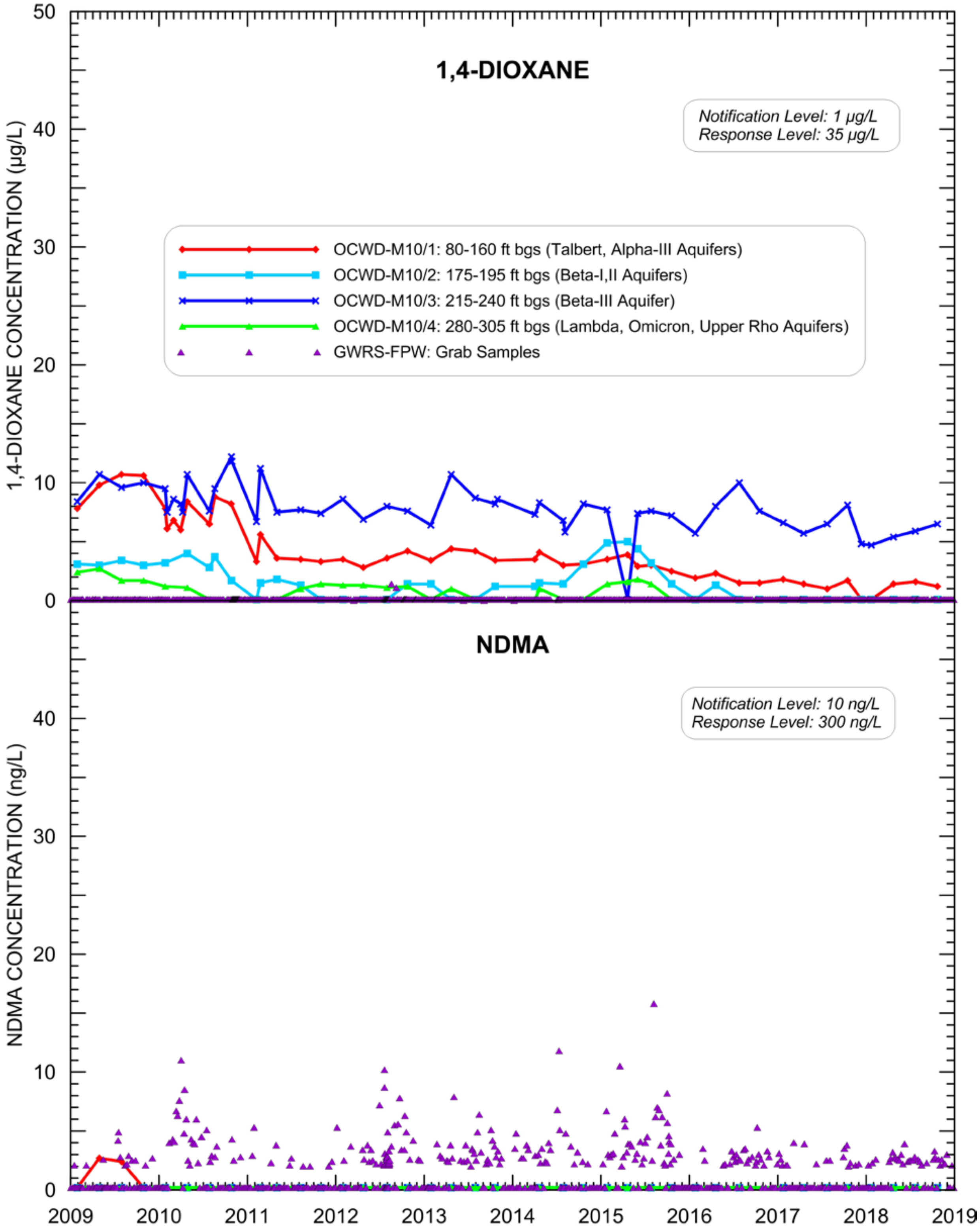


Figure 4-14. Monitoring Well OCWD-M10 1,4-Dioxane and NDMA Concentrations

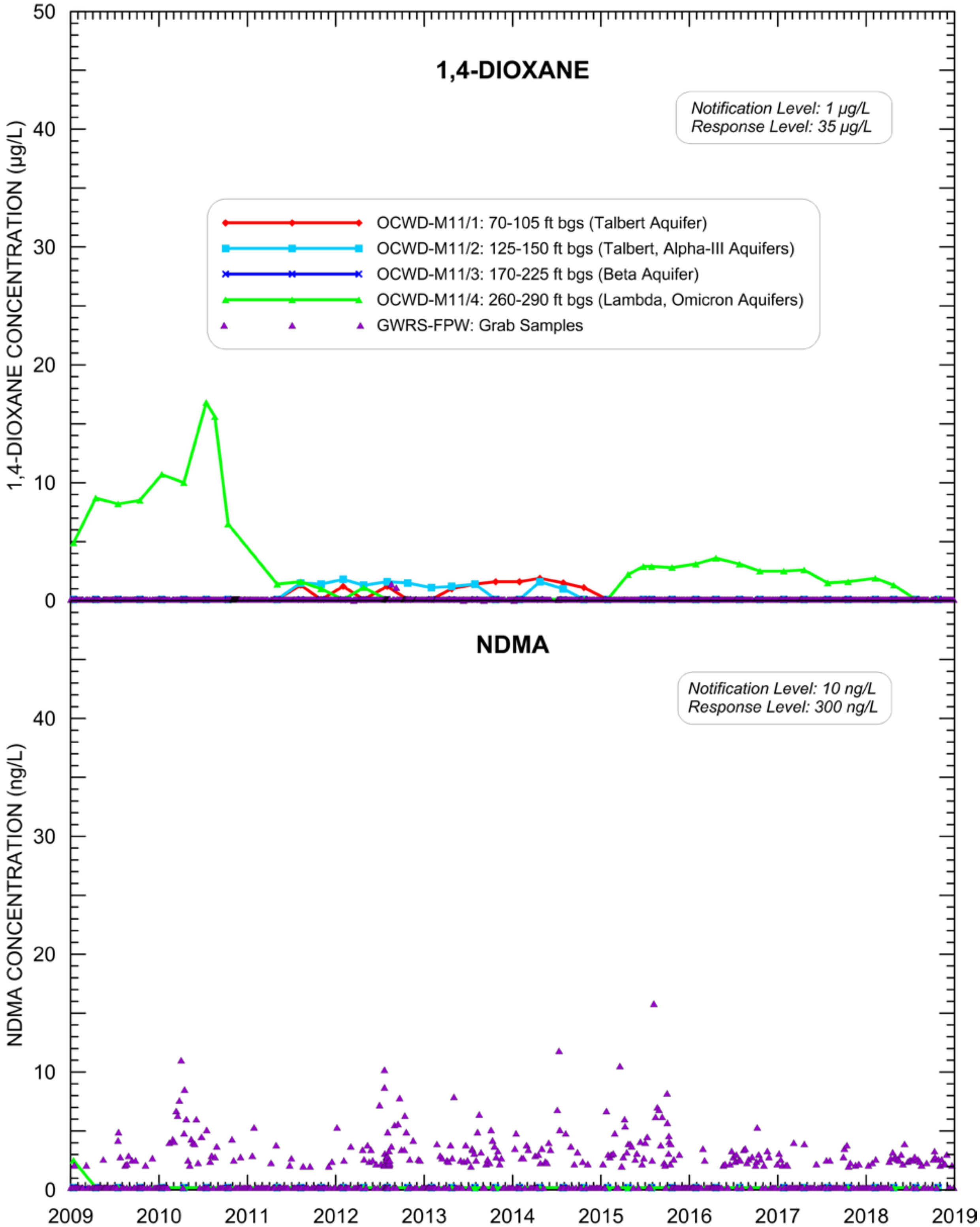


Figure 4-15. Monitoring Well OCWD-M11 1,4-Dioxane and NDMA Concentrations

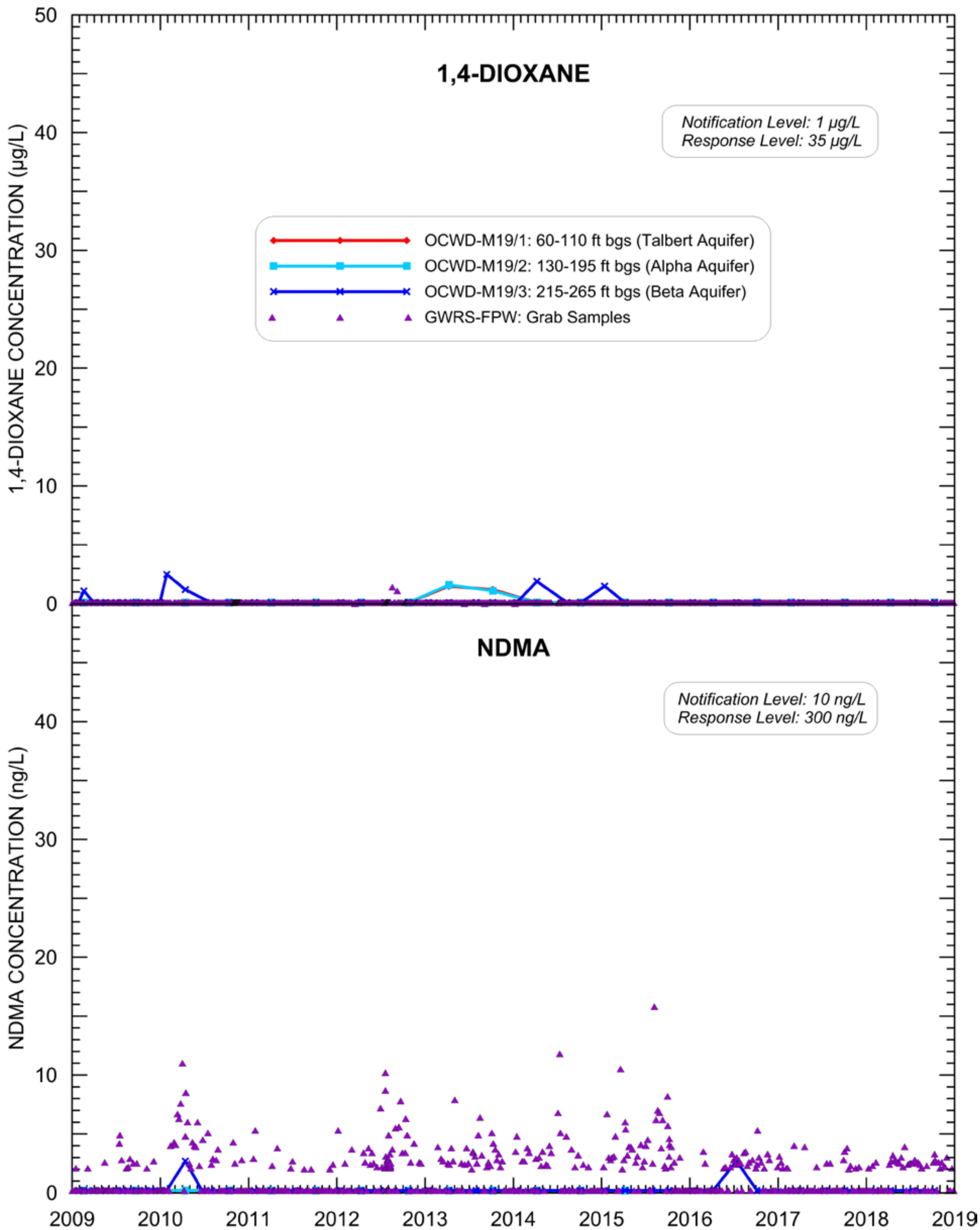


Figure 4-16. Monitoring Well OCWD-M19 1,4- Dioxane and NDMA Concentrations

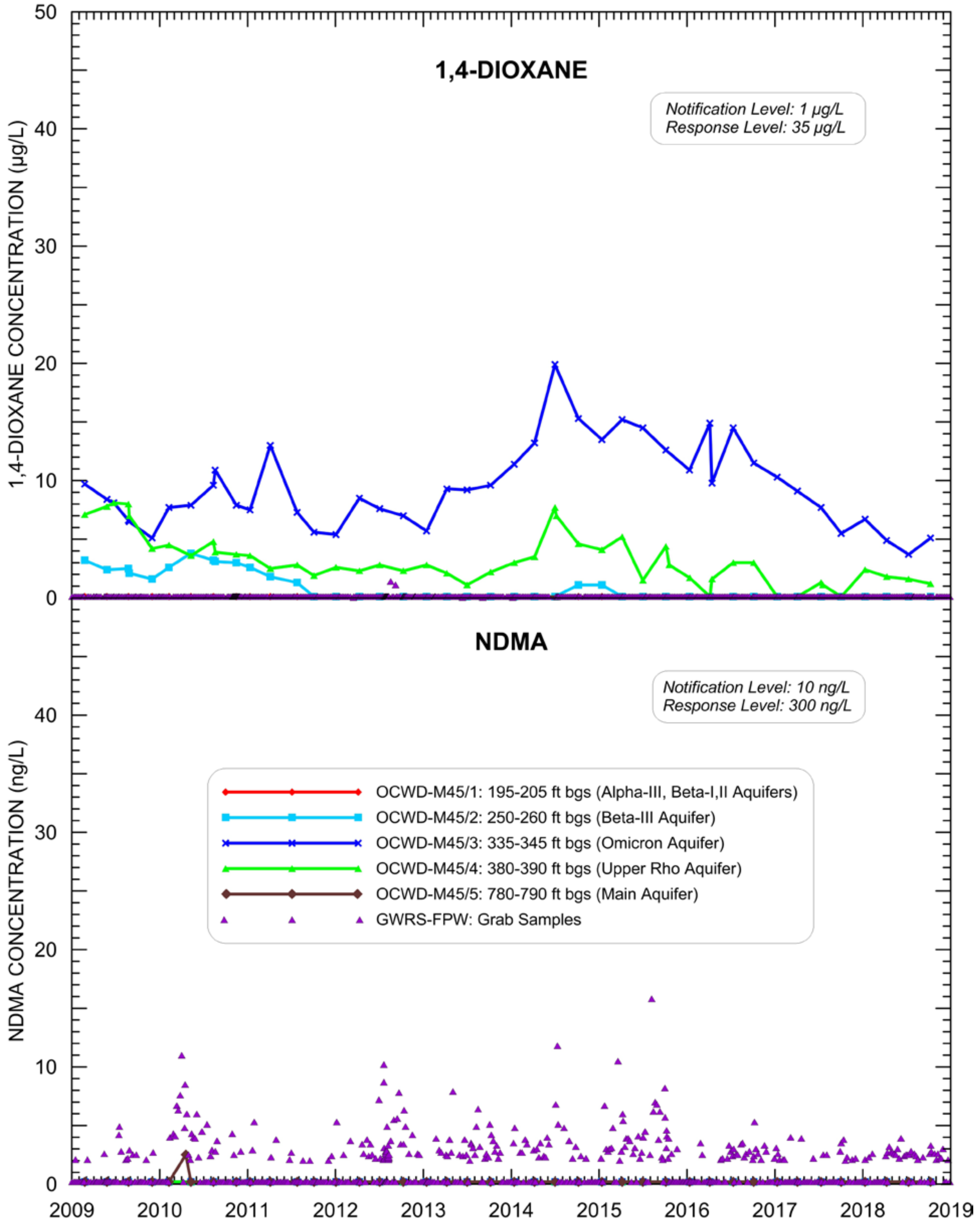


Figure 4-17. Monitoring Well OCWD-M45 1,4-Dioxane and NDMA Concentrations

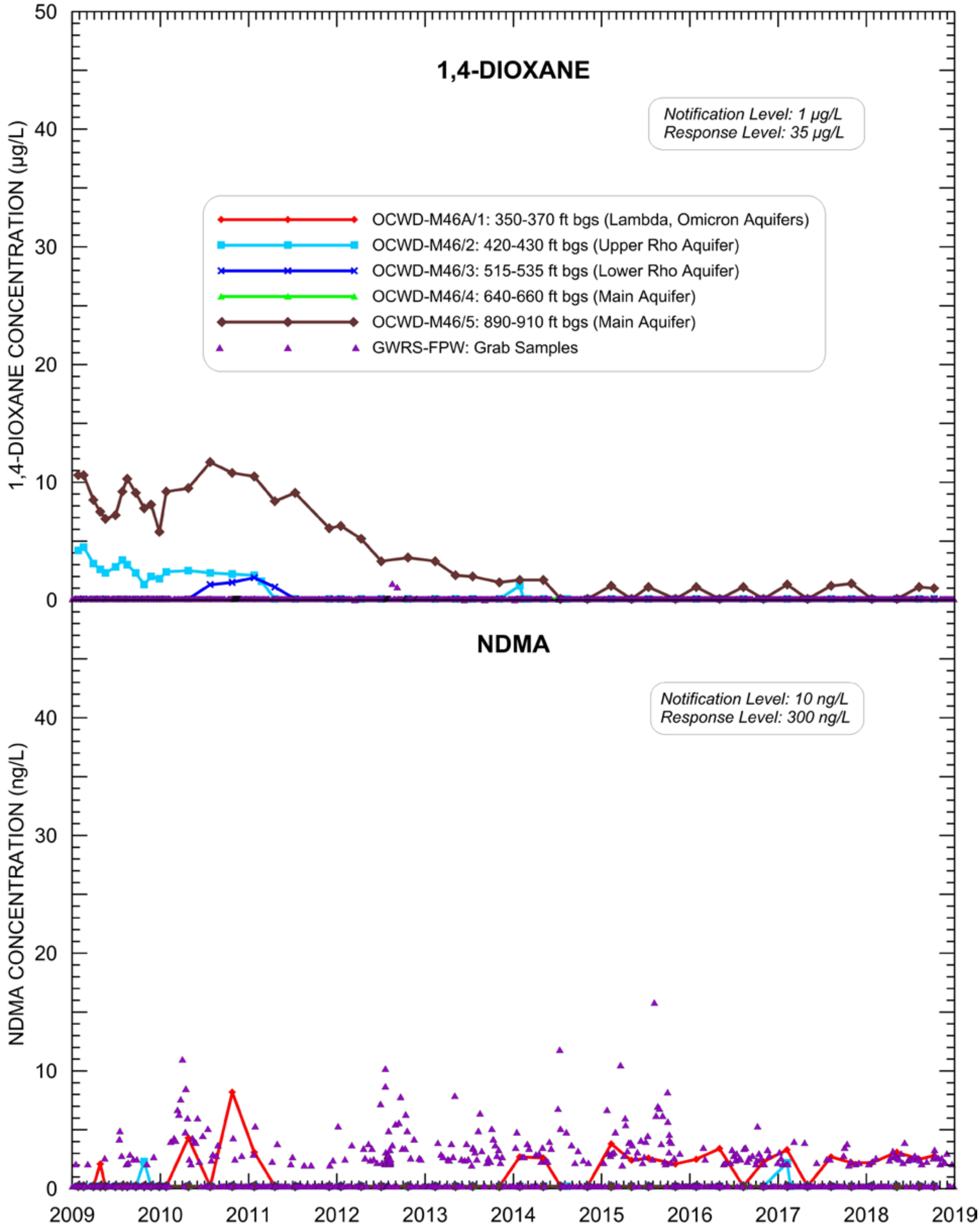


Figure 4-18. Monitoring Well OCWD-M46 1,4-Dioxane and NDMA Concentrations

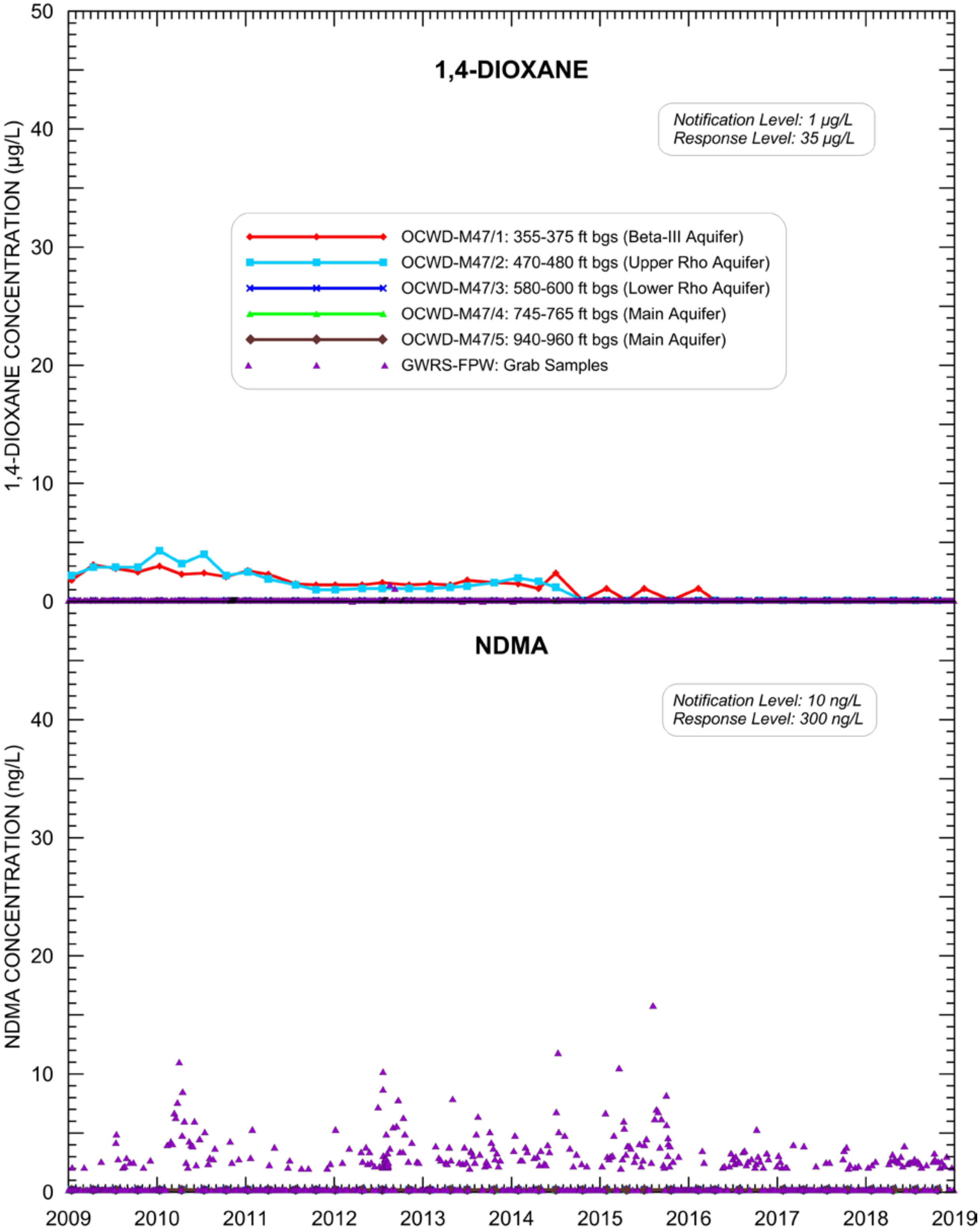


Figure 4-19. Monitoring Well OCWD-M47 1,4-Dioxane and NDMA Concentrations

of 2017 and first quarter of 2018. This declining trend was consistent with similarly declining and low chloride concentrations at this well (Figure 4-7), indicating a landward gradient and an increasing percentage of GWRS water. During the last three quarters of 2018, concentrations of 1,4-dioxane rose slightly to just above the RDL and were consistent with the contemporaneous increase in chloride concentrations at this well (Figure 4-7), which indicated a short-term reversal in the gradient from landward to seaward and caused older pre-GWRS injection water to migrate back to this well.

NDMA concentrations at monitoring well site M10 (all zones) remained below the RDL of 2 ng/L throughout 2018.

At monitoring well site M11, Figure 4-15 shows that concentrations of 1,4-dioxane remained below the RDL of 1 μg/L from 2015 through 2018 at all casings except at M11/4 (Lambda and Omicron aquifers) where 1,4-dioxane concentrations increased slightly during 2015 and the first half of 2016 up to 3.6 μg/L, consistent with the contemporaneous increase in chloride concentrations at M11/4 (Figure 4-8) and signaling a gradient shift or reversal that likely brought a pulse of older pre-GWRS water back to this well. Since the second half of 2016, concentrations of 1,4-dioxane at M11/4 have gradually declined and were below the RDL during the second half of 2018, consistent with the contemporaneous decline in chloride concentrations at this well due to an increasing percentage of GWRS water.

At M11/3 (Beta aquifer), 1,4-dioxane concentrations have been below the RDL since 2008 (Figure 4-15), indicating approximately 100% GWRS purified recycled water at this well for several years and confirmed by low chloride concentrations below 15 mg/L at this well since 2010.

At M11/1 (Talbert aquifer) and M11/2 (Talbert and Alpha aquifers), the non-detect 1,4-dioxane concentrations (Figure 4-15) since 2015 were consistent with contemporaneously low chloride concentrations (Figure 4-8) that indicated a predominance of GWRS water. However, during earlier years, non-detect or low 1,4-dioxane concentrations do not necessarily represent a predominance of GWRS water but rather a significant percentage of native groundwater (devoid of 1,4-dioxane) as evidenced by higher chloride concentrations during various years and likely caused by gradient shifts or reversals in the Talbert and Alpha aquifers at this location. During 2018, the short-term seaward shift in the gradient at M11/2 evidenced by the sharply increasing chloride concentrations at this well (Figure 4-8) did not cause 1,4-dioxane concentrations to rise above the RDL, likely because the groundwater flowing seaward back to this well was GWRS water that had flowed landward past this well the prior year.

NDMA concentrations at monitoring well site M11 (all zones) remained below the RDL of 2 ng/L throughout 2018.

At monitoring well site M19, 1,4-dioxane concentrations were below the RDL in all three zones during 2018, albeit for different reasons (Figure 4-16). At M19/1 (Talbert aquifer), relatively high chloride concentrations of approximately 80 mg/L during 2018 (Figure 4-9) indicated a continued seaward gradient with native groundwater (devoid of 1,4-dioxane) migrating to this well, whereas at M19/3 (Beta aquifer), low chloride concentrations at GWRS levels (Figure 4-9) indicated sustained arrival of 100% GWRS injection water due to a landward gradient at this well since late 2015. At M19/2 (Alpha aquifer), a blend of native groundwater and GWRS water likely existed during 2018 based on the chloride concentration trends at this well.

NDMA concentrations at monitoring well site M19 (all zones) remained below the RDL of 2 ng/L throughout 2018.

Monitoring for 1,4-dioxane and NDMA began in 2005 at compliance monitoring well sites M45, M46, and M47, and Figure 4-17 through Figure 4-19, respectively, show their trends over the 10-year period 2009-2018. Their data histories generally confirmed OCWD's hydrogeological understanding of the area and were consistent with previously discussed chloride concentration trends as related to inferred groundwater flow directions and gradient reversals. For example, the 1,4-dioxane concentrations observed at monitoring well site M45 were consistent with those found in previous years at monitoring well sites M10 and M11, indicating the continued long-term landward transport of older injection water in these areas.

At monitoring well site M45, Figure 4-17 shows that M45/3 (Omicron aquifer) and M45/4 (Upper Rho aquifer) had generally declining 1,4-dioxane concentrations during 2018 but remained above the RDL. At M45/3, concentrations of 1,4-dioxane began to decline in 2017 and dropped to a low of 3.7 μg/L by the third quarter of 2018 likely due to a continued landward gradient finally bringing GWRS water to this well casing as also evidenced by the contemporaneous chloride decline at this well (Figure 4-10). The first evident arrival of GWRS water at M45/3 in 2017 suggests a 1,4-dioxane travel time estimate of approximately 9 years. Since M45/3 is approximately 3,000 feet from the nearest barrier injection well, a 9-year mean travel time would equate to a slightly slow but yet still reasonable average groundwater velocity of approximately one foot per day, or a somewhat greater groundwater velocity if the flow path is curvilinear from a more distal injection well as the Lambda groundwater elevation contours on Figure 4-5 would suggest. Furthermore, any seasonal shifts in the gradient direction could lengthen the injection water travel path and thus lengthen the arrival time, as well as vertical migration from the Lambda aquifer at the legacy injection well points down into the Omicron aquifer to reach M45/3. During the fourth quarter of 2018, concentrations of 1,4-dioxane experienced a slight uptick to 5.1 μg/L, consistent with the contemporaneous slight increase in chloride concentrations at this well (Figure 4-10) and likely indicating a subtle shift in the gradient from landward to seaward due to higher groundwater conditions late in the year.

At M45/4 (Upper Rho aquifer), 1,4-dioxane concentrations (Figure 4-17) as well as chloride concentrations (Figure 4-10) have been considerably lower than M45/3 since 2010 due to the gradual decline in both of these constituents from 2010-12, indicating that some proportion of

GWRS water has likely arrived at M45/4 with an estimated GWRS arrival time of approximately 4 years. This equates to an average groundwater velocity of approximately 2 feet per day if originating from the nearest injection wells 3,000 feet away. Concentrations of 1,4-dioxane at M45/4 increased slightly from below the RDL in the fourth quarter of 2017 to 2.4 μg/L in the first quarter of 2018, consistent with a contemporaneous subtle uptick in chloride concentrations at this well (Figure 4-10) and likely indicating a brief gradient shift. Concentrations of 1,4-dioxane gradually decreased for the remainder of 2018 to just above the RDL at 1.2 μg/L in the fourth quarter, consistent with the gradually decreasing chloride concentrations at M45/3 back down to low GWRS levels and indicating a return to a predominantly landward gradient.

At M45/2 (Beta-III aquifer), Figure 4-17 shows that 1,4-dioxane concentrations remained below the RDL during 2018, consistent with contemporaneously low chloride concentrations at this well (Figure 4-10) and indicating a predominance of GWRS water due to a landward gradient from the barrier. Based on both 1,4-dioxane and chloride concentration trends at M45/2, a GWRS arrival time ranging from approximately 4 to 7 years was estimated.

At both M45/1 (Alpha-III and Beta-I,II aquifers) and M45/5 (Main aquifer), 1,4-dioxane has never been detected above the RDL (Figure 4-17), likely indicating that barrier injection has never reached these wells and confirmed by stable chloride concentrations trends (Figure 4-10) indicating native groundwater (devoid of 1,4-dioxane).

NDMA concentrations at monitoring well site M45 (all zones) remained below the RDL of 2 ng/L throughout 2018.

At monitoring well site M46, Figure 4-18 shows that concentrations of 1,4-dioxane remained below the RDL in all zones except M46/5 since 2015. From 2012 through 2017, low chloride concentrations below 10 mg/L at M46A/1 (Lambda aquifer) and below 15 mg/L at M46/2 (Upper Rho aquifer) indicated the predominance of GWRS purified recycled water in those two zones at this location, whereas at M46/3 (Lower Rho aquifer) and M46/4 (Main aquifer), similarly low chloride concentrations but with more dampened trends indicated at least some proportion of GWRS water but with less certainty due to low background chloride concentrations closer to that of GWRS water (Figure 4-11).

At M46/5 (Main aquifer), the decreasing trends from 2012 through 2014 for both 1,4-dioxane and chloride concentrations indicated that some percentage of GWRS water has likely reached this well, but the declines were too gradual to reliably infer an average arrival time. Since 2015, concentrations of 1,4-dioxane have oscillated seasonally each year from non-detect to just barely above the RDL of 1 μg/L. These minor detections over the last four years at M46/5 may indicate minor seasonal shifts in the gradient direction causing small pulses of older pre-GWRS water to temporarily migrate back and forth to this well in the Main aquifer. However, the gradient shift apparently was not significant enough to cause a noticeable increase in the chloride concentration (Figure 4-11).

NDMA concentrations at monitoring well site M46 (all zones) remained below the RDL of 2 ng/L throughout 2018 except at M46A/1 where NDMA concentrations remained relatively low and stable, ranging from 2.2 ng/L to 3.1 ng/L (well below the NL of 10 ng/L). The detections of NDMA at M46A/1 during late 2010, early 2011, early 2014, and 2015-18 all appear to correlate with small temporary increases in the GWRS injection water NDMA concentrations of similar or greater magnitude approximately seven to 10 months prior, thus implying a travel time of 7 to 10 months for injection water to reach M46A/1 in all four cases. The original travel time estimate for M46A/1 was 10 months based on the initial chloride concentration decline at this well in 2008. Since this well is 900 feet from the nearest injection well (I26), the 7- to 10-month range in travel time equates to an average groundwater velocity of 3 to 4 feet per day. The travel time likely fluctuates somewhat based on local injection operations on the east end of the barrier along with pumping conditions at nearby Mesa Water production wells.

At compliance monitoring well site M47, Figure 4-19 shows that 1,4-dioxane concentrations remained below the RDL in all zones during 2018, albeit for different reasons. At M47/1 (Beta and Lambda aquifers), historically higher 1,4-dioxane concentrations gradually decreased over time and dropped below the RDL for the first time in late 2014 and has remained below the RDL since early 2016. These 1,4-dioxane trends were consistent with chloride concentrations that contemporaneously declined to low near-GWRS levels (Figure 4-12), indicating a predominantly landward gradient from the barrier and nearly 100% GWRS water at this well since 2015.

At M47/2 (Upper Rho aquifer), Figure 4-19 shows that 1,4-dioxane concentrations historically behaved very similar to M47/1, dropping below the RDL for the first time in the fourth quarter of 2014 but then remained below the RDL rather than experiencing the minor seasonal detections in 2015 and 2016 as at M47/1.

At M47/3, M47/4, and M47/5 (Lower Rho and Main aquifers), 1,4-dioxane has never been detected, likely due to a lack of WF-21 injection into these aquifers in the central portion and east end of the barrier. Also, the inferred groundwater flow direction at M47 in the Lower Rho and Main aquifers appears to be predominantly to the east based on the Main aquifer groundwater elevation contours previously shown on Figure 4-6 representing June 2018. Based on the contours, groundwater flow arriving at M47 may largely be either native groundwater originating from north of the barrier or GWRS injection water originating from the far west end of the barrier, both devoid of 1,4-dioxane. Going forward, confirmation of GWRS arrival at M47 in the Lower Rho and Main aquifers may never be conclusive since native groundwater chloride concentrations at M47/3, M47/4, and M47/5 are relatively low ranging from approximately 12 to 20 mg/L (Figure 4-12) and thus are only marginally higher than GWRS water.

NDMA concentrations at monitoring well site M47 (all zones) remained below the RDL of 2 ng/L throughout 2018.

4.4.4 Production Wells

Data for water samples collected from several potable and non-potable production wells in the vicinity of the Talbert Barrier are summarized in Table 4-1.

The active municipal well closest to the Talbert Barrier is MCWD-5, which is owned and operated by Mesa Water and located approximately 3,300 feet northeast of the eastern end of the barrier. OCWD staff previously estimated the travel time for injection water to reach MCWD-5 to be between three and eight years (depending on the specific aquifer screened by the multi-aquifer production well) based on groundwater level conditions and injection operations over the last few years. NDMA and 1,4-dioxane concentrations for MCWD-5 and injection water for the last 10 years are shown on Figure 4-20. NDMA concentrations at MCWD-5 decreased below the RDL in early 2010 and remained below the RDL through 2018. In order to reduce final drinking water concentrations of NDMA, a UV treatment system was previously operated at the MCWD-5 well site from 2001-2010. The steady decline in NDMA levels below the RDL led to a DDW-approved shutdown of the UV system in 2010 via an accepted amendment to Mesa Water's Domestic Water Supply Permit.

As shown in Figure 4-20, concentrations of 1,4-dioxane at MCWD-5 have gradually decreased over time since 2010 except for minor intermittent upticks in some years likely related to shifts in the gradient direction based on groundwater level variations as was explained in the previous section for the GWRS compliance monitoring wells based on comparing 1,4-dioxane and chloride concentration trends. Concentrations of 1,4-dioxane have remained well below the DDW RL of 35 μg/L at MCWD-5 since sampling began in 2002. During 2018, concentrations of 1,4-dioxane were low and stable at 1 to 1.4 μg/L, just slightly above the RDL and DDW NL of 1 μg/L.

Since 1,4-dioxane concentrations at MCWD-5 did not quite drop below the RDL during 2018, GWRS arrival at this well is likely still blended with at least some small percentage of older pre-GWRS injection water. Due to the vertical blending in the well from the various screened intervals at MCWD-5, travel times for the individual aquifer zones screened at MCWD-5 are not discernable based on the vertically blended 1,4-dioxane concentrations from the pumped samples. The relatively low 1,4-dioxane concentrations at MCWD-5 over the last couple years (Figure 4-20) could possibly represent a blend of nearly 100% GWRS injection water from one or more of the screened aquifer zones along with older pre-GWRS injection water from one or more of the other screened aquifer zones. Although not shown on Figure 4-20, chloride concentrations at MCWD-5 have decreased steadily since 2011 and ranged from 14 to 16 mg/L during 2018 (Table 4-1), indicating the progressive arrival of greater proportions of GWRS water (but still less than 100%) that is consistent with the decline in 1,4-dioxane concentrations just slightly above the RDL.

Table 4-1. 2018 Water Quality for Potable and Non-Potable Wells Within the Influence of the Talbert Barrier

OCWD Well Name	Well Depth (ft bgs)[1]	Perforation Interval (ft bgs)[1]	Distance from Injection Site (ft)[2]	Concentration[3,4]								
				Arsenic (As) ug/L	Chloride (Cl) mg/L	Bromide (Br) mg/L	Total Dissolved Solids (TDS) mg/L	Nitrate Nitrogen (NO3-N) mg/L	Nitrite Nitrogen (NO2-N) mg/L	Total Organic Carbon (Unfiltered) (TOC) mg/L	n-Nitrosodi-methylamine (NDMA) ng/L	1,4-Dioxane (14DIOX) ug/L
Large System Municipal Wells												
MCWD-5	960	400 - 940	3,300	1.7 (ND - 2.8)	15.0 (14.3 - 16.2)	0.015 (ND - 0.038)	174 (154 - 188)	1.41 (1.32 - 1.63)	ND	0.13 (0.09 - 0.15)	ND	1.2 (1.0 - 1.4)
MCWD-7	793	363 - 753	4,200	ND	51.2	0.154 (0.15 - 0.158)	332	0.85 (0.82 - 0.87)	ND	0.23 (0.21 - 0.24)	ND	2.2 (2.0 - 2.4)
NB-DOLD	739	399 - 729	5,300	2.0 (1.9 - 2.0)	20.6 (20.1 - 20.9)	0.025 (ND - 0.055)	213 (194 - 226)	0.17 (0.14 - 0.21)	0.001 (ND - 0.003)	0.14 (0.13 - 0.16)	ND	2.7 (2.2 - 3.0)
NB-DOLS	366	201 - 356	5,300	0.7 (ND - 1.3)	45.3 (44.8 - 45.8)	0.146 (0.12 - 0.17)	355 (334 - 380)	2.70 (2.58 - 2.85)	ND	0.24 (0.15 - 0.50)	ND	ND
MCWD-3B	592	242 - 572	5,400	2.2	33.0	0.054 (ND - 0.098)	308	0.82 (0.77 - 0.88)	0.001 (ND - 0.002)	0.15 (0.14 - 0.16)	ND	3.6 (3.5 - 3.7)
NB-TAMD	700	395 - 690	5,700	3.6 (3.2 - 3.9)	11.3 (11.1 - 11.7)	0.018 (ND - 0.033)	143 (124 - 160)	0.70 (0.64 - 0.75)	ND	0.14 (0.10 - 0.22)	ND	ND
NB-TAMS	370	170 - 360	5,800	1.4 (1.3 - 1.5)	49.5 (43.1 - 53.4)	0.180 (0.13 - 0.20)	387 (368 - 406)	2.54 (2.42 - 2.67)	0.002 (ND - 0.004)	0.34 (0.20 - 1.00)	ND	0.8 (ND - 1.1)
FV-10	990	460 - 980	7,600	0.7 (ND - 1.3)	29.9	ND	287 (280 - 294)	1.67 (1.44 - 2.19)	0.013 (0.011 - 0.014)	0.14 (0.11 - 0.17)	ND	1.9 (1.7 - 2.0)
HB-3A	660	370 - 640	7,600	1.6	29.7	0.268 (0.14 - 0.397)	206	0.22 (0.20 - 0.23)	ND	0.50 (0.42 - 0.58)	ND	ND
HB-5	820	223 - 800	8,000	1.9	33.1	0.062 (ND - 0.113)	302	1.27 (1.25 - 1.28)	ND	0.16 (0.15 - 0.16)	ND	ND
HB-9	996	556 - 996	8,000	1.4 (1.3 - 1.4)[6]	25.3 (23.5 - 28.7)[6]	0.040 (ND - 0.11)[6]	281 (264 - 318)[6]	0.24 (0.20 - 0.32)[6]	0.001 (ND - 0.002)[6]	0.20 (0.14 - 0.30)[6]	ND[6]	ND[6]
Small System and Private Wells												
GKAW-FV2	125	120 - 125	700	ND	97.8 (94.7 - 102)	0.287 (0.25 - 0.31)	650 (644 - 656)	5.64 (5.44 - 5.91)	0.003 (ND - 0.008)	0.23 (0.22 - 0.24)	ND	4.9 (4.4 - 5.4)
KUBO-FV	133	122 - 132	2,900	ND	77.2	0.24	580	ND[6]	0.29 (0.25 - 0.33)[6]	0.24	ND	ND
LIBM-HB		NA	4,100	0.6 (ND - 1.0)	48.7 (41.1 - 57.4)	0.138 (0.12 - 0.16)	235 (138 - 296)	2.90 (2.69 - 3.23)	ND	0.17 (0.14 - 0.23)	ND	ND
Private Irrigation Wells												
CALL-FV		NA	400	0.9 (ND - 1.7)	12.5 (9.9 - 15.0)	ND	119 (102 - 136)	1.64 (1.62 - 1.65)	0.003 (ND - 0.005)	0.12 (0.09 - 0.14)	ND	ND
A1-HB	305	188 - 300	1,800	ND	38.6 (37.0 - 39.7)	0.110 (0.10 - 0.12)	326 (318 - 342)	1.72 (1.55 - 1.85)	0.008 (ND - 0.016)	0.19 (0.16 - 0.20)	ND	1.4 (1.1 - 1.7)

[1] ft bgs: Feet below ground surface

[2] Distance from Injection: Straight line shortest distance to the nearest Talbert Barrier injection well, estimated to the nearest 100 feet

[3] Concentrations are annual averages with annual ranges in parenthesis for the given year

[4] ND: Not detected or less than the detection limit

[5] Upgradient from injection site

[6] Concentrations are annual averages with annual ranges in parenthesis for 2017 (For 2018, well was off-line or unavailable)

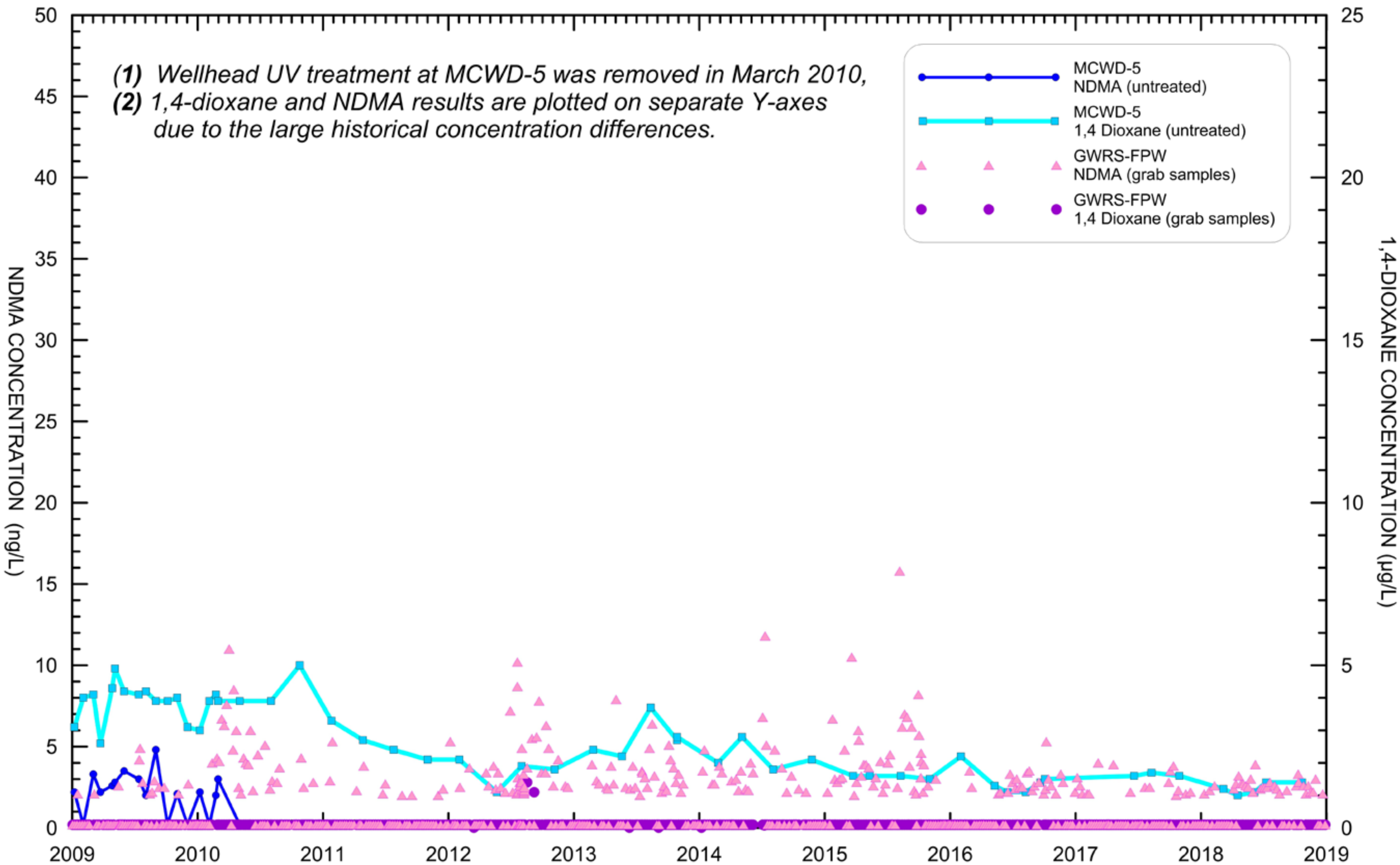


Figure 4-20. MCWD-5 Pre-Treatment and Injection Water 1,4-Dioxane and NDMA Concentrations

Municipal wells HB-5 and HB-9 owned and operated by the City of Huntington Beach are both located approximately 8,000 feet north of the Talbert Barrier in close proximity to each other (Figure 4-1) but display distinctly different water quality characteristics (Table 4-1) due to their different screened interval depths. HB-9 is screened exclusively in the Main aquifer, while HB-5 is screened across both the Main aquifer and the shallower intermediate depth aquifers that have historically received injection water directly from the Talbert Barrier legacy wells. HB-5 had moderate chloride concentrations ranging from approximately 25 to 60 mg/L over the last several years and had detectable concentrations of 1,4-dioxane from 2002-2008 (above the DDW NL but well below the RL), while HB-9 had very low chloride concentrations ranging from approximately 10 to 30 mg/L and 1,4-dioxane has never been detected there. However, with the commencement of injection directly into the Main aquifer at the I27 and I28 sites in 2004, and at the newer I29 through I32 sites in 2008, HB-9 will likely receive GWRS purified recycled injection water in the future.

Since these two production wells are approximately 8,000 feet north of the barrier, a travel time in the range of 10 to 20 years would be expected (assuming an average groundwater velocity of 1 to 2 feet per day). From inspection of older historical chloride concentrations at HB-5 from 1970-1990, it appears that historical barrier injection from WF-21 arrived at HB-5 during 1986-1988. During this two-year period, chloride concentrations increased from a background native groundwater chloride concentration of approximately 20 mg/L to approximately 50 mg/L by late 1988, indicating arrival of some percentage of WF-21 water. Since barrier injection first began in 1976, this would imply an average groundwater travel time of 10 to 12 years under the gradient conditions of that time.

At HB-5, the chloride concentration of 33 mg/L in January 2018 (Table 4-1) was lower than the previous two years but still within the lower end of the historical range for that well. Continued decline of chloride concentrations at HB-5 down closer to GWRS levels would signal arrival of GWRS injection water. At HB-9, the average chloride concentration during 2018 was typically low at 25 mg/L (Table 4-1); neither NDMA or 1,4-dioxane were detected in either HB-5 or HB-9.

5. KRAEMER-MILLER-MIRALOMA-LA PALMA BASINS OPERATIONS

During 2018 OCWD spread GWRS purified recycled water at Kraemer-Miller-Miraloma-La Palma (K-M-M-L) Basins to recharge the Orange County Groundwater Basin. Operation of the recharge facilities is presented in this section:

- Spreading water sources;
- Spreading water volumes; and
- K-M-M-L Basins operations.

5.1 Spreading Water Sources

Water from three sources was percolated at K-M-M-L Basins in 2018: (1) GWRS purified recycled water; (2) SAR water; and (3) imported water.

Anaheim Lake, Mini-Anaheim Lake, and La Jolla Basin are hydrogeologically part of the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins recharge system. As discussed in Section 1.4, Anaheim Lake and Mini-Anaheim Lake are adjacent to and upgradient of K-M-M-L Basins (Figures 1-16 and 1-19). La Jolla Basin is located downgradient of Kraemer-Miller-Miraloma Basins and downgradient/crossgradient of La Palma Basin that is located further south. SAR water and imported water recharged at Anaheim Lake, Mini-Anaheim Lake, and La Jolla Basin supplement and blend with the purified recycled water recharged at K-M-M-L Basins. While purified recycled water may only be recharged at K-M-M-L Basins, they may also receive other water sources (SAR water and imported water). Except for a minor volume of other water recharged at Miraloma Basin in 2017, both Miraloma Basin and La Palma Basin have been dedicated to recharging GWRS purified recycled water since their inception so as to prevent long-term clogging and maintain their exceptionally high percolation rates.

Prior to 2014, the volume of diluent was used for determining compliance with the maximum allowable Recycled Water Contribution (RWC), which was 75% at Kraemer-Miller-Miraloma Basins (La Palma Basin was not in operation at that time). Diluent consisted of SAR captured storm flow and imported water; SAR base flow was not classified as a diluent because the year-round base flow was principally comprised of tertiary treated wastewater effluent from upstream dischargers.

In 2014 DDW approved a maximum RWC at K-M-M-L Basins of 100%, eliminating the blending requirement (CDPH, 2014). The volumes of spreading water from the three aforementioned sources are still reported herein, but determination of the RWC and compliance with the RWC limit are no longer required.

In summary, GWRS purified recycled water, SAR water, and imported water were the spreading water sources utilized at the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins recharge system during 2018. Since determination of the RWC is no longer required, the two non-GWRS sources are grouped together herein as “other water.”

5.2 Spreading Water Flow Rates and Volumes

Spreading water volumes recharged in the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins area in 2018 are presented below and compared with historical spreading amounts in this area.

5.2.1 2018 Spreading Water Quantities

Table 5-1 presents the monthly recharge volumes at each of the individual recharge basins in this area. A total volume of approximately 44,530 MG (136,659 AF) of GWRS purified recycled water and other water, comprised of SAR water and imported water, was recharged at Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins during 2018.

Table 5-2 summarizes the monthly volumes of water that were recharged at Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins during calendar year 2018 based on OCWD Forebay Operations’ percolation records. The percolation records typically differ slightly from the AWPF purified recycled water production records due to storage effects in the spreading basins, GWR Pipeline, flow measurement/metering inaccuracies, and unmeasured rainfall and local runoff to the basins. Based on AWPF flow meter records during 2018, the following volumes and average daily flow rates of GWRS purified recycled water were delivered to the Anaheim Forebay:

- Kraemer Basin received approximately 217 MG (666 AF), or 0.59 MGD on average;
- Miller Basin received none (not used);
- Miraloma Basin received approximately 5,476 MG (16,805 AF), or 15.00 MGD on average; and
- La Palma Basin received approximately 17,217 MG (52,836 AF), or 47.17 MGD on average.

The total volume of GWRS purified recycled water delivered to the K-M-M-L Basins during 2018 was 22,910 MG (70,307 AF). The annual average daily flow rate of GWRS purified recycled water spread in 2018 was 62.8 MGD. No GWRS purified recycled water was recharged at Anaheim Lake, Mini-Anaheim Lake, or La Jolla Basin; spreading GWRS purified recycled water at these three sites is not allowed under the GWRS permit. Furthermore, the hydraulics of the water conveyance system at the Anaheim Forebay are such that delivery of GWRS purified recycled water to Anaheim Lake, Mini-Anaheim Lake, or La Jolla Basin is not physically possible at this time.

Table 5-1. 2018 Summary of Spreading Water Locations and Volumes [1]

Month	Kraemer Basin				Miller Basin				Miraloma Basin				La Palma Basin				Anaheim Lake	Mini-Anaheim Lake	La Jolla Basin	TOTAL PERCOLATION (AF)	TOTAL PERCOLATION (MG)
	GWRS Water (AF)	Other Water (AF)	Change in Storage (AF)	Total Percolation (AF)	GWRS Water (AF)	Other Water (AF)	Change in Storage (AF)	Total Percolation (AF)	GWRS Water (AF)	Other Water (AF)	Change in Storage (AF)	Total Percolation (AF)	GWRS Water (AF)	Other Water (AF)	Change in Storage (AF)	Total Percolation (AF)	Total Percolation (AF)[2]	Total Percolation (AF)[2]	Total Percolation (AF)[2]		
Jan	0	16	-137	153	0	0	-7	7	2,368	0	6	2,362	5,564	0	6	5,558	1,665	0	0	9,745	3,175
Feb	616	-52[3]	121	443	0	561	79	482	2,061	0	6	2,055	4,119	0	7	4,112	976	0	223	8,291	2,702
Mar	0	-73[3]	-170	97	0	80	-79	159	2,100	0	7	2,093	5,391	0	-6	5,397	236	0	4	7,986	2,602
Apr	0	0	0	0	0	2,638	314	2,324	1,778	0	4	1,774	4,748	0	-5	4,753	2,021	400	702	11,974	3,902
May	50	831	173	708	0	3,060	2	3,058	1,785	0	1	1,784	5,065	0	17	5,048	1,976	614	999	14,187	4,623
Jun	0	1,295	-17	1,312	0	2,816	-8	2,824	1,339	0	9	1,330	5,249	0	5	5,244	1,752	606	1,009	14,077	4,587
Jul	0	1,770	119	1,651	0	1,938	-309	2,247	1,180	0	-7	1,187	5,147	0	1	5,146	2,001	626	938	13,796	4,495
Aug	0	4,616	535	4,081	0	0	0	0	816	0	-35	851	3,136	0	-30	3,166	2,275	618	850	11,841	3,858
Sep	0	4,983	57	4,926	0	2,161	75	2,086	0	0	0	0	0	0	0	0	497	113	753	8,375	2,729
Oct	0	3,646	119	3,527	0	2,626	16	2,610	966	0	4	962	4,384	0	7	4,377	0	0	560	12,036	3,922
Nov	0	2,479	-28	2,507	0	2,642	87	2,555	1,166	0	6	1,160	4,729	0	6	4,723	1,458	176	624	13,203	4,302
Dec	0	1,224	-117	1,341	0	18	-179	197	1,247	0	2	1,245	5,304	0	7	5,297	2,907	57	104	11,148	3,633
TOTAL	**666**	**20,735**	**655**	**20,746**	**0**	**18,542**	**-7**	**18,549**	**16,805**	**0**	**2**	**16,803**	**52,836**	**0**	**15**	**52,821**	**17,764**	**3,210**	**6,766**	**136,659**	**44,530**

[1] Volumes include:

GWRS purified recycled water (GWRS water) data are based on AWPF flow meter records and Forebay Operations' records for flows discharged to individual spreading basins.

Other water volumes are estimated based on Forebay Operations' total percolation records and include:

- Santa Ana River (SAR) water
- Imported water

Total percolation volumes are based on Forebay Operations' percolation records.

Change in storage volume represents water retained in the basin that has not yet percolated based on Forebay Operations records. Change in storage volume are estimated values that may be positive (increase) or negative (decrease).

[2] Total percolation volumes shown for Anaheim Lake, Mini-Anaheim Lake, and La Jolla Basin are other water (non-GWRS water).

[3] Negative values are a result of Kraemer Basin being prepared for maintenance work when water was transferred from Kraemer Basin to Miller Basin per Forebay Operations records.

Table 5-2. 2018 Summary of Spreading Water Sources and Quantities [1]

Month	GWRS Purified Recycled Water[2]		Other Water[3]		Total Spreading Water		Total Change in Storage[4]	TOTAL PERCOLATION[4]	TOTAL PERCOLATION[4]
	(Avg. MGD)	(AF)	(Avg. MGD)	(AF)	(Avg. MGD)	(AF)	(AF)	(AF)	(MG)
January	83.4	7,932	17.7	1,681	101.1	9,614	(133)	9,745	3,175
February	79.1	6,797	19.9	1,708	99.0	8,505	214	8,291	2,702
March	78.7	7,491	2.6	247	81.3	7,737	(248)	7,986	2,602
April	70.9	6,527	62.6	5,761	133.5	12,288	313	11,974	3,902
May	72.5	6,900	78.6	7,480	151.2	14,380	194	14,187	4,623
June	71.6	6,588	81.2	7,478	152.8	14,066	(11)	14,077	4,587
July	66.5	6,327	76.4	7,273	142.9	13,600	(196)	13,796	4,495
August	41.5	3,952	87.9	8,359	129.4	12,311	469	11,841	3,858
September	0.0	0	92.4	8,507	92.4	8,507	132	8,375	2,729
October	56.2	5,349	71.8	6,833	128.0	12,182	146	12,036	3,922
November	64.0	5,895	80.2	7,379	144.2	13,274	71	13,203	4,302
December	68.9	6,550	45.3	4,310	114.2	10,860	(287)	11,148	3,633
TOTAL	**62.8**	**70,307**	**59.8**	**67,017**	**122.6**	**137,324**	**665**	**136,659**	**44,530**

[1] Spreading at Anaheim Lake, Mini-Anaheim Lake, Kraemer Basin, Miller Basin, Miraloma Basin, La Palma Basin, and La Jolla Basin.

[2] GWRS purified recycled water inflows are based on AWPF and Forebay Operations' flow records.

[3] Other water is Santa Ana River (SAR) water and/or imported water based on percolation records from Forebay Operations.

[4] Change in storage represents water retained in the basin that has not yet percolated based on Forebay Operations records. Change in storage volume are estimated values that may be positive (increase) or negative (decrease).

Captured flow was diverted from the SAR and recharged at Kraemer-Miller Basins as well as Anaheim Lake, Mini-Anaheim Lake and La Jolla Basin. Imported water was purchased and recharged at Anaheim Lake/Mini-Anaheim Lake/Kraemer-Miller/La Jolla Basins. In 2018, a total of approximately 21,837 MG (67,017 AF) of these three other (non-GWRS) sources was recharged in this area of the Anaheim Forebay. Kraemer and Miller Basins received primarily other water during 2018. Conversely, Miraloma and La Palma Basins received primarily GWRS purified recycled water during 2018 (excluding any unmeasured rainfall or site runoff), as these recharge basins have been dedicated almost exclusively to GWRS water to minimize clogging and to maintain the relatively high recharge rates at these sites.

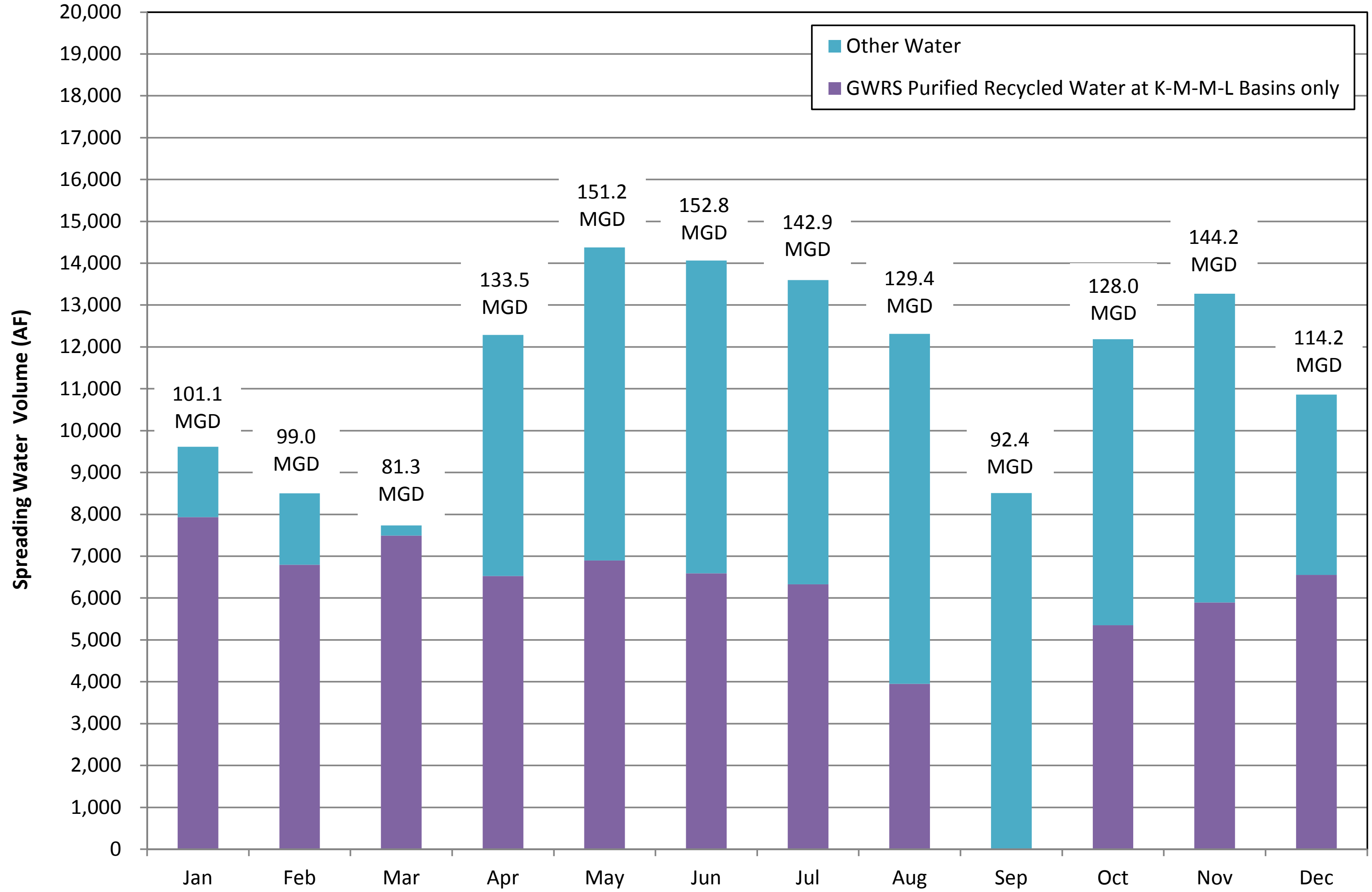
Figure 5-1 illustrates the total 2018 water supply volumes recharged in the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins area. As noted above, a total of approximately 22,910 MG (70,307 AF) of GWRS purified recycled water was recharged at K-M-M-L Basins. Miller Basin was not used, and of the remaining three basins, over 99% of the GWRS purified recycled water pumped to the Anaheim Forebay was recharged at Miraloma and La Palma Basins during 2018.

Figure 5-1 shows how the recharge of GWRS purified recycled water at the basins varied on a month-to-month basis. The monthly volume of purified recycled water delivered to the Anaheim Forebay varied throughout 2018, ranging from 0 AF in September due to the GWR Pipeline Rehabilitation Project to over 7,900 AF in January. The amounts of other water (SAR water and imported water) varied seasonally depending on availability. Other water monthly volumes ranged from approximately 200 to 8,500 AF. The monthly volume of GWRS purified recycled water exceeded the monthly volume of other water in five months during 2018: January, February, March, April, and December.

The average daily flow rate of GWRS purified recycled water recharged at K-M-M-L Basins was 62.8 MGD during 2018. The combined average daily flow rate of other water (SAR water and imported water) recharged at Anaheim Lake/Mini-Anaheim Lake/Kraemer-Miller/La Jolla Basins was approximately 59.8 MGD.

5.2.2 Historical Spreading Water Quantity

Prior to 2008, only SAR water and imported water were recharged at Kraemer-Miller Basins. GWRS purified recycled water spreading began at Kraemer Basin in January 2008 and continued through 2018. Purified recycled water spreading began at Miller Basin in January 2008 and continued through 2018 (Miller Basin was not used by GWRS in 2018). Purified recycled water spreading began at Miraloma Basin in July 2012 and continued through 2018. Purified recycled water spreading began at La Palma Basin when this basin first became operational in November 2016 and continued through 2018.



Note: Other water consists of SAR water and imported water.
Spreading water average flow rate shown in MGD

Figure 5-1. 2018 Spreading Water Sources and Volumes in the Anaheim Lake/Mini-Anaheim Lake/ K-M-M-L/La Jolla Basins

Figure 5-2 compares the volume of purified recycled water and other water recharged at K-M-M-L Basins in 2018 with historical recharge data since the GWRS began operation in January 2008. Over the last decade, the highest purified recycled water volume that was delivered to K-M-M-L Basins occurred in 2017 (23,610 MG or 72,458 AF). The purified recycled water delivered to K-M-M-L Basins declined from the 2017 historic high by 3% in 2018 (22,910 MG or 70,307 AF) because of the GWR Pipeline Rehabilitation Project that prevented deliveries to the Forebay for about six weeks, from August 22 until October 3. Besides the historic high in 2017, total GWRS recharge in 2018 was still higher than all other years since GWRS inception in 2008 because of the GWRS Initial Expansion in 2015 as well as lower Talbert Barrier injection of GWRS water in 2018 resulting from higher Basin storage conditions.

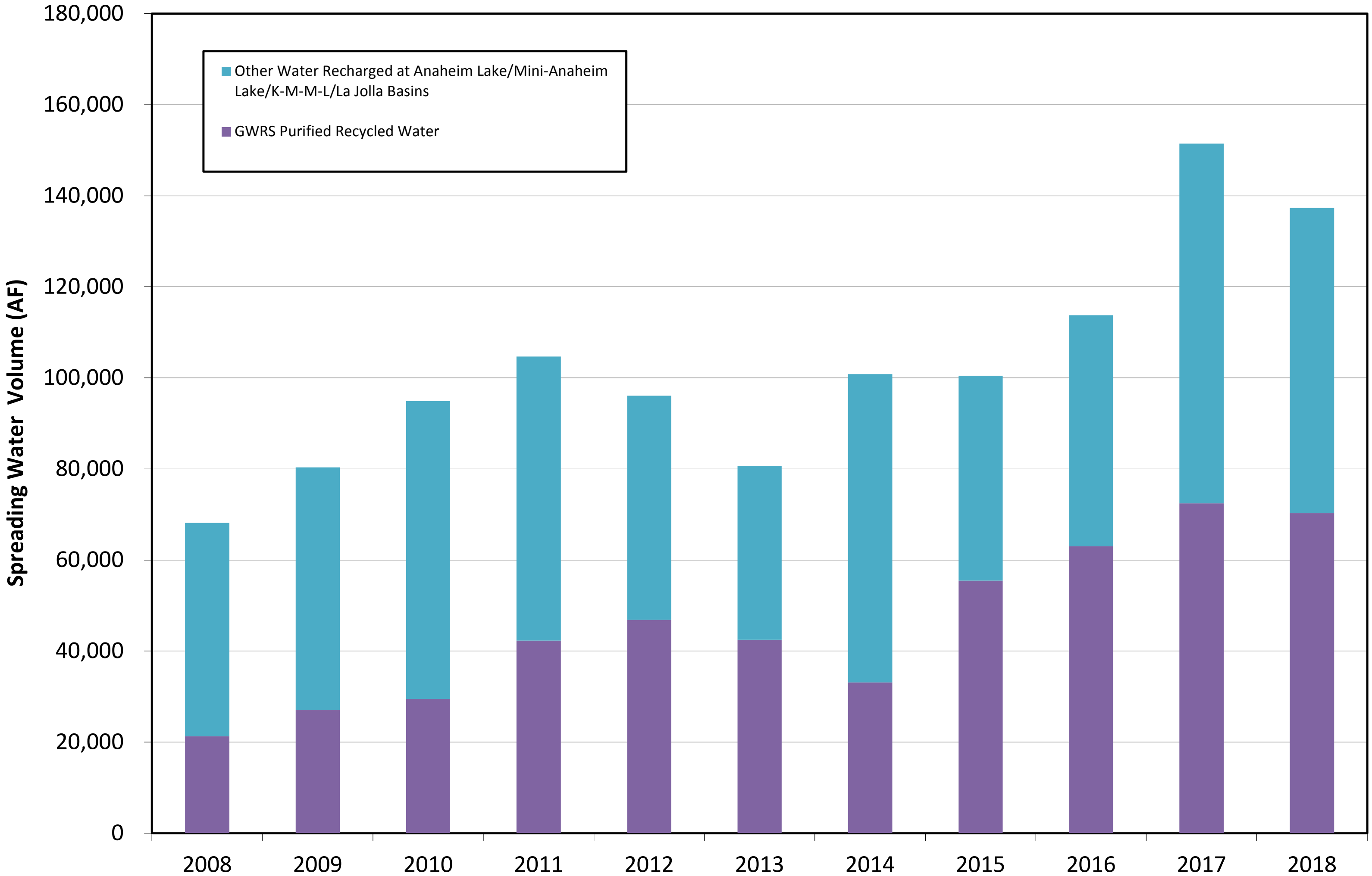
Figure 5-2 also shows that the combined total of 136,659 AF (GWRS and other water) recharged at Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins during 2018 was approximately 10% less than the 2017 peak but still greater than in other years since GWRS inception. A significant volume of imported replenishment water was purchased and recharged between April and November of 2018.

Table 5-3 summarizes the historic volumes of all waters recharged at Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins since the GWRS began operation. With regard to the other water sources (SAR water and imported water), approximately 15% less non-GWRS water was recharged at the Anaheim Forebay in 2018 (67,017 AF) than in 2017 (78,984 AF) due to above average rainfall during the 2017 winter months.

5.3 K-M-M-L Basins Operations

Purified recycled water produced by the AWPF was pumped to the Anaheim Forebay and spread at K-M-M-L Basins in 2018. Kraemer and Miller Basins have received purified recycled water since January 2008 (except that Miller Basin was not used in 2018). Miraloma Basin has received purified recycled water since July 2012. Spreading of purified recycled water at La Palma Basin began in November 2016.

Miraloma Basin and La Palma Basin were the primary sites used for recharging purified recycled water throughout 2018, as detailed in Table 5-4 and illustrated on Figure 5-3. La Palma Basin received more than three times the volume of purified recycled water as Miraloma Basin. A minimal volume of purified recycled water was recharged at Kraemer Basin, and Miller Basin received no purified recycled water in 2018. These latter two spreading basins were primarily utilized to recharge other water during 2018. No GWRS purified recycled water was delivered to any of the K-M-M-L Basins while the GWR Pipeline Rehabilitation Project was being completed (August 22 to October 3, 2018).



Note: Other water consists of SAR water and imported water

Figure 5-2. Spreading Water Sources and Volumes Since 2008

Table 5-3. Summary of Spreading Water Sources and Volumes since 2008 in the Anaheim Forebay [1]

Year	Other Water[2,3] (AF)	GWRS Purified Recycled Water[4] (AF)	TOTAL PERCOLATION[5] (AF)	TOTAL PERCOLATION[5] (MG)
2008	46,871	21,307	68,178	22,216
2009	53,304	27,023	80,327	26,175
2010	65,457	29,473	94,930	30,933
2011	62,396	42,283	104,678	34,109
2012	49,204	46,865	96,070	31,304
2013	38,213	42,478	80,691	26,293
2014	67,740	33,091	100,831	32,856
2015	44,993	55,472	100,465	32,737
2016	50,685	63,048	113,407	36,955
2017	78,984	72,458	151,448	49,349
2018	67,017	70,307	136,659	44,530
TOTAL	**624,864**	**503,805**	**1,127,684**	**367,458**

[1] Spreading at Anaheim Lake, Mini-Anaheim Lake, Kraemer Basin, Miller Basin, Miraloma Basin, La Palma Basin, and La Jolla Basin.

[2] Other water is captured/recharged Santa Ana River (SAR) water and/or imported water. Total water flows are based on percolation records measured by OCWD Forebay Operations staff. Other water is calculated by subtraction: (Other water = Total - GWRS water) with adjustments for estimated storage in basin (water not yet percolated).

[3] Other water shown for 2015 represents a corrected volume based on OCWD flow records.

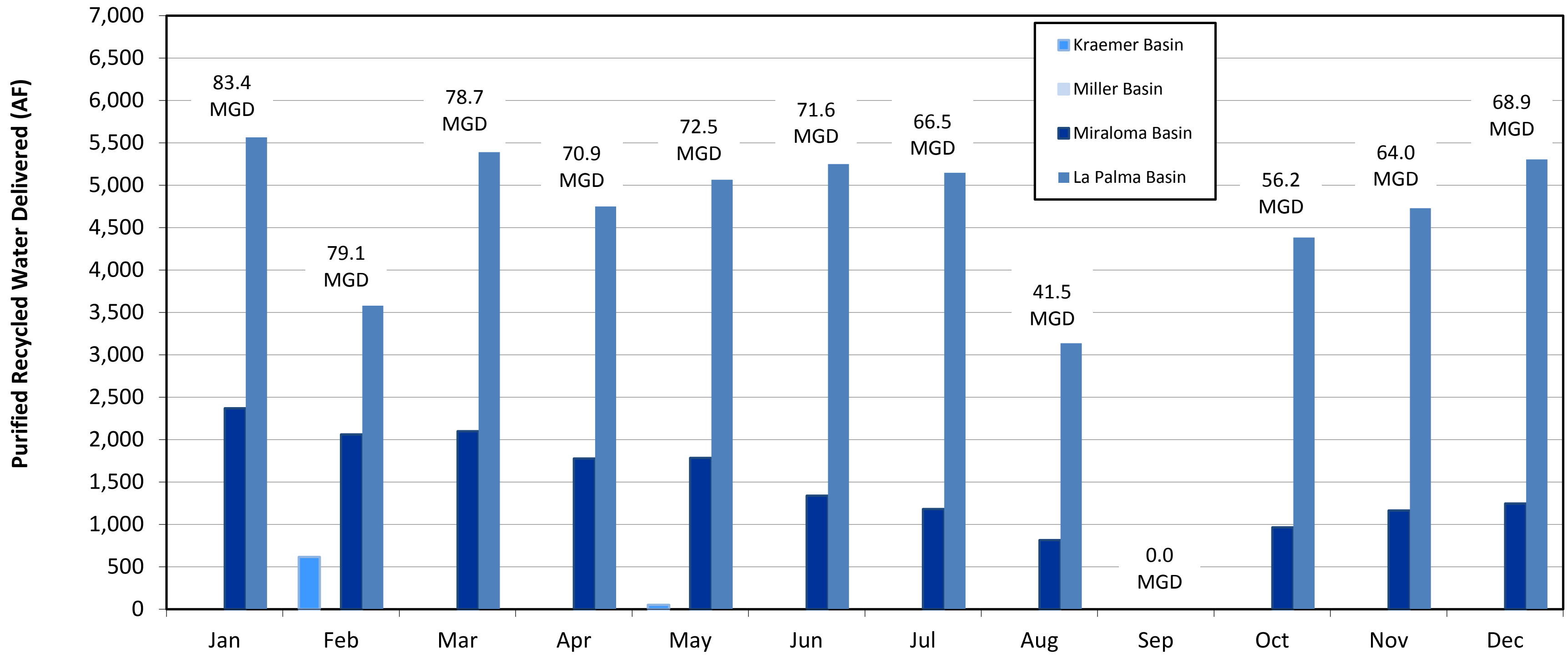
[4] GWRS purified recycled water flows are based on AWPF flow records.

[5] Totals based on percolation records from Forebay Operations.

OCWD does not have a regularly scheduled cleaning cycle for K-M-M-L Basins. The need for a basin to be taken out of service and cleaned depends on the percolation performance.

Table 5-4. 2018 Purified Recycled Water Spreading Volumes and Flow Rates

Month	Kraemer Basin			Miller Basin			Miraloma Basin			La Palma Basin			TOTAL		
	(AF)	(MG)	(Avg. MGD)	(AF)	(MG)	(Avg. MGD)	(AF)	(MG)	(Avg. MGD)	(AF)	(MG)	(Avg. MGD)	(AF)	(MG)	(Avg. MGD)
January	0	0	0.0	0	0	0.0	2,368	772	24.9	5,564	1,813	58.5	7,932	2,585	83.4
February	616	201	7.2	0	0	0.0	2,061	672	24.0	4,119	1,342	47.9	6,797	2,215	79.1
March	0	0	0.0	0	0	0.0	2,100	684	22.1	5,391	1,757	56.7	7,491	2,441	78.7
April	0	0	0.0	0	0	0.0	1,778	580	19.3	4,748	1,547	51.6	6,527	2,127	70.9
May	50	16	0.5	0	0	0.0	1,785	582	18.8	5,065	1,650	53.2	6,900	2,248	72.5
June	0	0	0.0	0	0	0.0	1,339	436	14.5	5,249	1,710	57.0	6,588	2,147	71.6
July	0	0	0.0	0	0	0.0	1,180	384	12.4	5,147	1,677	54.1	6,327	2,062	66.5
August	0	0	0.0	0	0	0.0	816	266	8.6	3,136	1,022	33.0	3,952	1,288	41.5
September	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
October	0	0	0.0	0	0	0.0	966	315	10.1	4,384	1,428	46.1	5,349	1,743	56.2
November	0	0	0.0	0	0	0.0	1,166	380	12.7	4,729	1,541	51.4	5,895	1,921	64.0
December	0	0	0.0	0	0	0.0	1,247	406	13.1	5,304	1,728	55.7	6,550	2,134	68.9
TOTAL	**666**	**217**	**0.6**	**0**	**0**	**0.0**	**16,805**	**5,476**	**15.0**	**52,836**	**17,217**	**47.2**	**70,307**	**22,910**	**62.8**



Note: Average Flow Rate in MGD to All Basins

Figure 5-3. 2018 Purified Recycled Water Spreading Operations

6. GROUNDWATER MONITORING AT THE ANAHEIM FOREBAY

OCWD has maintained a comprehensive groundwater monitoring program in the Anaheim and Orange Forebay areas for decades as part of its recharge operations and to monitor ambient groundwater quality. Much of OCWD's current Forebay groundwater monitoring program was developed as a part of the Santa Ana River Water Quality and Health (SARWQH) Study, which was conducted from 1994-2004 in the Anaheim Forebay (OCWD, 2004a; NWRI, 2004). The purpose of the SARWQH Study was to assess the use of SAR water as a recharge source for the Basin because of the treated wastewater component of SAR base flow.

For the purposes of GWRS permit compliance, OCWD began groundwater monitoring activities in the Anaheim Forebay downgradient of the GWRS spreading basins in 2005, well in advance of the initial delivery and spreading of GWRS purified recycled water in 2008. This annual report for 2018 marks eleven years of Forebay compliance monitoring at the well sites specified in the GWRS permit (RWQCB, 2004, 2008, 2014a, and 2016). This section describes the following for calendar year 2018:

- Anaheim Forebay aquifer system;
- Groundwater monitoring program;
- Groundwater elevations and directions of flow; and
- Groundwater quality.

6.1 Anaheim Forebay Aquifer System

Earlier studies (DWR, 1934; DWR, 1967) divided the alluvial Orange County Groundwater Basin (the Basin) into the Pressure and Forebay areas. The Forebay refers to the inland area of intake or recharge generally characterized by higher permeability sediments (e.g., sands and gravels) and unconfined aquifer conditions. In contrast, the Pressure area refers to the coastal and central regions of the Basin where the presence of low-permeability clay and silt deposits limits surface percolation and creates confined or pressurized aquifer conditions at depth.

During the SARWQH Study, OCWD gained valuable insight into the local hydrogeology in the vicinity of K-M-M-L Basins through: (1) the installation of several multi-depth nested monitoring wells; (2) extensive groundwater quality testing; and (3) the performance of large-scale artificial tracer tests from various recharge basins (OCWD, 2004a; LLNL, 2004). These studies generally confirmed that the dominant majority of sediments down to approximately 1,000 ft bgs are coarse-grained, high-permeability sands and gravels, with only a minimal presence of intervening low-permeability sediments that do not appear to be laterally extensive.

For the purposes of the OCWD Basin-wide Groundwater Flow Model (Phraner, 2001; OCWD, 2004b) and the Annual Groundwater Storage Change calculation (OCWD, 2007), the Basin has been vertically characterized into three distinct aquifer systems: (1) Shallow, (2) Principal, and (3) Deep. Over 90% of groundwater production in the Basin occurs from the Principal aquifer. The approximate vertical intervals of the three aquifer systems in the immediate vicinity of K-M-M-L Basins are presented in Table 6-1. It should be noted that the Principal and Deep aquifers rapidly thicken and deepen to the west/southwest of this area, conforming to the Basin's overall synclinal structure (Herndon and Bonsangue, 2006).

Table 6-1. Approximate Aquifer System Depths in the Vicinity of K-M-M-L Basins

Shallow Aquifer (ft bgs)	Principal Aquifer (ft bgs)	Deep Aquifer (ft bgs)
0 – 300	300 -1,250	1,250 – 1,750

As required by state regulations (CCR, 2014), OCWD has established retention time buffer areas for the control of pathogenic microorganisms and response retention time in the area downgradient of K-M-M-L Basins that are illustrated on Figure 6-1; potable drinking water wells are prohibited in these areas. The buffer areas are based on an artificial tracer test conducted in Kraemer Basin (Clark, 2009), with sequential modifications via numerical modeling and GIS to incorporate Miraloma Basin (OCWD, 2011; OCWD, 2012, CDPH, 2012; RWQCB, 2012; RWQCB, 2014a) and La Palma Basin (OCWD and DDB Engineering, Inc., 2014, RWQCB 2016, OCWD, 2016). No existing public water supply wells are located inside the existing buffer areas. With the recent changes to the GWRS Pathogen Log Reduction Requirements (Section 2.3.9, Table 2-9), the four-month buffer area now serves as both the primary and secondary project boundary. The buffer areas are enforced by the City of Anaheim and Orange County Health Care Agency well permitting authorities, as well as DDW.

6.2 Groundwater Monitoring Program

As part of the comprehensive groundwater monitoring program required by the current permit for the GWRS (RWQCB, 2004, 2008, 2014a, and 2016), the following OCWD monitoring well sites in the vicinity of K-M-M-L Basins were sampled in 2018: nested monitoring wells AMD-10 and AMD-12, plus single-point monitoring wells AM-7, AM-8, and AM-10. Although not required under the permit, another single-point monitoring well, OCWD-KB1, was also sampled in 2018 because of its close proximity to the Kraemer Basin recharge site.

The locations of these wells and nearby municipal production wells are shown on Figure 6-1. A generalized geologic cross-section showing these wells in relation to the nearby recharge basins

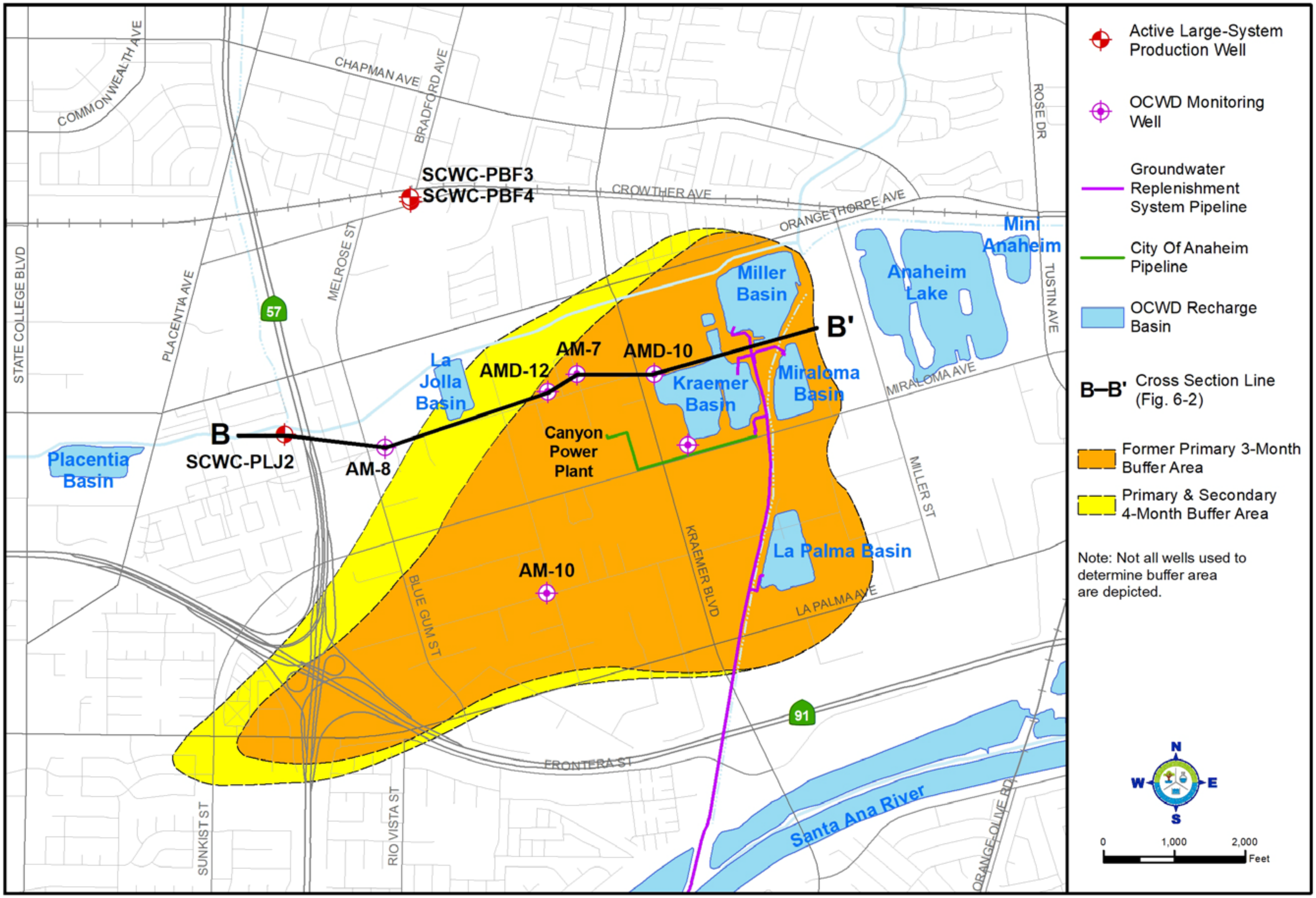


Figure 6-1. Selected Forebay Monitoring Well Locations and Buffer Areas

is presented on Figure 6-2. Note compliance well AM-10 is not shown on the cross-section since it is located farther south along the flow path emanating from La Palma Basin.

Groundwater levels are measured at least quarterly for the monitoring wells shown on Figure 6-1, as well as at several other monitoring wells in the general vicinity to determine groundwater flow directions in this area and to track changes in groundwater storage, as this unconfined area represents the majority of the Basin's available groundwater storage capacity.

6.3 Groundwater Elevations and Directions of Flow

Figure 6-3 illustrates the inferred groundwater flow paths within the Shallow aquifer near K-M-M-L Basins, based on the groundwater elevation contours representing June 30, 2018. As shown by the inferred flow arrows on Figure 6-3, the dominant groundwater flow direction was west-southwest away from the recharge basins similar to previous years while also showing the influence of La Palma Basin.

Although groundwater levels at individual wells rise and fall over time, they generally behave similarly in this area. Thus, the shape of the groundwater elevation contours and the resulting groundwater gradient and flow directions don't change significantly from year to year in the Anaheim Forebay; the June 2018 contour patterns are similar to those shown for June 2017 presented in last year's annual report. Due to the large volume of recharge into La Palma Basin during 2018, Figure 6-3 shows that the groundwater flow direction towards compliance monitoring well AM-10 likely originated from La Palma Basin in June 2018 for the second straight year since commencement of that basin. Prior to recharge at La Palma Basin, the groundwater flow direction towards AM-10 typically appeared to originate from Kraemer Basin, as in June 2016 just prior to new La Palma Basin being placed on-line as presented on Figure 6-3 of the 2016 GWRS Annual Report (DDB Engineering, Inc., 2017).

With the commencement of recharge operations at La Palma Basin in November 2016, the rise in Shallow aquifer groundwater elevations immediately surrounding La Palma Basin changed the shape of the groundwater elevation contours in this immediate area relative to previous years when lower groundwater elevations or a "trough" typically existed approximately halfway between the two recharge areas of the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins complex and the SAR (where La Palma Basin is now located). Since 2017 and evident in Figure 6-3 for the June 2018 period, this trough is now located farther south approximately halfway between La Palma Basin and the SAR.

The June 2018 Shallow aquifer groundwater elevations shown in Figure 6-3 were approximately 10 feet higher than in June 2017 at La Palma Basin as well as in the outlying Anaheim Forebay area away from the recharge basins but were nearly the same immediately surrounding Miller

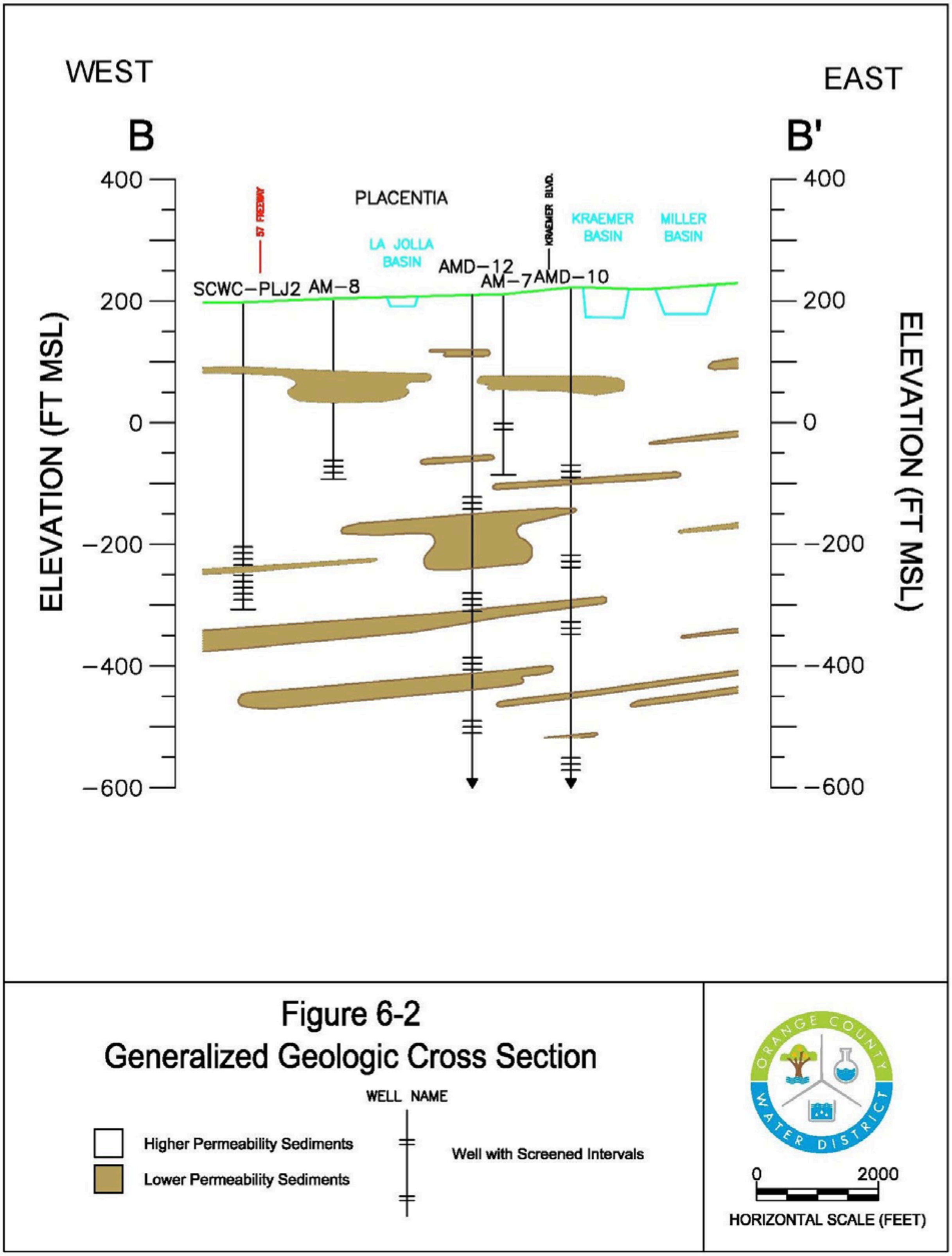


Figure 6-2. Generalized Geologic Cross Section in the Anaheim Forebay

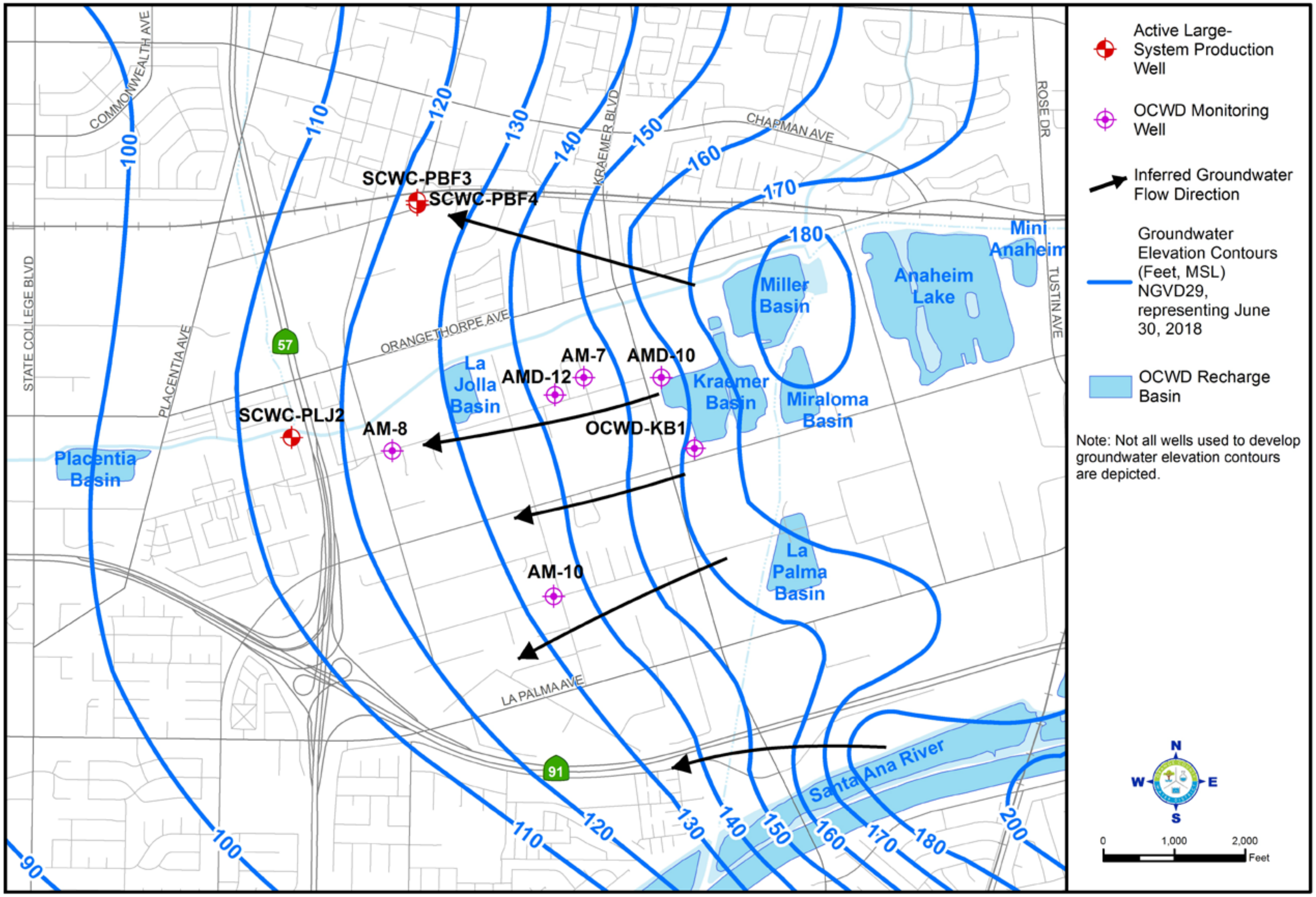


Figure 6-3. Shallow Aquifer Groundwater Elevation Contours and Inferred Groundwater Flow Directions in the Anaheim Forebay Area

and Miraloma Basins in the geometric center of the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins complex. In this vicinity, Shallow aquifer groundwater elevations in June 2018 were approximately 180 feet above mean sea level and formed an enclosed mound or local maximum as in June 2017 due to the cumulative recharge of all these basins.

From June 2017 to June 2018, Shallow aquifer groundwater elevations rose by approximately 10 feet near AMD-10 adjacent to Kraemer Basin and by approximately 13 feet farther downgradient near AM-8. The Shallow aquifer groundwater elevation difference from the western edge of Kraemer Basin near AMD-10 to downgradient monitoring well AM-8 was approximately 33 feet in June 2018 (Figure 6-3) as compared to 36 feet in June 2017, indicating that the gradient in this area decreased just slightly. Farther south at compliance well AM-10, Shallow aquifer groundwater elevations rose approximately 12 feet from June 2017 to June 2018, and the groundwater elevation difference from the northeast corner of La Palma Basin to AM-10 was approximately 38 feet in June 2018 as compared to approximately 40 feet in June 2017, indicating a similar but slightly flatter gradient also.

Groundwater level (piezometric elevation) hydrographs for monitoring well sites OCWD-KB1, AMD-10, AM-7, AMD-12, AM-8, and AM-10 are shown on the upper graphs of Figure 6-4 through Figure 6-9, respectively. These figures also show chloride concentrations on the lower graphs, which are discussed in Section 6.4. All five graphs show a 10-year period from 2009-2018. The groundwater level fluctuations over this period evident in the hydrographs reflect the effects of OCWD's managed recharge activities, local precipitation, groundwater production, and the Basin's overall groundwater storage condition.

Groundwater level trends at all six monitoring wells typically follow a seasonal pattern: (1) rising during the winter and early spring months, (2) declining in the late spring and summer months, and (3) recovering somewhat in the late fall months near the end of the year. These seasonal trends are typically caused by a combination of increased recharge (both natural and managed) from local rainfall and captured SAR storm flows during the winter months and increased groundwater pumping during the warmer and drier summer months.

During 2018, groundwater level trends were very similar at all six monitoring wells but did not follow the typical winter rise described above. Rather, groundwater levels declined during the first quarter by 10 to 15 feet in the wake of the late 2017 historical highs because of increased pumping as the Basin-wide In-Lieu Program ended in January along with a lack of rainfall. During the second quarter, groundwater levels rose slightly by 5 to 10 feet resulting from relatively large recharge volumes of imported replenishment water at the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins complex (Figure 6-1), which began in April and overshadowed the contemporaneous gradual increase in production as the season warmed. During the third quarter, groundwater levels declined once again by 10 to 15 feet due to increased summer

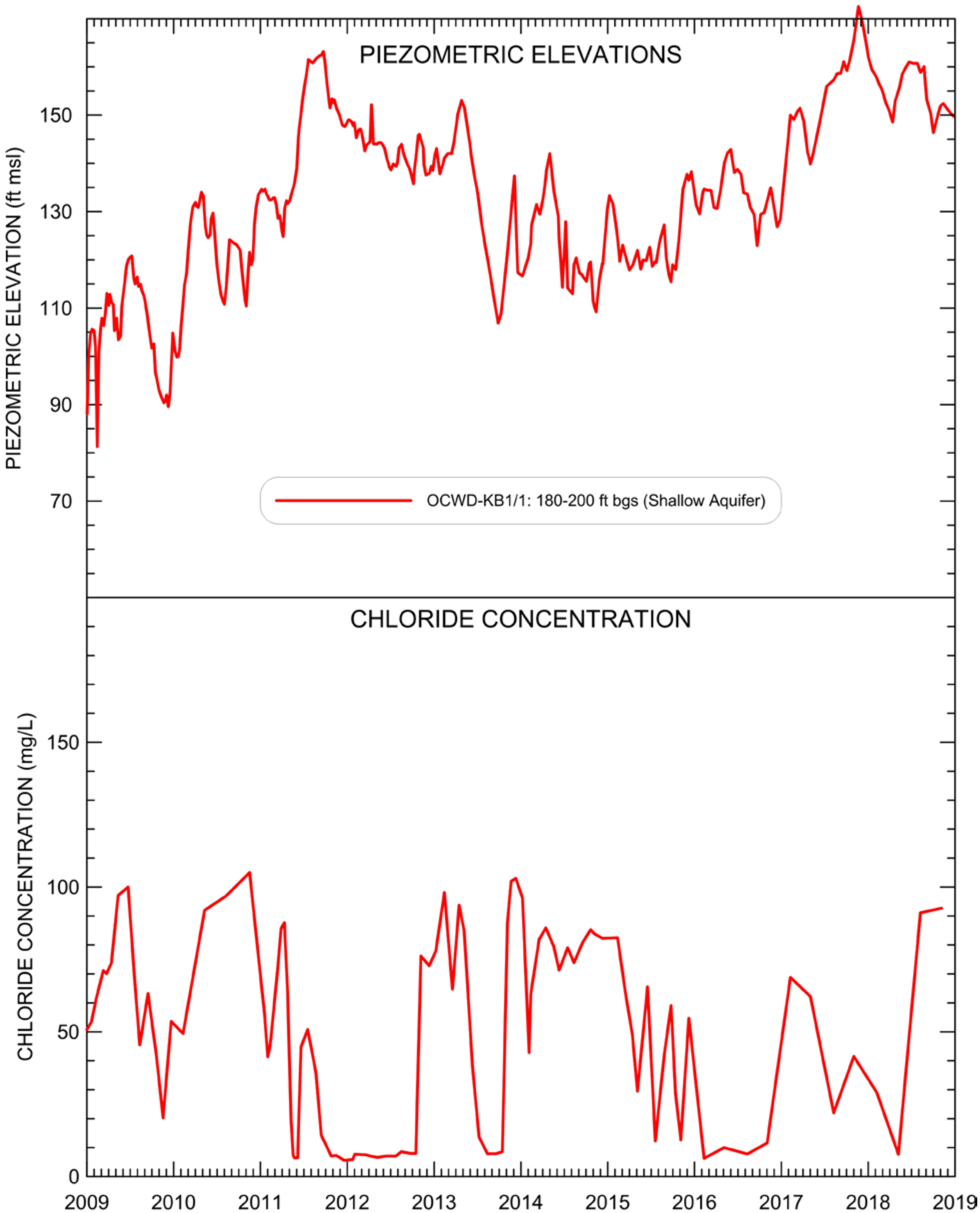


Figure 6-4. Monitoring Well OCWD-KB1 Piezometric Elevations and Chloride Concentration

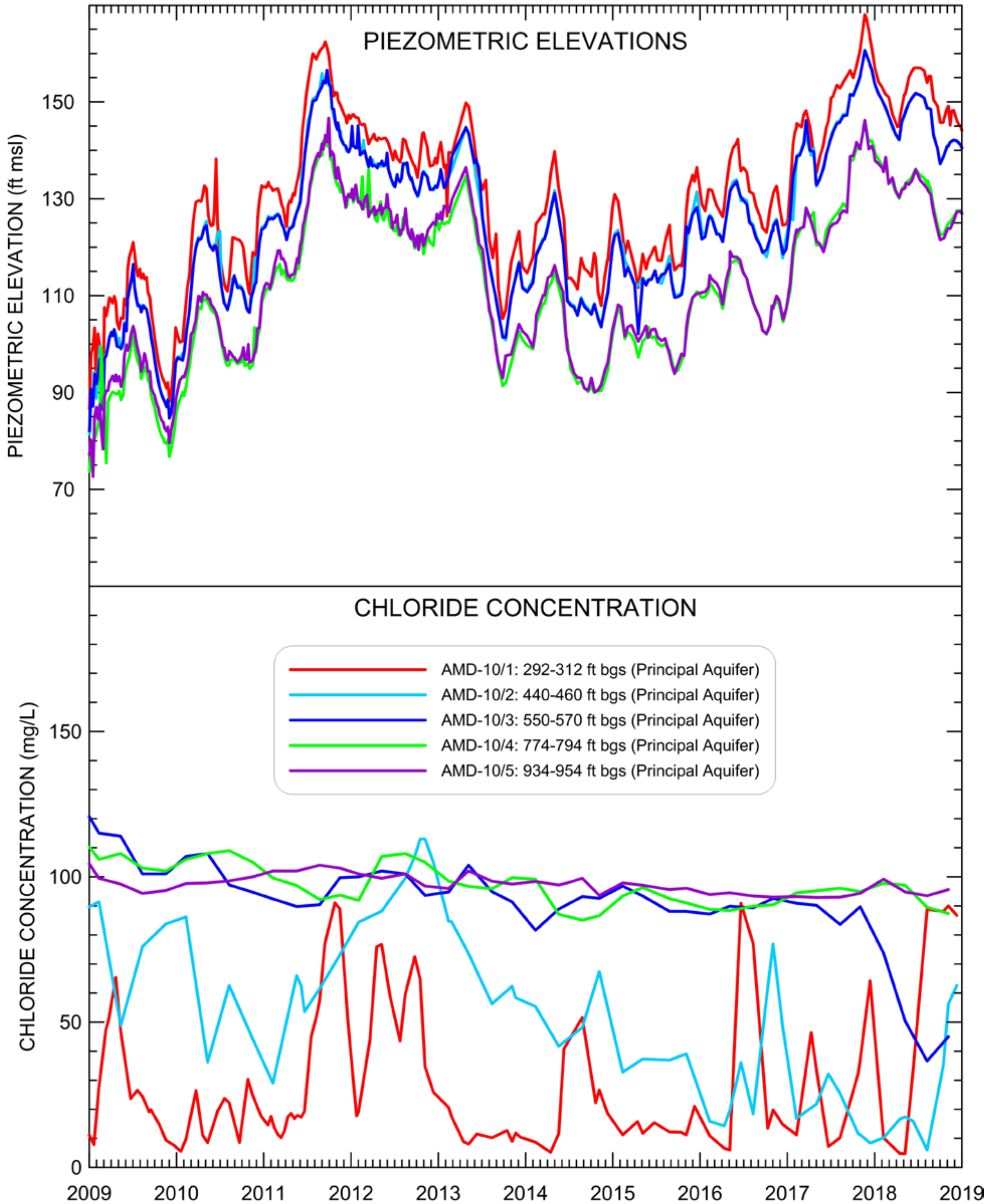


Figure 6-5. Monitoring Well AMD-10 Piezometric Elevations and Chloride Concentration

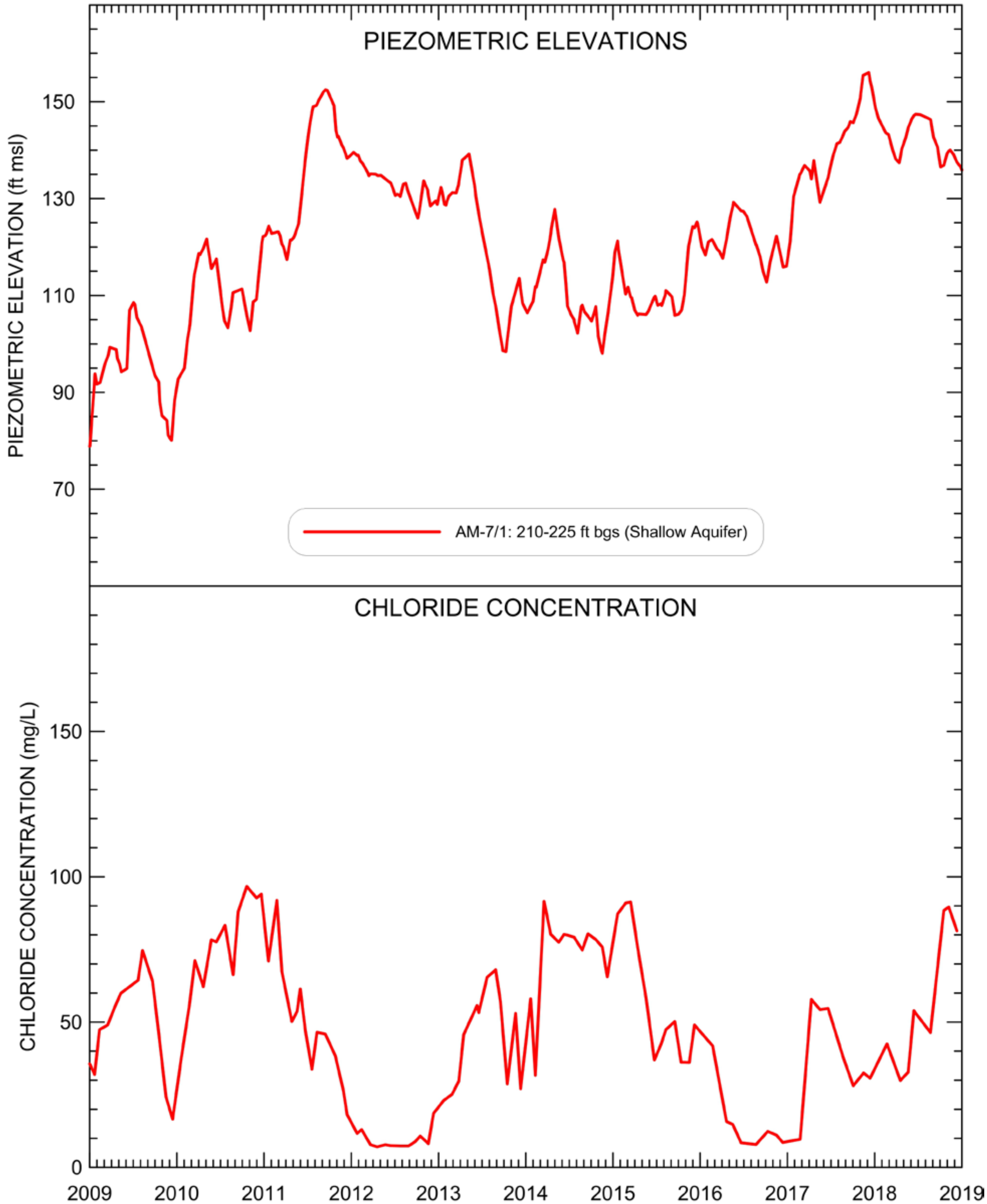


Figure 6-6. Monitoring Well AM-7 Piezometric Elevations and Chloride Concentration

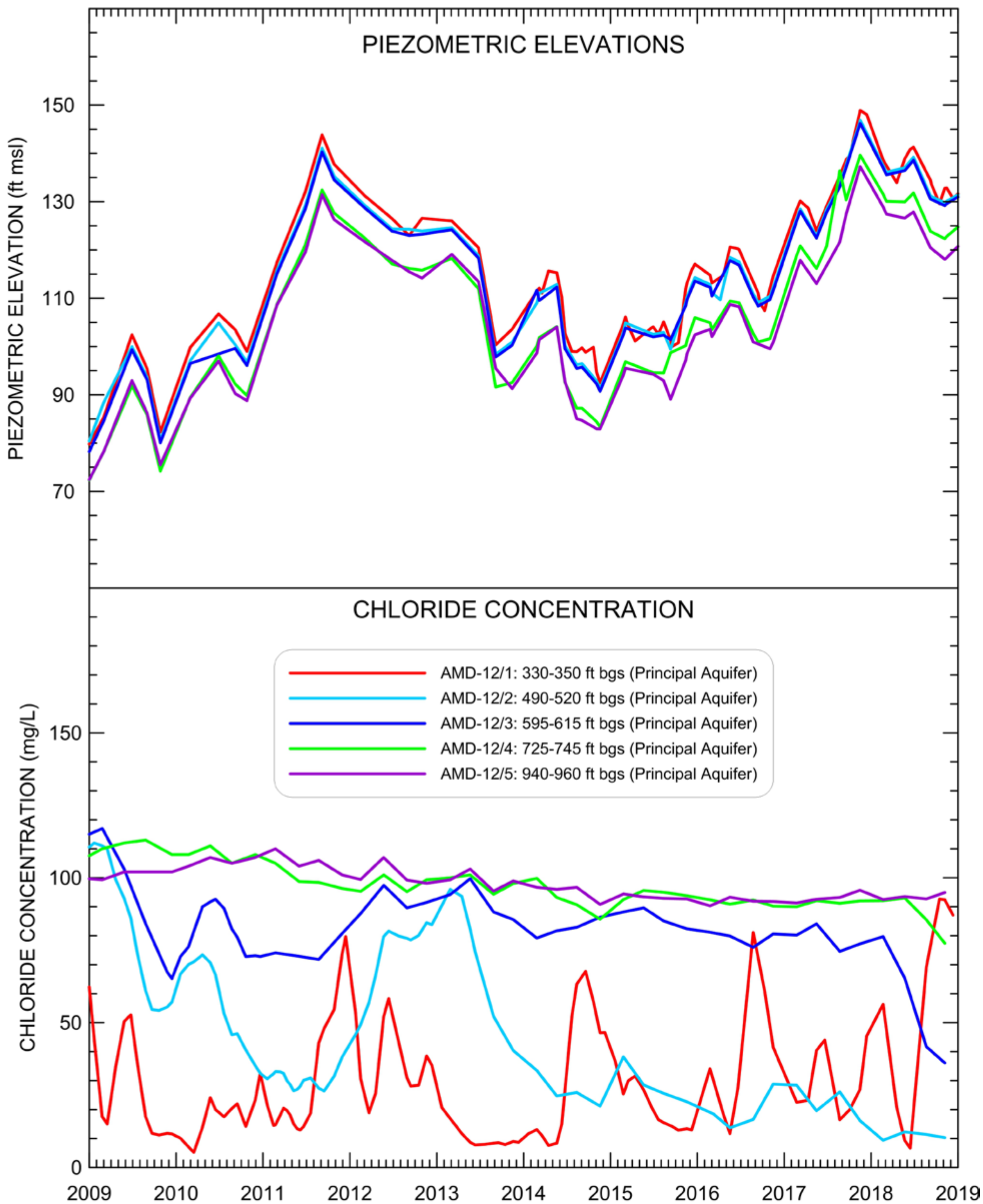


Figure 6-7. Monitoring Well AMD-12 Piezometric Elevations and Chloride Concentration

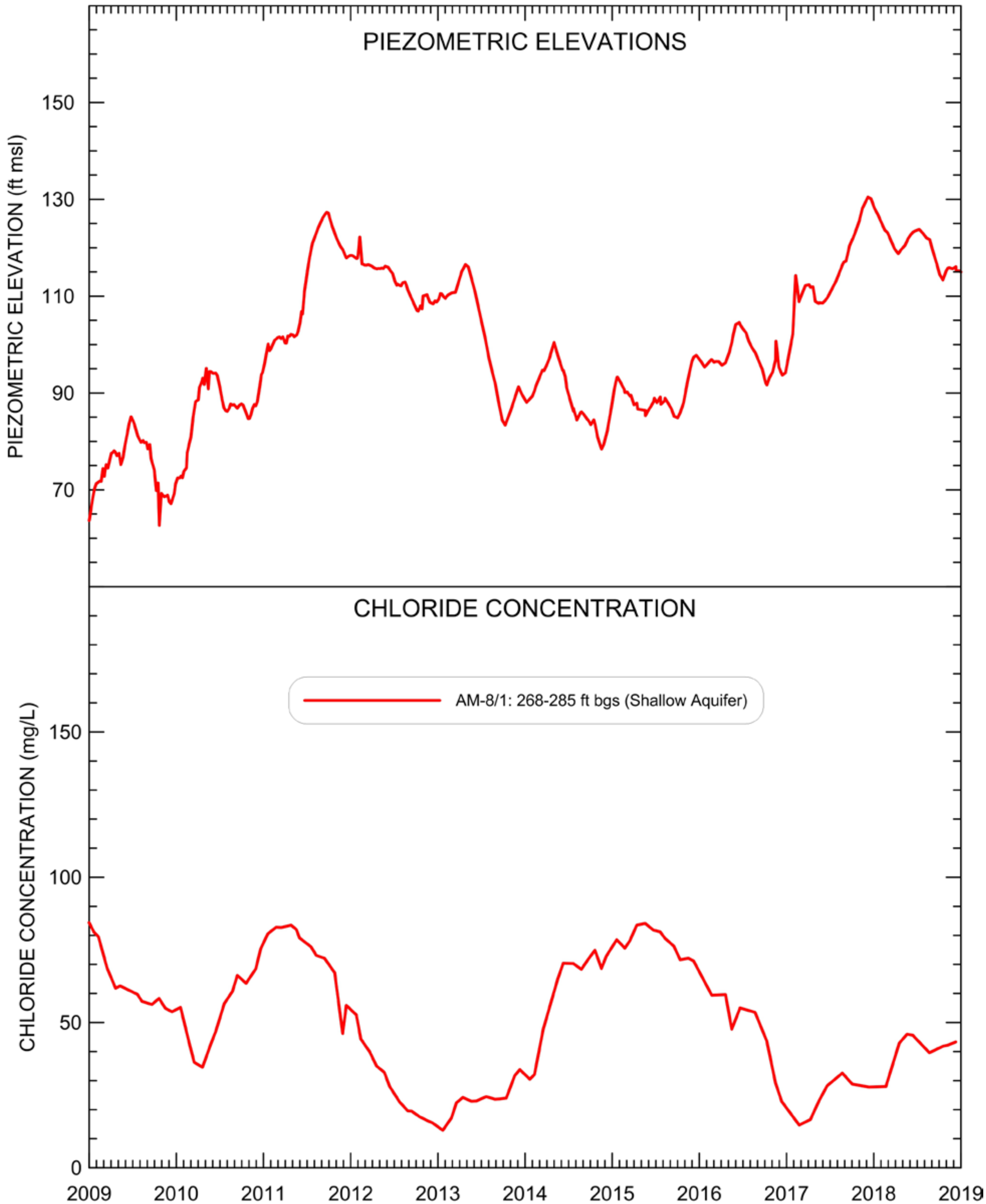


Figure 6-8. Monitoring Well AM-8 Piezometric Elevations and Chloride Concentration

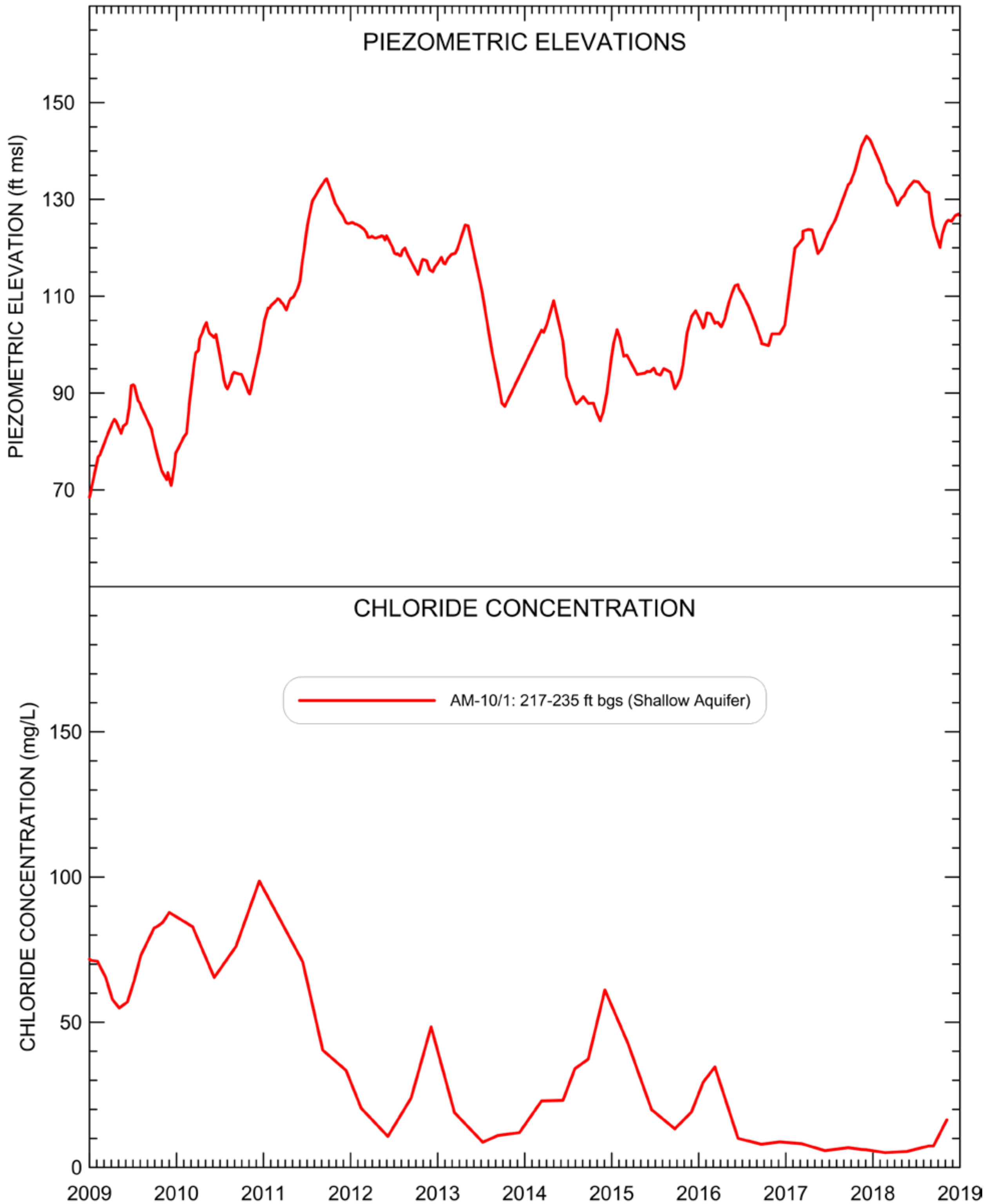


Figure 6-9. Monitoring Well AM-10 Piezometric Elevations and Chloride Concentration

pumping and no GWRS recharge at K-M-M-L Basins from August 22 to October 3. However, the decline would have been more significant if not for the continued recharge of relatively large volumes of imported replenishment water. During the fourth quarter, groundwater levels remained relatively stable, experiencing a slight uptick of approximately 5 feet or less, as recharge of imported water continued through November and early season rainfall helped to offset groundwater production.

At all six monitoring wells, groundwater levels at the end of 2018 were approximately 10 to 15 feet lower than at the beginning of the year and approximately 20 feet lower than the historical high experienced in late 2017. At OCWD-KB1, the peak groundwater levels in November 2017 (Figure 6-4) represented a depth to water of only 50 feet below ground surface at that location, equating to the approximate bottom elevation of adjacent Kraemer Basin and potentially indicating mounding beneath that basin. By the end of 2018, groundwater levels at OCWD-KB1 were approximately 20 feet below the bottom of Kraemer Basin, indicating the presence of an unsaturated zone beneath the basin more conducive for recharge operations.

Of the six monitoring wells shown on Figure 6-4 through Figure 6-9, the four single-point wells (OCWD-KB1, AM-7, AM-8, and AM-10) are screened in the Shallow aquifer, whereas all casings for the two nested wells (AMD-10 and AMD-12) are individually screened entirely in the Principal aquifer. However, all six monitoring wells have very similar groundwater elevation trends; only small differences are seen with depth within the Principal aquifer at nested monitoring wells AMD-10 and AMD-12. As mentioned earlier, the Anaheim Forebay area in the vicinity of K-M-M-L Basins is largely devoid of any laterally extensive low-permeability aquitards. Therefore, the Shallow and Principal aquifers behave quite similarly and relatively rapid vertical transport of recharge water occurs.

6.4 Groundwater Quality

This section describes monitoring well groundwater quality for general constituents and arsenic in the Anaheim Forebay area in the vicinity of K-M-M-L Basins.

6.4.1 Monitoring Wells – General Water Quality

Quarterly compliance groundwater quality data for 2018 are presented in Appendix J. General groundwater quality data for 2014-2018 are summarized in Appendix J for the compliance monitoring wells. Compliance monitoring wells were tested for: (1) an extensive list of inorganic, organic, and radiological parameters, (2) the majority of U.S. Environmental Protection Agency (EPA) Priority Pollutants, and (3) 1,4-dioxane and NDMA. During 2018, groundwater quality at the compliance monitoring wells complied with all Federal and State Primary Drinking Water Standards. All 1,4-dioxane and NDMA results were non-detect in 2018. During 2018, some of the analyses at monitoring well sites AM-8 and AMD-10 revealed constituents above the EPA

Secondary MCL for apparent color, odor, iron, and manganese. At monitoring wells AM-8 and AMD-10, iron was also detected above the Secondary MCL but dissolved iron concentrations were relatively low and well below the Secondary MCL, confirming that particulate iron from corrosion of the mild steel well casing was likely the primary contributing factor causing the Secondary MCL exceedances for total iron. All of the other Secondary MCL exceedances at AMD-10 during 2018 were consistent with the prior monitoring data collected from 2008-2018 and were not associated with the presence of GWRS purified recycled water.

There were no microbial detections at any of the compliance monitoring wells during the first quarter of 2018, which marked the end of the required reporting period for microbial detections as was described in Section 4.4.1.

The RWQCB and DDW approved a revised groundwater monitoring frequency beginning in 2011 and 2010, respectively. The revised monitoring frequency allows for selected analytes with no detections to be monitored on an annual basis in lieu of quarterly (RWQCB, 2011 and CDPH, 2010a).

6.4.2 Monitoring Wells – Intrinsic Chloride Tracer

As shown earlier in Section 4 for the Talbert Barrier area, dissolved chloride concentrations can be used to trace the subsurface movement of groundwater because chloride is relatively unaffected by sorption, chemical, or biological reactions in the aquifer. Thus, chloride is considered to be a good conservative tracer. Groundwater flow paths determined from groundwater level monitoring are also verified by comparing groundwater quality changes and trends in the recharge source water with nearby monitoring wells, primarily using chloride concentrations and EC. However, since applied recharge in the Anaheim Forebay comes from multiple sources (see Section 5), water quality responses at the monitoring wells discussed in this section do not always follow a single source water trend.

Chloride concentration time series for the 10-year period 2009-2018 for the six monitoring wells near K-M-M-L Basins are shown on the lower graph on Figure 6-4 through Figure 6-9. Prior to GWRS start-up, chloride concentrations in all five wells had similar overall trends, fluctuating somewhat from year to year but remaining within a range of approximately 80 to 120 mg/L, reflective of SAR water and MWD imported supplies from the Colorado River, which historically have been OCWD's primary source of recharge water. Occasional decreases below this range prior to GWRS start-up may be indicative of periods of greater SAR storm water recharge and/or greater recharge of MWD imported supplies from the State Water Project (SWP), both of which feature relatively lower EC, TDS, and chloride concentrations, but still noticeably higher than for GWRS purified recycled water.

Since the initial deliveries of GWRS water in January 2008 to Kraemer-Miller Basins, in July 2012 to Miraloma Basin, and in November 2016 to La Palma Basin, the migration of this purified recycled water in the subsurface is evidenced by chloride concentrations decreasing below 60 mg/L at all six monitoring well sites: OCWD-KB1, AMD-10, AMD-12, AM-7, AM-8, and AM-10 (Figure 6-4 through Figure 6-9, respectively). These chloride concentrations below 60 mg/L were lower than the bulk of historical recharge source waters. Furthermore, the timing of these chloride concentration decreases corresponded well with previously established groundwater travel times away from Kraemer-Miller Basins (LLNL, 2004; Clark, 2009). The chloride concentration of GWRS water has historical ranged from 4 to 11 mg/L and is largely dependent on OCSD feed water quality and the collective performance and age of the AWPF RO membranes in service.

Comparing Table 5-1, Table 5-2, and Figure 5-1 presented earlier in Section 5 provides a temporal sense of the volume and proportion of GWRS purified recycled water in the vicinity of K-M-M-L Basins relative to other recharge sources in 2018; these factors influence how well the GWRS low chloride signal can be tracked in surrounding groundwater.

OCWD-KB1/1 is screened in the Shallow aquifer (screened from 180 to 200 ft bgs) adjacent to the southwest corner of Kraemer Basin (Figure 6-3). Chloride concentrations at OCWD-KB1/1 are dominated by Kraemer Basin recharge with a travel time estimate of approximately one month whenever Kraemer Basin recharge volumes are sufficiently large. However, based on past chloride trends discussed in previous Annual Reports, when Kraemer Basin is either empty or operated at a relatively low monthly recharge volume of less than approximately 1,000 AF, GWRS water recharged at Miraloma Basin can migrate laterally downgradient within the Shallow aquifer to OCWD-KB1/1. Figure 6-4 shows that chloride concentrations at OCWD-KB1/1 remained low at GWRS levels throughout 2016, consistent with the large volume of approximately 100% GWRS water recharged in Kraemer Basin that entire year. Chloride concentrations at OCWD-KB1/1 increased sharply to nearly 70 mg/L in February 2017 due to the large volumes of non-GWRS recharge in Kraemer Basin beginning one month prior in January. Chloride concentrations at OCWD-KB1/1 decreased during the first half of 2018 to low GWRS levels by May, indicating a pulse of GWRS water arriving at this well in the Shallow aquifer that likely originated from Miraloma Basin as Kraemer Basin was minimally operated with very low monthly recharge volumes (mostly non-GWRS water) of considerably less than 1,000 AF from January through May. Chloride concentrations at OCWD-KB1/1 subsequently increased sharply to just over 90 mg/L during the second half of 2018, indicating the arrival of non-GWRS water from adjacent Kraemer Basin which had relatively large non-GWRS monthly recharge volumes greater than 1,000 AF from June through the end of the year.

AMD-10/1 is screened in the uppermost Principal aquifer (screened from 292 to 312 ft bgs) adjacent to the northwest corner of Kraemer Basin (Figure 6-3). As documented in previous Annual Reports, chloride concentrations at AMD-10/1 (Figure 6-5) historically did not appear to be dominated by Kraemer Basin recharge events since AMD-10/1 is screened somewhat deeper in the uppermost zone of the Principal aquifer. Since 2017 however, chloride concentration trends at AMD-10/1 have been very similar to those at the shallower OCWD-KB1/1 discussed above. This may be due to the unusually high groundwater levels in this vicinity over the last two years in part from the newer La Palma Basin as well as increased Basin storage conditions. Chloride concentrations at AMD-10/1 decreased sharply during the first half of 2018 down to low GWRS levels from February through May, indicating a pulse of GWRS water arriving at AMD-10/1 within the uppermost Principal aquifer that likely originated from GWRS water recharged at Miraloma Basin in prior months. Chloride concentrations at AMD-10/1 subsequently increased sharply to approximately 90 mg/L during the second half of 2018, mimicking the contemporaneous trend at OCWD-KB1/1 and indicating arrival of non-GWRS water likely from Kraemer Basin which was fully operational with non-GWRS water from June through the end of the year.

In prior years when Kraemer Basin was fully operational, chloride concentrations at AMD-10/1 typically indicated arrival of GWRS recharge from upgradient Miraloma Basin due to hydraulic interference of Kraemer Basin recharge in the Shallow aquifer forcing Miraloma Basin recharge to migrate vertically into the uppermost Principal aquifer prior to migrating westward beneath Kraemer Basin. However, due to the high groundwater levels in 2017 and 2018 (since the commencement of La Palma Basin), it appears that Miraloma Basin recharge may now migrate vertically to successively deeper Principal aquifer zones before migrating westward beneath Kraemer Basin, as evidenced by the first significant chloride concentration decline at the deeper AMD-10/3 (screened from 550 to 570 ft bgs) from background levels of approximately 90 mg/L in late 2017 down to a historical low of 37 mg/L by the third quarter of 2018 (Figure 6-5), likely indicating the first arrival of some percentage of GWRS water at this well.

AM-7/1 is screened in the Shallow aquifer (screened from 210 to 225 ft bgs) and is located approximately 2,000 feet west or downgradient of Kraemer Basin (Figure 6-3). Chloride concentration trends since 2008 at AM-7/1 (Figure 6-6) have been very similar to those at OCWD-KB1/1 (Figure 6-4) but are typically lagged by 2 to 3 months and often dampened (i.e., greater dispersion) due to its farther distance downgradient from Kraemer Basin. Consistent with this pattern, chloride concentrations at AM-7/1 (Figure 6-6) decreased sharply during the first quarter of 2016 and remained low near GWRS levels for the remainder of the year, nearly identical to the chloride trend at OCWD-KB1/1 (Figure 6-4) but lagged by 2 to 3 months. During 2018, chloride concentrations at AM-7/1 once again followed a similar trend as OCWD-KB1/1 and lagged by 2 to 3 months, although the chloride decline during the first half of 2018 was more dampened without reaching low GWRS levels likely due to dispersive transport along this more distant flow path. The increase in chloride concentrations at AM-7/1 during the second half of 2018 reached approximately 90 mg/L similar to OCWD-KB1/1 and was likely due to the large consistent volume of non-GWRS recharge in Kraemer Basin throughout the second half of 2018.

AMD-12/1 is located slightly downgradient from AM-7/1 (Figure 6-3) and is screened in the uppermost Principal aquifer (screened from 330 to 350 ft bgs) analogous to AMD-10/1 discussed above. Consistent with historical observations, chloride concentration trends at AMD-12/1 during 2018 mimicked those at AMD-10/1 but were delayed by 2 to 3 months due to AMD-12/1 being farther downgradient from Kraemer and Miraloma Basins. Chloride concentrations at AMD-12/1 (Figure 6-7) decreased sharply during the first half of 2018 to low GWRS levels in May, correlative with a similar chloride decline to GWRS levels at AMD-10/1 (Figure 6-5) three months prior in February. Chloride concentrations at AMD-12/1 subsequently rose sharply during the second half of 2018 to over 90 mg/L, consistent with the same trend at AMD-10/1 but once again lagged by approximately two to three months.

At AM-8/1 screened in the Shallow aquifer (screened from 268 to 285 ft bgs) and located the farthest downgradient from K-M-M-L Basins (Figure 6-3), chloride concentrations declined throughout 2016 down to a low of 15 mg/L by early 2017 (Figure 6-8), indicating a relatively high percentage of sustained GWRS water at this well in the Shallow aquifer. Given the estimated travel time of 5 to 6 months for Kraemer Basin recharge to arrive at AM-8/1, the 2016 and early 2017 chloride concentration decline was due to the consistent recharge of nearly 100% GWRS water in Kraemer Basin from the second half of 2015 and throughout most of 2016. During 2018, chloride concentrations at AM-8/1 rose gradually from 28 mg/L in the first quarter to 43 mg/L in the fourth quarter and were once again consistent with the estimated travel time of 5 to 6 months given recharge of primarily non-GWRS water in Kraemer Basin from mid-2017 to mid-2018, albeit at relatively small recharge volumes during the first few months of 2018.

AM-10/1 is located approximately 3,000 feet downgradient of both Kraemer and La Palma Basins (Figure 6-3) and screened in the Shallow aquifer (screened from 217 to 235 ft bgs). Figure 6-9 shows that chloride concentrations at AM-10/1 were low and stable below 10 mg/L from the second half of 2016 through the first three quarters of 2018, indicating approximately 100% sustained GWRS water arrival at this well in the Shallow aquifer during that time. Chloride concentrations at AM-10/1 increased slightly to 16 mg/L in November 2018, denoting the first arrival of some percentage of non-GWRS water at AM-10/1 since the commencement of La Palma Basin and likely resulting from no GWRS flows to K-M-M-L Basins from August 22 to October 3. The groundwater flow direction to AM-10/1 in the Shallow aquifer inferred from the June 2018 groundwater elevation contours (Figure 6-3) originates from La Palma Basin. Since there was no GWRS recharge in La Palma Basin in September 2018, the November uptick in chloride concentrations at AM-10/1 may imply a travel time of approximately 2 months from La Palma Basin to this well under these relatively high groundwater conditions. Previous tracer tests indicated that the travel time from Kraemer Basin to AM-10/1 was approximately 2 months for first arrival and nearly 5 months for peak arrival.

At the slightly deeper monitoring wells AMD-10/2, AMD-10/3, AMD-12/2, and AMD-12/3 (Figure 6-5 and Figure 6-7, respectively), chloride concentration trends were more delayed and dampened as compared to the shallowest zone at these two well sites because of extended transport through less permeable vertical flow paths and the associated mixing via dispersive transport.

At AMD-10/2 (screened from 440 to 460 ft bgs), chloride concentration trends in this Principal aquifer zone were very similar to the shallower AMD-10/1 from 2014-2018 but were somewhat dampened and lagged by approximately 2 to 3 months (Figure 6-5). In December 2017, chloride concentrations at AMD-10/2 decreased to a new historical low of 8 mg/L, marking the first occurrence of near-100% GWRS water at this well. Chloride concentrations at AMD-10/2 increased slightly during the first half of 2018 but remained relatively low at less than 20 mg/L for the first three quarters of the year before increasing sharply to over 60 mg/L in December, consistent with the sharp chloride increase at AMD-10/1 approximately three months prior.

At AMD-10/3 (screened from 550 to 570 ft bgs), chloride concentrations had remained relatively stable and high ranging from approximately 90 to 120 mg/L over the last several years and did not appear to be noticeably affected by GWRS recharge until 2018 when chloride concentrations decreased significantly for the first time to a new historical low of 37 mg/L by the third quarter of 2018, indicating the first arrival of a significant percentage of GWRS water at this deeper well. As previous discussed, this appears to support that during the recently high groundwater conditions of 2017 and 2018 with the addition of La Palma Basin, GWRS recharge at Miraloma Basin may now vertically migrate deeper, taking the path of least resistance if the Shallow and uppermost Principal aquifers are largely mounded and thus creating hydraulic interference in this immediate area.

At AMD-12/2 (screened from 490 to 520 ft bgs), chloride concentration trends in this somewhat deeper Principal aquifer zone appeared to correlate with the shallower AMD-12/1 from 2014-2018 but were significantly dampened and delayed by approximately 5 to 6 months (Figure 6-7). Chloride concentrations at AMD-12/2 dropped just below 10 mg/L in February 2018, representing a new historical low and the first occurrence of near-100% GWRS at this well, similar to what occurred at the analogous AMD-10/2 two months prior. Chloride concentrations at AMD-12/2 remained low and stable for the rest of 2018 at near-GWRS levels of 10 to 12 mg/L. Since the chloride trends at AMD-12/2 are lagged by approximately 5 to 6 months from AMD-12/1, the increase in chloride concentration at AMD-12/1 in August 2018 had not yet occurred at AMD-12/2 by the end of 2018.

At AMD-12/3 (screened from 595 to 615 ft bgs), chloride concentration trends were much more dampened than at AMD-12/2 but not as stable as the progressively deeper zones at this well site. While AMD-12/3 appeared to show some arrival of GWRS recharge from Kraemer-Miller Basins during 2009-2012, chloride concentration trends since 2012 have been too subtle to estimate a reliable groundwater travel time to this well. Similar to the analogous AMD-10/3 but lagged by approximately three months, chloride concentrations at AMD-12/3 declined significantly during

2018 from background levels of approximately 80 mg/L in the first quarter to a new historical low of 36 mg/L in the fourth quarter, thus signifying arrival of the largest percentage of GWRS water historically to this well. Once again, this appears to support that GWRS recharge at Miraloma Basin is now vertically migrating into successively deeper Principal aquifer zones.

In the deeper zones at AMD-10 and AMD-12 (AMD-10/4, AMD-10/5, AMD-12/4, and AMD-12/5), chloride concentrations have remained relatively stable over the last several years and do not appear to be noticeably affected by GWRS recharge. However as shown on Figure 6-5 (AMD-10) and Figure 6-7 (AMD-12), chloride concentrations have very gradually decreased from approximately 105 to 95 mg/L over the last 10 years, a decline of approximately 10%. This gradual decline may be due to a small percentage of GWRS water vertically migrating into these deeper zones or could just be an ambient trend. Based on groundwater age estimates developed for these deeper aquifer zones using tritium/helium age dating, these zones at AMD-10 and AMD-12 likely have average groundwater ages on the order of 10 years or greater (LLNL, 2004). At AMD-10/4 (screened from 774 to 794) and AMD-12/4 (screened from 725 to 745), chloride concentrations showed a subtle but noticeable decrease during the second half of 2018, as shown on Figure 6-5 and Figure 6-7, respectively. This subtle decrease may be related to the larger chloride concentration decline at their shallower counterparts AMD-10/3 and AMD-12/3 but lagged by three to four months and could indicate further evidence of deeper migration of GWRS water. However, due to dispersive transport along these deeper flow paths, arrival of GWRS recharge from K-M-M-L Basins to these wells may never reach a sufficiently large percentage that would make the GWRS low-chloride signal completely identifiable.

6.4.3 Monitoring Wells - Arsenic

Previous studies have indicated the potential for surface spreading of reverse osmosis purified wastewater to mobilize metals from alluvial aquifer sediments (Li et al., 2006). In addition to the metals testing for the quarterly compliance monitoring, OCWD implemented a supplemental monthly sampling program of selected monitoring wells downgradient of K-M-M-L Basins to coincide with the first GWRS purified recycled water deliveries to the basins in January 2008.

Of all the metals analyzed, arsenic represents the greatest public health concern and has a Primary MCL of 10 μg/L. Figure 6-10 through Figure 6-12 feature grouped time series plots of total arsenic concentrations measured quarterly at: (1) single-point monitoring wells AM-7/1, AM-8/1, and AM-10/2; (2) multi-depth nested monitoring well site AMD-10; and (3) multi-depth nested monitoring well site AMD-12, respectively. During 2018, either non-detect, low stable concentrations, or decreases in total arsenic were generally observed in all of these monitoring wells, with the following exceptions:

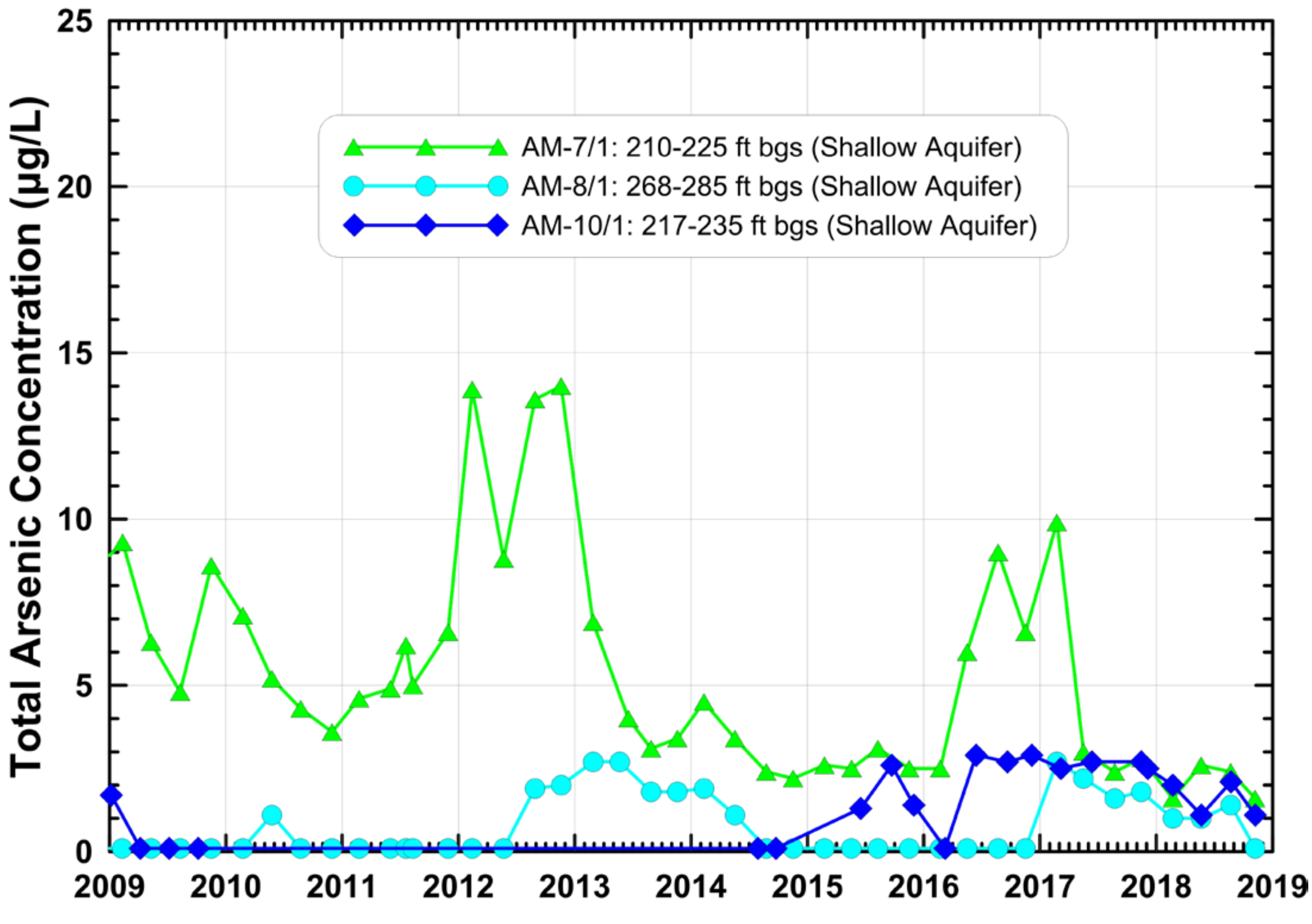


Figure 6-10. Monitoring Wells AM-7 and AM-8 Total Arsenic Concentrations

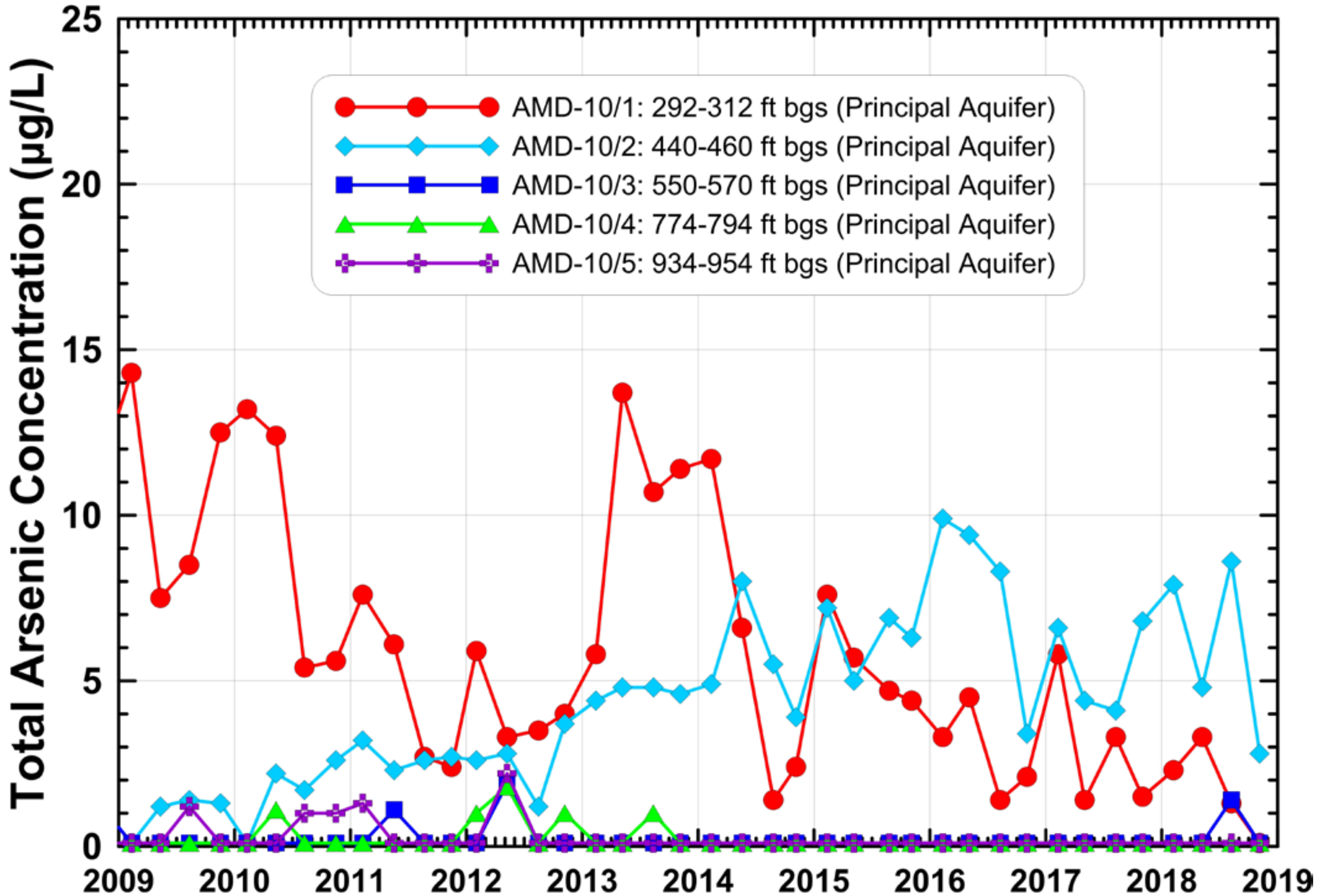


Figure 6-11. Monitoring Well AMD-10 Total Arsenic Concentrations

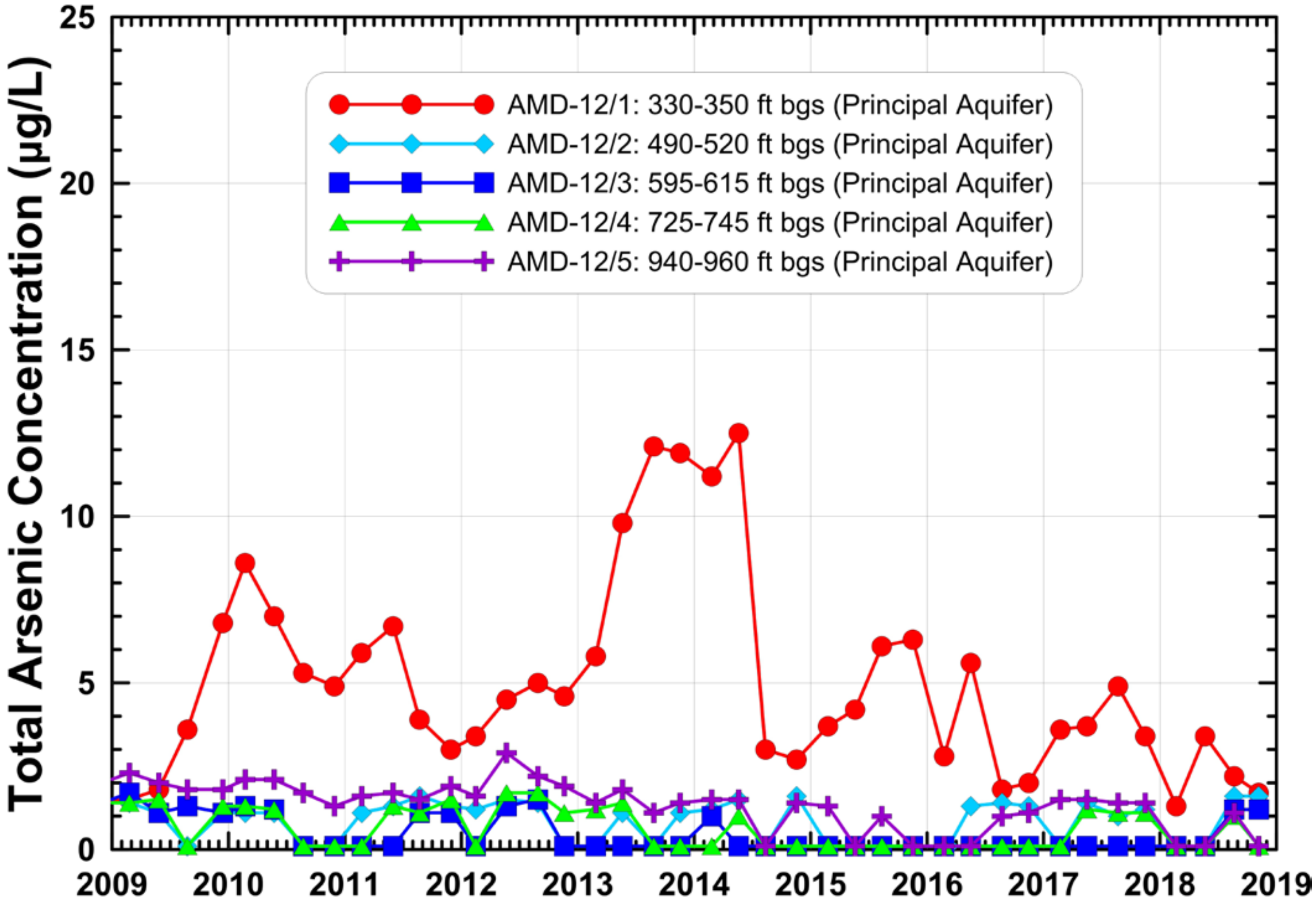


Figure 6-12. Monitoring Well AMD-12 Total Arsenic Concentrations

- AMD-10/1 – increased slightly to 2.3 µg/L and 3.3 µg/L in the first and second quarters of 2018, respectively, but then decreased during the second half of the year to below the RDL of 1 µg/L for the first time at this well in the fourth quarter of 2018;
- AMD-10/2 – increased slightly to 7.9 µg/L in the first quarter of 2018 µg/L, decreased to 4.8 µg/L in the second quarter, increased to an annual high of 8.6 µg/L in the third quarter, and then decreased to an annual low of 2.8 µg/L in the fourth quarter of 2018;
- AMD-12/1 – increased slightly from 1.3 µg/L in the first quarter of 2018 to 3.4 µg/L in the second quarter, before decreasing to 1.7 µg/L in the fourth quarter of 2018.

Over the course of the GWRS groundwater monitoring program, an inverse relationship between the percentage of GWRS water present (as represented by chloride concentration) and the observed arsenic concentration at monitoring wells has been observed. This is graphically presented on time series plots of dissolved arsenic at AMD-10/1 and AM-7/1 as shown on Figure 6-13 and Figure 6-14, respectively. Note that this additional, non-compliance (voluntary) monitoring for dissolved arsenic has been performed at least bimonthly, as compared to the quarterly compliance monitoring for total arsenic. Increases in arsenic concentrations appeared to be associated with decreases in chloride concentrations, and vice versa. These trends confirmed that the arsenic increases were related to the arrival of GWRS water, whereas the arsenic decreases were likely due to the arrival of other recharge sources (SAR storm flow and/or imported water).

A review of the chloride and dissolved arsenic concentration trends (e.g., Figure 6-13 and Figure 6-14) indicated a generally non-linear and spatially-variable relationship between the percentage of GWRS purified recycled water and arsenic concentration in groundwater, after a minimum threshold percentage of purified recycled water reached the monitoring well. The threshold percentage of recycled water required to cause an initial arsenic concentration increase above background appears to increase with travel distance downgradient from K-M-M-L Basins, implying a greater degree of geochemical stabilization within the aquifer with increased travel distance and/or less available arsenic for mobilization at locations farther from the recharge basins.

Although the GWRS purified recycled water was the likely cause of the increased arsenic concentrations, it is not the arsenic source. The mechanism leading to the arsenic increases are the result of complex geochemical interactions between the GWRS purified recycled water and arsenic bound to and/or comprising the aquifer matrix. A historical review of SAR water quality analyses showed arsenic concentrations during the late 1980s as high as 8 to 16 µg/L, which is similar in magnitude to the maximum arsenic peaks observed at the compliance monitoring wells in prior years corresponding to the first arrival of sustained 100% GWRS recharge events. Current SAR arsenic concentrations generally range between 2 and 5 µg/L. Arsenic is known to adsorb onto naturally occurring alumina, iron, or manganese oxyhydroxides found on mineral surfaces

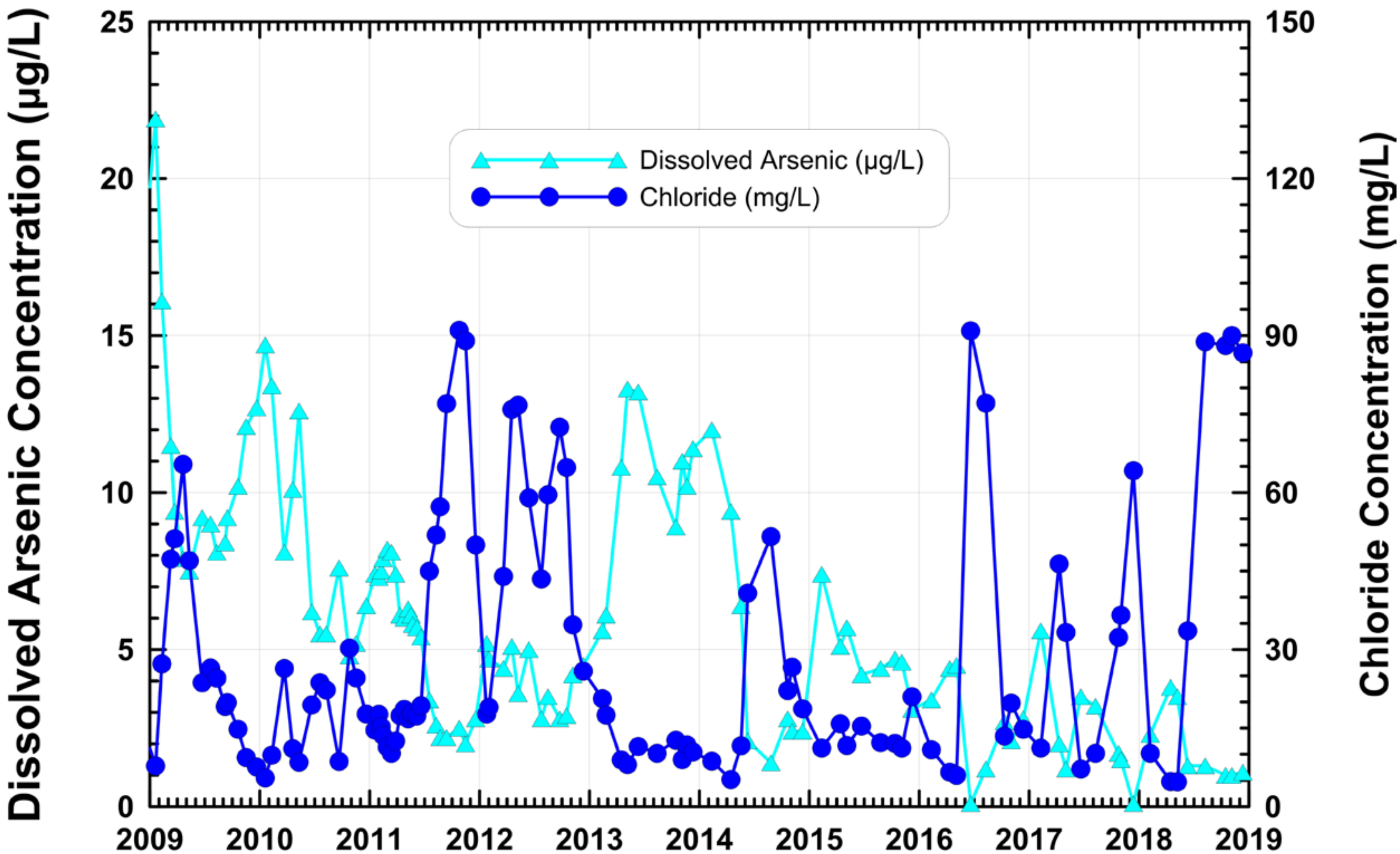


Figure 6-13. Monitoring Well AMD-10/1 Chloride and Dissolved Arsenic Concentrations

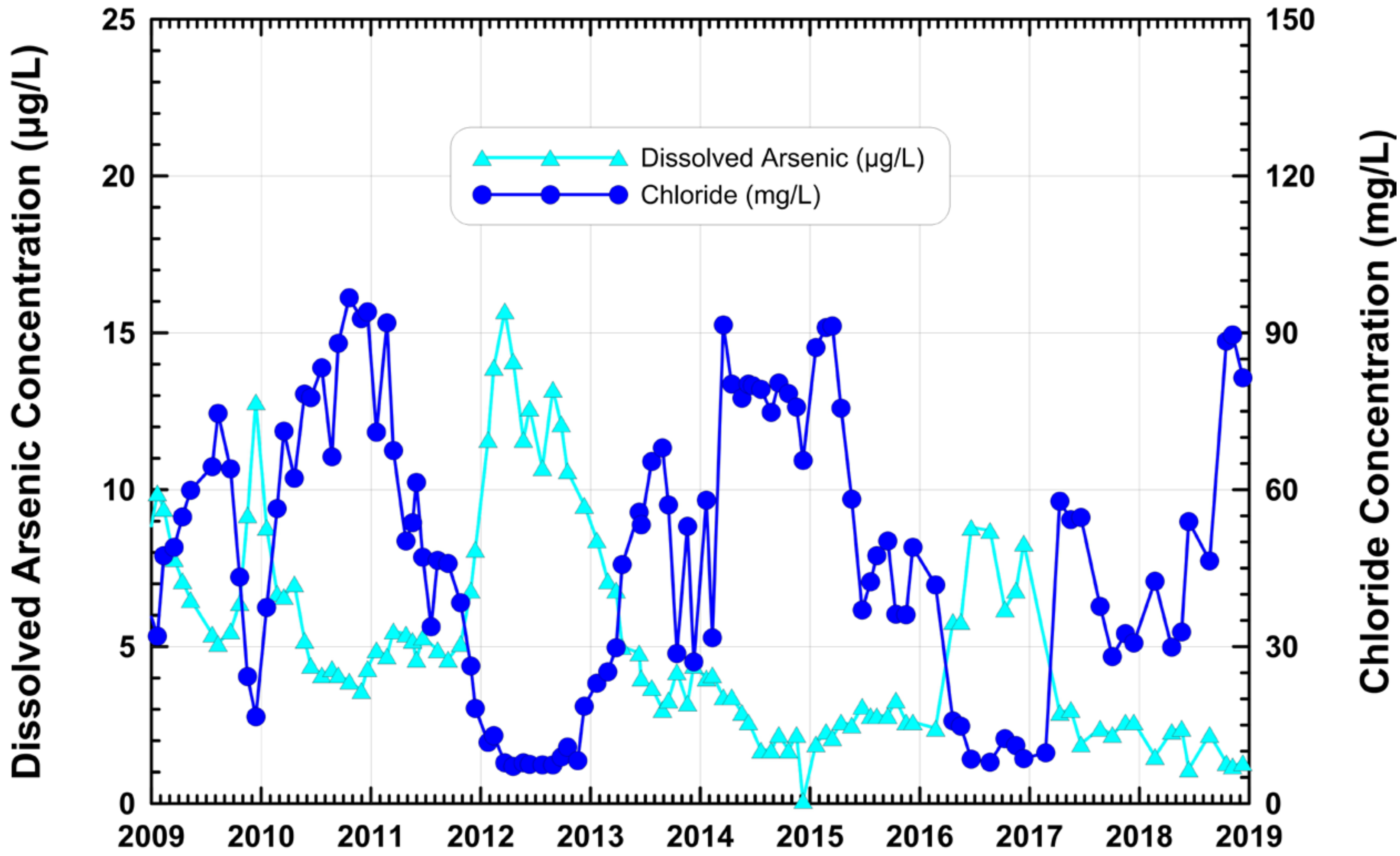


Figure 6-14. Monitoring Well AM-7 Chloride and Dissolved Arsenic Concentrations

within an alluvial aquifer matrix (Bowell, 1994). The higher initial pH or lower ionic strength of GWRS recycled water relative to surrounding groundwater has the potential to release this adsorbed arsenic by altering the surface charge of these mineral surfaces relative to their isoelectric point (Welch and Stollenwerk, 2003).

Repeated cycles of sustained 100% GWRS recharge arrival events are expected to result in diminishing arsenic peaks with each subsequent event due primarily to arsenic mass removal from the aquifer matrix during each event. Similarly, following each sustained 100% GWRS event, low arsenic concentrations due to the subsequent arrival of other recharge sources (SAR flows and imported water) have generally been below the pre-GWRS baseline arsenic concentrations due to arsenic mass removal during the aforementioned sustained 100% GWRS events. For example, dissolved arsenic concentrations at AMD-10/1 (Figure 6-13) declined to a low point below the RDL of 1 µg/L (well below pre-GWRS baseline levels) for the first time during June 2016 after three successive GWRS water arrival cycles in 2012, 2015, and early 2016, then declined below the RDL again in December 2017 after a fourth GWRS water arrival cycle, and finally declined to 1.1 µg/L just slightly above the RDL in the fourth quarter of 2018 after a fifth GWRS arrival cycle that occurred during the first half of 2018.

The decline in dissolved arsenic concentrations at AMD-10/1 to below or just above the RDL in mid-2016, late-2017, and late-2018 likely coincided with the arrival of other recharge sources as indicated by the contemporaneous chloride increase in all three cases. Similarly, dissolved arsenic concentrations at AM-7/1 (Figure 6-14) also declined to a low point below the RDL (below pre-GWRS baseline levels) during December 2014 likely due to the arrival of other recharge sources following the sustained 100% GWRS event at this well during 2012.

At AM-7/1, dissolved arsenic concentrations peaked at just over 8 µg/L during the second and third quarters of 2016 and remained relatively high for the remainder of the year (Figure 6-14), consistent with the total arsenic trends at that well (Figure 6-10). The sustained dissolved arsenic peak was consistent with the contemporaneous low chloride concentrations down at GWRS levels at this well, indicating another 100% GWRS recharge event sustained for approximately 8 to 9 months. As discussed above in relation to arsenic mass removal with each successive sustained 100% GWRS arrival event, the arsenic peak in 2016 was much lower in magnitude than the prior peak in 2012. Dissolved arsenic concentrations at AM-7/1 abruptly decreased during the first half of 2017 and have gradually decreased further since then down to 1.1 µg/L just above the RDL in the fourth quarter of 2018, likely due to the arrival of other recharge sources as indicated by the contemporaneous higher chloride concentrations at this well.

In the case of AMD-10/1 and AMD-12/1 (Figure 6-11 and Figure 6-12, respectively), both screened in the uppermost Principal aquifer, it is possible that the higher arsenic peaks in 2013 through early 2014 were not only the result of a longer sustained 100% GWRS recharge event but also the result of the transport of mobilized arsenic from aquifer sediments directly beneath

Miraloma Basin once this basin was first put into operation. The longer duration 100% GWRS recharge event that arrived at AMD-10/1 and AMD-12/1 in 2013 through early 2014 (Figures 6-5 and 6-7) was likely due to the consistent 100% GWRS recharge from new Miraloma Basin migrating directly down into the uppermost Principal aquifer before laterally migrating downgradient because of interference from concurrent Kraemer Basin recharge into the Shallow aquifer. Thus, the arsenic peaks in 2013 through early 2014 at both AMD-10/1 and AMD-12/1 likely represent the first arrival of 100% GWRS recharge from this newer and somewhat deeper flow path.

The arsenic peaks that occurred in 2015 and early 2016 at both AMD-10/1 and AMD-12/1 were significantly reduced from the prior 2013-2014 peaks. As previously discussed, these arsenic peak reductions were expected based on the premise of arsenic mass removal with each successive event of sustained 100% GWRS water arrival, especially when considering the potentially amplifying first time effect on the 2013-2014 arsenic peaks from this new deeper flow path from Miraloma Basin as mentioned above. However, another potential contributing factor to the 2015 and 2016 arsenic peak reduction at AMD-10/1 and AMD-12/1 was the 2015 sustained GWRS water arrival events never quite reaching 100% GWRS water and the 2016 GWRS events not being sustained for a sufficiently long period for full arsenic desorption at both of these wells. Subsequent GWRS water arrival events during mid-2017 and early-2018 were both short-term events that likely never quite reached 100% GWRS water for a sufficiently sustained period to cause full desorption of arsenic, thus explaining the relatively small arsenic increases during 2017-2018.

To limit arsenic mobilization, the operation of the AWPF post-treatment decarbonation and lime stabilization processes were modified during 2010-2015. Completion of the GWRS Initial Expansion post-treatment system upgrades in 2015 improved the ability to more closely control the FPW pH, targeting 8.5. During 2016-2018, there were no notable changes to the post-treatment operations.

OCWD's supplemental metals monitoring will continue to evaluate the effects of any and all operational changes and the DDW, RWQCB, and NWRI GWRS Independent Advisory Panel will continue to be informed of any pertinent findings.

OCWD performed a laboratory study in 2012 with Stanford University in an effort to identify the geochemical controls governing metals mobilization with GWRS purified recycled water as well as optimizing post-treatment operating parameters such as pH. Findings revealed the important role of divalent cations in controlling the mobilization of arsenic. Specifically, it has been shown that the magnitude of observed arsenic desorption is directly correlated to the concentrations of calcium and magnesium in GWRS water (Fakhreddine et al., 2015). It is thus hypothesized that cation bridging within finer-grained portions of the aquifer may be the mechanism controlling the arsenic mobilization.

6.4.4 Production Well

The closest downgradient potable production well is SCWC-PLJ2 (Figure 6-3) owned and operated by Golden State Water Company (formerly Southern California Water Company). As was shown previously on Figure 6-1, this well is located farther downgradient outside of the former primary three-month and new primary and secondary four-month buffer areas.

Other potable production wells are located outside the area influenced by the GWRS spreading operations at K-M-M-L Basins.

Water quality data for samples taken during 2018 at large system production well SCWC-PLJ2 are summarized in Table 6-2. Water from Well SCWC-PLJ2 complied with all federal and state drinking water standards in 2018.

Well SCWC-PLJ2 is screened in the Principal aquifer and likely has never received 100% GWRS water as indicated by chloride concentrations in the well having never decreased to GWRS levels. Historically, chloride concentrations in this well ranged from 80 to 100 mg/L prior to the commencement of GWRS recharge in Kraemer-Miller Basins in 2008 and then significantly decreased upon arrival of GWRS water from these basins in 2009 down to nearly 20 mg/L. Since then, chloride concentrations at SCWC-PLJ2 have generally remained in the 20 to 60 mg/L range, indicating a significant percentage of GWRS water but never reaching 100%. During 2018, chloride concentrations remained relatively low and stable and ranged from 29 to 42 mg/L at this well.

Table 6-2. 2018 Water Quality for Potable Well Within the Influence of K-M-M-L Basins

OCWD Well Name	Well Depth (ft bgs)[1]	Perforation Interval (ft bgs)[1]	Distance from Recharge Site (ft)[2]	Concentration [3,4]								
				Arsenic (As), ug/L	Chloride (Cl) mg/L	Bromide (Br) mg/L	Total Dissolved Solids (TDS) mg/L	Nitrate Nitrogen (NO3-N) mg/L	Nitrite Nitrogen (NO2-N) mg/L	Total Organic Carbon (Unfiltered) (TOC) mg/L	n-Nitrosodimethylamine (NDMA) ng/L	1,4-Dioxane (14DIOX) ug/L
Large System Municipal Well												
SCWC-PLJ2	504	402 - 492	5,300	ND	34.8 (29.3 - 41.6)	ND	225 (202 - 257)	0.80 (0.61 - 1.08)	0.001 (ND - 0.003)	0.27 (0.20 - 0.39)	ND	ND

[1] Feet below ground surface

[2] Distance from purified recycled water spreading: Straight line shortest distance to eastern edge of Kraemer Basin, estimated to the nearest 100 feet

[3] Concentrations are annual averages with annual ranges in parenthesis for the given year

[4] ND: Not detected or less than the detection limit

7. DMBI PROJECT OPERATIONS

The Demonstration Mid-Basin Injection (DMBI) Project provides operational and groundwater quality data to support the engineering design and permitting of a multi-well injection project in the central portion of the Basin (See Figure 1-1). The primary objective of the Mid-Basin Injection (MBI) Centennial Park Project, which is scheduled to begin operation in 2019, is to more locally and directly replenish a heavily pumped region of the Principal aquifer with available purified recycled water from the existing GWRS AWPF and ultimately from the planned GWRS Final Expansion. The MBI Centennial Park Project will also increase the recharge capacity of the Basin while preserving needed recharge capacity in the OCWD Forebay spreading grounds for available SAR and imported water flows.

The DMBI Project consists of a test injection well (MBI-1) along with two nearby multi-depth nested monitoring wells (SAR-10 and SAR-11), located approximately three miles north of the Talbert Barrier, along the GWR Pipeline at the Santa Ana River and Edinger Avenue (Figure 1-21). MBI-1 was equipped with an electric vertical turbine pump and motor assembly dedicated for frequent backwashing of the well; other infrastructure at the DMBI site include pipelines and appurtenances for GWRS injection water supply and backwash discharge.

The two monitoring wells SAR-10 and SAR-11 were installed during late 2011 and 2012, and injection well MBI-1 was drilled and constructed during 2012. MBI-1 was placed on-line in April 2015 using 100% GWRS purified recycled water and is operated and maintained by Barrier Operations staff.

Operation of the demonstration facilities is presented in this section:

- DMBI injection water source;
- DMBI injection water volume; and
- DMBI facilities operations.

7.1 DMBI Injection Water Source

Only one type of water was injected at MBI-1 during 2018: purified recycled water produced by the GWRS AWPF and delivered via the GWR Pipeline. Both DDW (CDPH, 2010b) and the RWQCB (RWQCB, 2010) indicated support for the DMBI Project and injection of 100% purified recycled water.

7.2 Injection Water Flow Rates and Volumes

A total volume of approximately 496 MG (1,521 AF) of purified recycled water was injected at MBI-1 during 2018. A minor volume of approximately 6 MG (20 AF) was pumped from MBI-1 during 2018 from the regularly occurring backwash events throughout the year to remove any build-up of particulate matter and/or biological growth in the well and thereby maintain the injection capacity. The backwash volume during 2018 represented approximately 1.3% of MBI-1 injection. Monthly quantities of GWRS purified recycled water injected and backwash water pumped at the DMBI Project are summarized in Table 7-1 and illustrated on Figure 7-1.

As shown in Table 7-1 below, the 2018 injection volume was fairly constant except for late August through September when the AWPF product water pump station was off-line for about six weeks for the GWR Pipeline Rehabilitation Project. Excluding the down time in August and September, the average injection flow rate during 2018 at MBI-1 ranged from 1.26 MGD in April to 2.35 MGD in December.

Table 7-1. 2018 Monthly Injection and Backwash Quantities at DMBI Project

Month	MBI-1 GWRS FPW Injection			MBI-1 Backwash Pumping	
	(Avg. MGD)	(MG)	(AF)	(MG)	(AF)
January	1.42	43.89	134.68	0.57	1.74
February	1.42	39.65	121.68	0.56	1.72
March	1.39	43.23	132.67	0.67	2.06
April	1.26	37.91	116.34	0.53	1.63
May	1.48	45.82	140.60	0.74	2.28
June	1.33	39.79	122.11	0.54	1.65
July	1.32	40.99	125.78	0.51	1.56
August	0.86	26.56	81.51	0.56	1.72
September	0.00	0.00	0.00	0.44	1.36
October	1.39	43.07	132.18	0.57	1.74
November	2.06	61.90	189.97	0.41	1.27
December	2.35	72.90	223.73	0.34	1.05
Totals	**1.36**	**495.70**	**1,521.26**	**6.45**	**19.78**

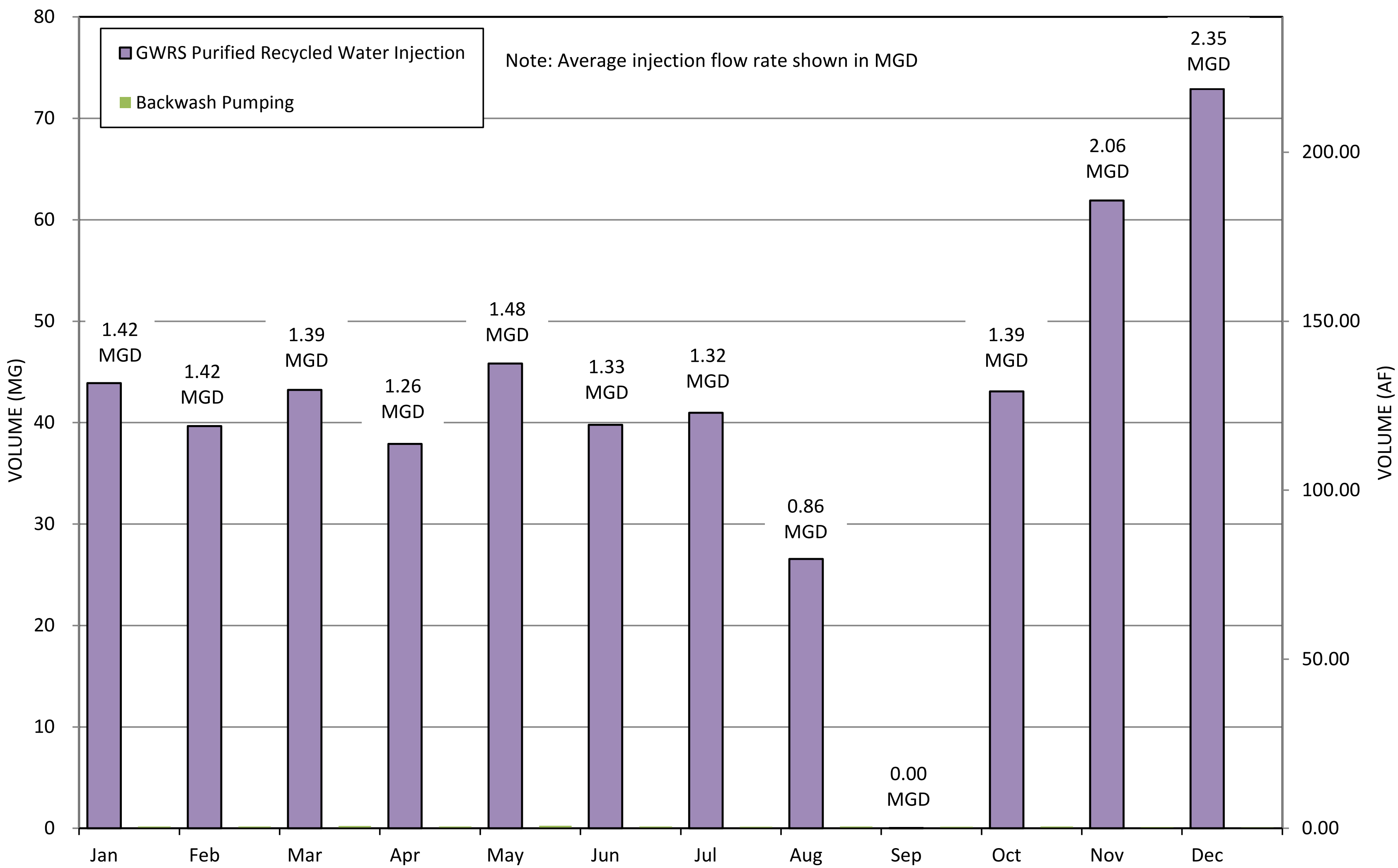


Figure 7-1. 2018 Monthly Injection and Backwash Quantities at DMBI Project

7.3 DMBI Project Operations

Test injection well MBI-1 was screened entirely within the Principal aquifer and was constructed very similar to a typical municipal large system production well, with a 20-inch diameter blank well casing in the upper portion of the well to accommodate the vertical turbine pump. The well casing reduces to 16-inch diameter in the lower portion for the well screens, with the topmost screen at 530 ft bgs and bottommost screen at 1,190 ft bgs as illustrated on Figure 7-2.

Injection of GWRS purified recycled water produced by the AWPF at MBI-1 began on April 15, 2015. Purified recycled water is delivered to MBI-1 via a lateral from the GWR Pipeline. No other back-up injection supply is provided at the injection well site. Therefore, during brief AWPF and/or GWR Pipeline shutdowns, MBI-1 is not injecting.

MBI-1 was off-line for approximately six weeks from August 22 to October 3 of 2018 due to the GWR Pipeline Rehabilitation Project, which involved draining the pipeline, repairing the existing interior cement mortar lining, and then applying an epoxy coating onto the interior mortar lining of Reach I (extending from near the AWPF in Fountain Valley to just north of the DMBI site). The cement mortar lining had previously shown visible signs of erosion and wear due to the aggressiveness of the GWRS water and was thought to be contributing to physical clogging at MBI-1.

Figure 7-3 shows MBI-1 injection rates during 2018, generally remaining stable within a narrow range from approximately 700 to 1,100 gpm (1.2 to 1.6 MGD) from January to August, except for a couple lower outliers related to brief AWPF shutdowns or MBI-1 maintenance activities. The lower end of this daily range (1.2 to 1.3 MGD) typically represented the weekly backwash event days in which no injection occurred for at least 70 minutes, thus reducing the overall injection volume for those days. Figure 7-3 shows the six-week period in which MBI-1 was off-line from August 22 to October 3 for the GWR Pipeline Rehabilitation Project. When MBI-1 came back on-line in October, injection was increased from approximately 1,000 gpm (1.5 MGD) to 1,450 gpm (2.1 MGD) after two weeks of operation since injection yields were significantly higher than prior to the shutdown. MBI-1 injection rates were increased once again in mid-December to approximately 1,780 gpm (2.55 MGD) for the last two weeks of 2018 to test the injection capacity of MBI-1 post-rehabilitation of the GWR Pipeline.

The average daily injection at MBI-1 during 2018 was 1,078 gpm (1.54 MGD) excluding the six-week down time and represented an increase of nearly 12% from the prior year due to increased injection rates post-rehabilitation of the GWR Pipeline. Besides the six-week shutdown of the GWR Pipeline, injection operations at MBI-1 were continuous throughout the year except for 3 days in April and 2 days in August due to brief AWPF shutdowns (Figure 7-3).

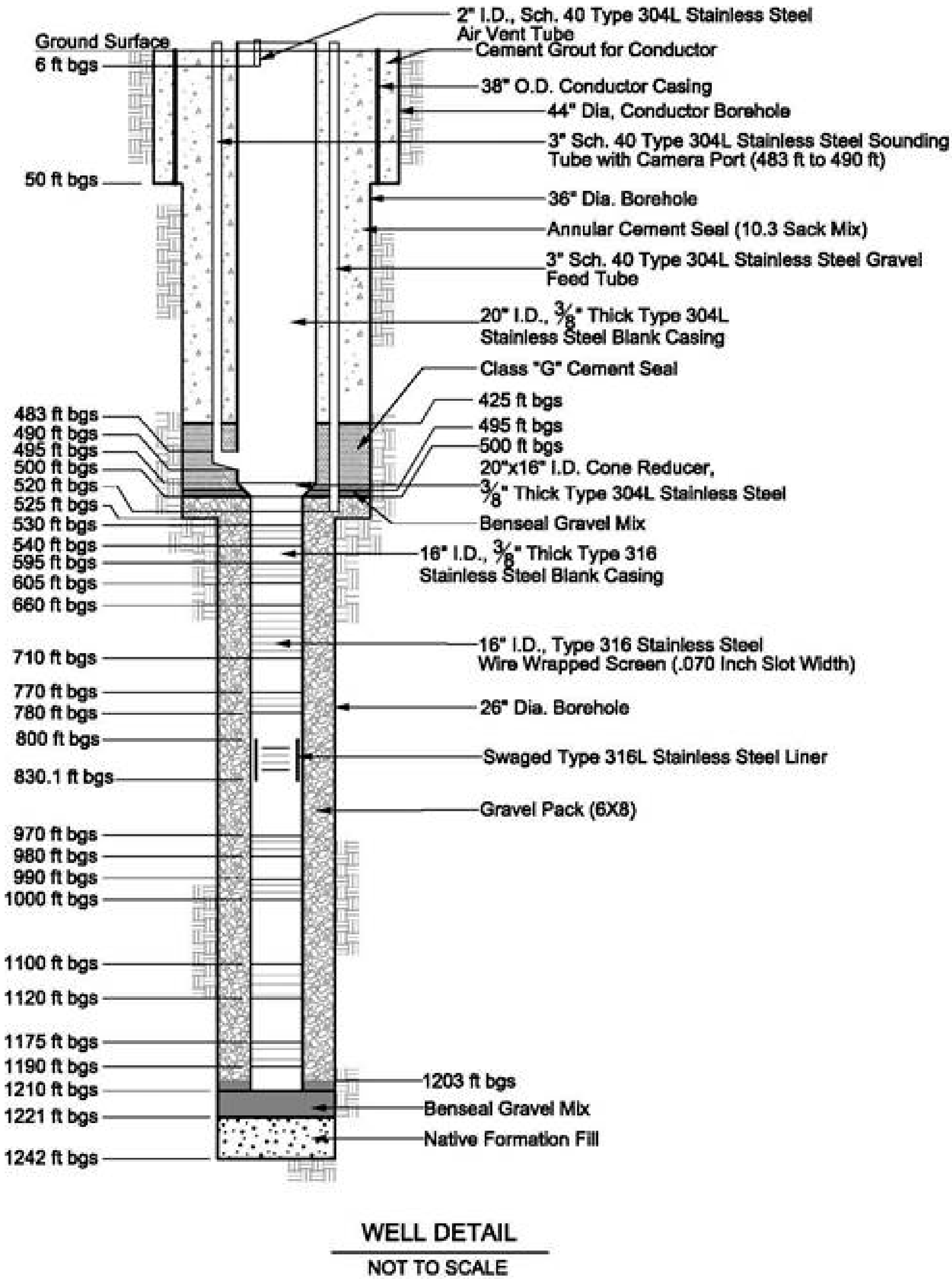


Figure 7-2. Injection Well MBI-1 As-Built Construction Diagram

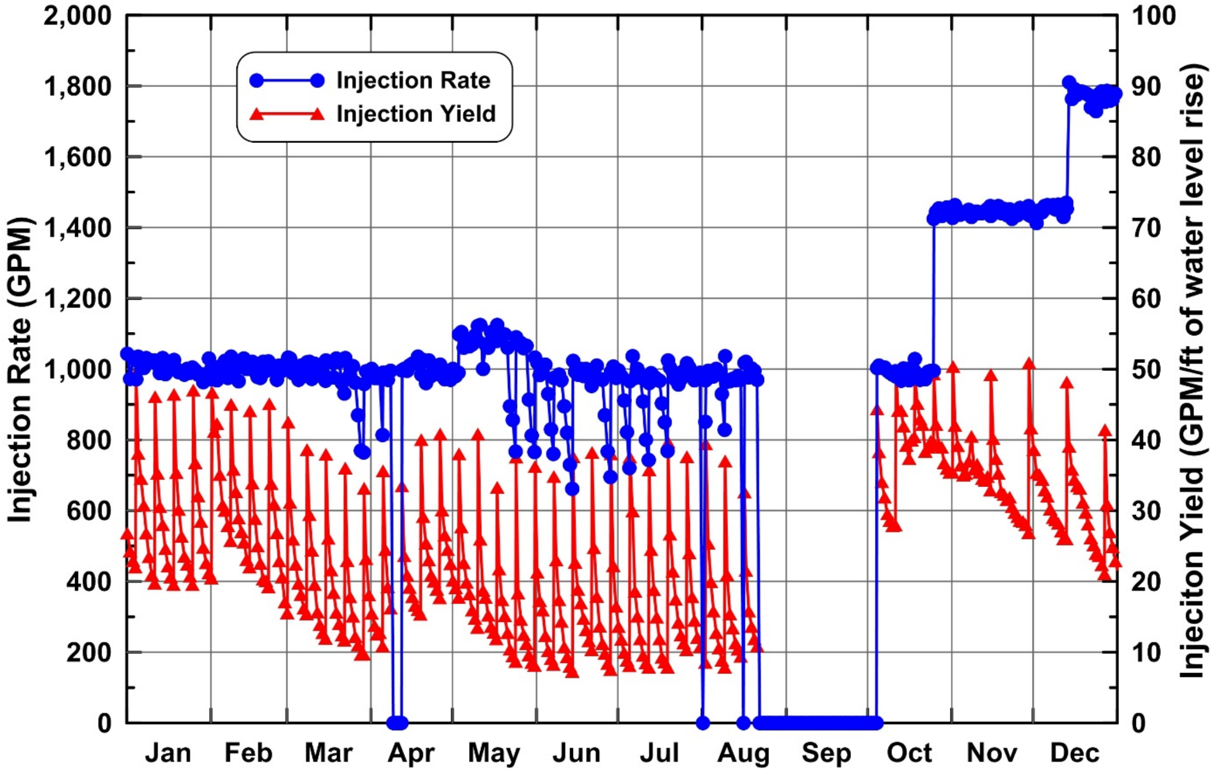


Figure 7-3. 2018 MBI-1 Injection Performance

Figure 7-3 also shows the variation of injection yield at MBI-1 during 2018. The injection yield is defined as the injection flow rate in gpm per foot of groundwater level rise from static conditions within the injection well and is comparable to the specific capacity for a production well. The repeating cyclical trend in the injection yield at MBI-1 was due to the weekly backwash events. The injection yield ranged from 8 to 51 gpm/ft during 2018. As expected, the injection yield was always highest immediately following a backwash, then quickly declining thereafter and triggering another backwash once the injection yield dropped to a low threshold value. For a given water source with stable water quality, the rate of injection yield decline is typically proportional to the injection rate; the higher the injection rate, the more frequently backwashing is required. In fact, the backwash frequency was based on the cumulative volume of water injected between backwashes since this volume dictates the amount of particulate matter that entered the well over the interval.

The injection yields at MBI-1 increased significantly post-rehabilitation of the GWR Pipeline (Figure 7-3) likely because of a reduction in particulate matter that had previously originated from the interior cement mortar lining of the GWR Pipeline. A secondary reason for the increase in injection yields could be due to weekly backwashing of MBI-1 during the six-week shutdown, thereby cleaning the previously accumulated particulate matter more thoroughly. MBI-1 injection yields during the second half of October (when injection rates were comparable to pre-rehabilitation of the GWR Pipeline) ranged from approximately 35 to 50 gpm/ft, as compared to approximately 10 to 35 gpm/ft in August just prior to the shutdown. Even after injection rates were increased to 1,450 gpm from late October to mid-December, the injection yield immediately following a backwash remained high at approximately 50 gpm/ft. However, the injection yield just prior to a backwash dropped below 30 gpm/ft in late November as the backwash frequency had been reduced to biweekly. Finally, in late December, with injection rates increased once again to approximately 1,780 gpm with biweekly backwashing, the injection yield began to decline and ranged from approximately 20 to 40 gpm/ft during the last two-week injection cycle of the year. This operational testing during the last three months of the year with improved water quality (less particulate matter) appears to indicate that the new optimal and sustainable condition for MBI-1 is an injection rate of approximately 1,450 gpm (2 MGD) with a backwash frequency of one to two weeks.

As can be seen on Figure 7-3 for each weekly or biweekly injection cycle during 2018, the rate of injection yield decline was steepest immediately following a backwash. Once the injection yield further declined after a few days, the rate of decline became more gradual. Therefore, the average injection yield over a typical injection cycle was always lower than the median for that cycle. As such, the average daily injection yield during 2018 was 25 gpm/ft, slightly closer to the low end of the 8 to 51 gpm/ft range. Figure 7-3 shows that the peak injection yield values (immediately following a backwash event) ranged from 35 to 40 gpm/ft from January through August pre-rehabilitation of the GWR Pipeline but were consistently higher post-rehabilitation ranging from approximately 40 to 50 gpm/ft from October through December.

Figure 7-4 shows the MBI-1 pumping rate for all backwash events during 2018. The average pumping rate of all backwash events during 2018 was approximately 3,500 gpm. The backwash pumping rate peaked at approximately 3,700 gpm in January and then gradually declined to an annual low of 3,300 gpm in September, before gradually rising once again for the remainder of the year. The high backwash pumping rates during January and the gradual decline into the summer months likely resulted from high groundwater levels and increased Basin storage conditions in January as Basin pumping was significantly reduced because of the In-Lieu Program which ended in January. Thereafter, as Basin pumping increased and groundwater levels dropped, the MBI-1 pumping rate automatically declined at the given valve setting because of the increased pumping lift. The slightly lower backwash pumping rates from May through August were likely the reason for the slight decline in injection yield during that time. The increase in the MBI-1 pumping rate post-rehabilitation of the GWR Pipeline was likely due to rising groundwater levels as is typical in the fall but also due to increased pumping yields resulting from improved injection water quality containing less particulate matter.

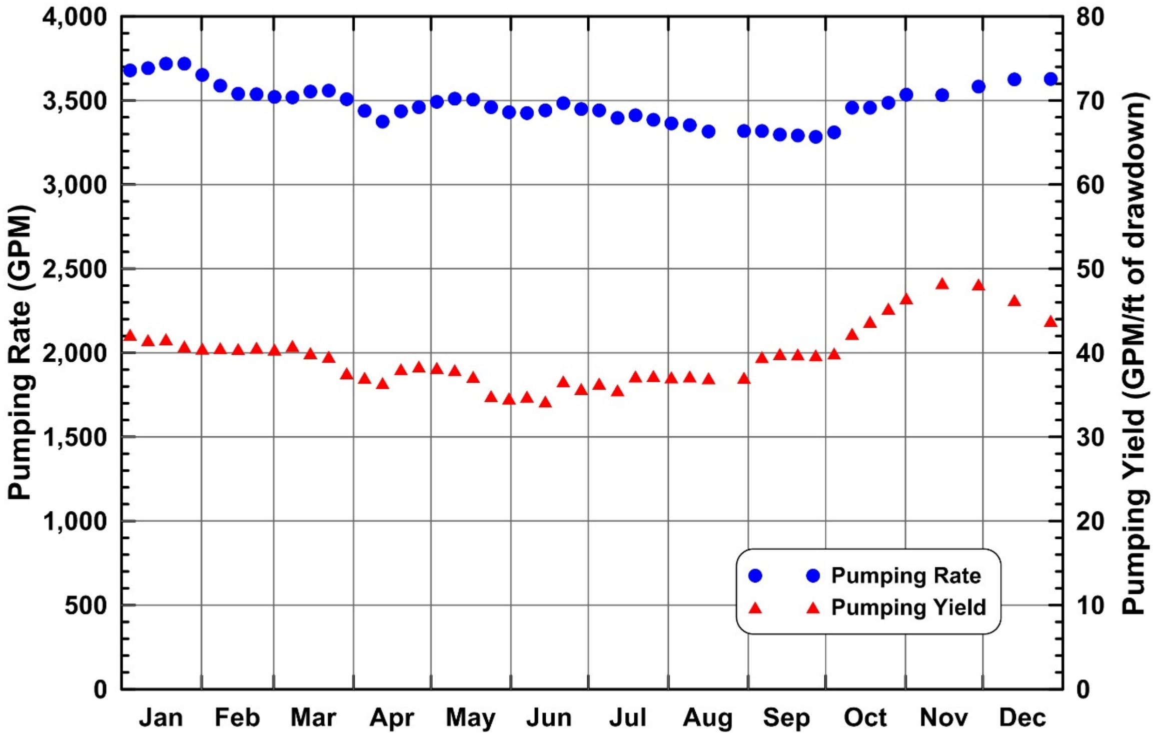


Figure 7-4. 2018 MBI-1 Pumping Performance

During 2018, pumping at MBI-1 typically occurred for approximately 40 minutes for each backwash event with a weekly frequency, except for the last two months of the year in which biweekly backwashing was employed to analyze the longer injection rate decay under the improved injection water quality conditions. As before, injection at MBI-1 typically resumed at least 30 minutes after each backwash to first allow groundwater levels to recover back to static conditions so that the injection yield could be accurately calculated for the next cycle. The first injection yield value following a backwash event is typically reported two hours after injection is resumed, allowing the injection mound to somewhat stabilize.

Figure 7-4 also shows the MBI-1 pumping yield or specific capacity for all backwash events during 2018, ranging from 34 to 48 gpm/ft of drawdown in the well. The resulting average backwash pumping yield during 2018 was 40 gpm/ft, similar to the prior year and indicating that the weekly backwash events have so far been effective in maintaining the specific capacity of MBI-1. The MBI-1 pumping yield showed a significant increase during October and November of 2018 post-rehabilitation of the GWRS Pipeline, likely due to less particulate matter in the injection supply water as well as the weekly backwashing during the six-week shutdown which likely removed some previously accumulated particulate matter from the MBI-1 filter pack. The MBI-1 pumping yield decline in December likely resulted from increased injection rates in conjunction with the reduced biweekly backwash frequency.

The required backwash frequency provides a gauge of injection well performance. For a given injection rate, the longer the time required between backwashes, the better the injection performance (i.e., the slower the rate of clogging). Based on early operational data, backwash pumping at approximately three times per week was required for MBI-1 to achieve and maintain its design injection rate of 2 MGD (1,400 gpm). From 2016 to August 2018, slightly lower injection rates averaging 1.5 MGD (1,000 gpm) have resulted in a more acceptable weekly backwash frequency. Most recently post-rehabilitation of the GWR Pipeline, MBI-1 operational data over the last three months of 2018 suggest a sustainably higher injection rate of 2 MGD with a backwash frequency of one to two weeks. However, since this was a relatively short time frame, further testing during 2019 is needed to determine if a less frequent backwash frequency would now be sustainable post-rehabilitation of the GWR Pipeline. Preliminarily though, it appears that the MBI-1 backwash frequency may still need to be more frequent than required by the modern injection wells at the Talbert Barrier (4-8 weeks). Potential reasons for the accelerated rate of injection yield decline and thus more frequent backwashes at MBI-1 include the following:

- Differences in local geology at the DMBI site versus the Talbert Barrier;
- Higher sustained injection rate; and
- Previously accumulated particulate matter from erosion of the injection supply pipeline.

Inspection of MBI-1 geologic drill cuttings revealed an absence of coarse-grained sediments and rare medium-grained sediments, with fine-grained sediments making up the majority of those encountered. The predominance of finer sediments indicates a less permeable aquifer and reduced injection capacity. The fine-grained sediments also tend to physically clog faster than coarse-grained sediments if any particulates are present in the injection water.

As was discussed in Section 3.3, the GWRS purified recycled water has been shown to cause some erosion (breakdown or shedding) of the inner lining of certain reaches of the barrier pipeline as well as the interior cement mortar lining of the large 13-mile GWR Pipeline to the Forebay, which also supplies MBI-1. Visual inspection of the interior of the GWRS Pipeline during 2014 indicated that the erosion was most prominent at the field-applied mortar joints, and subsequent inspection during 2016 indicated that the erosion was still occurring to some extent. To address this problem, Reach I of the GWR Pipeline (from the AWPF product water pump station to the MBI-1 turnout) was rehabilitated during the summer of 2018 as previously discussed by first repairing any damaged portions of the interior mortar lining and then applying an epoxy coating to prevent further erosion.

Injection water quality is monitored by staff utilizing in-line turbidity meters and bypass filters (1 and 5 micron) strategically placed at the AWPF, along the Talbert Barrier, and at MBI-1. Filter data indicated significant particle loading in the injection supply water as it traveled in the distribution system from the AWPF to MBI-1 prior to the GWR Pipeline Rehabilitation Project.

In August 2015, a series of downhole spinner log tests were performed in MBI-1 to determine the relative contribution of each individual screened interval (Table 7-2) during backwash pumping, injection (pre- and post-backwash), and non-operational static conditions (OCWD, 2015b).

Table 7-2 summarizes the results of these spinner log tests, indicating that the uppermost two screens contribute only a minor amount of injection (screen #1) or have water flowing into the well during injection (screen #2) due to higher heads in these upper zones relative to the lower zones. Note that during static conditions, groundwater flows into the well via these uppermost two screens and flows back out of the well in the remaining deeper screens due to downward vertical head gradients. Also, the deepest screened interval (screen #9) appears to only contribute a minor amount of injection, especially after backwashing. This deepest screen is furthest removed from the backwash pump and therefore likely does not get cleaned as effectively during backwashing.

Table 7-2. Injection Well MBI-1 Spinner Log Test Results [1,2]

MBI-1 Screen No.	MBI-1 Screened Interval (ft bgs)	MBI-1 Screen Length (ft)	Flow contribution from each screened interval (%)			
			Backwash Pumping 3,000 gpm	*Pre-backwash* Injection 1,000 gpm	*Post-backwash* Injection 1,100 gpm	Static 0 gpm
1	530-540	10	20	6	11	71
2	595-605	10	6	-6	-4	29
3	660-710	50	20	52	24	-29
4	770-780	10	13	16	17	-14
5	800-830 [3]	30	0	0	0	0
6	970-980	10	7	16	18	-14
7	990-1,000	10	9	6	14	-14
8	1,100-1,120	20	14	3	17	-15
9	1,175-1,190	15	11	7	3	-14
	Totals:	165	100	100	100	0

[1] Spinner log tests conducted on August 4, 2015.
[2] For the static case, a negative sign indicates flow out of the well screen; for the injection case, a negative sign indicates flow into the well.
[3] Liner installed in 2012 due to excessive sand production during well development.

OCWD is continuing efforts to determine a consistent, achievable injection rate for MBI-1 that balances total injection volume with the required frequency and duration of backwash pumping. Most recently post-rehabilitation of the GWR Pipeline as discussed above, an injection rate averaging approximately 2 MGD with a backwash frequency of one to two weeks appears to be optimal and sustainable.

7.4 MBI Centennial Park Project

Figure 7-5 shows the location of the MBI Centennial Park Project. OCWD completed drilling and construction of four additional MBI wells in December 2018 and is currently constructing the wellhead facilities, appurtenances, and associated pipelines within Centennial Park, located on the east side of the Santa Ana River and south of Edinger Avenue, just to the southeast of MBI-1 in the City of Santa Ana. These four injection wells, designated as MBI-2, MBI-3, MBI-4, and MBI-5, are strategically located to help raise depressed groundwater levels in the Principal aquifer and are expected to be placed on-line in 2019. Well construction, testing, and operational data for the four new injection wells will be included in Section 7 of next year's Annual Report.

Two new nested monitoring wells, designated as SAR-12 and SAR-13, were constructed in December and October of 2017, respectively. These two monitoring wells are strategically located downgradient south of Centennial Park to track the injected GWRS water as it potentially migrates toward the nearest downgradient drinking water production wells IRWD-12 and IRWD-17 (Figure 7-5). Groundwater level and quality data for these two new monitoring wells will subsequently be included in Section 8 of next year's Annual Report.

Based on the MBI-1 spinner log results discussed in the previous section, the Centennial Park injection wells were constructed similar to MBI-1 but without the uppermost two screens and the lowermost screen (screen numbers 1, 2, and 9 in Table 7-2). However, additional screened footage was added to the other screened interval depths to the extent possible based on the local geology encountered during drilling, such that the total screened footage for each of the four new injection wells is either the same or greater than MBI-1. Well construction as-built diagrams for the four new injection wells (similar to Figure 7-2 for MBI-1) will be presented in Section 7 of next year's Annual Report.

MBI-3 and MBI-5 were constructed using glass beads for placement in the borehole annulus adjacent to the screened interval depths, whereas MBI-2 and MBI-4 were constructed using the more industry standard natural gravel pack. Due to the spherical uniformity of the glass beads, they are expected to stack and pack more efficiently with less settlement and therefore have a higher permeability than natural gravel. The glass beads are also chemically inert. Initial pump test results from these four wells are currently being evaluated, and once these wells are placed on-line, the pumping and injection yields for MBI-3 and MBI-5 will be compared to MBI-2 and MBI-4 to determine any improvement related to use of the glass beads.

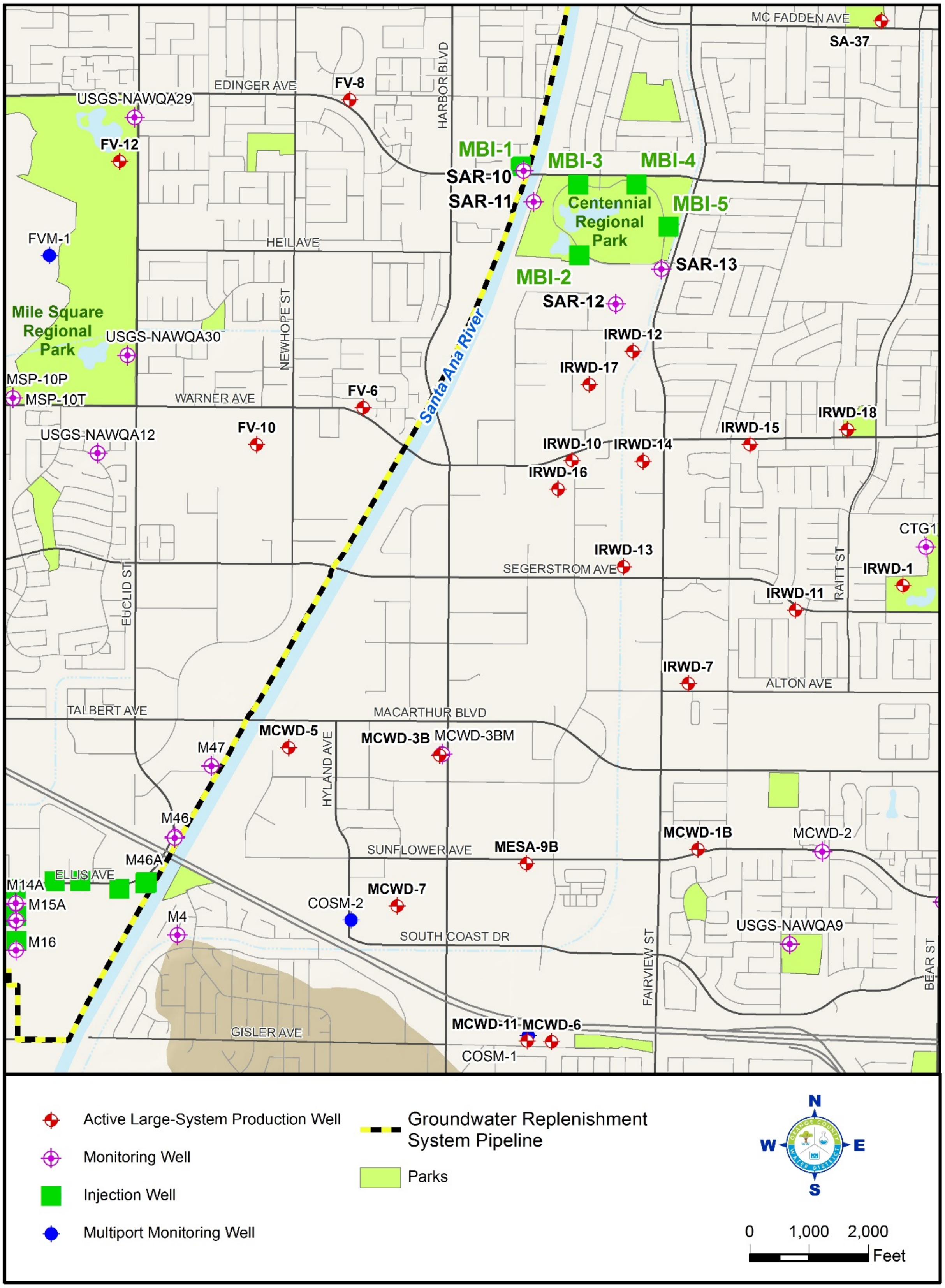


Figure 7-5. DMBI Project and MBI Centennial Park Project Location Map

8. GROUNDWATER MONITORING AT THE DMBI PROJECT

OCWD has maintained a comprehensive groundwater monitoring program throughout the Basin for decades, testing ambient groundwater for various contaminants as well as organic and inorganic mineral content at OCWD monitoring wells and potable drinking water wells.

In the DMBI Project area, OCWD began groundwater monitoring activities in 2012 for the purposes of GWRS permit compliance to acquire background data prior to injecting GWRS purified recycled water at test injection well MBI-1, which began on April 15, 2015.

Two nested monitoring wells, SAR-10 and SAR-11, were constructed during late 2011 and 2012 for the DMBI Project and are located approximately 80 and 650 feet, respectively, downgradient from test injection well MBI-1 as shown in Figure 8-1. The DMBI Project site is located approximately 3 miles north of the Talbert Barrier, along the GWR Pipeline at the Santa Ana River and Edinger Avenue.

Two additional nested monitoring wells, SAR-12 and SAR-13, were constructed during late 2017 approximately one half mile southeast and downgradient of SAR-10 and SAR-11 (Figure 8-1). As discussed in Section 7, these two wells were strategically located downgradient of MBI-1 and the four newly constructed MBI wells in Centennial Park, along the flow path towards the nearest drinking water wells IRWD-12 and IRWD-17. SAR-12 and SAR-13 will serve as the two required downgradient monitoring wells (CCR, 2014) for the combined five injection well MBI project and data from these two monitoring wells will be included in next year's Annual Report, as the four new injection wells are planned to be placed on-line during 2019.

This section presents the following for calendar year 2018:

- Aquifers in the DMBI Project area;
- Overview of groundwater monitoring program;
- Groundwater elevations and directions of flow; and
- Groundwater quality.

8.1 Aquifers in the DMBI Project Area

Earlier studies (DWR, 1934; DWR, 1967) divided the Basin into the Forebay and Pressure areas. As was discussed in Section 6, the Forebay refers to the inland area of intake or recharge generally characterized by coarse-grained high permeability sediments (e.g., sands and gravels) and

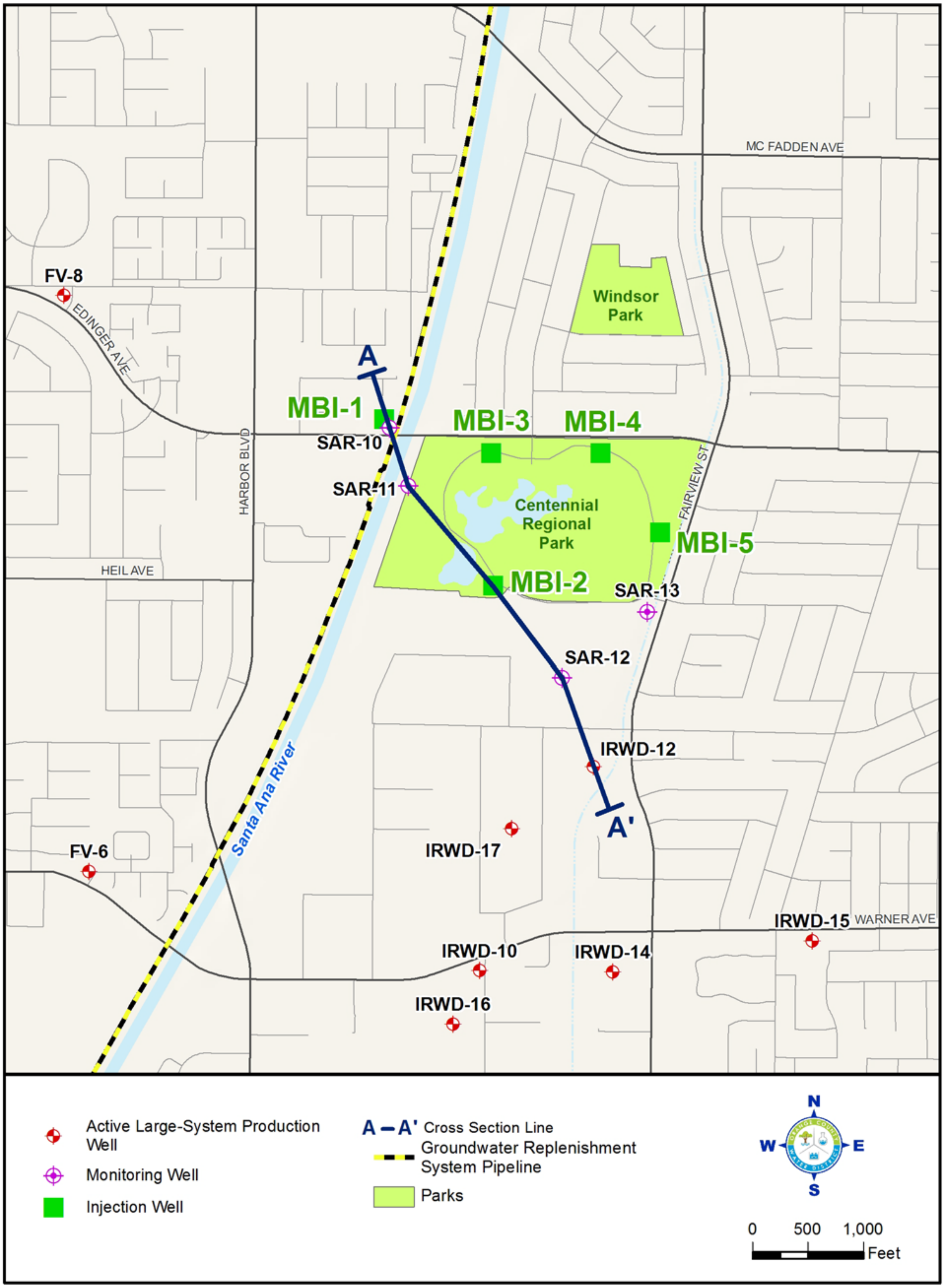


Figure 8-1. DMBI Project Area and Well Location Map

unconfined aquifer conditions, allowing for surface percolation of applied water for recharging the Basin. In contrast, the Pressure area refers to the coastal and central regions of the Basin where the presence of intervening fine-grained low-permeability clay and silt deposits creates confined or pressurized aquifer conditions at depth, thus making large-scale percolation of surface water for replenishing the Basin impractical in these areas. Therefore, the most feasible method of recharge in the Pressure area is by direct injection into targeted confined aquifers.

For the purposes of the OCWD Basin-wide Groundwater Flow Model (Phraner, 2001; OCWD, 2004b) and the Annual Groundwater Storage Change calculation (OCWD, 2007), the Basin has been vertically characterized into three distinct aquifer systems: (1) Shallow, (2) Principal, and (3) Deep. Over 90% of groundwater production in the Basin occurs from the Principal aquifer system. The approximate vertical intervals of the three aquifer systems in the vicinity of the DMBI Project are presented in Table 8-1. The Principal and Deep aquifers are both approximately 1,000 feet thick in the DMBI Project area and both rise and thin slightly to the southeast towards the IRWD Dyer Road Well Field, conforming to the Basin's overall synclinal structure that plunges to the northwest towards the Buena Park area (Herndon and Bonsangue, 2006).

Table 8-1. Approximate Aquifer System Depths in the DMBI Project Area

Shallow Aquifer (ft bgs)	Principal Aquifer (ft bgs)	Deep Aquifer (ft bgs)
0 – 250	250 -1,250	1,250 – 2,250

Figure 8-2 shows a schematic geological cross-section from the DMBI Project wells (MBI-1, SAR-10, and SAR-11) to the southeast through newly constructed MBI-2, SAR-12, and IRWD-12. Since the cross-section in Figure 8-2 is a generalized schematic, it shows both IRWD-12 and IRWD-17, which are the two nearest municipal production wells directly downgradient from the MBI site. Figure 8-1 shows the alignment (A-A') of this schematic cross-section.

Extrapolating the same aquifer naming scheme used in the Talbert Barrier area from earlier studies (DWR, 1966), Figure 8-2 shows that the Shallow aquifer system is comprised of only the Alpha aquifer in the DMBI area since the Talbert aquifer pinches out near the SAR in this vicinity.

The Principal aquifer, from shallowest to deepest, consists of the following aquifers:

- Beta and Lambda aquifers, often locally merged;
- Omicron aquifer;
- Upper Rho aquifer;
- Lower Rho aquifer; and
- Main aquifer.

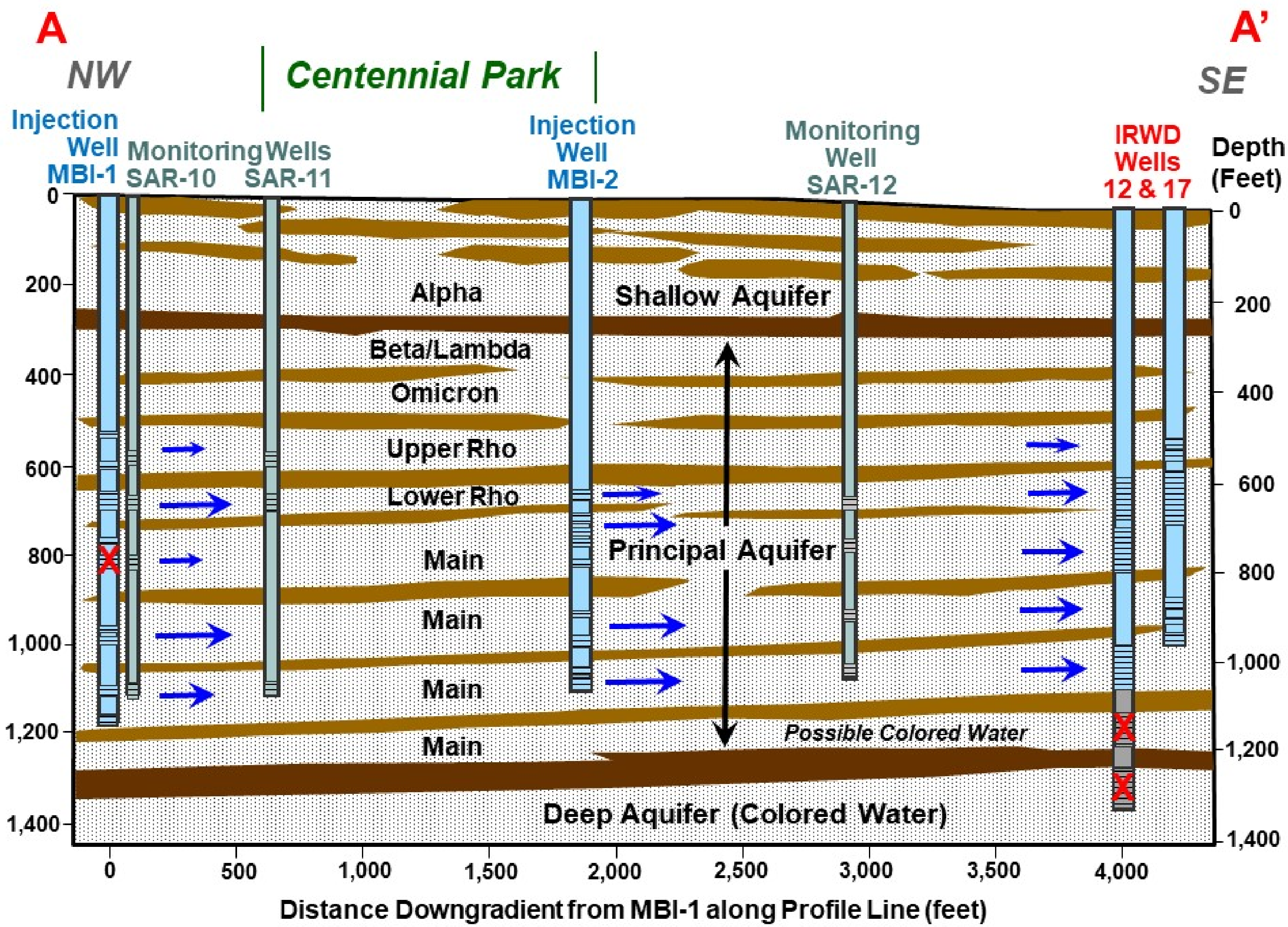


Figure 8-2. Schematic Geological Cross Section Through the DMBI Project Area

The Main aquifer is the most prolific and thickest aquifer within the Principal aquifer system, typically segregated into multiple discrete aquifer zones separated by low-permeability aquitards that are not entirely laterally extensive (Figure 8-2), thus allowing the Main aquifer units to be somewhat hydraulically connected to one another and act as one overall aquifer with only minor vertical head gradients between the individual units.

Due to the synclinal structure of the Basin plunging to the northwest, the aquifers comprising the Principal aquifer system rise slightly to the southeast from the DMBI site to the nearest production wells, IRWD-12 and IRWD-17. The shallowest Principal aquifer zones (Beta and Lambda) are interpreted to be approximately 50 feet shallower at IRWD-12 and IRWD-17, while the deepest Principal aquifer zone (Main) is interpreted to be as much as 100 to 150 feet shallower at IRWD-12 and IRWD-17 than at the DMBI site (Figure 8-2). The correlated aquifer names and depths at the DMBI site and the nearby production wells were based on staff review of all hydrogeologic data for the DMBI wells and nearby production wells, including geophysical logs, existing OCWD basin-wide geologic cross-sections in the vicinity, and depth-specific groundwater level and quality data, especially for SAR-10 and SAR-11.

Test injection well MBI-1 was screened entirely within the Principal aquifer system and was constructed similar to nearby production wells (Figure 8-2). The Principal aquifer system has significantly lower groundwater levels than the Shallow and Deep aquifer systems in the DMBI Project area and throughout most of the Basin due to the large amount of pumping from the Principal aquifer. Therefore, the greatest need for replenishing the Basin in the DMBI area is within the Principal aquifer, especially due to the proximity to the IRWD Dyer Road Well Field where groundwater levels often decline to as low as 100 feet below mean sea level during the summertime higher pumping months.

Downward vertical gradients typically exist between the individual aquifer units comprising the Principal aquifer system in the DMBI Project area and throughout the larger Pressure area of the Basin, with groundwater levels becoming progressively lower with each successively deeper Principal aquifer unit. Groundwater levels are typically highest in the shallowest Beta and Lambda aquifers, and lowest in the deepest Main aquifer unit. These vertical gradients have consequences for injection well performance as was discussed in Section 7. For production or injection wells screened across these Principal aquifer units, groundwater level differences between these units can cause wellbore flow under static or idle conditions, effectively producing water from screened intervals with higher head (pressure) and injecting this same water back out of the well into screened intervals with lower groundwater head. Under pumping and injection conditions, such groundwater level differences can significantly influence the amount of water pumped from or injected into each screened interval (OCWD, 2010).

Lastly, it should be noted that the screened interval from 800 to 830 ft bgs at MBI-1 in the uppermost Main aquifer unit was swaged off with a blank stainless steel liner to block off this zone due to excessive fine sand entering the well during the pumping development phase of construction. This swaged screened interval is shown schematically with an "X" through the screen in Figure 8-2.

8.2 Groundwater Monitoring Program

The DMBI Project follows a similar groundwater monitoring program as the other GWRS recharge areas (Talbert Barrier and K-M-M-L Basins.)

Nested monitoring wells SAR-10 and SAR-11 were screened in Principal aquifer zones corresponding to individual screened intervals at MBI-1 for the purposes of monitoring the fate and transport of the injected GWRS purified recycled water. SAR-10 has four separate monitoring well casings each screened at different depths and nested together in one borehole, while SAR-11 has three nested monitoring well casings (Figure 8-2).

One of the main constituents monitored along the injection flow path is arsenic, since mobilization of aquifer sediment-bound arsenic has been shown to occur at some locations in association with the recharge and injection of GWRS purified recycled water. Total arsenic, other metals, and general minerals such as chloride, sulfate, and TDS were sampled quarterly from 2012 through 2017, while dissolved arsenic, dissolved vanadium and selected other constituents have been sampled more frequently as part of the metals mobilization monitoring program from April 2015 (when MBI-1 was placed on-line with GWRS water) through 2016 and then reduced to quarterly since 2017.

Groundwater levels at SAR-10 and SAR-11 were manually measured approximately monthly during 2018. In addition, all zones of both wells have been periodically equipped with automated data loggers and pressure transducers for at least daily groundwater level monitoring due to close proximity to MBI-1 with its alternating injection and backwash cycles. The monthly hand-measured water levels verified that the pressure transducers were accurate and within acceptable calibration limits.

Testing and water quality results obtained from SAR-10 and SAR-11 during the DMBI Project will be used to help gain regulatory approval for other MBI injection projects, including the four newly constructed injection wells in Centennial Park adjacent to and southeast of the DMBI site.

8.3 Groundwater Elevations and Directions of Flow

This section discusses groundwater elevations and groundwater flow paths within the Principal aquifer in the DMBI Project area.

8.3.1 Principal Aquifer

For the DMBI Project, the Principal aquifer is of primary concern since test injection well MBI-1 is screened in this aquifer zone, as are the nearest downgradient production wells (IRWD-12 and IRWD-17) that could eventually receive injected GWRS water from the project. Principal aquifer groundwater elevations vary considerably due to seasonal fluctuations in the amount and the location of Basin pumping, as well as year-to-year changes in Basin groundwater storage. However, groundwater flow directions have remained relatively stable in the DMBI Project area over the last several years.

Figure 8-3 shows interpreted groundwater elevation contours and inferred groundwater flow directions for the Principal aquifer for June 30, 2018. Groundwater levels from SAR-10 and SAR-11 were used to help construct and constrain these Basin-wide regional contours near the DMBI site. As shown on Figure 8-3, groundwater elevations in the Principal aquifer were approximately 46 feet below mean sea level at SAR-10 and 48 feet below mean sea level at SAR-11 at the end of June 2018, approximately 14 feet higher at both wells than in June 2017. Based on the groundwater elevation contours, the inferred groundwater flow direction is to the southeast towards the IRWD Dyer Road Well Field, similar to prior years.

FV-8 is the closest large system active production well to the DMBI Project site but is located upgradient of the site. IRWD-12 is the closest downgradient production well, located approximately 3,600 feet downgradient from the DMBI Project site. Figure 8-3 shows that Principal aquifer groundwater elevations near IRWD-12 at the end of June 2018 were approximately 61 feet below mean sea level, approximately 20 feet higher than in June 2017. The June 2018 groundwater elevations at IRWD-12 were approximately 15 feet lower than at SAR-10 adjacent to the MBI-1 site, as compared to 21 feet lower than SAR-10 in June 2017, resulting in a slightly flatter gradient in June 2018 and thus likely a somewhat slower groundwater velocity. The slightly flatter gradient during June 2018 was likely due to higher overall Basin storage conditions as well as variations in the timing and amount of local pumping from the IRWD Dyer Road Well Field. Based on analysis of groundwater levels before and after MBI-1 injection began, injection operations during both 2017 and 2018 at MBI-1 did not appear to have a noticeable effect on the regional gradient and flow direction within the Principal aquifer in this vicinity.

Drilling and construction of new injection wells MBI-2, MBI-3, MBI-4, and MBI-5 was completed in December 2018. The ancillary well head plumbing, appurtenances, and injection supply line in Centennial Park are still under construction. Although these new wells are shown in Figure 8-3, they were not active in 2018 and are expected to be placed on-line in 2019.

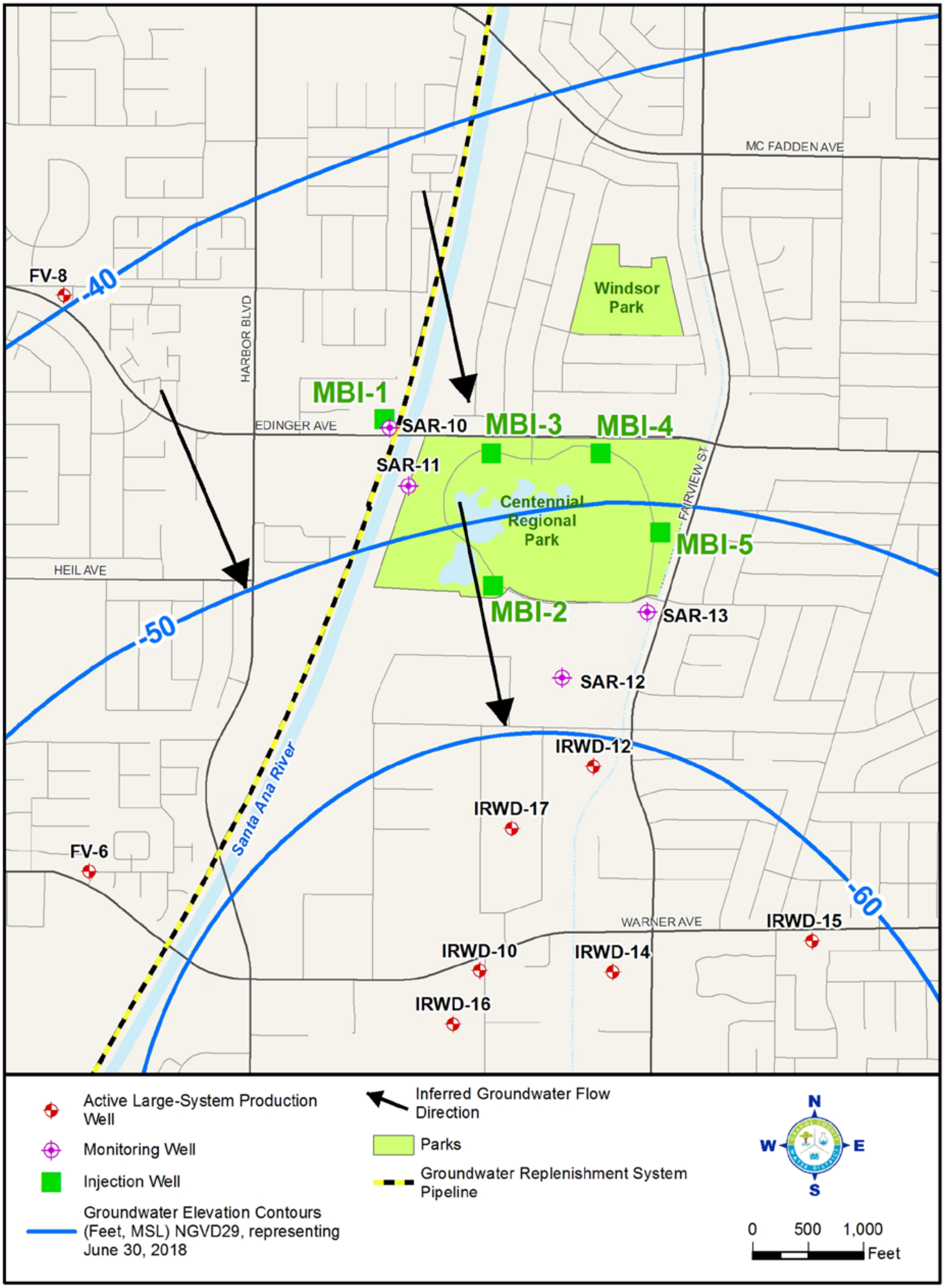


Figure 8-3. Principal Aquifer Potentiometric Surface with Inferred Groundwater Flow Directions in the DMBI Area

8.3.2 Compliance Monitoring Well Trends

Groundwater level hydrographs for DMBI Project monitoring wells SAR-10 and SAR-11 are shown on Figure 8-4 and Figure 8-5, respectively. These figures also show chloride concentrations on the lower half of the graphs, which are discussed in Section 8.4.1. Figure 8-4 and Figure 8-5 focus on the period leading up to and since April 2015 when MBI-1 came on-line while still showing one year of ambient background data. Both SAR-10 and SAR-11 monitor the Principal aquifer system, with separate screened casings in the Upper Rho, Lower Rho, and Main aquifers, corresponding to selected screened intervals at the test injection well MBI-1 and production wells IRWD-12 and IRWD-17.

All zones at SAR-10 (Figure 8-4) and SAR-11 (Figure 8-5) were equipped with automated data loggers for frequent (at least daily) monitoring of groundwater levels throughout the 2014-2018 period shown on the two figures, with the exception of pressure transducer malfunctions, in which case only monthly hand-measured water levels were available for those periods.

Groundwater level trends at SAR-10 and SAR-11 typically follow a seasonal pattern: (1) rising during the winter and early spring months, (2) declining in the late spring and summer months, and (3) recovering somewhat in the late fall months near the end of the year. In the mid-Basin area, these seasonal trends largely result from seasonal water demands which lead to increased pumping during the summer and reduced pumping during the winter, and to a lesser degree from increased Forebay recharge (both natural and managed) from local rainfall and captured SAR storm flows during the winter months.

During 2018, Principal aquifer groundwater levels at SAR-10 (Figure 8-4) and SAR-11 (Figure 8-5) were similar to one another but did not follow the typical winter rise described above. Rather, groundwater levels declined sharply during the first quarter by approximately 25 feet in the wake of the late 2017 high because of increased pumping as the Basin-wide In-Lieu Program ended in January along with a lack of rainfall during the winter of 2017-2018. Principal aquifer groundwater levels at both monitoring wells continued to decline into the late spring and summer months as is typical, declining to an annual low in September that was similar to the summer low the prior year. During the fourth quarter, Principal aquifer groundwater levels at both wells rose by an amount similar in magnitude to the third quarter summertime decline because of reduced pumping and increased Forebay recharge stemming in part from early season rainfall. At both monitoring wells, Principal aquifer groundwater levels ended 2018 approximately 30 feet lower than at the beginning of the year but still higher than the 2014-2016 period shown on Figure 8-4 and Figure 8-5.

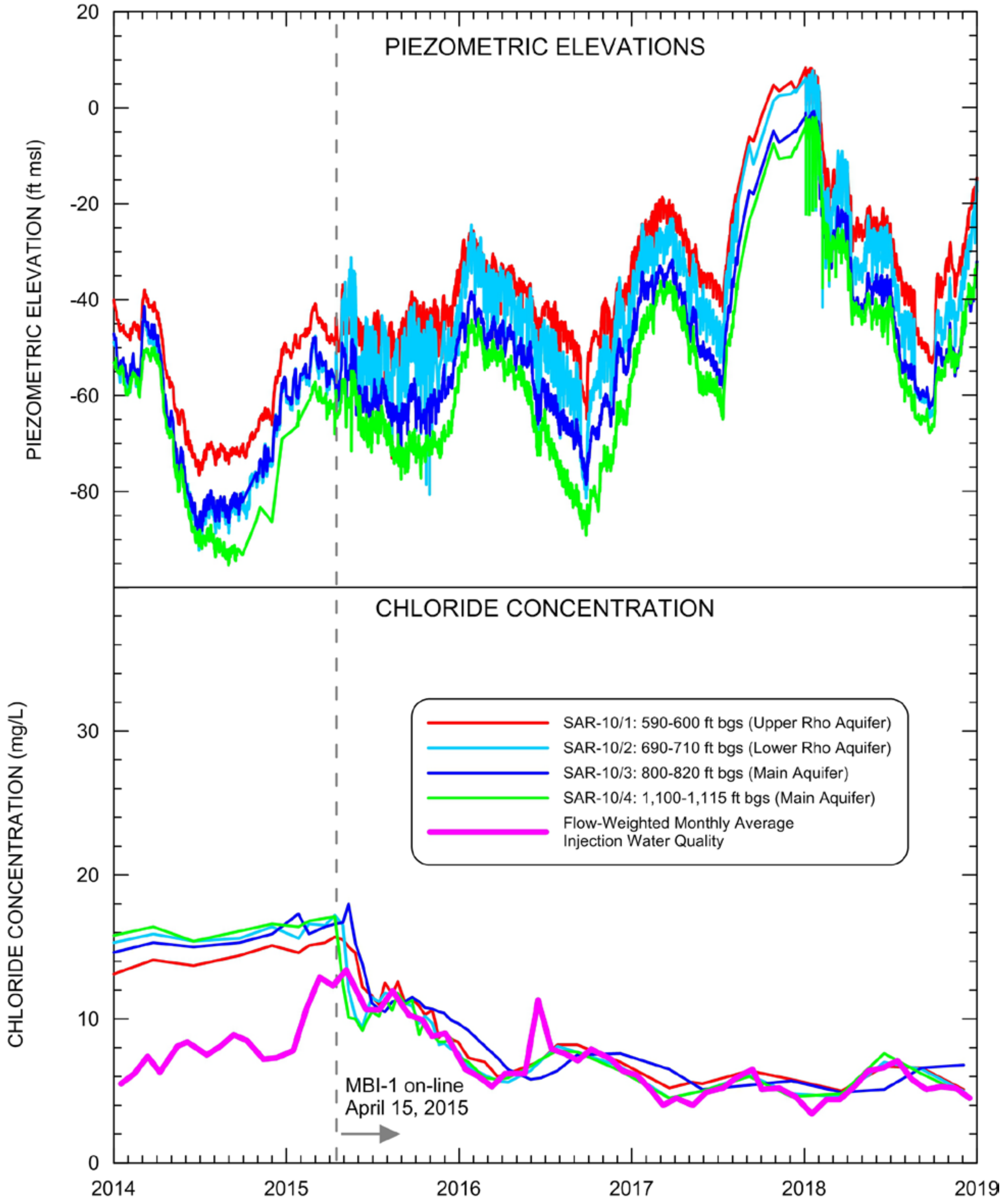


Figure 8-4. Monitoring Well SAR-10 Piezometric Elevations and Chloride Concentration

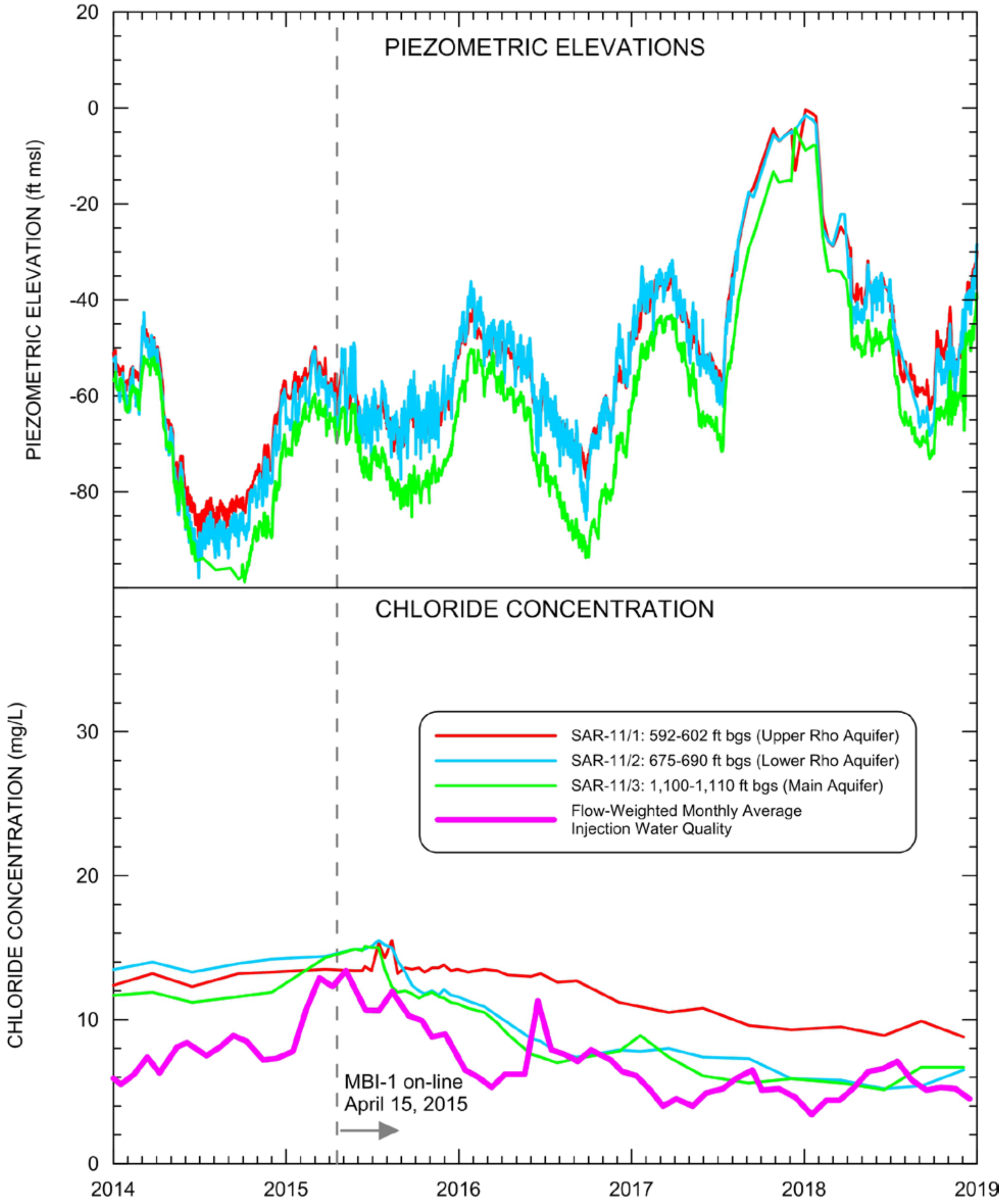


Figure 8-5. Monitoring Well SAR-11 Piezometric Elevations and Chloride Concentration

Downward vertical gradients typically exist between the individual aquifer units comprising the Principal aquifer system in the DMBI Project area and throughout the larger Pressure area of the Basin, with groundwater levels becoming progressively lower with each successively deeper Principal aquifer unit. This downward vertical gradient is evident at both SAR-10 (Figure 8-4) and SAR-11 (Figure 8-5), especially prior to the beginning of MBI-1 operations, with the highest groundwater elevations (heads) occurring in the shallowest Upper Rho aquifer zone and lowest heads in the lowermost Main aquifer zone.

With the commencement of injection at MBI-1 on April 15, 2015, groundwater levels immediately rose in all zones of SAR-10 and SAR-11 as shown in Figure 8-4 and Figure 8-5, respectively. The largest head rise was in the Lower Rho aquifer zone at both monitoring wells, rising as much as 16 feet during the first week of MBI-1 injection at the closer SAR-10/2 and approximately half as much rise (8 feet) at the more distal SAR-11/2. As was shown in Table 7-2, the screened interval from 660 to 710 ft bgs at MBI-1 corresponding to the Lower Rho aquifer zone accounted for 24% to 52% of the total MBI-1 injection for post- and pre-backwash conditions, respectively, for an average injection contribution of 38%. This represented the largest injection contribution of all screened intervals in MBI-1, supporting the largest head increase. In comparison, the injection contribution from the lowermost Main aquifer zone screened from 1,100 to 1,120 ft bgs at MBI-1 ranged from 3% to 17% for pre- and post-backwash conditions, respectively, for an average injection contribution of 10%. As a result, groundwater levels in this lowermost Main aquifer zone rose approximately 4 feet at the closer SAR-10/4 and approximately half that (2 feet) at the more distal SAR-11/3. The head rise in each zone appears to vary somewhat linearly with the injection contribution from that zone. For example, the MBI-1 average injection contribution in the Lower Rho zone (38%) was approximately four times greater than in the lowermost Main aquifer zone (10%), resulting in a four times larger head rise in the Lower Rho zone at both SAR-10/2 (16 feet) and SAR-11/2 (8 feet) as compared to the lowermost Main aquifer zone at SAR-10/4 (4 feet) and SAR-11/3 (2 feet).

The larger head response to MBI-1 injection in the Lower Rho zone at both SAR-10/2 and SAR-11/2 led to a shift in the typical downward vertical gradient pattern previously discussed. At SAR-10/2, peak groundwater levels approached those of the shallower Upper Rho zone in SAR-10/1 during each (approximately weekly) injection cycle since injection operations began in April 2015 but also decreased by 5 to 10 feet during each (approximately weekly) backwash pumping event (Figure 8-4). Therefore, groundwater levels at SAR-10/2 exhibit a weekly fluctuation that did not exist prior to MBI-1 operations. At SAR-11/2, Lower Rho groundwater levels often exceeded those of the shallower Upper Rho zone in SAR-11/1 by a couple feet (Figure 8-5) during most injection cycles, thus frequently inducing a slight upward vertical gradient between these two zones during sustained MBI-1 injection since April 2015.

8.4 Groundwater Quality

Quarterly compliance sampling continued at monitoring wells SAR-10 and SAR-11 during 2018, following periods of more frequent voluntary monitoring in 2015 and 2016 around the startup of MBI-1 operations. Groundwater quality data for 2018 are presented in Appendix K. These two DMBI monitoring wells were tested for: (1) an extensive list of inorganic, organic and radiological parameters, (2) the majority of the U.S. Environmental Protection Agency (EPA) Priority Pollutants, and (3) 1,4-dioxane and NDMA.

During 2018 groundwater quality at SAR-10 and SAR-11 complied with all Federal and State Primary Drinking Water Standards, and there were no Secondary MCL exceedances. Also, there were no microbial detections reported at SAR-10 or SAR-11 during the first quarter of 2018, which marked the end of the required reporting period for microbial detections as was described in Section 4.4.1.

This section describes monitoring well groundwater quality for general constituents used as intrinsic tracers, 1,4-dioxane and NDMA, and arsenic, vanadium, aluminum, and iron at SAR-10 and SAR-11, with comparison to their respective MCLs or other relevant water quality standards. Groundwater quality for production wells in the vicinity of the DMBI Project area is also summarized.

8.4.1 Monitoring Wells – Intrinsic Chloride Tracer

As discussed in Section 4 and Section 6 related to the Talbert Barrier and Anaheim Forebay recharge facilities, respectively, chloride has been effectively used as an intrinsic tracer of GWRS water in the subsurface arriving at nearby downgradient monitoring wells. Chloride is a conservative tracer and thus is expected to migrate at approximately the same groundwater velocity as the recharged water without any significant reactions with other constituents in the groundwater or the aquifer substrate.

The lower graph of Figure 8-4 and Figure 8-5 show that ambient background chloride concentrations at all zones of SAR-10 and SAR-11 ranged from approximately 12 to 17 mg/L prior to the commencement of GWRS injection at MBI-1. The lack of chloride variability between these aquifer zones and the lack of seasonal chloride variation provided a reliable and stable background condition. Also, as discussed in Section 8.4.7, chloride concentrations at the nearest downgradient production wells IRWD-12 and IRWD-17 were similarly stable within approximately the same range over a much longer historical period than SAR-10 and SAR-11.

Monthly chloride concentrations of GWRS purified recycled water during 2018 ranged from approximately 3 to 7 mg/L, with an annual average of approximately 5 mg/L, similar to 2017 and noticeably less than in 2015-2016 due to replacement of RO membranes at the AWPF. Since

2015, GWRS FPW chloride concentrations have remained slightly less than ambient groundwater at SAR-10 and SAR-11.

At SAR-10 located approximately 80 feet downgradient of MBI-1, chloride concentrations declined rapidly after the commencement of MBI-1 injection on April 15, 2015 (Figure 8-4). After this initial decline, chloride concentrations in all four zones at SAR-10 have remained essentially the same as the GWRS injected water since the second half of 2015. The initial chloride concentration declines indicated breakthrough of GWRS water arriving in all four zones at slightly different times. The fastest arrival of GWRS water occurred in less than two weeks in the deepest injection zone at SAR-10/4 (lowermost Main aquifer zone), while the slowest arrival occurred in approximately 6 to 8 weeks in the shallowest injection zone at SAR-10/1 (Upper Rho aquifer).

At SAR-11, located approximately 650 feet downgradient of MBI-1, the chloride concentration decline following commencement of MBI-1 injection operations was more delayed and dispersed than at the closer SAR-10 (Figure 8-5). In the shallowest injection zone at SAR-11/1 (Upper Rho aquifer), chloride concentrations gradually decreased for the first time during the second half of 2016 and likely indicated initial arrival of GWRS water blended with ambient groundwater. From the chloride data only, a precise initial arrival time was difficult to discern, possibly due to limited injection into this interval (Table 7-2) discussed previously.

Chloride concentrations at SAR-11/1 gradually declined during 2016-2018 and stabilized at approximately 9 to 10 mg/L during 2018, still slightly higher than GWRS chloride concentrations and thus indicating some small remaining proportion of non-GWRS water at this location along this slower and more dispersive flow path.

For the other two deeper zones at SAR-11, the fastest arrival of GWRS water occurred in approximately 13 weeks and was once again in the deepest injection zone at SAR-11/3 (lowermost Main aquifer zone), while arrival was somewhat slower and occurred in approximately 17 weeks in SAR-11/2 (Lower Rho aquifer).

Sulfate was also used as an intrinsic tracer to estimate the arrival time of GWRS water at SAR-10 and SAR-11. Sulfate is typically considered less conservative in the subsurface but features a greater difference between the ambient background concentration at SAR-10 and SAR-11 (39 to 44 mg/L) as compared to the GWRS injection supply (approximately 1 mg/L). Over these relatively short travel distances from MBI-1 to SAR-10 and SAR-11 along with relatively constant injection, sulfate appeared to behave quite conservatively and yielded essentially the same GWRS arrival times as chloride and the breakthrough curves were more definitive with sulfate.

Figure 8-6 and Figure 8-7 show chloride and sulfate concentrations during 2015-2018 for all zones at SAR-10 and SAR-11, respectively. In all cases, the timing of the chloride and sulfate concentration declines were consistent with each other but were much more obvious with

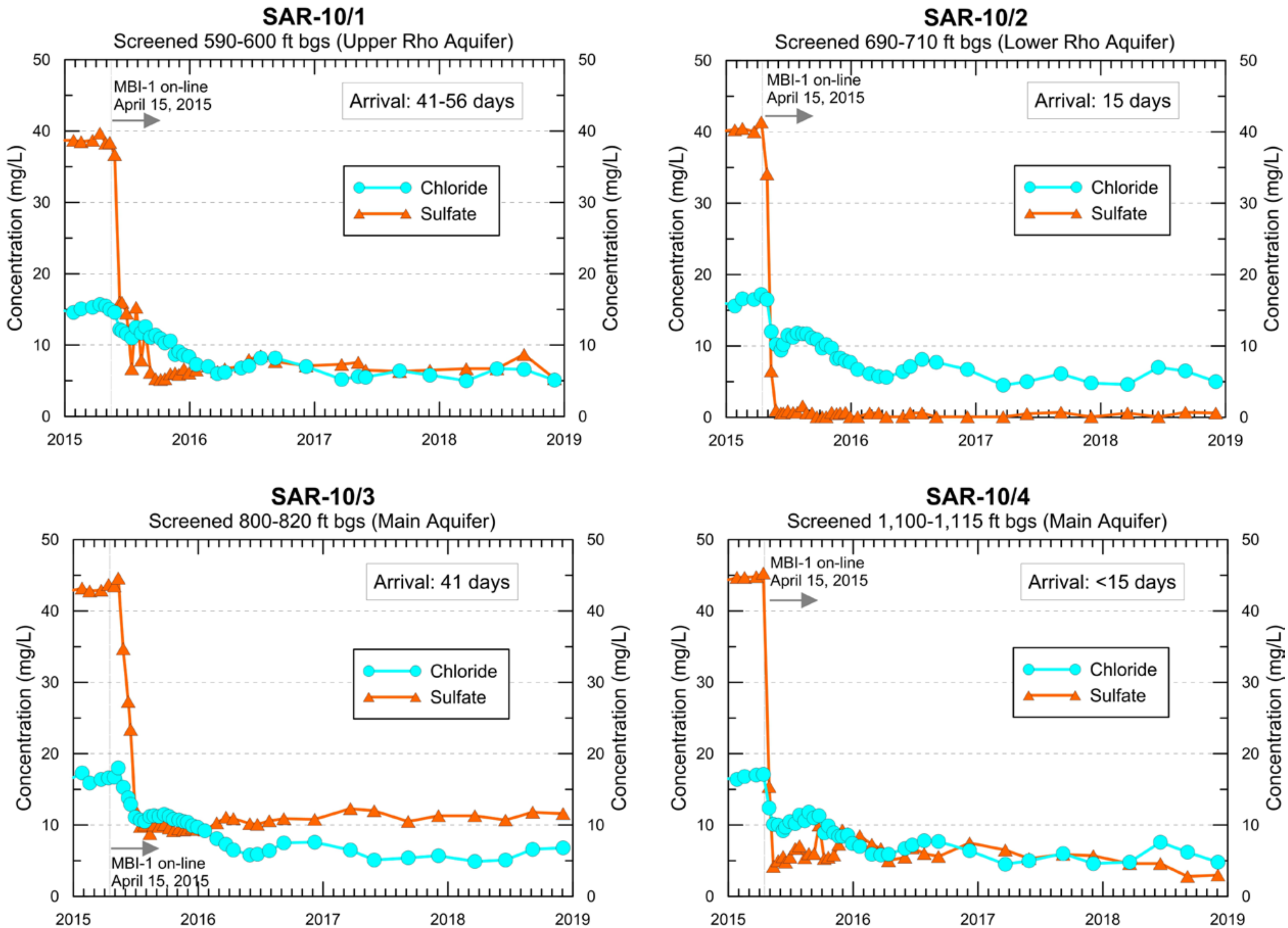


Figure 8-6. Monitoring Well SAR-10 Chloride and Sulfate Concentrations

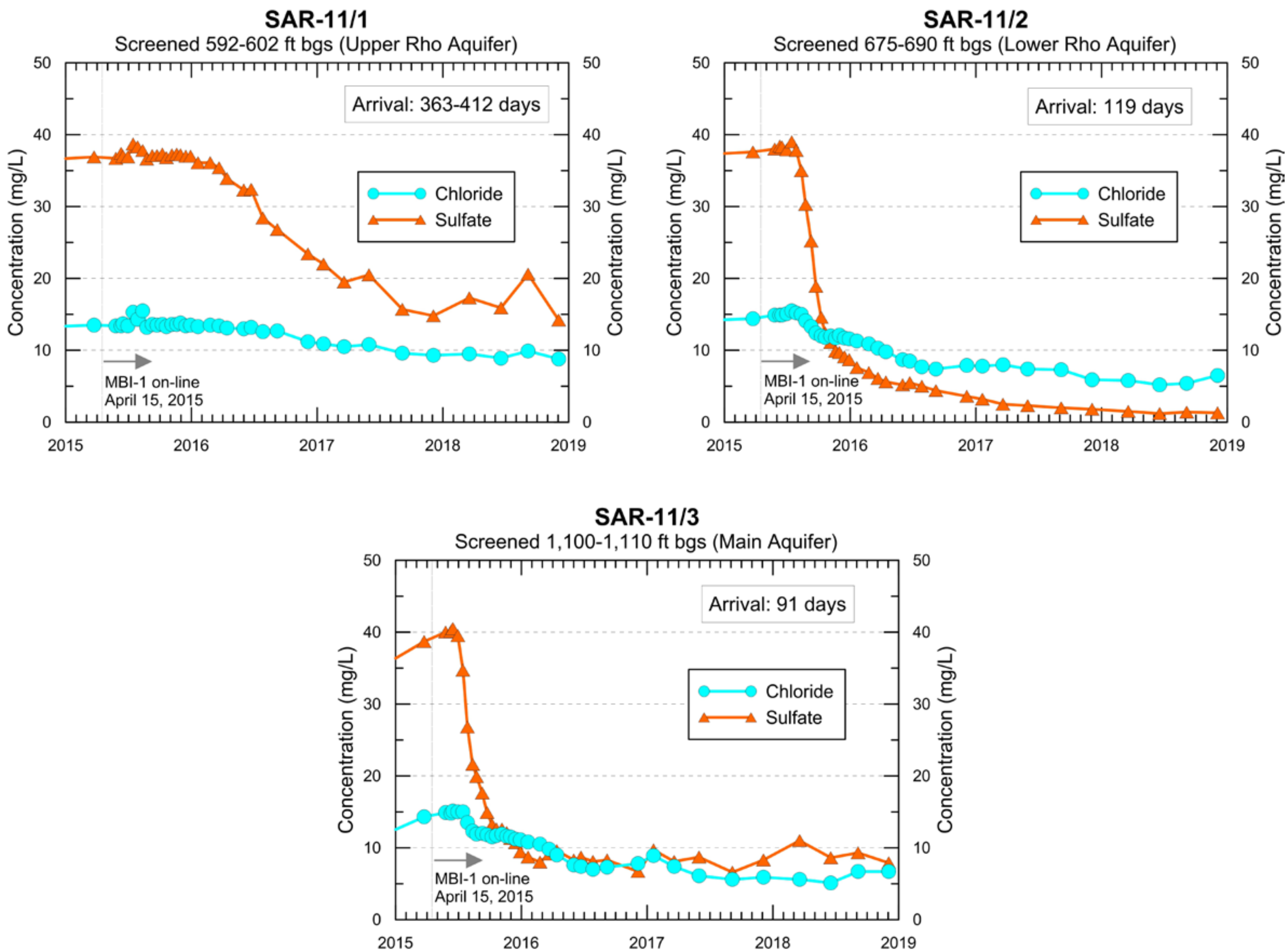


Figure 8-7. Monitoring Well SAR-11 Chloride and Sulfate Concentrations

sulfate due to the larger range between ambient and GWRS sulfate concentrations. Therefore, the estimated GWRS arrival times shown on each graph in Figure 8-6 and Figure 8-7 were based on the sulfate breakthrough curves but are the same as discussed above for chloride, except in the case of SAR-11/1 where breakthrough was only distinguishable for sulfate.

As shown on Figure 8-7, breakthrough or arrival of GWRS water at SAR-11/1 was not apparent based on the relatively stable and low chloride concentrations at this well but finally became evident when sulfate concentrations began to decline in April 2016, approximately one year after injection operations began at MBI-1. At SAR-11/2 and SAR-11/3, the sulfate reduction breakthrough was much more obvious but yet slightly more gradual than for these analogous zones at SAR-10 due to dispersion along the flow path farther downgradient from MBI-1.

Table 8-2 summarizes the GWRS water arrival time estimates for SAR-10 and SAR-11.

Table 8-2. GWRS Water Arrival Time Estimates from MBI-1 to SAR-10 and SAR-11

Monitoring Well	Screened Interval (ft bgs)	Aquifer Name	Sulfate[1] Arrival Time (days)	Sulfate[1] Arrival Time (weeks)
SAR-10/1	590 - 600	Upper Rho	41 - 56	6 - 8
SAR-10/2	690 - 710	Lower Rho	15	2
SAR-10/3	800 - 820	Main	41	6
SAR-10/4	1,100 - 1,115	Main	< 15	< 2
SAR-11/1	592 - 602	Upper Rho	363 - 412	52 - 59
SAR-11/2	675 - 690	Lower Rho	119	17
SAR-11/3	1,100 - 1,110	Main	91	13

[1] Sulfate biweekly sampling with arrival times based on 10 to 20% reduction from ambient, except for SAR-11/1 arrival time in 2016 when sulfate sampling frequency was approximately monthly.

During 2018, sulfate concentrations were as low as GWRS concentrations at only SAR-10/2 (Figure 8-6) and SAR-11/2 (Figure 8-7), thus indicating approximately 100% sustained GWRS water at these two wells both screened in the Lower Rho aquifer which was shown to receive the largest proportion of MBI-1 injection (Table 7-2). At SAR-10/4, sulfate concentrations declined slightly from 5 to 3 mg/L during 2018, thus indicating an increasing percentage of nearly 100% GWRS water at this well in the Main aquifer. The other zones at SAR-10 and SAR-11 during 2018 appear to still show a small proportion of non-GWRS water at these wells based on sulfate concentrations remaining low and stable but slightly above GWRS levels. At SAR-11/1, sulfate concentrations experienced a slight uptick in September 2018 to 21 mg/L, indicating a temporary increase in the percentage of non-GWRS water at this well possibly due to MBI-1 being off-line at that time (from August 22 to October 3) which could have caused a temporary subtle shift in the hydraulic gradient.

8.4.2 Monitoring Wells – 1,4-Dioxane and NDMA

Concentrations of 1,4-dioxane at DMBI Project monitoring wells SAR-10 and SAR-11 are shown in the upper graph of Figure 8-8 and Figure 8-9, respectively. As expected, all four zones at SAR-10 and all three zones at SAR-11 continued to be non-detect for 1,4-dioxane, given historical ambient background results and GWRS-FPW water quality.

As discussed in Section 4.4.3, OCWD has historically monitored for NDMA in the vicinity of the Talbert Barrier for GWRS permit compliance purposes and to track the release of NDMA within the aquifers receiving injection in the late 1990s and early 2000s from WF-21. Since then, through a combination of industrial source control, appropriate polymer selection and waste stream diversion at OCSD, improved NDMA rejection by RO membranes, and UV treatment, the concentration of NDMA in GWRS-FPW has been significantly reduced and historically was consistently non-detect (OCWD, 2015c).

In recent years, the occurrence of NDMA in GWRS-FPW has been increasing slightly and is likely attributable to aging RO membranes permitting greater concentrations of NDMA precursors to pass through the membranes. Any NDMA precursors that pass through the RO membranes and are not inactivated by the UV/AOP process, can then form NDMA due to the presence of residual combined chlorine and elevated pH created during the post-treatment lime addition process (See Section 2.2.4). NDMA concentrations in GWRS-FPW were slightly less in 2016-2018 than the prior two years, being largely below the RDL from December 2015 through mid-May 2016 and then only occasionally detected above the RDL but never exceeding 5 ng/L, thus remaining well below the NL of 10 ng/L. Implementation of a lower pH target down to 8.5 in the post-treatment process during late 2015 in combination with on-going replacement of RO membranes since December 2015 may be largely responsible for the NDMA reduction in GWRS-FPW since then. The RO membrane replacements appear to be effective in further reducing the amount of precursor passing through to the downstream processes and thus help limit NDMA reformation (OCWD, 2015c).

NDMA concentrations at SAR-10 for 2014-2018 are shown in the lower graph of Figure 8-8, along with NDMA concentrations for GWRS-FPW for comparison. Prior to the onset of GWRS injection at MBI-1, all four zones were consistently non-detect under ambient background conditions. Shortly after the commencement of MBI-1 injection, NDMA concentrations in all four zones of SAR-10 have been detected and varied from approximately 2 to 10 ng/L, with a maximum peak

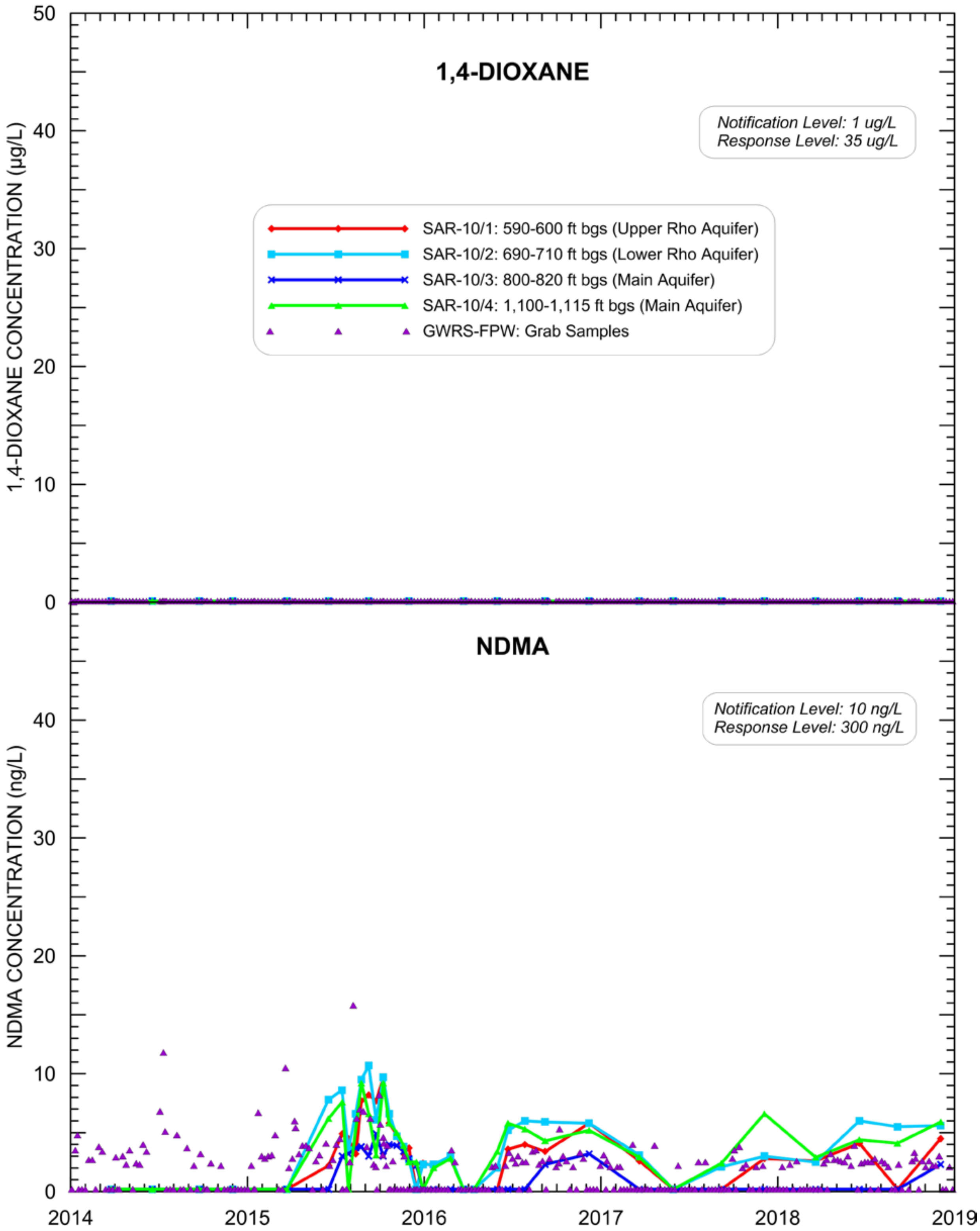


Figure 8-8. Monitoring Well SAR-10 1,4-Dioxane and NDMA Concentrations

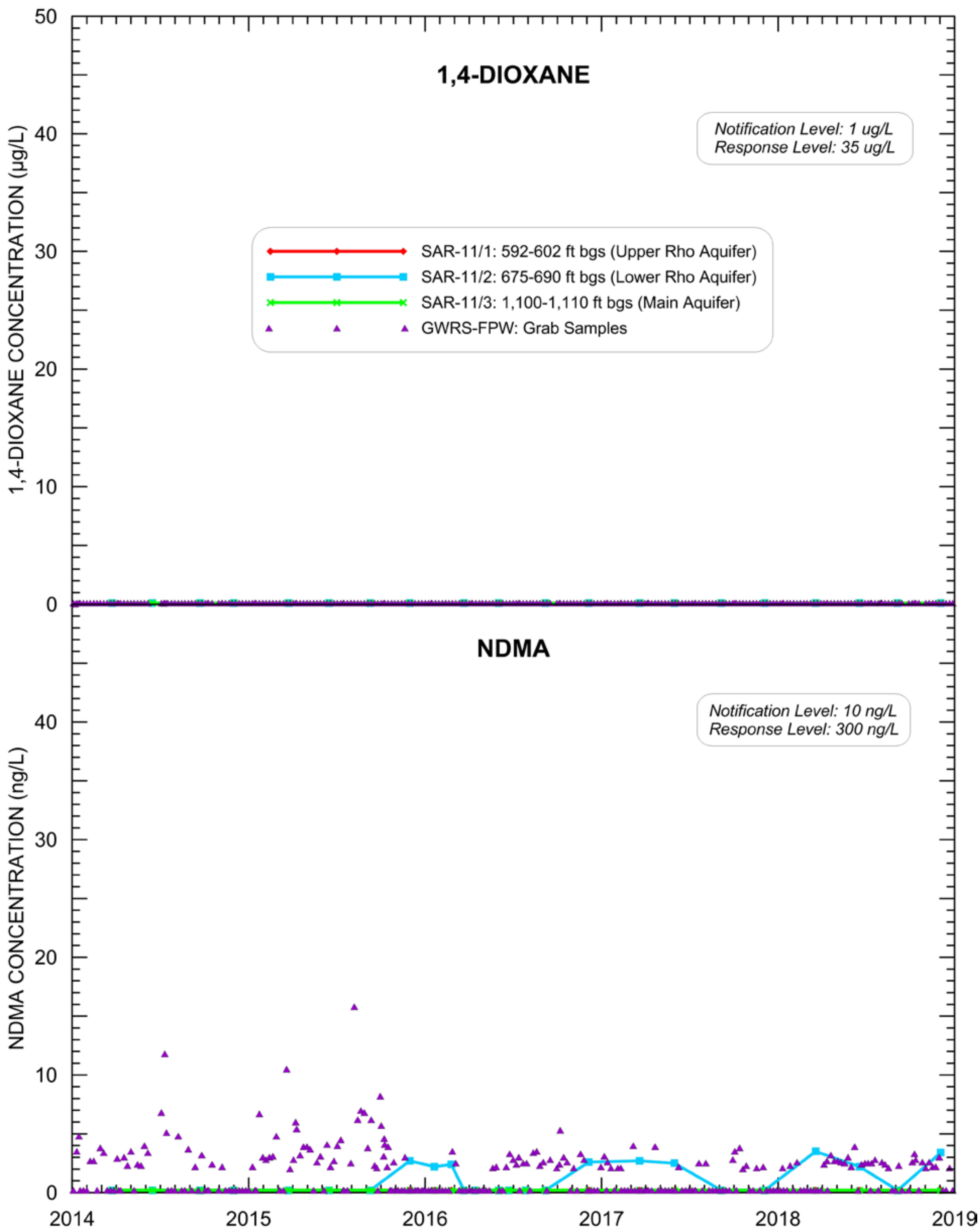


Figure 8-9. Monitoring Well SAR-11 1,4-Dioxane and NDMA Concentrations

value of 10.7 ng/L in September 2015 at SAR-10/2, just slightly above the NL of 10 ng/L but well below the RL of 300 ng/L set by DDW and consistent with the slightly higher NDMA concentrations in GWRS-FPW during that time. During 2018, NDMA concentrations in all four zones at SAR-10 ranged from below the RDL to 6 ng/L. At SAR-10/2 and SAR-10/4, NDMA concentrations were slightly higher than in the other two wells at the SAR-10 site and ranged from 4 to 6 ng/L during the last three quarters of 2018, representing nearly double the NDMA concentrations of GWRS-FPW during that time. SAR-10/2 and SAR-10/4 have been shown to have relatively fast GWRS arrival times of approximately 15 days or less. Therefore, the slightly elevated NDMA concentrations at these two wells may be due to a subtle shift in the hydraulic gradient bringing somewhat older GWRS water previously injected at MBI-1 to these wells, especially since the 2018 NDMA concentrations were similar to those in late 2016 (Figure 8-8).

NDMA concentrations at SAR-11 for 2014-2018 are shown in the lower graph of Figure 8-9. As with SAR-10, all three zones at SAR-11 were consistently non-detect prior to the onset of GWRS injection at MBI-1. Since the commencement of MBI-1 injection, SAR-11/1 and SAR-11/3 have consistently been non-detect. At SAR-11/2, NDMA concentrations rose slightly above the RDL in late 2015 and remained just below 3 ng/L from late November 2015 to late February 2016. Based on the estimated arrival time of 119 days for GWRS water to reach SAR-11/2 (Table 8-2), this three-month NDMA increase at SAR-11/2 likely resulted from increased NDMA concentrations in GWRS-FPW injected at MBI-1 approximately four months prior from late July through late October 2015 (Figure 8-9). NDMA concentrations at SAR-11/2 were detected in the 2 to 3 ng/L range intermittently during 2016-2018 and were generally consistent with GWRS-FPW concentrations. Overall, the NDMA concentrations were much lower at SAR-11 as compared to SAR-10 due to mixing via dispersive transport for the longer travel distance to SAR-11 and possible biodegradation.

8.4.3 Monitoring Wells - Arsenic

As previously documented, the mobilization of arsenic from aquifer sediments has been observed at some locations downgradient of GWRS water injected at the Talbert Barrier and percolated in K-M-M-L Basins in the Anaheim Forebay area. Figure 8-10 and Figure 8-11 show dissolved arsenic and chloride concentrations during 2015-2018 for SAR-10 and SAR-11, respectively. Dissolved arsenic is shown in these figures rather than total arsenic because total arsenic was only sampled quarterly for compliance whereas dissolved arsenic was sampled much more frequently along with chloride: monthly prior to MBI-1 injection, biweekly thereafter for the remainder of 2015, monthly during the first three quarters of 2016, then defaulting back to quarterly thereafter. The dissolved arsenic concentrations were found to be consistent with and nearly equal to the quarterly total arsenic concentrations. Therefore, for the discussion that follows, dissolved arsenic will be referred to simply as arsenic.

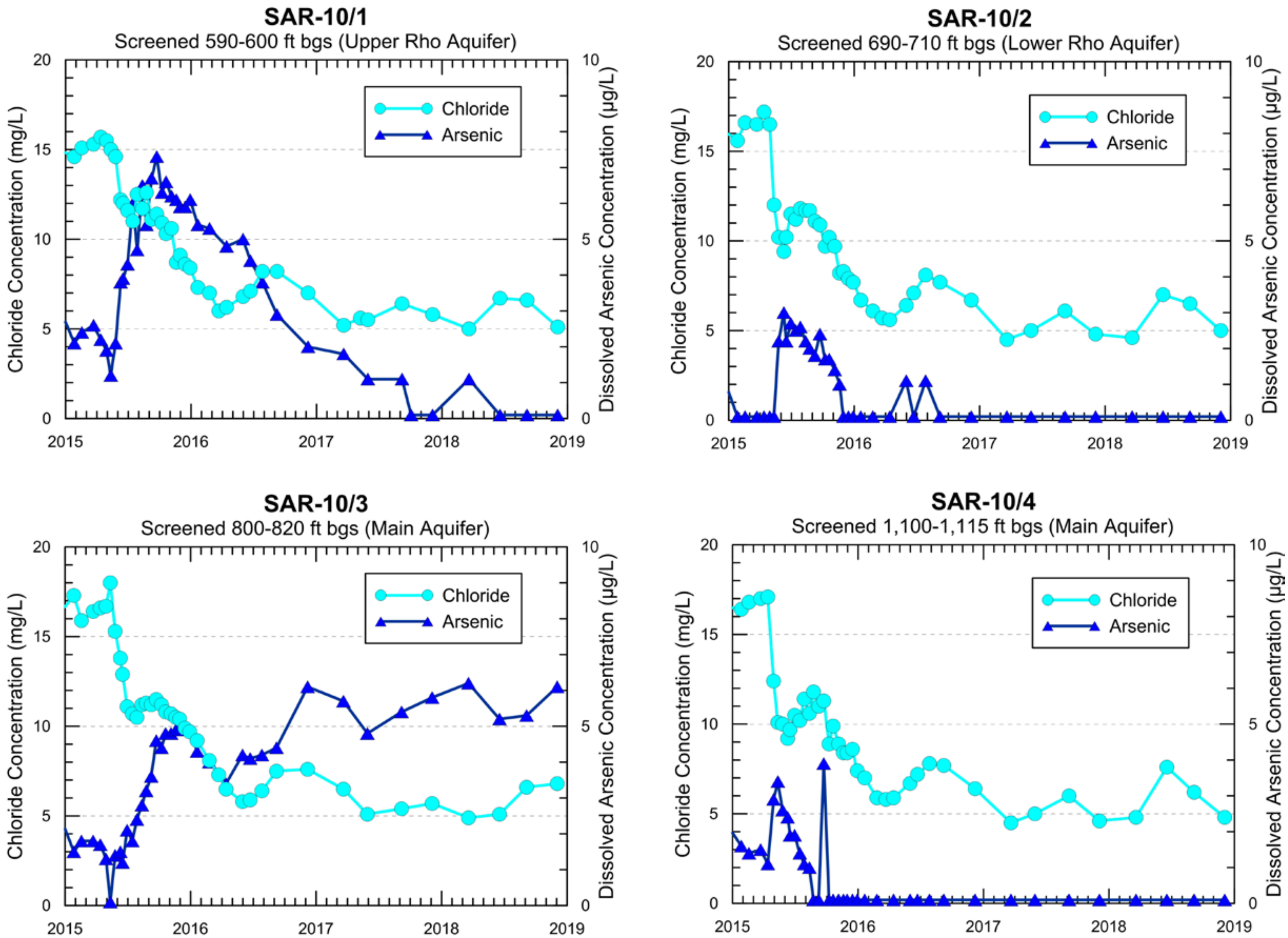


Figure 8-10. Monitoring Well SAR-10 Chloride and Dissolved Arsenic Concentrations

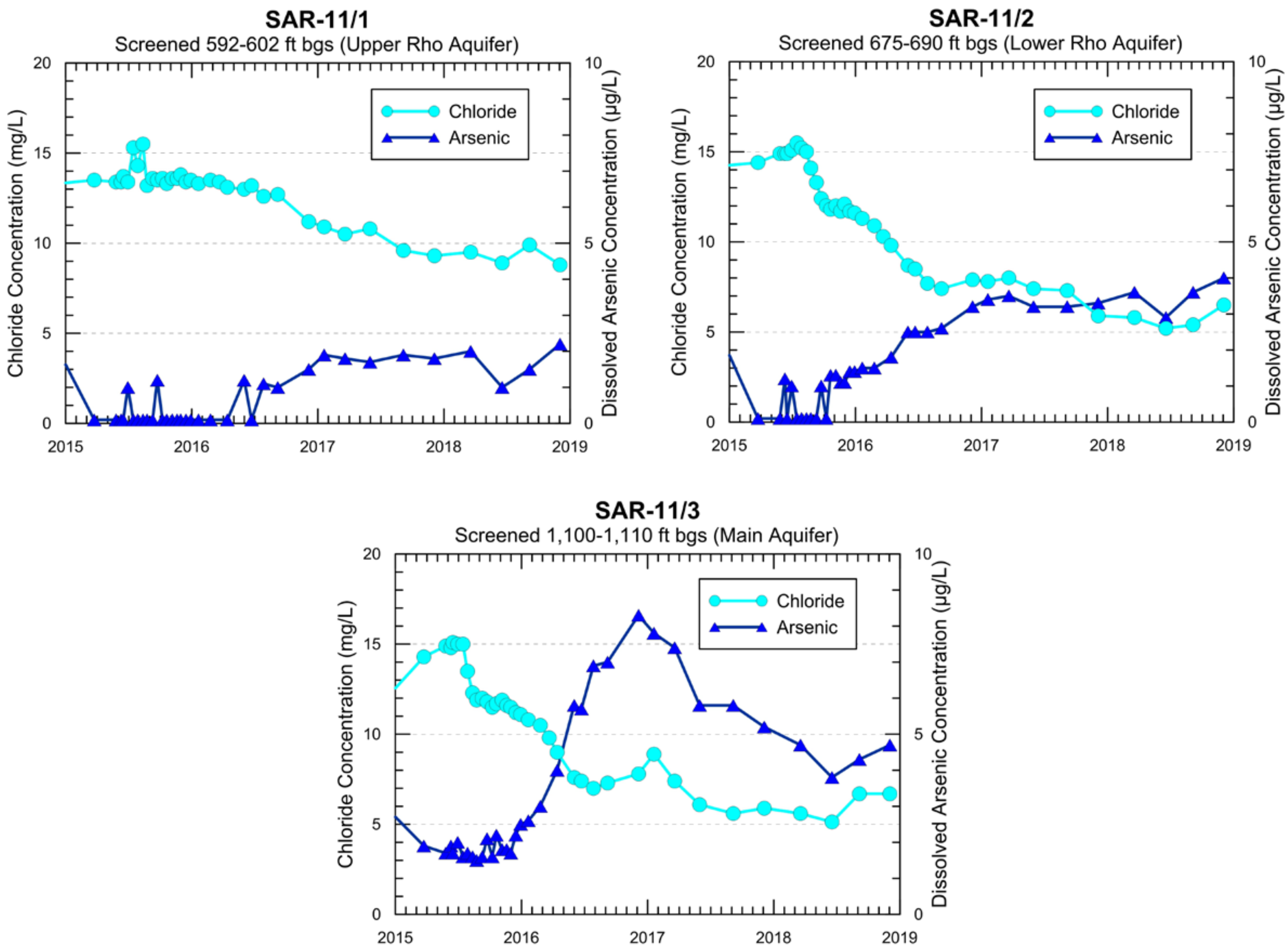


Figure 8-11. Monitoring Well SAR-11 Chloride and Dissolved Arsenic Concentrations

At SAR-10, Figure 8-10 shows that the pre-injection ambient background arsenic concentration ranged from below the RDL of 1 µg/L to 2.5 µg/L for all four zones. With the arrival of GWRS water, arsenic concentrations increased along with the contemporaneous decline in chloride concentrations similar to what was observed in the Anaheim Forebay (Section 6.4.3). Arsenic concentrations in all four zones of SAR-10 remained below the MCL of 10 µg/L during 2015, with the highest concentration of 7.3 µg/L occurring at SAR-10/1 in September 2015. Arsenic concentrations in SAR-10/2 and SAR-10/4 reached a peak of 3.0 µg/L in June 2015 and 3.4 µg/L in May 2015, respectively, before beginning a downward trend down to below the RDL at SAR-10/2 by late 2016 and SAR-10/4 by late 2015. The timing of the peak arsenic concentration in these two zones is consistent with their GWRS arrival time estimates (Table 8-2) and consistent with the contemporaneous chloride decline to approximately 10 mg/L, indicating approximately 100% GWRS water arrival in these two zones. As was discussed in Section 6.4.3 for the Anaheim Forebay compliance monitoring wells, the sustained arrival of 100% GWRS water tends to reduce arsenic concentrations below ambient background levels due to arsenic mass removal from the aquifer sediments.

Since peaking in late 2015, arsenic concentrations at SAR-10/1 gradually declined and were below the RDL of 1 µg/L for the last three quarters of 2018 (Figure 8-10), once again due to arsenic mass removal from the aquifer sediments with sustained arrival of GWRS water.

After the sustained presence of 100% GWRS water, small variations in the chloride concentrations observed at all SAR-10 zones during 2016-18 (Figure 8-10) likely reflect the small variations in injected GWRS water over time, and not a varying blend of recycled water and ambient groundwater; as such, unlike observations in the Anaheim Forebay (Section 6.4.3), these small changes in chloride concentration do not correlate with changes in arsenic concentrations over time and would not be expected to, as the percentage of GWRS water present should be relatively constant near 100% due to typically consistent year-round MBI-1 injection operations. Although MBI-1 was off-line for approximately six weeks from August 22 to October 3 during 2018, the relatively low and stable chloride concentrations during 2018 in all four zones at SAR-10 do not suggest the arrival of any significant percentage of non-GWRS water.

At SAR-10/3, arsenic concentrations have risen slightly since the first arrival of GWRS water in 2015, reaching temporary peaks of approximately 6 µg/L in December 2016, March 2018, and December 2018, slightly higher than the initial peak of approximately 5 µg/L in late 2015 (Figure 8-10). As was discussed in the previous section, sulfate concentrations of approximately 10 to 12 mg/L at SAR-10/3 during 2016-2018 (Figure 8-6) indicated the likely arrival of less than 100% GWRS water at this well, and thus the potential for some additional future mobilization.

At SAR-11, Figure 8-11 shows that the pre-injection ambient background arsenic concentrations were consistent with those at SAR-10, ranging from below the RDL to 3.0 µg/L for all three zones. At SAR-11/1, GWRS water was estimated to arrive somewhere between mid-April to early June of 2016 based on a slow but steady decline in sulfate concentrations and consistent with an increase in arsenic concentrations from non-detect to approximately 2 µg/L during the second half of 2016 and ranging from 1 to 2.2 µg/L during 2018. At SAR-11/2 and SAR-11/3, the initial arsenic increase resulting from the first arrival of GWRS water was smaller and more gradual than for these two analogous aquifer zones at SAR-10 due to the longer flow path to SAR-11 allowing more time for mixing via dispersive transport. However, arsenic concentrations began to rise in both wells in late 2015 and continued to gradually rise to a high of 4 µg/L at SAR-11/2 by the end of 2018, whereas a steeper rise to 8.3 µg/L occurred at SAR-11/3 in December 2016 before gradually declining thereafter below 5 µg/L during 2018 (Figure 8-11).

The source of the arsenic release in the DMBI project area is likely the oxidation of iron sulfide minerals, such as pyrite, which was detected in some aquifer sediment samples collected from the DMBI project well borings. Arsenic is known to associate with pyrite and can be released into the aqueous phase during oxidation by introducing oxidized GWRS water into a geochemically reduced aquifer, as measured by oxidation-reduction potential (ORP). Prior to the onset of MBI-1 injection, all SAR-10 and SAR-11 zones showed negative ORP, while GWRS water has positive ORP. However, the oxidation of pyrite can also create hydroferrous oxide (HFO) coatings to the aquifer mineral surfaces. These HFOs can provide sorption sites for arsenic and other species that are controlled by pH and other geochemical factors, thereby limiting the extent of mobilization.

8.4.4 Monitoring Wells - Vanadium

Vanadium is regulated as a NL and RL contaminant in drinking water by DDW, with a NL of 50 µg/L and a RL of 500 µg/L. There is no state or Federal MCL for vanadium. The basis for the DDW NL and RL is a memo in 2000 from the California Office of Environmental Health Hazard Assessment to DDW (then within the California Department of Health Services), which cites non-cancer endpoints related to developmental and reproductive effects in rats (DDW, 2015; OCWD, 2015c). Vanadium typically displays redox behavior similar to chromium, generally portioning strongly onto solids under reducing conditions and more weakly under oxidizing conditions.

Minor mobilization of vanadium has been previously observed with the arrival of GWRS water in the subsurface at a few monitoring wells near the Talbert Barrier and Anaheim Forebay, but all increases were temporary and remained well below the NL of 50 µg/L. Figure 8-12 and Figure 8-13 show dissolved vanadium and chloride concentrations during 2015-2018 for SAR-10 and SAR-11, respectively. As with arsenic discussed above, dissolved vanadium was used in Figure 8-12 and Figure 8-13 rather than total vanadium because of the more frequent sampling for dissolved vanadium: monthly prior to MBI-1 injection, biweekly for the remainder of 2015, monthly during the first three quarters of 2016, and quarterly thereafter. Dissolved vanadium concentrations were found to be consistent with and nearly equal to the quarterly total

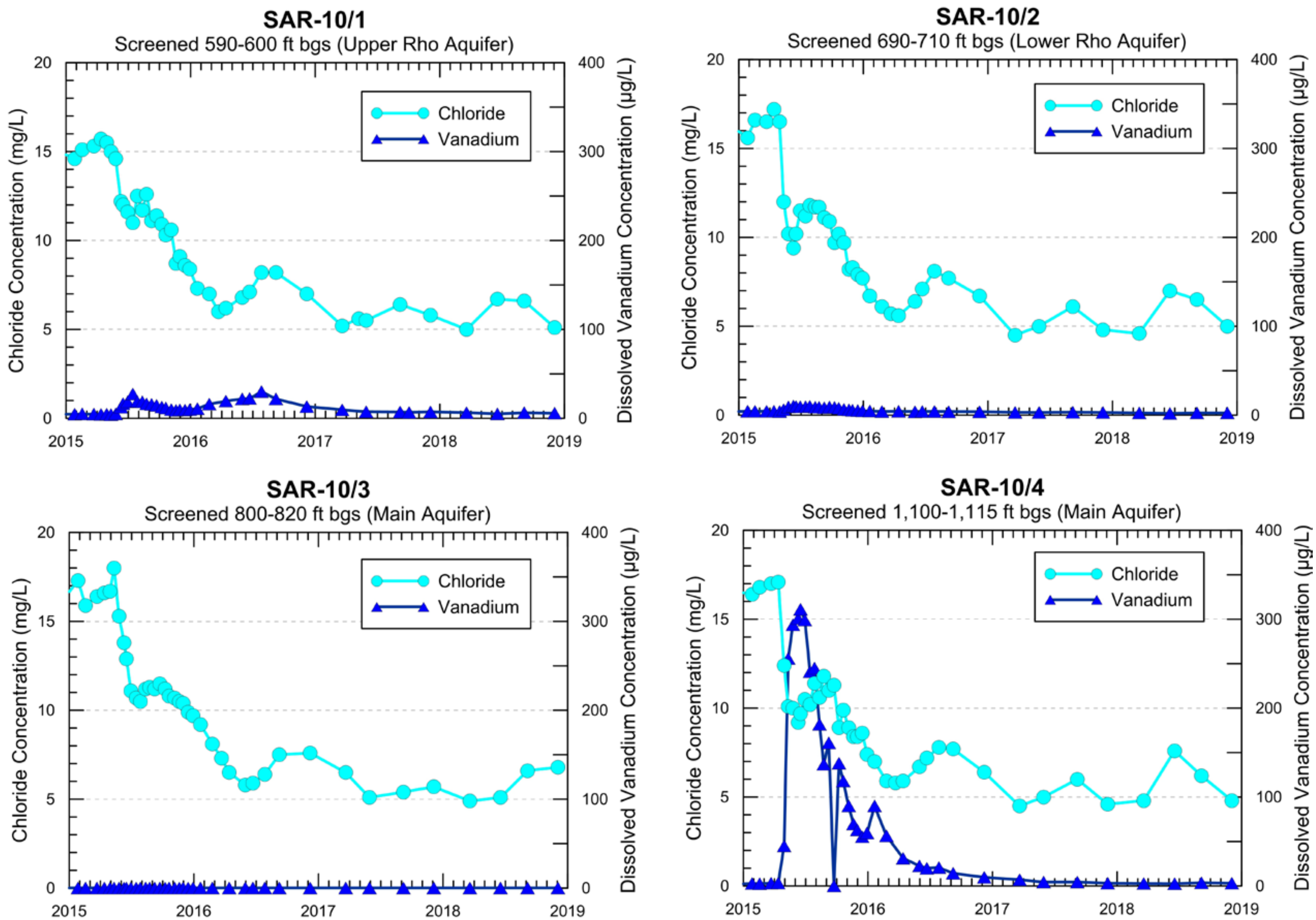


Figure 8-12. Monitoring Well SAR-10 Chloride and Dissolved Vanadium Concentrations

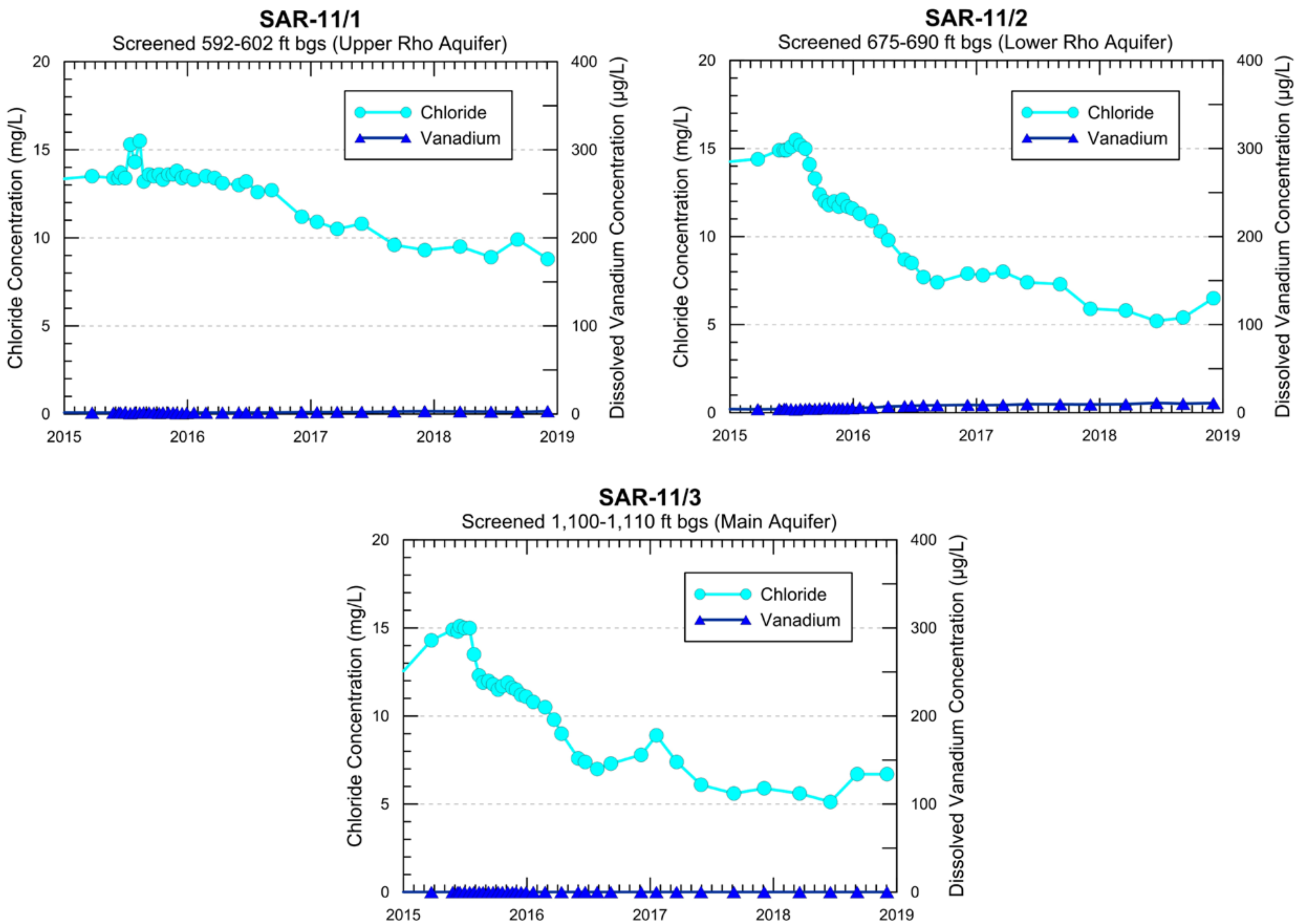


Figure 8-13. Monitoring Well SAR-11 Chloride and Dissolved Vanadium Concentrations

vanadium compliance samples. As such, for the discussion that follows, dissolved vanadium will be referred to simply as vanadium. In all zones at SAR-10 and SAR-11, pre-injection ambient background vanadium concentrations ranged from below the RDL (1 µg/L) to approximately 6 µg/L. The time series vanadium plots in Figure 8-12 and Figure 8-13 have y-axes with a large vanadium concentration range of 400 µg/L to accommodate the large vanadium concentration peak at SAR-10/4. Therefore, the much lower vanadium concentration trends at the rest of the wells shown on these figures are more difficult to see than their arsenic counterparts in Figure 8-10 and Figure 8-11.

At SAR-10, Figure 8-12 shows that each of the four zones had different vanadium concentration responses with the arrival of GWRS water, likely resulting from variations in mineral composition of the sediments comprising each of the screened aquifers. At SAR-10/1, vanadium concentrations rose from background levels (ranging from 4 to 5 µg/L) to a peak of 27.3 µg/L in July 2015, consistent with the contemporaneous chloride concentration decline indicating the arrival of GWRS water at this well, albeit at less than 100%. Vanadium concentrations at SAR-10/1 reached a slightly higher peak in mid-2016 to 30.1 µg/L, possibly resulting from the GWRS arrival reaching 100% or a slight change in the gradient exposing the GWRS water to new aquifer sediments. Vanadium concentrations at SAR-10/1 have gradually declined since the mid-2016 peak and ranged from 5.1 to 6.4 µg/L during 2018, just slightly higher than ambient concentrations of approximately 5 µg/L at this well.

At SAR-10/2 (Figure 8-12), vanadium concentrations increased to a maximum of 10.3 µg/L in June 2015, decreased down to ambient levels of approximately 4 µg/L by early 2016, and then gradually decreased further before stabilizing at just over 2 µg/L during 2018. As was discussed previously for arsenic, mass removal of vanadium due to the sustained arrival of 100% GWRS water likely caused vanadium concentrations to equilibrate to below ambient levels at this well.

At SAR-10/3, vanadium concentrations have remained below the RDL of 1 µg/L both before and after the arrival of GWRS water (Figure 8-12). At SAR-10/4, vanadium concentrations displayed the most significant increase with the arrival of GWRS water, increasing sharply from a pre-injection background of approximately 3 µg/L to a maximum of 311 µg/L (above the NL but below the RL) in June 2015 (Figure 8-12). Since then, vanadium concentrations have asymptotically declined and were relatively low and stable ranging from 2.6 to 3.5 µg/L during 2018, similar to pre-injection ambient levels. As was similarly discussed for arsenic, the declining vanadium trends during sustained GWRS arrival are primarily due to vanadium mass removal and therefore subtle contemporaneous chloride concentration trends should not be expected to correlate with the declining vanadium trends; rather, the subtle chloride trends at these wells were simply mimicking the GWRS-FPW chloride trends but lagged by their respective GWRS arrival times.

At SAR-11, Figure 8-13 shows that SAR-11/1 did not have any discernible change in vanadium concentrations during 2015-2018 even though GWRS water was documented to finally arrive at this well in mid-2016 but likely at much less than 100% GWRS water. At SAR-11/2, vanadium concentrations began to rise during 2016 from ambient background concentrations of 4 to 5 µg/L to approximately 11 µg/L during 2018 as GWRS arrival likely reached 100% during this time based on contemporaneous chloride and sulfate concentrations declining to approximately GWRS levels. At SAR-11/3, vanadium concentrations have remained below the RDL of 1 µg/L both before and after the arrival of GWRS water. The lack of significant changes in vanadium concentration at SAR-11 with the presence of 100% GWRS water indicates that the greater mobilization observed at SAR-10 is likely a localized effect.

8.4.5 Aluminum

Aluminum is regulated via California primary and secondary MCL's of 1,000 µg/L and 200 µg/L, respectively, as well as a PHG of 600 µg/L. Prior to the onset of MBI-1 injection, total aluminum concentrations at SAR-10/1 ranged from 4.5 to 83.7 µg/L. With the arrival of GWRS water in June 2015 (Table 8-2), total aluminum concentrations at SAR-10/1 increased and were mostly above the Secondary MCL (Figure 8-14). During 2017, total aluminum at SAR-10/1 increased during the first quarter sampling event to a one-time peak value of 4,070 µg/L, before dropping back below the MCL for the remainder of the year. During 2018, total aluminum concentrations at SAR-10/1 were consistently below the Secondary MCL, ranging from 11 to 74 µg/L and similar to ambient levels.

As displayed on Figure 8-14, no other MBI monitoring well zones at SAR-10 or SAR-11 have exhibited comparably significant increases in total aluminum as those observed at SAR-10/1, indicating a localized effect. In contrast to the SAR-10/1 results, the SAR-11/1 (equivalent aquifer interval at the downgradient monitoring well site) has displayed no increases in total aluminum with the arrival of GWRS water, with concentrations ranging from 2 to 16 µg/L, similar to pre-injection conditions. Furthermore, dissolved aluminum concentrations at SAR-10/1 have been much lower than those for total aluminum, ranging from 4.4 to 23.6 µg/L since GWRS water arrival in June 2015, featuring only a subtle increase from the pre-injection background conditions (Figure 8-14); the lower dissolved aluminum concentrations indicate localized particle association is contributing to the elevated total aluminum concentrations, potentially due to pH-mediated aluminum hydroxide dissolution from the SAR-10/1 aquifer zone.

8.4.6 Iron

Iron is regulated via California and Federal Secondary MCL's both set at 300 µg/L. Total iron concentrations at SAR-10/1 followed a nearly identical trend as total aluminum since June 2015 and also peaked contemporaneously with aluminum in the first quarter of 2017 to 1,860 µg/L, well above the Secondary MCL. Dissolved iron concentrations at SAR-10/1 were considerably lower than for total iron, but also followed the general temporal trends, albeit at much lower

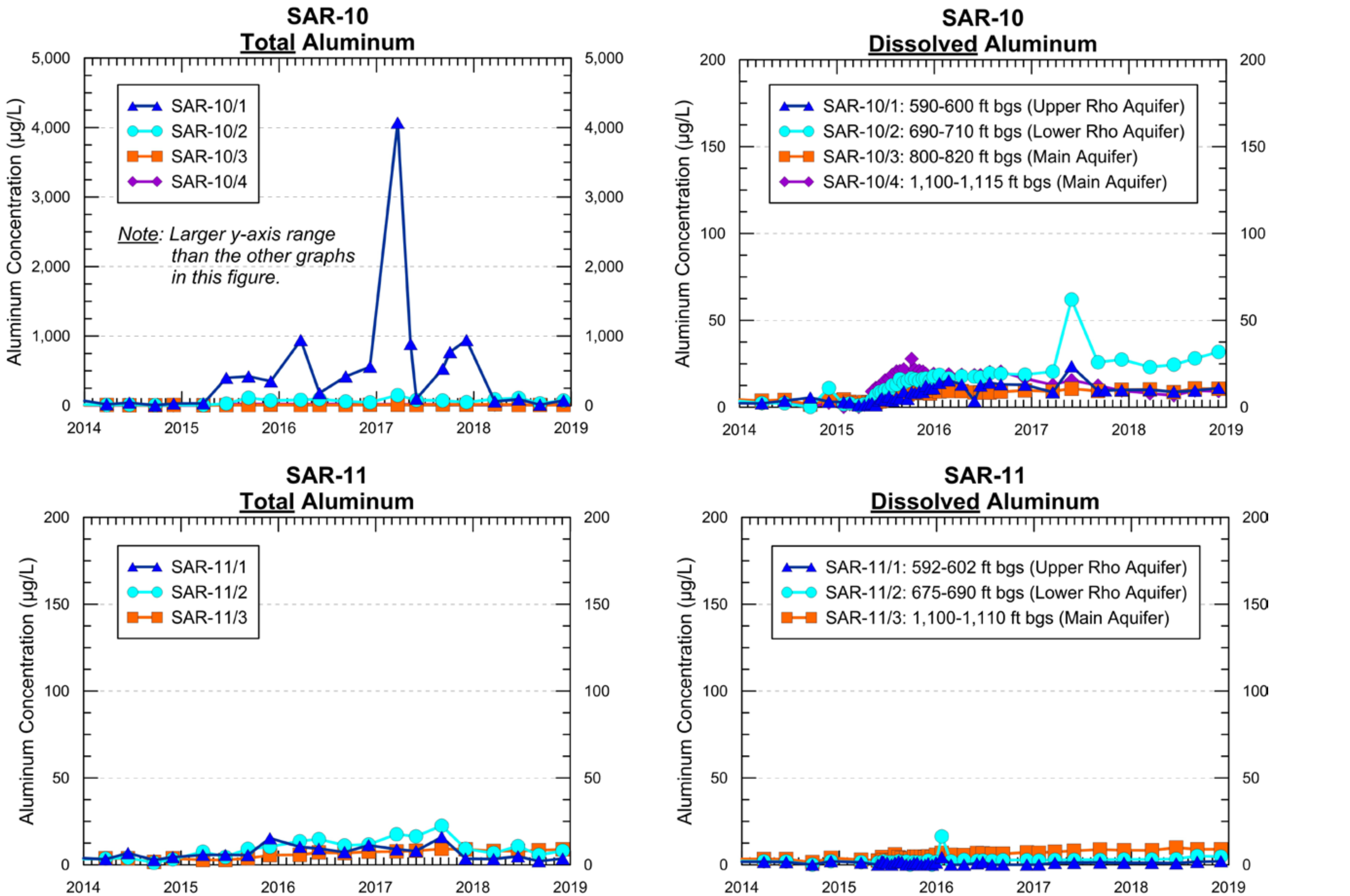


Figure 8-14. Monitoring Wells SAR-10 and SAR-11 Total and Dissolved Aluminum Concentrations

concentrations. Similar to aluminum discussed above, the elevated total iron concentrations at SAR-10/1 were likely related to the arrival of GWRS purified recycled water in June 2015. The iron has likely been released by the oxidation of pyrite and other iron sulfide minerals known to occur in the Principal aquifer system. The oxidized iron can then potentially be resorbed to the aquifer mineral surfaces. No other DMBI monitoring well zones at SAR-10 or SAR-11 have exhibited comparably significant increases in total iron as those observed at SAR-10/1, indicating a localized effect similar to what was observed for total aluminum.

8.4.7 Production Wells

Data for water samples collected from potable production wells in the vicinity of the DMBI Project are summarized in Table 8-3. Municipal production wells IRWD-12 and IRWD-17 are the two nearest downgradient drinking water wells from the DMBI Project, with IRWD-12 being just 200 feet closer than IRWD-17. Municipal production well FV-8 is upgradient from the DMBI Project, while FV-6 is somewhat cross-gradient (Figure 8-3).

Groundwater modeling performed in support of the DMBI Project's permitting estimated a mean travel time from MBI-1 to IRWD-12 to be 4.2 years assuming a maximum injection rate of 4 MGD at MBI-1 (DDB Engineering, Inc., 2009b). Currently the Title 22 regulations for direct injection of recycled water require a minimum of two months of response retention time for projects employing GWRS type treatment, with potentially additional retention required for pathogenic microorganism control depending on the credits granted for the pre-injection above ground treatment (CCR, 2014); under these regulations, GWRS is currently permitted for a minimum retention time of four months.

Table 8-3 shows both chloride and sulfate concentrations at these nearby production wells during 2018 since these two constituents were used as intrinsic tracers to track the GWRS water injected at MBI-1 as discussed in Section 8.4.2. Based on quarterly samples, both IRWD-12 and IRWD-17 had relatively low and stable chloride concentrations during 2018, ranging from 15 to 17 mg/L at IRWD-12 and approximately 20 mg/L at IRWD-17. Sulfate concentrations during 2018 at IRWD-12 and IRWD-17 were also relatively stable and ranged from 37 to 40 mg/L and 44 to 45 mg/L, respectively. These 2018 chloride and sulfate concentrations at IRWD-12 and IRWD-17 were very similar to the ambient pre-injection background concentrations at DMBI Project monitoring wells SAR-10 and SAR-11 discussed previously.

Figure 8-15 shows historical chloride and sulfate concentrations at IRWD-12 and IRWD-17 over the life of those two production wells. Both chloride and sulfate showed a slight gradual increase over the last 20 years, possibly due to decades of managed Anaheim Forebay recharge with SAR and imported water having a higher TDS than native groundwater in the Principal aquifer and migrating slowly south to the IRWD Dyer Road Well Field area. At IRWD-12, both chloride and

Table 8-3. 2018 Water Quality for Potable Wells Within the Influence of the DMBI Project

OCWD Well Name	Well Depth (ft bgs)[1]	Perforation Interval (ft bgs)[1]	Distance from Injection Site (ft)[2]	Concentration [3,4]								
				Arsenic (As), ug/L	Chloride (Cl) mg/L	Sulfate (SO4) mg/L	Total Dissolved Solids (TDS) mg/L	Nitrate Nitrogen (NO3-N) mg/L	Nitrite Nitrogen (NO2-N) mg/L	Total Organic Carbon (Unfiltered) (TOC) mg/L	n-Nitrosodi-methylamine (NDMA) ng/L	1,4-Dioxane (14DIOX) ug/L
Large System Municipal Wells												
FV-8[5]	864	312 - 844	3,097	ND	29.3 (27.3 - 30.7)	61.8 (60.0 - 63.6)	341 (338 - 342)	1.43 (1.19 - 1.61)	ND	0.16 (0.07 - 0.45)	ND	ND
IRWD-12	1,335	580 - 1,040	3,655	0.3 (ND - 1.1)	15.9 (15.4 - 16.5)	38.7 (37.3 - 40.4)	244 (230 - 254)	0.36 (0.33 - 0.39)	ND	0.14 (0.06 - 0.36)	ND	ND
IRWD-17	980	504 - 960	3,864	ND	20.4 (20.2 - 20.6)	44.9 (44.5 - 45.2)	251 (236 - 266)	0.34 (0.32 - 0.36)	ND	0.09 (0.07 - 0.11)	ND	ND
FV-6	1,120	370 - 1,110	4,867	ND	40.4 (37.1 - 42.4)	72.0 (67.4 - 74.7)	362 (344 - 386)	0.90 (0.84 - 0.94)	ND	0.13 (0.10 - 0.16)	ND	1.9 (1.7 - 2.2)

[1] Feet below ground surface

[2] Straight line shortest distance to the nearest DMBI injection well, estimated to the nearest 100 feet

[3] Concentrations are annual averages with annual ranges in parenthesis for the given year

[4] ND: Not detected or less than the detection limit

[5] Upgradient from injection site

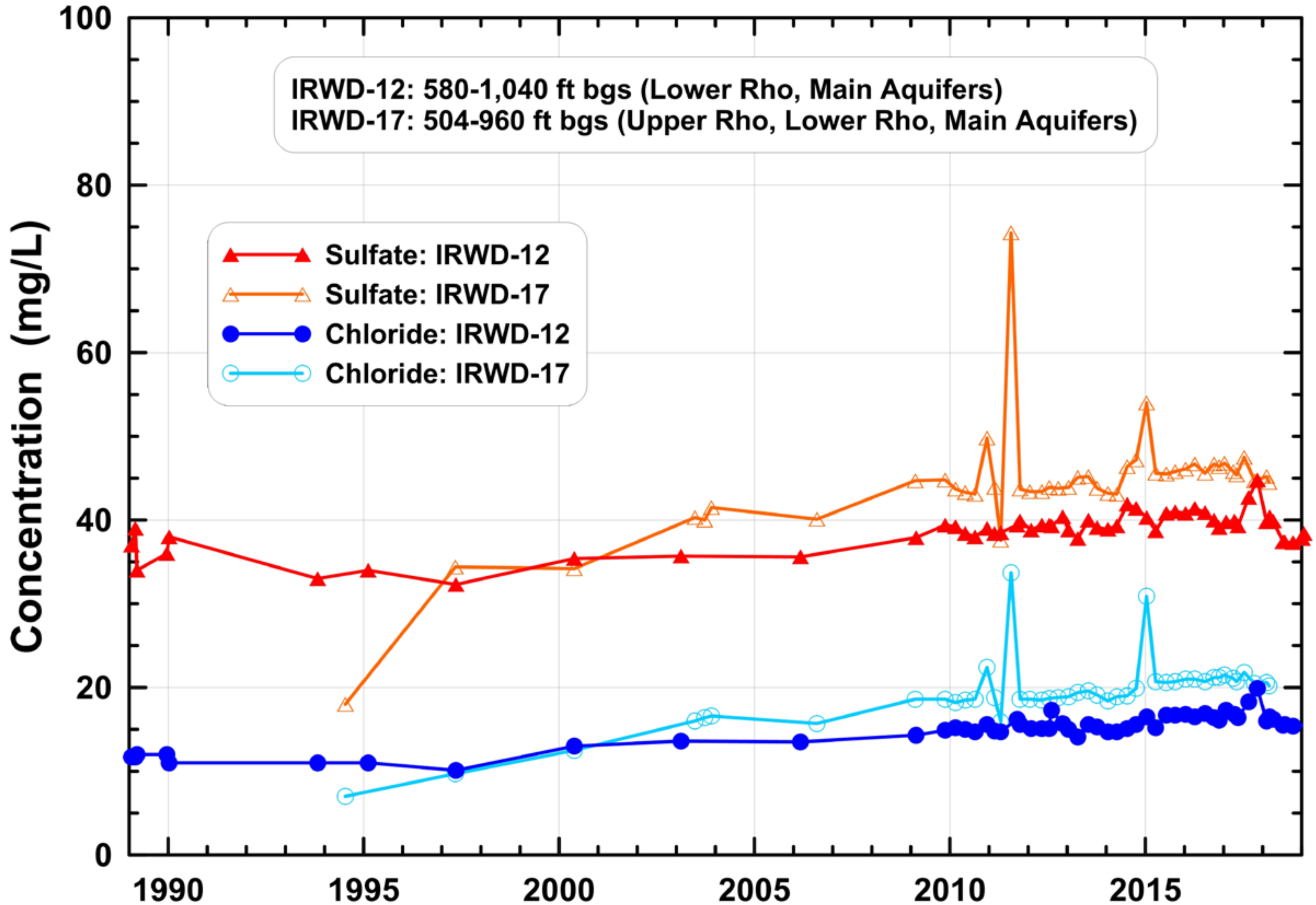


Figure 8-15. Wells IRWD-12 and IRWD-17 Chloride and Sulfate Concentrations

sulfate concentrations experienced a slight uptick during late 2017 and then a slight decrease during 2018. Although very subtle and inconclusive, this could signal initial arrival of a small percentage of GWRS water, which would equate to a travel time of approximately three years.

The relatively stable chloride and sulfate concentrations over the last several years confirm that the similar background concentrations observed at SAR-10 and SAR-11 prior to MBI-1 injection were representative of longer-term regional conditions in this area. As shown on Figure 8-15, both chloride and sulfate concentrations are slightly higher at IRWD-17 than at IRWD-12, likely due to IRWD-17 being screened slightly shallower than IRWD-12. Mineral content and overall TDS tend to decrease with depth within the Principal aquifer as these lower aquifer zones are more vertically removed from surficial recharge operations in the Forebay area of the Basin. As shown in the schematic cross-section in Figure 8-2, IRWD-17 is screened in the same aquifers as MBI-1 (Upper Rho, Lower Rho, and Main), albeit with a slightly shallower bottommost screen, while IRWD-12 is only screened in the Lower Rho and Main aquifers. As discussed in Section 8.1, these Principal aquifer zones are interpreted to be approximately 50 to 150 feet shallower at IRWD-12 and IRWD-17 than at MBI-1 due to the synclinal structure of the Basin dipping to the northwest.

IRWD-12 and IRWD-17 have shown minor detections of arsenic and vanadium over the last several years. Historically, arsenic concentrations at IRWD-12 have ranged from below the RDL of 1 µg/L to occasional detections up to 2 µg/L, thus remaining well below the MCL of 10 µg/L. During 2018, IRWD-12 had only one minor detection of 1.1 µg/L based on quarterly samples. At IRWD-17, arsenic concentrations ranged historically from below the RDL to 2.4 µg/L, and during 2018 IRWD-17 had no detections of arsenic based on one sample. Low levels of vanadium were very similar at both IRWD-12 and IRWD-17, historically ranging from 2.4 to 5.9 µg/L, remaining well below the NL of 50 µg/L.

In closing, since injection operations at MBI-1 began in April 2015, first arrival of a small percentage of GWRS water may have occurred at IRWD-12 during 2018 but is inconclusive and would otherwise be expected during 2019 or later based on the observed arrival times discussed above and groundwater modeling results. However, the low-chloride GWRS signal at either IRWD-12 or IRWD-17 could ultimately be too weak or dampened to be discernible for this longer flow path due to dispersive transport and mixing, and sulfate may not be sufficiently conservative for this longer flow path. The four newly constructed MBI wells in Centennial Park are scheduled to be placed on-line sometime during 2019. If arrival of GWRS water from MBI-1 has not been observed by that time at IRWD-12 or IRWD-17, the additional injection from the four Centennial Park wells would strengthen the GWRS signal and likely steepen the gradient within the Principal aquifer and reduce anticipated arrival times going forward.

ACRONYMS LIST

1,2,3-TCP	1,2,3-trichloropropane
ABF	ammonium bifluoride (antiscalant)
AF	acre-foot, acre-feet
AFY	acre-feet per year
AI	Aggressive Index or Aggressivity Index
AL	action level
AOP	advanced oxidation process
ARTIC	Anaheim Regional Transportation Intermodal Center
AS	activated sludge
AS1	OCSD Plant No. 1 P1-82 Activated Sludge Plant
AS2	OCSD Plant No. 2 P1-102 Activated Sludge Plant
ASTM	American Society for Testing and Materials (ASTM International)
AVG	average
AWPF	advanced water purification facility
AWT	advanced water treatment
Basin	Orange County Groundwater Basin
Basin Model	OCWD Basin-wide Groundwater Flow Model
bgs	below ground surface
BP	Basin Plan (Water Quality Control Plan for the Santa Ana River Basin)
BPL	UV reactor ballast power level
BPP	basin production percentage
BPS	barrier pump station
BWW	backwash waste

CA UCMR	California Unregulated Chemical Monitoring Regulations
CBOD	carbonaceous biochemical oxygen demand
CCPP	calcium carbonate precipitation potential
CDPH	California Department of Public Health (formerly DHS; now DDW)
CEC	chemicals of emerging concern or constituents of emerging concern
cfm	cubic feet per minute
CFS	cubic feet per second
CIP	clean-in-place
Cl^-	chloride
CPP	(Anaheim) Canyon Power Plant
CPTP	Coastal Pumping Transfer Program
CUP	Conjunctive Use Program
DBP	disinfection by-product
DDW	Division of Drinking Water, State Water Resources Control Board (formerly CDPH)
DHS	California Department of Health Services (now CDPH)
DMBI	Demonstration Mid-Basin Injection
DPW	decarbonated product water
DRWF	Dyer Road Well Field
DWR	California Department of Water Resources
EC	electrical conductivity
EED	electrical energy dose
EPA	U. S. Environmental Protection Agency
FPW	finished product water or final product water (purified recycled water)
FPWB	finished product water bypass structure

ft	foot, feet
FV	Fountain Valley, City of Fountain Valley
GAC	granular activated carbon
GAP	Green Acres Project
gpm, GPM	gallons per minute
GSWC	Golden State Water Company (formerly Southern California Water Company)
GWR	Groundwater Replenishment
GWRS	Groundwater Replenishment System
HFO	hydroferrous oxide
hr	hour(s)
I	injection well numbering designation
IRWD	Irvine Ranch Water District
IWF-21	Interim Water Factory 21
kgal	thousand gallons
K-M-M-L	Kraemer-Miller-Miraloma-La Palma (Basins)
kW	kilowatt
kWh	kilowatt-hours
LP	UV reactor lamp output
LRV	log reduction value (for pathogenic microorganisms)
LSI	Langelier Saturation Index
M	monitoring well numbering designation
m^3	cubic meter
m^3/day	cubic meters per day
MBI	Mid-Basin Injection

MCL	maximum contaminant level
MCWD	Mesa Water District (formerly Mesa Consolidated Water District)
Mesa Water	Mesa Water District
MF	microfiltration
MFE	microfiltration effluent (filtrate)
MFF	microfiltration feed
MFL	million fibers greater than 10 microns in length per liter
MG	million gallons
mil gal	million gallons
mJ/cm^2	millijoules per square centimeter
MGD	million gallons per day
mg/L	milligrams per liter
micron	micrometer
mL	milliliters
MPN	most probable number
msl	mean sea level
MWD	Metropolitan Water District of Southern California
na	not analyzed
N/A	not applicable
ND	non-detect, not detected (numerically designated as 10% of the reportable detection limit for purposes of calculating the average)
NDMA	N-nitrosodimethylamine
NdN	nitrification/denitrification
ng/L	nanograms per liter
NL	California Notification Level

nm	nanometers
nr	not reported
NR	Not Required
NS	not sampled
NTU	nephelometric turbidity unit
NWRI	National Water Research Institute
OC-44	MWD Turnout designation in Huntington Beach
OCHCA	Orange County Health Care Agency
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
OMMP	Operation, Maintenance, and Monitoring Plan
OOP	Operation Optimization Plan
ORP	oxidation reduction potential
%	percent
Panel	Independent Advisory Panel
PCS	process control system
PDT	pressure decay test
PEPS	Primary Effluent Pump Station
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
PISB	Primary Influent Splitter Box
PMCL	Primary Maximum Contaminant Level
psi	pounds per square inch
PVDF	polyvinylidene difluoride
PWPS	product water pump station

Q	flow rate
Q1	secondary effluent from OCSD Plant No. 1 (same as Q-1)
R	number of reactors in service in a UV train
RAS	return activated sludge
RDL	reportable detection limit
RL	California Response Level
RO	reverse osmosis
ROF	reverse osmosis feed
ROP	reverse osmosis product
%RW	percentage recycled water (instantaneous; not averaged over 60 months)
RWC	recycled water contribution (monthly; averaged over 60 months)
RWQCB	Regional Water Quality Control Board, Santa Ana Region
SALS	Steve Anderson Lift Station (at OCSD Plant No. 1)
SAR	Santa Ana River
SARI	Santa Ana Regional Interceptor
SARWQH	Santa Ana River Water Quality and Health (Study)
SCADA	supervisory control and data acquisition (see also PCS)
SCE	Southern California Edison
SCWC	Southern California Water Company, now Golden State Water Company
SEB	Southeast Barrier Pipeline
SMCL	secondary maximum contaminant level
SOC	synthetic organic compound
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TF	trickling filter(s)

TIC	tentatively identified compound
TMP	transmembrane pressure
TOC	total organic carbon
TR	trace
ug/L, µg/L	micrograms per liter
µmhos/cm, µm/cm, um/cm	micromhos per centimeter
UPS	uninterruptible power supply
UR	unregulated chemicals requiring monitoring
UV	ultraviolet (light exposure or irradiation)
UV/AOP	ultraviolet/advanced oxidation process
UVF	ultraviolet/advanced oxidation process feed
UVP	ultraviolet/advanced oxidation process product
UV%T, %UVT	percent UV Transmissivity
VFD	variable frequency drive
VOC	volatile organic compound
WF-21	Water Factory 21
WRMS	Water Resources Management System

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APPENDICES

Appendix	Title
A	Water Quality Requirements for Groundwater Replenishment System and Final Product Water Quality Data, January 1 through December 31, 2018
B	Laboratory Methods of Analysis
C	Water Quality Constituents with Laboratory Methods
D	Operator Certifications, Operations and Maintenance Summary and Calibration Records
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G	Groundwater Quality Data at the Talbert Barrier
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Appendix A

Water Quality Requirements for

Groundwater Replenishment System

and

Final Product Water Quality Data

January 1 through December 31, 2018

Advanced Water Treatment Facility

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

WATER QUALITY -- GWRS PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1])
AVERAGES FOR ALL AVAILABLE DATA FOR 2018[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2018 Quarter 1	2018 Quarter 2	2018 Quarter 3	2018 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Total Purified Recycled Water Flow	Plant Monitoring	N/A	MGD	95.99	93.90	62.99	92.96				≤ 100
REQUIRED REVERSE OSMOSIS PRODUCT MONITORING[5]											
Ultraviolet Transmittance (UV%/T) at 254	Plant Monitoring	0.10%	%	97.8%	97.1%	97.9%	97.3%				>90%
Turbidity	Plant Monitoring	N/A	NTU	0.04	0.03	0.05	0.07		5		<0.2/0.5[6]
BIOLOGICAL											
E. Coli (Colilert - MPN/100mL) (ECOLIQ)	9223B	1	MPN	ND	ND	ND	ND				N/A
E. Coli (Membrane Filtration - CFU/100ml) (ECOLI)	M-TEC	1	CFU/100	NR	NR	ND	NR				
Fecal Coliform (Mult. Tube Fermentation) (FCOLIM)	9221E	1.1	MPN	NR	NR	ND	ND				
Total Coliform (Colilert - MPN/100mL) (TCOLIQ)	9223B	1	MPN	ND	ND	0.70	0.11				2.2
Total Coliform (Membrane Filtration-CFU/100ml) (TCOLIF)	9222B	1	CFU/100	NR	NR	0.7	NR				
Total Coliform (Mult. Tube Fermentation) (TCOLIM)	9221B	1.1	MPN	NR	NR	ND	ND				
INORGANIC											
Aggressive Index (AI)	UNKWQAN		A.I.	11.7	11.8	11.7	11.8				>11.0
Alkalinity-Phenolphthalein (ALKPHE)	2320B	1	mg/L	0.25	ND	0.73	0.32				N/A
Aluminum (Al)	X200.8	1	ug/L	1.1	ND	2.0	1.5	1,000	200		200[7]
Ammonia Nitrogen (NH3-N)	350.1	0.1	mg/L	0.11	0.34	0.18	0.15				N/A
Antimony (Sb)	X200.8	1	ug/L	ND	ND	ND	ND	6			6
Apparent Color (unfiltered) (APCOLR)	2120B	3	UNITS	ND	ND	ND	ND		15		15
Arsenic (As)	X200.8	1	ug/L	ND	ND	ND	ND	10			10
Asbestos (ASBESTOS)	100.2	0.2	MFL	ND	ND	ND	ND	7			7
Barium (Ba)	X200.8	1	ug/L	ND	ND	ND	ND	1,000			1,000
Beryllium (Be)	X200.8	1	ug/L	ND	ND	ND	ND	4			4
Bicarbonate (as CaCO3) (HCO3Ca)	2320B	1	mg/L	38.85	37.17	38.21	38.12				N/A
Bicarbonate (as HCO3) (HCO3)	UNKWQAN	1.2	mg/L	47.36	45.32	46.57	46.49				N/A
Boron (B)	X200.7	0.1	mg/L	0.21	0.23	0.24	0.26			1	N/A
Bromate (BrO3)	300.1B	5	ug/L	ND	ND	ND	ND	10			10
Bromide (Br)	300.1B / X1-300.0	0.01 - 0.1	mg/L	0.014	0.01	0.011	ND				N/A
Cadmium (Cd)	X200.8	1	ug/L	ND	ND	ND	ND	5			5
Calcium (Ca)	X200.7	0.5	mg/L	14.01	13.45	13.80	13.74				N/A
Calcium Hardness (CaHRD)	X200.7	0.25	mg/L	35.00	33.62	34.51	34.29				N/A
Carbonate (as CaCO3) (CO3Ca)	2320B	1	mg/L	0.40	ND	1.36	0.54				N/A
Cation-Anion meq balance (CATANI)	UNKWQAN		RATIO	-10.40	5.33	-4.44	0.10				N/A
Chlorate (CLO3)	300.1B	10	ug/L	ND	ND	12.7	ND			800	N/A
Chloride (Cl)	X1-300.0	0.5	mg/L	4.1	5.9	6.0	5.0		250		55[8]
Chlorite (CLO2)	300.1B	10	ug/L	ND	ND	ND	ND	1,000			1,000
Chromium (Cr)	X200.8	1	ug/L	ND	ND	ND	ND	50			50

WATER QUALITY -- GWRS PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1])
AVERAGES FOR ALL AVAILABLE DATA FOR 2018[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2018 Quarter 1	2018 Quarter 2	2018 Quarter 3	2018 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Cobalt (Co)	X200.8	1	ug/L	ND	ND	ND	ND				N/A
Copper (Cu)	X200.8	1	ug/L	ND	ND	ND	ND		1,000	1,300	1,000[9]
Corrosivity (CORROS)	2330B	-100	S.I.	-0.79	-0.79	-0.57	-0.78				N/A
Cyanide (CN)	X1-335.4	5	ug/L	ND	ND	ND	ND	150			150
Electrical Conductivity (EC)	2510B	1	um/cm	93.23	102.46	103.96	94.83		900		900
Fluoride (F)	X1-300.0	0.1	mg/L	ND	ND	ND	ND	2			2
Free Chlorine (FRCL2)	4500CLF	0.1	mg/L	ND	ND	ND	ND				N/A
Free Res. Chlorine - Amperometric Method (FRCL2A)	4500CLD	0.1	mg/L	ND	ND	ND	ND				N/A
Gadolinium (Gd)	X200.8	10	ng/L	NR	ND	NR	ND				N/A
Hexavalent Chromium (CrVI)	X1-218.6 / X1-218.7	0.2	ug/L	ND	ND	ND	ND	10			10
Hydrogen Peroxide (H2O2)	H2O2	0.1	mg/L	2.21	2.06	1.91	2.23				N/A
Hydroxide (as CaCO3) (OHCa)	2320B	1	mg/L	ND	ND	ND	ND				N/A
Iron (Fe)	X200.7	5	ug/L	ND	ND	ND	ND		300		300
Lead (Pb)	X200.8	1	ug/L	ND	ND	ND	ND			15	15[10]
Magnesium (Mg)	X200.7	0.5	mg/L	ND	ND	ND	ND				N/A
Manganese (Mn)	X200.8	1	ug/L	ND	ND	ND	ND		50	500	50[11]
Manganese (dissolved) (Mn-DIS)	X200.8	1	ug/L	ND	ND	ND	ND				N/A
Mercury (Hg)	X200.8	1	ug/L	ND	ND	ND	ND	2			2
Molybdenum (Mo)	X200.8	1	ug/L	ND	ND	ND					N/A
Nickel (Ni)	X200.8	1	ug/L	ND	ND	ND	ND	100			100
Nitrate (NO3)	4500NO3F / UNKWQAN	0.4	mg/L	2.93	4.04	4.33	3.11	45			45
Nitrate + Nitrite Nitrogen (NO3NO2-N)	4500NO3F	0.1	mg/L	0.70	0.95	1.02	0.74	10			10[12]
Nitrate Nitrogen (NO3-N)	4500NO3F	0.1	mg/L	0.66	0.91	0.97	0.70	10			3[12]
Nitrite (NO2)	UNKWQAN	0.007	mg/L	0.138	0.152	0.153	0.117				N/A
Nitrite Nitrogen (NO2-N)	4500NO3F	0.002	mg/L	0.042	0.046	0.046	0.036	1			1
Odor Range High (ODORHI)	2150B	0	TON	ND	ND	ND	ND				N/A
Odor Range Low (ODORLO)	2150B	0	TON	ND	ND	ND	ND				N/A
Organic Nitrogen (ORG-N)	X1-351.2	0.1	mg/L	0.013	ND	0.027	0.013				N/A
Perchlorate (CLO4)	332.0	2.5	ug/L	ND	ND	ND	ND	6			6
pH (pH)	4500H+B	1	UNITS	7.93	7.99	8.16	7.93				6 - 9
Phosphate Phosphorus (orthophosphate) (PO4-P)	365.1	0.01	mg/L	ND	ND	ND	ND				N/A
Potassium (K)	X200.7	0.5	mg/L	ND	0.30	0.23	ND				N/A
Selenium (Se)	X200.8	1	ug/L	ND	ND	ND	ND	50			50
Silica (SIO2)	4500SIOC	1	mg/L	ND	ND	1.2	ND				N/A
Silver (Ag)	X200.8	1	ug/L	ND	ND	ND	ND		100		100
Sodium (Na)	X200.7	0.5	mg/L	4.67	6.65	6.97	5.80				45[13]
Sulfate (SO4)	X1-300.0	0.5	mg/L	0.42	ND	0.42	0.35		250		100[14]
Surfactants (MBAS)	5540C	0.02	mg/L	ND	ND	ND	ND		0.5		0.5
Thallium (Tl)	X200.8	1	ug/L	ND	ND	ND	ND	2			2

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Parameters[3]	Methods	Reportable Detection Limit	Units	2018 Quarter 1	2018 Quarter 2	2018 Quarter 3	2018 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Threshold Odor Number (Median) (ODOR)	2150B	0	TON	ND	ND	ND	ND		3		3
Title 22 Cation-Anion Balance (T22CAB)	UNKWQAN		meq/L	-10.18	5.56	-4.15	0.41				N/A
Title 22 Total Anions (T22ANI)	UNKWQAN		meq/L	0.87	0.88	1.03	0.98				N/A
Title 22 Total Cations (T22CAT)	UNKWQAN		meq/L	0.89	0.98	0.96	0.94				N/A
Tot. Res. Chlorine - Amperometric Method (TOTCLA)	4500CLD	0.1	mg/L	ND	ND	ND	ND				N/A
Total Alkalinity (as CaCO3) (TOTALK)	2320B	1	mg/L	39.15	37.17	39.48	38.57				N/A
Total Anions (TOTANI)	UNKWQAN		meq/L	0.87	0.88	1.04	0.98				N/A
Total Cations (TOTCAT)	UNKWQAN		meq/L	0.78	0.93	0.99	0.98				N/A
Total Chlorine (TOTCL2)	4500CLF	0.1	mg/L	0.80	1.70	1.30	1.70				N/A
Total Dissolved Solids (TDS)	2540C	1 - 2.5	mg/L	50.0	54.6	55.8	49.8		500		500[15]
Total Hardness (as CaCO3) (TOTHRD)	X200.7	1	mg/L	34.50	34.43	32.83	34.63				240[16]
Total Kjeldahl Nitrogen (TKN)	X1-351.2	0.2	mg/L	0.06	0.16	0.12	0.06				N/A
Total Nitrogen (TOT-N)	X1-351.2	0.3	mg/L	0.80	1.17	1.18	0.84				5
Total Organic Carbon (Unfiltered) (TOC)	5310C	0.05	mg/L	0.10	0.11	0.10	0.09				0.5[17]
Trivalent Chromium (CrIII)	X200.8	1	ug/L	ND	ND	ND	ND				N/A
Vanadium (V)	X200.8	1	ug/L	ND	ND	ND	ND			50	N/A
Zinc (Zn)	X200.8	1	ug/L	ND	ND	ND	1.9		5,000		5,000
ORGANIC											
1,1,1,2-Tetrachloroethane (1112PC)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
1,1,1-Trichloroethane (111TCA)	524.2 / 551.1	0.1 - 0.5	ug/L	ND	ND	ND	ND	200			200
1,1,1-Trichloropropanone (111TCP)	551.1	0.1	ug/L	ND	ND	ND	ND				N/A
1,1,2,2-Tetrachloroethane (1122PC)	524.2	0.5	ug/L	ND	ND	ND	ND	1			1
1,1,2-Trichloroethane (112TCA)	524.2 / 551.1	0.1 - 0.5	ug/L	ND	ND	ND	ND	5			5
1,1-Dichloro-2-propanone (11DC2P)	551.1	0.1	ug/L	ND	0.1	0.1	0.1				N/A
1,1-Dichloroethane (11DCA)	524.2	0.5	ug/L	ND	ND	ND	ND	5			5
1,1-Dichloroethene (11DCE)[18]	524.2	0.5	ug/L	ND	ND	ND	ND	6			6
1,1-Dichloropropene (11DCP)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
1,2,3-Trichlorobenzene (123TCB)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
1,2,3-Trichloropropane (123TCP)	14DIOX / 504.1 / 524.2 / 524M-TCP / 551.1	0.005 - 0.5	ug/L	ND	ND	ND	ND	0.005			N/A
1,2,4-Trichlorobenzene (124TCB)	524.2 / 625	0.5 - 10	ug/L	ND	ND	ND	ND	5			5
1,2,4-Trimethylbenzene (124TMB)	524.2	0.5	ug/L	ND	ND	ND	ND			330	N/A
1,2-Dibromo-3-chloropropane (DBCP)[19]	14DIOX / 504.1 / 524.2 / 524M-TCP / 551.1	0.01 - 0.5	ug/L	ND	ND	ND	ND	0.2			0.2
1,2-Dibromoethane (EDB)[20]	14DIOX / 504.1 / 524.2 / 524M-TCP / 551.1	0.005 - 0.5	ug/L	ND	ND	ND	ND	0.05			0.05
1,2-Dichlorobenzene (12DCB)	524.2 / 625	0.5 - 10	ug/L	ND	ND	ND	ND	600			600
1,2-Dichloroethane (12DCA)	524.2	0.5	ug/L	ND	ND	ND	ND	0.5			0.5
1,2-Dichloropropane (12DCP)	524.2	0.5	ug/L	ND	ND	ND	ND	5			5

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Parameters[3]	Methods	Reportable Detection Limit	Units	2018 Quarter 1	2018 Quarter 2	2018 Quarter 3	2018 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
1,2-Diphenylhydrazine (12DPH)	625	10 - 21	ug/L	ND	ND	ND	ND				N/A
1,3,5-Trimethylbenzene (135TMB)	524.2	0.5	ug/L	ND	ND	ND	ND			330	N/A
1,3-Dichlorobenzene (13DCB)	524.2 / 625	0.5 - 10	ug/L	ND	ND	ND	ND			600	N/A
1,3-Dichloropropane (13DCP)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
1,4-Dichlorobenzene (14DCB)	524.2 / 625	0.5 - 10	ug/L	ND	ND	ND	ND	5			5
1,4-Dioxane (14DIOX)	14DIOX	1	ug/L	ND	ND	ND	ND			1	N/A
17a-Estradiol (aESTRA)	CEC	1	ng/L	ND	ND	ND	ND				N/A
17a-Ethynylestradiol (aETEST)[21]	CEC	2	ng/L	ND	ND	ND	ND				N/A
17b-Estradiol (bESTRA)	CEC	2	ng/L	ND	ND	ND	ND				N/A
2,2-Dichloropropane (22DCP)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1613B	4.7 - 4.8	pg/L	ND	ND	ND	ND	30			30
2,4,5-Trichlorophenol (245TCP)	625	10 - 21	ug/L	ND	ND	ND	ND				N/A
2,4,6-Trichlorophenol (246TCP)	625	10 - 21	ug/L	ND	ND	ND	ND				N/A
2,4-Dichlorophenol (24DCPH)	625	10	ug/L	ND	ND	ND	ND				N/A
2,4-Dimethylphenol (24DMP)	625	10 - 21	ug/L	ND	ND	ND	ND			100	N/A
2,4-Dinitrophenol (24DNP)	625	20 - 41	ug/L	ND	ND	ND	ND				N/A
2,4-Dinitrotoluene (24DNT)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
2,6-Dinitrotoluene (26DNT)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
2-Chloroethylvinyl ether (2ClEVE)	14DIOX	1	ug/L	ND	ND	ND	ND				N/A
2-Chloronapthalene (2ClNAP)	625	10	ug/L	ND	ND	ND	ND				N/A
2-Chlorophenol (2ClPNL)	625	10	ug/L	ND	ND	ND	ND				N/A
2-Chlorotoluene (2CLTOL)	524.2	0.5	ug/L	ND	ND	ND	ND			140	N/A
2-Methyl napthalene (2MNAP)	625	10	ug/L	ND	ND	ND	ND				N/A
2-Methyl-4,6-Dinitrophenol (2MDNP)	625	20 - 21	ug/L	ND	ND	ND	ND				N/A
2-Methylphenol (oCRESL)	625	10	ug/L	ND	ND	ND	ND				N/A
2-Nitroaniline (oNTANL)	625	10 - 21	ug/L	ND	ND	ND	ND				N/A
2-Nitrophenol (2NPNL)	625	10	ug/L	ND	ND	ND	ND				N/A
3- & 4-Methylphenol (mpCRESL)	625	10	ug/L	ND	ND	ND	ND				N/A
3,3'-Dichlorobenzidine (DCBZDE)	625	20 - 21	ug/L	ND	ND	ND	ND				N/A
3-Nitroaniline (mNTANL)	625	20 - 21	ug/L	ND	ND	ND	ND				N/A
4-Androstene-3, 17-dione (ANDROS)	CEC	2	ng/L	ND	ND	ND	ND				N/A
4-Bromophenyl phenyl ether (4BrPPE)	625	10	ug/L	ND	ND	ND	ND				N/A
4-Chloro-3-methylphenol (43CMP)[22]	625	20 - 21	ug/L	ND	ND	ND	ND				N/A
4-Chloroaniline (pClANL)	625	10	ug/L	ND	ND	ND	ND				N/A
4-Chlorophenyl phenyl ether (4ClPPE)	625	10	ug/L	ND	ND	ND	ND				N/A
4-Chlorotoluene (4CLTOL)	524.2	0.5	ug/L	ND	ND	ND	ND			140	N/A
4-Isopropyltoluene (4IPTOL)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
4-Nitroaniline (pNTANL)	625	20 - 21	ug/L	ND	ND	ND	ND				N/A
4-Nitrophenol (4NPNL)	625	20 - 21	ug/L	ND	ND	ND	ND				N/A

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Parameters[3]	Methods	Reportable Detection Limit	Units	2018 Quarter 1	2018 Quarter 2	2018 Quarter 3	2018 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
4-n-Octylphenol (4nOCPH)	CEC	0.2	ug/L	ND	ND	ND	ND				N/A
4-tert-Octylphenol (4tOCPH)	CEC	0.2	ug/L	ND	ND	ND	ND				N/A
Acetaldehyde (ACEALD)	556	2	ug/L	ND	3.5	4.2	ND				N/A
Acetone (ACETNE)	524.2	10 - 20	ug/L	ND	ND	ND	ND				N/A
Aniline (ANLN)	625	10	ug/L	ND	ND	ND	ND				N/A
Aspartame (ASPATM)	CEC	100	ng/L	ND	ND	ND	ND				N/A
Atenolol (ATENOL)	CEC	5	ng/L	ND	ND	ND	ND				N/A
Benzaldehyde (BENALD)	556	2	ug/L	ND	ND	ND	ND				N/A
Benzene (BENZ)	524.2	0.5	ug/L	ND	ND	ND	ND	1			1
Benzidine (BNZDE)	625	40 - 41	ug/L	ND	ND	ND	ND				N/A
Benzoic Acid (BNZACD)	625	20 - 21	ug/L	ND	ND	ND	ND				N/A
Benzyl Alcohol (BNZALC)	625	20 - 21	ug/L	ND	ND	ND	ND				N/A
bis (2-chloroethoxy) methane (B2CEM)	625	10	ug/L	ND	ND	ND	ND				N/A
bis (2-chloroethyl) ether (B2CLEE)	524.2 / 625	5 - 25	ug/L	ND	ND	ND	ND				N/A
bis (2-chloroisopropyl) ether (B2CIPE)	625	10	ug/L	ND	ND	ND	ND				N/A
Bisphenol A (BisPHA)	CEC	0.2	ug/L	ND	ND	ND	ND				N/A
Bromobenzene (BRBENZ)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Bromochloroacetic Acid (BCAA)	552.2	1	ug/L	ND	ND	ND	ND				N/A
Bromochloroacetonitrile (BCAN)	551.1	0.1	ug/L	0.4	0.4	0.4	0.2				N/A
Bromochloromethane (CH2BrC)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Bromodichloroacetic Acid (BDCAA)	552.2	1	ug/L	ND	ND	ND	ND				N/A
Bromodichloromethane (CHBrCl)[23]	524.2 / 551.1	0.1 - 0.5	ug/L	0.90	1.07	1.40	0.96				N/A
Bromoform (CHBr3)	524.2 / 551.1	0.1 - 0.5	ug/L	ND	ND	ND	ND				N/A
Bromomethane (CH3Br)[24]	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Carbon Disulfide (CS2)	524.2	0.5	ug/L	ND	ND	ND	ND			160	N/A
Carbon tetrachloride (CCl4)	524.2 / 551.1	0.1 - 0.5	ug/L	ND	ND	ND	ND	0.5			0.5 ug/L
Chlorobenzene (CLBENZ)[25]	524.2	0.5	ug/L	ND	ND	ND	ND	70			70 ug/L
Chlorodibromoacetic Acid (CDBAA)	552.2	1	ug/L	ND	ND	ND	ND				N/A
Chlorodifluoromethane (FREN22)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Chloroethane (ClETHA)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Chloroform (CHCl3)	524.2 / 551.1	0.1 - 0.5	ug/L	1.50	1.93	2.35	1.93				N/A
Chloromethane (CH3Cl)[26]	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Chloropicrin (ClPICR)	551.1	0.1	ug/L	ND	ND	ND	ND			50	N/A
cis-1,2-Dichloroethene (c12DCE)[27]	524.2	0.5	ug/L	ND	ND	ND	ND	6			6
cis-1,3-Dichloropropene (c13DCP)	524.2	0.5	ug/L	ND	ND	ND	ND	0.50			0.5
Crotonaldehyde (CRTALD)	556	2	ug/L	ND	ND	ND	ND				N/A
Cyclohexanone (CYCHXN)	556	2	ug/L	ND	ND	ND	ND				N/A
Dacthal Acid Metabolites (tDCPA) (DCPA-Dacthal)	515.3 / 515.4	0.1 - 0.25	ug/L	ND	ND	ND	ND				N/A
Decanal (DECNAL)	556	2	ug/L	ND	ND	ND	ND				N/A

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Parameters[3]	Methods	Reportable Detection Limit	Units	2018 Quarter 1	2018 Quarter 2	2018 Quarter 3	2018 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Dibenzofuran (DBFUR)	625	10	ug/L	ND	ND	ND	ND				N/A
Dibromoacetic Acid (DBAA)[28]	552.2	1	ug/L	ND	ND	ND	ND				60, total HAA5
Dibromoacetonitrile (DBAN)	551.1	0.1	ug/L	ND	ND	0.2	ND				N/A
Dibromochloromethane (CHBr2C)[29]	524.2 / 551.1	0.1 - 0.5	ug/L	0.08	0.07	0.13	0.05				N/A
Dibromomethane (CH2Br2)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Dichloroacetic Acid (DCAA)[28]	552.2	1	ug/L	ND	ND	ND	ND				60, total HAA5
Dichloroacetonitrile (DCAN)	551.1	0.1	ug/L	0.5	0.8	0.8	0.6				N/A
Dichlorodifluoromethane (CCl2F2)	524.2	0.5	ug/L	ND	ND	ND	ND			1,000	N/A
Diclofenac (DICLFN)	CEC	5	ng/L	ND	ND	ND	ND				N/A
Diethylstilbestrol (DESTBL)	CEC	2	ng/L	ND	ND	ND	ND				N/A
Diisopropyl ether (DIPE)	524.2	1	ug/L	ND	ND	ND	ND				N/A
Dilantin (DILANT)	CEC	10	ng/L	ND	ND	ND	ND				N/A
Endosulfan II (ENDOII)[30]	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Epitestosterone (cis-Testosterone) (EPITES)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Equilin (EQUILN)	CEC	5	ng/L	ND	ND	ND	ND				N/A
Estriol (ESTRIO)	CEC	2	ng/L	ND	ND	ND	ND				N/A
Estrone (ESTRON)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Ethyl tert-butyl ether (ETBE)	524.2	1	ug/L	ND	ND	ND	ND				N/A
Ethylbenzene (EtBENZ)	524.2	0.5	ug/L	ND	ND	ND	ND	300			300
Fluoxetine (FLUXET)	CEC	5 - 10	ng/L	ND	ND	ND	ND				N/A
Formaldehyde (FORALD)	556	2	ug/L	13	18	21	19			100	N/A
Freon 123a (FR123A)	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Glyoxal (GLYOXL)	556	2	ug/L	ND	ND	ND	ND				N/A
HCH-alpha(Alpha-BHC) (BHCa)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND			0.015	N/A
HCH-beta(Beta-BHC) (BHCb)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND			0.025	N/A
HCH-delta(Delta-BHC) (BHCd)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Heptanal (HEPNAL)	556	2 - 5	ug/L	ND	ND	ND	ND				N/A
Hexachlorobutadiene (HClBut)	524.2 / 625	0.5 - 10	ug/L	ND	ND	ND	ND				N/A
Hexachloroethane (HCE)	625	10	ug/L	ND	ND	ND	ND				N/A
Hexanal (HEXNAL)	556	2	ug/L	ND	ND	ND	ND				N/A
Iohexol (IOHEXL)	CEC	20	ng/L	ND	ND	ND	ND				N/A
Iopromide (IOPRMD)	CEC	10	ng/L	ND	ND	ND	ND				N/A
Isophorone (IPHOR)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Isopropylbenzene (ISPBNZ)	524.2	0.5	ug/L	ND	ND	ND	ND			770	N/A
Linuron (LINURN)	532 / CEC	0.005	ug/L	ND	ND	ND	ND				N/A
m,p-Xylene (mp-XYL)[35]	524.2	0.5	ug/L	ND	ND	ND	ND	1,750			1750[35]
Meprobamate (MEPROB)	CEC	5	ng/L	ND	ND	ND	ND				N/A
Methyl Ethyl Ketone (MEK)	524.2	5	ug/L	ND	ND	ND	ND				N/A
Methyl Isobutyl Ketone (MIBK)	524.2	5	ug/L	ND	ND	ND	ND			120	N/A

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Methyl tert-butyl ether (MTBE)[31]	524.2	0.2	ug/L	ND	ND	ND	ND	13	5		5[31]
Methylene Chloride (CH2Cl2)[32]	524.2	0.5	ug/L	ND	0.25	ND	0.11	5			5
Methylglyoxal (MGLYOX)	556	2	ug/L	ND	ND	ND	ND				N/A
Methylisothiocyanate (MITC)	14DIOX	0.1	ug/L	ND	0.07	0.80	ND			190	N/A
Metolachlor (METOCL)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Monobromoacetic Acid (MBAA)[28]	552.2	1	ug/L	ND	ND	ND	ND				60, total HAA5
Monochloroacetic Acid (MCAA)[28]	552.2	1	ug/L	ND	ND	ND	ND				60, total HAA5
Naphthalene (NAP)	524.2 / 525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND			17	N/A
Naproxen (NAPRXN)	CEC	5	ng/L	ND	ND	ND	ND				N/A
n-Butylbenzene (nBBENZ)	524.2	0.5	ug/L	ND	ND	ND	ND			260	N/A
Neotam (NEOTAM)	CEC	10	ng/L	ND	ND	ND	ND				N/A
Nitrobenzene (NBENZ)	625	20 - 21	ug/L	ND	ND	ND	ND				N/A
N-Nitrosodiethylamine (NDEA)	NDMA-LOW	2	ng/L	NR	NR	NR	ND				
n-Nitrosodimethylamine (NDMA)	NDMA-LOW	2	ng/L	0.66	2.37	1.42	1.88			10	N/A
n-Nitroso-di-n-propylamine (NDPA)	625	2 - 10,000	ng/L	ND	ND	ND	ND			10	N/A
n-Nitrosodiphenylamine (NDPhA)	625	10,000	ng/L	ND	ND	ND	ND				N/A
N-Nitrosomorpholine (NMOR)	NDMA-LOW	2 - 10	ng/L	ND	ND	ND	ND				N/A
Nonanal (NONNAL)	556	2	ug/L	ND	ND	ND	ND				N/A
Nonylphenol (NONYPH)	CEC	0.2	ug/L	ND	ND	ND	ND				N/A
o-Xylene (o-XYL)[35]	524.2	0.5	ug/L	ND	ND	ND	ND	1,750			1750[35]
para-Chlorobenzene sulfonic acid (pCBSA)	CEC	200	ng/L	ND	ND	ND	ND				N/A
PCB-1016 (PCB16)[33]	508	0.1 - 0.5	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1221 (PCB21)[33]	508	0.1 - 0.5	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1232 (PCB32)[33]	508	0.1 - 0.5	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1242 (PCB42)[33]	508	0.1 - 0.5	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1248 (PCB48)[33]	508	0.1 - 0.5	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1254 (PCB54)[33]	508	0.1 - 0.5	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1260 (PCB60)[33]	508	0.1 - 0.5	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCBs, Total (TOTPCB)[33]	508	0.5	ug/L	NR	ND	ND	ND	0.5[33]			0.5[33]
Perfluoro butane sulfonic acid (PFBS)	537	4	ng/L	ND	ND	ND	ND				N/A
Perfluoro heptanoic acid (PFHpA)	537	4	ng/L	ND	ND	ND	ND				N/A
Perfluoro hexane sulfonic acid (PFHxS)	537	4	ng/L	ND	ND	ND	ND				N/A
Perfluoro nonanoic acid (PFNA)	537	4	ng/L	ND	ND	ND	ND				N/A
Perfluoro octane sulfonic acid (PFOS)	537	4	ng/L	ND	ND	ND	ND			13	N/A
Perfluoro octanoic acid (PFOA)	537	4	ng/L	ND	ND	ND	ND			14	N/A
Perfluoro-2-propoxypropanoic acid (GenX)	537	4	ng/L	NR	NR	ND	ND				N/A
Perfluorodecanoic acid (PFDA)	537	4	ng/L	NR	NR	ND	ND				N/A
Perfluorododecanoic acid (PFDoA)	537	4	ng/L	NR	NR	ND	ND				N/A
Perfluorohexanoic acid (PFHxA)	537	4	ng/L	NR	NR	ND	ND				N/A

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Parameters[3]	Methods	Reportable Detection Limit	Units	2018 Quarter 1	2018 Quarter 2	2018 Quarter 3	2018 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Perfluorotetradecanoic acid (PFTA)	537	4	ng/L	NR	NR	ND	ND				N/A
Perfluorotridecanoic acid (PFTrDA)	537	4	ng/L	NR	NR	ND	ND				N/A
Perfluoroundecanoic acid (PFUnA)	537	4	ng/L	NR	NR	ND	ND				N/A
PFOA + PFOS (PFOAOS)	UNKWQAN	4	ng/L	ND	ND	ND	ND				N/A
Phenol (PHENOL)	625	10	ug/L	ND	ND	ND	ND			4,200	N/A
PhenylPhenol (PHNYPH)	CEC	0.2	ug/L	ND	ND	ND	ND				N/A
Progesterone (PRGSTR)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Propylbenzene (PRPBNZ)	524.2	0.5	ug/L	ND	ND	ND	ND			260	N/A
sec-Butylbenzene (sBBENZ)	524.2	0.5	ug/L	ND	ND	ND	ND			260	N/A
Styrene (STYR)	524.2	0.5	ug/L	ND	ND	ND	ND	100			100
Sucralose (SUCRAL)	CEC	100	ng/L	ND	ND	ND	ND				N/A
Sum of five Haloacetic Acids (HAA5)	UNKWQAN	1	ug/L	ND	ND	ND	ND	60			60
Sum of nine Haloacetic Acids (HAA9)	UNKWQAN	1	ug/L	NR	ND	ND	ND				N/A
Sum of Six Brominated Haloacetic Acids (HAA6Br)	UNKWQAN	1	ug/L	NR	ND	ND	ND				N/A
Terbufos Sulfone (TERSUL)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Tert-amyl methyl ether (TAME)	524.2	1	ug/L	ND	ND	ND	ND				N/A
tert-butyl alcohol (TBA)	524.2	2	ug/L	ND	ND	ND	ND			12	N/A
tert-Butylbenzene (tBBENZ)	524.2	0.5	ug/L	ND	ND	ND	ND			260	N/A
Testosterone (trans-Testosterone) (TESTOR)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Tetrabromobisphenol A (TBBISA)	CEC	0.2	ug/L	ND	ND	ND	ND				N/A
Tetrachloroethene (PCE)[34]	524.2 / 551.1	0.1 - 0.5	ug/L	ND	ND	ND	ND	5			5
Toluene (TOLU)	524.2	0.5	ug/L	ND	ND	ND	ND	150			150
Total 1,3-Dichloropropene (x13DCP)	524.2	0.5	ug/L	ND	ND	ND	ND	0.5			0.5
Total Trihalomethanes (TTHMs)	524.2 / 551.1	0.1 - 0.5	ug/L	2.50	3.07	3.90	2.88	80			80
Total Xylenes (m,p,&o) (TOTALX)[35]	524.2	0.5	ug/L	ND	ND	ND	ND	1,750			1750[35]
trans-1,2 Dichloroethene (t12DCE)[36]	524.2	0.5	ug/L	ND	ND	ND	ND	10			10
trans-1,3-Dichloropropene (t13DCP)	524.2	0.5	ug/L	ND	ND	ND	ND	0.50			0.5
Tribromoacetic Acid (TBAA)	552.2	1	ug/L	ND	ND	ND	ND				N/A
Trichloroacetic Acid (TCAA)[28]	552.2	1	ug/L	ND	ND	ND	ND				60, total HAA5
Trichloroacetonitrile (TCAN)	551.1	0.1	ug/L	ND	ND	ND	ND				N/A
Trichloroethene (TCE)[37]	524.2 / 551.1	0.1 - 0.5	ug/L	ND	ND	ND	ND	5			5
Trichlorofluoromethane (Freon 11) (CCl3F)	524.2	0.5	ug/L	ND	ND	ND	ND	150			150
Trichlorotrifluoroethane (Freon 113) (Cl3F3E)[38]	524.2	0.5	ug/L	ND	ND	ND	ND	1,200			1,200
Trimethoprim (TRIMTP)	CEC	5 - 10	ng/L	ND	ND	ND	ND				N/A
Tris-2-chlorethyl phosphate (TCEP)	CEC	5	ng/L	ND	ND	ND	ND				N/A
Vinyl chloride (VNYLCL)	524.2	0.5	ug/L	ND	ND	ND	ND	0.5			0.5
RADIOLOGICALS											
Gross Alpha Excluding Uranium (TOTa-U)	UNKWQAN	DLR[40], 3 pCi/L	pCi/L	ND	0.60	ND	ND	15			15

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Natural Uranium (NTUr)	908.0	DLR[40], 1 pCi/L	pCi/L	ND	ND	ND	ND	20			20
Natural Uranium Counting Error (NTUrCE)	908.0	0.342 - 0.47	pCi/L	0.64	0.26	ND	ND				N/A
Radium 226 + Radium 228 (Ra6Ra8)	UNKWQAN	DLR[40], 1 pCi/L	pCi/L	0.02	0.04	ND	0.06	5			5
Radium 226 + Radium 228 Counting Error (Ra68CE)	UNKWQAN	0.383 - 0.506	pCi/L	0.71	0.57	ND	0.76				N/A
Total Alpha (TOTa)	7110C	1.11 - 1.28	pCi/L	ND	0.60	ND	ND				N/A
Total Alpha Counting Error (TOTaCE)	7110C	1.11 - 1.28	pCi/L	0.76	1.18	ND	ND				N/A
Total Beta (TOTb)	900.0	DLR[40], 4 pCi/L	pCi/L	0.41	0.25	0.78	2.01	50			50
Total Beta Counting Error (TOTbCE)	900.0	1.17 - 1.62	pCi/L	1.01	0.92	0.94	1.43				N/A
Total Radium 226 (TRa226)	903.0	0.274 - 0.322	pCi/L	0.02	0.04	ND	0.03				N/A
Total Radium 226 Counting Error (TRa6CE)	903.0	0.274 - 0.322	pCi/L	0.08	0.07	ND	0.08				N/A
Total Radium 228 (TRa228)	RA-05	0.383 - 0.506	pCi/L	ND	ND	ND	0.02				N/A
Total Radium 228 Counting Error (TRa8CE)	RA-05	0.383 - 0.506	pCi/L	0.63	0.50	ND	0.67				N/A
Total Strontium-90 (TS90)	905.0	DLR[40], 2 pCi/L	pCi/L	0.34	0.18	0.46	ND	8			8
Total Strontium-90 Counting Error (TS90CE)	905.0	0.395 - 0.546	pCi/L	0.25	0.24	0.35	ND				N/A
Total Tritium (TTr)	906.0	DLR[40], 1,000 pCi/L	pCi/L	82.05	238.75	150.48	107.26	20,000			20,000
Total Tritium Counting Error (TTrCE)	906.0	434	pCi/L	271.00	273.25	271.50	269.40				N/A
SEMI-ORGANIC											
1-Naphthol (NPTHOL)	531	5	ug/L	ND	ND	ND	ND				N/A
2,4,5-T (245T)	515.3	0.2	ug/L		ND	ND	ND				N/A
2,4,5-TP (Silvex) (245TP)	515.3 / 515.4	0.2 - 0.5	ug/L	ND	ND	ND	ND	50			50
2,4-DB (24DB)	515.3	2	ug/L		ND	ND	ND				N/A
2,4-Dichlorophenoxyacetic Acid (24D)	515.3 / 515.4	0.4 - 0.5	ug/L	ND	ND	ND	ND	70			70
3,5-Dichlorobenzoic Acid (35DBA)	515.3	1	ug/L		ND	ND	ND				N/A
3-Hydroxycarbofuran (HYDCFR)	531	2	ug/L	ND	ND	ND	ND				N/A
4,4'-DDD (DDD)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
4,4'-DDE (DDE)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
4,4'-DDT (DDT)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Acenaphthene (ACNAPE)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Acenaphthylene (ACENAP)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Acetaminophen (ACTMNP)	CEC	5	ng/L	ND	ND	ND	ND				N/A
Acetochlor (ACETOC)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Acifluorfen (ACIFEN)	515.3 / 515.4	0.4 - 0.5	ug/L	ND	ND	ND	ND				N/A
Alachlor (ALACHL)	525.2	0.1	ug/L	ND	ND	ND	ND	2			2
Aldicarb (ALDI)	531	1	ug/L	ND	ND	ND	ND			7	N/A
Aldicarb sulfone (ALDISN)	531	2	ug/L	ND	ND	ND	ND				N/A
Aldicarb sulfoxide (ALDISX)	531	2	ug/L	ND	ND	ND	ND				N/A
Aldrin (ALDRIN)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND			0.002	N/A
Ametryn (AMERYN)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A

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Anthracene (ANTHRA)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Atrazine (ATRAZ)	525.2 / CEC	0.001 - 0.1	ug/L	ND	ND	ND	ND	1			1
Azithromycin (AZTMCN)	CEC	10 - 50	ng/L	ND	ND	ND	ND				N/A
Baygon (BAYGON)	531	1	ug/L	ND	ND	ND	ND			30	N/A
Bentazon (BENTAZ)	515.3 / 515.4	1 - 2	ug/L	ND	ND	ND	ND	18			18
Benzo(a)anthracene (BaANTH)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Benzo(a)pyrene (BaPYRE)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND	0.2			0.2
Benzo(b)fluoranthene (BbFLUR)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Benzo(g,h,i)perylene (BghiPR)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Benzo[k]fluoranthene (BkFLUR)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
bis (2-ethylhexyl) adipate (DEHA)[41]	525.2	2	ug/L	ND	ND	ND	ND	400			400
bis (2-ethylhexyl) phthalate (DEHP)[42]	525.2 / 625	2 - 21	ug/L	ND	ND	ND	ND	4			4
Bromacil (BROMAC)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Butachlor (BUTACL)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Butanal (BUTAN)	556	2	ug/L	ND	ND	ND	ND				N/A
Butylate (BTYATE)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Butylbenzyl phthalate (BBP)	525.2 / 625	2 - 21	ug/L	ND	ND	ND	ND				N/A
Caffeine (CAFFEI)	525.2 / CEC	3 - 100	ng/L	ND	ND	5.7	ND				N/A
Captan (CAPTAN)	525.2	0.1	ug/L	ND	ND	ND	ND			15	N/A
Carbamazepine (CBMAZP)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Carbaryl (CARBAR)	531	2	ug/L	ND	ND	ND	ND			700	N/A
Carbofuran (CARBOF)	531	1	ug/L	ND	ND	ND	ND	18			18
Chlordane (ClDANE)	508	0.1	ug/L	ND	ND	ND	ND	0.1			0.1
Chlordane-alpha (CLDA)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Chlordane-gamma (CLDG)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Chlorobenzilate (CLBZLA)	508 / 525.2	0.05 - 0.1	ug/L	ND	ND	ND	ND				N/A
Chloroneb (CLNEB)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Chloropropham (CPRPHM)	525.2	0.1	ug/L	ND	ND	ND	ND			1,200	N/A
Chlorothalonil (CLTNIL)	508 / 525.2	0.05 - 0.1	ug/L	ND	ND	ND	ND				N/A
Chlorpyrifos (ClPYRI)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Chrysene (CHRYS)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Dalapon (DALAPN)	515.3 / 552.2	0.4 - 1	ug/L	ND	ND	ND	ND	200			200
DCPA-Dacthal (DCPA)	508 / 525.2	0.05 - 0.1	ug/L	ND	ND	ND	ND				N/A
Diazinon (DIAZI)	525.2	0.1	ug/L	ND	ND	ND	ND			1.2	N/A
Dibenzo(a,h)anthracene (DBahAN)	525.2 / 625	0.1 - 21	ug/L	ND	ND	ND	ND				N/A
Dicamba (DICAMB)	515.3 / 515.4	0.081 - 0.6	ug/L	ND	ND	ND	ND				N/A
Dichlorprop (24DP)	515.3	0.3	ug/L	NR	ND	ND	ND				N/A
Dichlorvos (DCLVOS)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Dieldrin (DIELDR)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND			0.002	N/A

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Diethyl phthalate (DEP)	525.2 / 625	2 - 10	ug/L	ND	ND	ND	ND				N/A
Dimethoate (DMTH)	525.2	1	ug/L	ND	ND	ND	ND			1	N/A
Dimethyl phthalate (DMP)	525.2 / 625	2 - 10	ug/L	ND	ND	ND	ND				N/A
Di-n-butylphthalate (DnBP)	525.2 / 625	2 - 21	ug/L	ND	ND	ND	ND				N/A
Di-n-octyl phthalate (DnOP)	525.2 / 625	2 - 21	ug/L	ND	ND	ND	ND				N/A
Dinoseb (DINOSB)	515.3 / 515.4	0.4 - 0.5	ug/L	ND	ND	ND	ND	7			7
Diphenamid (DPHNMD)	525.2	0.1	ug/L	ND	ND	ND	ND			200	N/A
Diquat (DIQUAT)	549.2	4	ug/L	ND	ND	ND	ND	20			20
Diuron (DIURON)	CEC	0.005	ug/L	ND	ND	ND	ND				N/A
Endosulfan I (ENDOI)[43]	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Endosulfan sulfate (ENDOSL)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Endothall (ENDOTL)	548.1	45	ug/L	ND	ND	ND	ND	100			100
Endrin (ENDRIN)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND	2			2
Endrin Aldehyde (ENDR-A)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Endrin Ketone (ENDR-K)	508	0.1	ug/L	ND	NR	NR	NR				N/A
EPTC (EPTC)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Erythromycin (ERYTHN)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Ethion (ETHION)	525.2	0.1	ug/L	ND	ND	ND	ND			4	N/A
Ethoprop (ETHPRP)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Etridiazole (ETRDZL)	508 / 525.2	0.05 - 0.1	ug/L	ND	ND	ND	ND				N/A
Fluoranthene (FLANTH)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Fluorene (FLUOR)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Gemfibrozil (GMFIBZ)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Glyphosate (GLYPHO)	547	25	ug/L	ND	ND	ND	ND	700			700
HCH-gamma (Lindane) (LINDNE)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND	0.2			0.2
Heptachlor (HEPTA)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND	0.01			0.01
Heptachlor epoxide (HEPEPX)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND	0.01			0.01
Hexachlorobenzene (HEXCLB)	508 / 625	0.05 - 10	ug/L	ND	ND	ND	ND	1			1
Hexachlorocyclopentadiene (HClCPD)	508 / 625	0.05 - 21	ug/L	ND	ND	ND	ND	50			50
Hexazinone (HEXZON)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Ibuprofen (IBPRFN)	CEC	1 - 2	ng/L	ND	ND	ND	ND				N/A
Indeno(1,2,3-cd)pyrene (INDPYR)	525.2 / 625	0.1 - 21	ug/L	ND	ND	ND	ND				N/A
Malathion (MALATH)	525.2	2	ug/L	ND	ND	ND	ND			160	N/A
Methiocarb (MTHCRB)	531	4	ug/L	ND	ND	ND	ND				N/A
Methomyl (MTHOMY)	531	1	ug/L	ND	ND	ND	ND				N/A
Methoxychlor (METHOX)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND	30			30
methyl-Parathion (MPARA)	525.2	0.5	ug/L	ND	ND	ND	ND			2	N/A
Metribuzin (MTRBZN)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Molinate (MOLINT)	525.2	0.1	ug/L	ND	ND	ND	ND	20			20

WATER QUALITY -- GWRS PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1])
AVERAGES FOR ALL AVAILABLE DATA FOR 2018[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2018 Quarter 1	2018 Quarter 2	2018 Quarter 3	2018 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
N,N-diethyl-m-toluamide (DEET)	CEC	1 - 5	ng/L	ND	ND	ND	ND				N/A
Norflurazon (NORFLR)	525.2	1	ug/L	ND	ND	ND	ND				N/A
Oxamyl (OXAMYL)	531	2	ug/L	ND	ND	ND	ND	50			50
Paraquat (PARAQT)	549.2	4	ug/L	ND	ND	ND	ND				N/A
Parathion (PARA)	525.2	0.5	ug/L	ND	ND	ND	ND			40	N/A
Pentachlorophenol (PCP)	515.3 / CEC	0.1 - 21	ug/L	ND	ND	ND	ND	1			1
Pentanal (PENTNL)	556	2	ug/L	ND	ND	ND	ND				N/A
Permethrin-(total of cis/trans) (PMTHRN)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Phenanthrene (PHENAN)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Picloram (PICLOR)	515.3 / 515.4	0.5 - 0.6	ug/L	ND	ND	ND	ND	500			500
Primidone (PRIMDN)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Prometryn (PROMET)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Pronamide (PROAMD)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Propachlor (PROPCL)	508 / 525.2	0.05 - 0.1	ug/L	ND	ND	ND	ND			90	N/A
Propanal (PROPNL)	556	2	ug/L	ND	ND	ND	ND				N/A
Propazine (PROPAZ)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Pyrene (PYRENE)	525.2 / 625	0.1 - 10	ug/L	ND	ND	ND	ND				N/A
Simazine (SIMAZ)	525.2 / CEC	0.005 - 0.1	ug/L	ND	ND	ND	ND	4			4
Sulfamethoxazole (SULTHZ)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Tebuthiuron (TBTURN)	525.2	2	ug/L	ND	ND	ND	ND				N/A
Terbacil (TRBACL)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Thiobencarb (THIO)[39]	525.2	0.1	ug/L	ND	ND	ND	ND	70	1		1[39]
Toxaphene Mixture (TOXA)	508	1	ug/L	ND	ND	ND	ND	3			3
Triclosan (TRICLN)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Trifluralin (TRFLRN)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				N/A
Trithion (TRTION)	525.2	0.1	ug/L	ND	ND	ND	ND			7	N/A

APPENDIX A
Orange County Water District
GWRS WATER QUALITY REQUIREMENTS

Purified Recycled Water Monitoring

Footnotes:

1 Purified Recycled Water (also called Finished Product Water (FPW) or Final Product Water) is the final recycled water flow stream.
2 For purposes of calculating quarterly averages, 10% of corresponding Reportable Detection Limits (RDL) was used for all non-detect (ND) values. If all data for the quarter were ND, then the average is shown as ND.
3 Permit and monitoring and reporting requirements per RWQCB Order Nos. R8-2004-0002 amended by R8-2008-0058, R8-2014-0054, R8-2016-0051 and R8-2019-0007
4 California Drinking Water Standards are shown as applicable. Abbreviations are: Action Level = AL; Primary MCL = 1MCL; Secondary MCL = 2MCL(recommended value (more stringent value) is considered); Notification Level = NL (includes notification levels and archived advisory levels); Unregulated Chemicals Requiring Monitoring = UR; California Unregulated Chemical Monitoring Regulation = CA UCMR; N/A = not applicable. While not drinking water standards, the RWQCB Basin Plan requirements for the permit are noted as BP in this column with Talbert Barrier area water quality objectives shown.
5 ROP is the RO Permeate or RO Product flow stream. Permit requirements for UV%T and turbidity are applicable to the ROP flow stream.
6 ROP turbidity shall not exceed: 0.2 Nephelometric Turbidity Units (NTU) more than 5 percent of the time in any 24-hour period; and 0.5 NTU at any time.
7 Aluminum has a Primary MCL of 1 mg/L and a Secondary MCL of 0.2 mg/L. The permit limit is the lower of these two values.
8 Chloride has a Secondary MCL of 250 mg/L and a RWQCB Basin Plan Water Quality Objective of 55 mg/L.
9 Copper has a Secondary MCL of 1 mg/L and an Action Level of 1.3 mg/L.
10 Lead has an Action Level of 0.015 mg/L.
11 Manganese has a Secondary MCL of 50 ug/L and a Notification Level of 500 ug/L.
12 Nitrate-nitrogen has a Primary MCL of 10 mg/L (as nitrogen) and a RWQCB Basin Plan Water Quality Objective of 3 mg/L. The sum of nitrate-nitrogen plus nitrite-nitrogen has a primary MCL of 10 mg/L (as nitrogen).
13 Sodium has a RWQCB Basin Plan Water Quality Objective of 45 mg/L.
14 Sulfate has a Secondary MCL of 250 mg/L and a RWQCB Basin Plan Water Quality Objective of 100 mg/L.
15 Total Dissolved Solids has a Secondary MCL of 500 mg/L and a RWQCB Basin Plan Water Quality Objective of 500 mg/L.
16 Total Hardness (as CaCO3) has a RWQCB Basin Plan Water Quality Objective of 240 mg/L.
17 TOC limit of 0.5 mg/L is based on the maximum allowable Recycled Water Contribution (RWC) of 100% at Talbert Barrier. The TOC limit is calculated by dividing 0.5 mg/L by the approved maximum RWC specified by CDPH for each recharge site. On November 25, 2009, CDPH approved the 100% RWC at Talbert Barrier, making the TOC requirement calculated by dividing 0.5 mg/L by 100%, or equal to 0.5 mg/L thereafter, at that site. The TOC permit requirement for Kraemer-Miller Basins remains 0.7 mg/L based on the approved RWC of 75% at that location. However, because the same FPW is supplied to both sites, the maximum TOC concentration is effectively 0.5 mg/L.
18 Alternate name for 1,1-Dichloroethene is 1,1-Dichloroethylene.
19 Alternate name for 1,2-Dibromo-3-chloropropane is Dibromochloropropane (DBCP).
20 Alternate name for Dibromoethane is Ethylene Dibromide (EDB).
21 Alternate name for 17a-Ethynyl Estradiol is Ethinyl Estradiol.
22 Alternate name for 4-Chloro-3-methylphenol is 3-Methyl-4-Chlorophenol.
23 Alternate name for Bromodichloromethane is Dichlorobromomethane.
24 Alternate name for Bromomethane is Methyl Bromide.
25 Alternate name for Chlorobenzene is Monochlorobenzene .
26 Alternate name for Chloromethane is Methyl Chloride.
27 Alternate name for cis-1,2-Dichloroethene is cis-1,2-Dichloroethylene.
28 Total Haloacetic acids (five) (HAA5) are listed separately as Monochloroacetic Acid, Dichloroacetic Acid, Trichloroacetic Acid, Monobromoacetic Acid, and Dibromoacetic Acid.
29 Alternate name for Dibromochloromethane is Chlorodibromomethane.
30 Alternate name for Endosulfan II is Beta Endosulfan.
31 MTBE has a Primary MCL of 13 ug/L and a Secondary MCL of 5 ug/L. The permit limit is the lower of these two values.
32 Alternate name for Methylene chloride is Dichloromethane.
33 Polychlorinated Biphenyls are listed separately as PCB-1016, PCB-1221, PCB-1232, PCB-1242, PCB-1248, PCB-1254, and PCB-1260; however the PMCL is for the total mixture of PCB congeners (TOTPCB) and not individual PCB's.
34 Alternate name for Tetrachloroethene is Tetrachloroethylene.
35 Primary MCL for Total Xylenes and not isomers (o-, m-, p-xylene).
36 Alternate name for trans-1,2-Dichloroethene is trans-1,2-Dichloroethylene.
37 Alternate name for Trichloroethene is Trichloroethylene.
38 Alternate name for Trichlorotrifluoroethane (Freon 113) is 1,1,2-Trichloro-1,2,2-Trifluoroethane.
39 Thiobencarb has a Primary MCL of 70 ug/L and a Secondary MCL of 1 ug/L. The permit limit is the lower of these two values.
40 California Detection Level for purposes of Reporting (DLR).
41 Alternate name for bis (2-ethylhexyl) adipate is Di(2-ethylhexyl)adipate.
42 Alternate name for bis (2-ethylhexyl) phthalate is Di(2-ethylhexyl)phthalate (DEHP).
43 Alternate name for Endosulfan I is Alpha Endosulfan.

GWRS 2018 Quarterly Sampling Dates
OCWD Water Quality Department
GWRS FINAL PRODUCT WATER (FPW)

Monitoring Well	Qtr 1	Qtr 2	Qtr 3	Qtr 4
GWRS-FPW	01/10/2018	04/12/2018	07/11/2018	10/10/2018

Notes for Appendix A Tables:

► Listed dates (above) are the quarterly compliance monitoring dates; other samples may have been collected during the year. Detections of organic chemicals are reported for all samples collected in 2017 and are not limited to the quarterly compliance samples.

► Appendices B and C contain a list of all methods and reportable detection limits (RDL).

► Detailed data reports are available upon request.

► The more stringent value in the range of secondary MCLs is used in the tables (e.g., <MCL) for TDS, electrical conductivity (EC), chloride and sulfate.

► Analysis for priority pollutants is performed by multiple inorganic and organic methods

► MCL: Maximum Contaminant Level

► N/A: Not applicable

► ND: Not detected at reportable detection limit (RDL)

► NL: SWRCB DDW (formerly CDPH) Notification Level

► NS: Not sampled

► SMCL: Secondary Maximum Contaminant Level

► TR: Trace

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	Permit Limit	GWRS-FPW Qtr 1	GWRS-FPW Qtr 2	GWRS-FPW Qtr 3	GWRS-FPW Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	200	1.1	ND	2.0	1.5
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND	ND	ND	ND
Asbestos (ASBESTOS), MFL	EUROFINS	7	ND	ND	ND	ND
Barium (Ba), ug/L	OCWD	1000	ND	ND	ND	ND
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Cyanide (CN), ug/L	OCWD	150	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	ND	ND	ND	ND
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND	ND	ND	ND
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	3	0.5 - 0.78	0.6 - 1.34	0.78 - 1.38	0.58 - 1.05
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.084	ND - 0.071	0.02 - 0.085	0.024 - 0.061
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND	ND
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), pg/L	TALSAC	30	ND	ND	ND	ND
Primary Drinking Water Standards - Radioactivity						
Gross Alpha Excluding Uranium (TOTa-U), pCi/L	FGL	15	ND	0.596	ND	ND
Other Radionuclides	FGL/TestAmerSL	Varies	ND < PMCL	ND < PMCL	ND < PMCL	ND < PMCL
Primary Drinking Water Standards - Disinfection By-Products						
Sum of five Haloacetic Acids (HAA5), ug/L	OCWD	60***	ND	ND	ND	ND
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	2.2 - 2.8	2.8 - 3.2	3.4 - 4.4	1.1 - 4.6
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	2.2	ND	ND	ND - 9.8	ND - 1
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	N/A	79 - 102	90 - 112	89 - 116	87 - 121
Iron (Fe), ug/L	OCWD	300	ND	ND	ND	ND
Manganese (Mn), ug/L	OCWD	50	ND	ND	ND	ND
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND	ND	ND	ND
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	43.5 - 54.5	44.5 - 61.5	49.5 - 72.0	42 - 60
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1000	ND	ND	ND	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
DDW Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.21	0.23	0.24	0.26
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	ND	ND	ND	ND
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD/TestAmer	N/A	ND	ND	ND	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD/TestAmer	N/A	ND	ND	ND	ND
4,4'-DDE (DDE), ug/L	OCWD / Weck	N/A	ND	ND	ND	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	ND	ND	ND
Dacthal Acid Metabolites (tDCPA) (DCPA-Dacthal), ug/L	OCWD / Weck	N/A	ND	ND	ND	ND
EPTC (EPTC), ug/L	OCWD	N/A	ND	ND	ND	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	ND	ND	ND
Nitrobenzene (NBENZ), ug/L	TestAmer	N/A	ND	ND	ND	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	ND	ND	ND

* MCL based on total (not dissolved); ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	GWRS-FPW Qtr 1	GWRS-FPW Qtr 2	GWRS-FPW Qtr 3	GWRS-FPW Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND	ND < MCL	ND < MCL	ND
1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin	TALSAC	ND	ND	ND	ND
504.1	EDB, DBCP & 123TCP	OCWD	ND	ND	ND	ND
508	Chlorinated Pesticides	OCWD / Weck	ND	ND	ND	ND
515.3 & 515.4	Chlorinated Acids	OCWD / Weck	ND	ND	ND	ND
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
524M-TCP	123TCP & EDB	OCWD	ND	ND	ND	ND
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	ND	ND	ND
531	Carbamates	OCWD	ND	ND	ND	ND
537	PFAS Compounds	OCWD	ND	ND	ND	ND
547	Glyphosate	OCWD	ND	ND	ND	ND
548.1	Endothall	Weck	ND	ND	ND	ND
549.2	Diquat and Paraquat	OCWD	ND	ND	ND	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
552.2	Disinfection Byproducts (DBPs) - Haloacetic Acids	OCWD	ND	ND	ND	ND
556	Determination of Carbonyl Compounds	Weck	ND < NL	ND < NL	ND < NL	ND < NL
625	Semi-Volatile Organic Compounds, including Priority Pollutants	TestAmer	ND	ND	ND	ND
CEC	Chemicals of Emerging Concern	OCWD	ND	ND	ND - Detections	ND
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < NL

GWRS-FPW
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/10/2018	9:30	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
1/10/2018	9:30	Chloroform (CHCl3)	1.8	ug/L	0.5
1/10/2018	9:30	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/10/2018	9:30	Bromochloroacetonitrile (BCAN)	0.4	ug/L	0.1
1/10/2018	9:30	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.1
1/10/2018	9:30	Chloroform (CHCl3)	1.2	ug/L	0.1
1/10/2018	9:30	Dibromochloromethane (CHBr2C)	0.1	ug/L	0.1
1/10/2018	9:30	Dichloroacetonitrile (DCAN)	0.5	ug/L	0.1
1/10/2018	9:30	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.1

METHOD: 556

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/10/2018	9:30	Formaldehyde (FORALD)	13	ug/L	2

METHOD: NDMA-LOW

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/10/2018	9:30	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2
1/26/2018	7:50	n-Nitrosodimethylamine (NDMA)	2.3	ng/L	2
2/9/2018	7:50	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2

Year 2018, Quarter 2

METHOD: 14DIOX

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
6/8/2018	8:20	Methylisothiocyanate (MITC)	0.84	ug/L	0.1

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/12/2018	9:45	Bromodichloromethane (CHBrCl)	1.1	ug/L	0.5

GWRS-FPW
Organic Detections by Method

Year 2018, Quarter 2

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/12/2018	9:45	Chloroform (CHCl3)	2.1	ug/L	0.5
4/12/2018	9:45	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
4/12/2018	9:45	Total Trihalomethanes (TTHMs)	3.2	ug/L	0.5
4/12/2018	10:25	Bromodichloromethane (CHBrCl)	1.1	ug/L	0.5
4/12/2018	10:25	Chloroform (CHCl3)	2.1	ug/L	0.5
4/12/2018	10:25	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
4/12/2018	10:25	Total Trihalomethanes (TTHMs)	3.2	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/12/2018	9:45	1,1-Dichloro-2-propanone (11DC2P)	0.1	ug/L	0.1
4/12/2018	9:45	Bromochloroacetonitrile (BCAN)	0.4	ug/L	0.1
4/12/2018	9:45	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.1
4/12/2018	9:45	Chloroform (CHCl3)	1.6	ug/L	0.1
4/12/2018	9:45	Dibromochloromethane (CHBr2C)	0.1	ug/L	0.1
4/12/2018	9:45	Dichloroacetonitrile (DCAN)	0.8	ug/L	0.1
4/12/2018	9:45	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.1

METHOD: 556

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/12/2018	9:45	Acetaldehyde (ACEALD)	3.5	ug/L	2
4/12/2018	9:45	Formaldehyde (FORALD)	18	ug/L	2

METHOD: NDMA-LOW

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/6/2018	8:15	n-Nitrosodimethylamine (NDMA)	2.4	ng/L	2
4/12/2018	9:45	n-Nitrosodimethylamine (NDMA)	2.7	ng/L	2
4/20/2018	8:00	n-Nitrosodimethylamine (NDMA)	3.2	ng/L	2
4/27/2018	8:05	n-Nitrosodimethylamine (NDMA)	2.7	ng/L	2
5/4/2018	7:45	n-Nitrosodimethylamine (NDMA)	2.7	ng/L	2
5/11/2018	7:50	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2
5/18/2018	8:00	n-Nitrosodimethylamine (NDMA)	2.5	ng/L	2
5/25/2018	8:05	n-Nitrosodimethylamine (NDMA)	3.0	ng/L	2
6/1/2018	7:50	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2
6/8/2018	8:20	n-Nitrosodimethylamine (NDMA)	3.9	ng/L	2
6/22/2018	8:20	n-Nitrosodimethylamine (NDMA)	2.4	ng/L	2

GWRS-FPW

Organic Detections by Method

Year 2018, Quarter 2

METHOD: NDMA-LOW

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
6/29/2018	8:05	n-Nitrosodimethylamine (NDMA)	2.5	ng/L	2

Year 2018, Quarter 3

METHOD: 14DIOX

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/27/2018	8:20	Methylisothiocyanate (MITC)	10.8	ug/L	0.1
7/31/2018	16:25	Methylisothiocyanate (MITC)	1.47	ug/L	0.1
8/1/2018	11:18	Methylisothiocyanate (MITC)	0.16	ug/L	0.1
8/3/2018	8:10	Methylisothiocyanate (MITC)	0.18	ug/L	0.1

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/11/2018	10:55	Bromodichloromethane (CHBrCl)	1.5	ug/L	0.5
7/11/2018	10:55	Chloroform (CHCl3)	2.9	ug/L	0.5
7/11/2018	10:55	Total Trihalomethanes (TTHMs)	4.4	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/11/2018	10:55	1,1-Dichloro-2-propanone (11DC2P)	0.1	ug/L	0.1
7/11/2018	10:55	Bromochloroacetonitrile (BCAN)	0.4	ug/L	0.1
7/11/2018	10:55	Bromodichloromethane (CHBrCl)	1.3	ug/L	0.1
7/11/2018	10:55	Chloroform (CHCl3)	1.8	ug/L	0.1
7/11/2018	10:55	Dibromoacetonitrile (DBAN)	0.2	ug/L	0.1
7/11/2018	10:55	Dibromochloromethane (CHBr2C)	0.2	ug/L	0.1
7/11/2018	10:55	Dichloroacetonitrile (DCAN)	0.8	ug/L	0.1
7/11/2018	10:55	Total Trihalomethanes (TTHMs)	3.4	ug/L	0.1

METHOD: 556

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/11/2018	10:55	Acetaldehyde (ACEALD)	4.2	ug/L	2
7/11/2018	10:55	Formaldehyde (FORALD)	21	ug/L	2

GWRS-FPW
Organic Detections by Method

Year 2018, Quarter 3

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/11/2018	10:55	Caffeine (CAFFEI)	6.8	ng/L	3

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/6/2018	8:10	n-Nitrosodimethylamine (NDMA)	2.5	ng/L	2
7/13/2018	8:00	n-Nitrosodimethylamine (NDMA)	2.5	ng/L	2
7/20/2018	8:00	n-Nitrosodimethylamine (NDMA)	2.8	ng/L	2
8/3/2018	8:10	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2
8/10/2018	7:25	n-Nitrosodimethylamine (NDMA)	2.4	ng/L	2
8/17/2018	8:05	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2
9/7/2018	8:10	n-Nitrosodimethylamine (NDMA)	2.3	ng/L	2

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/5/2018	8:30	Bromodichloromethane (CHBrCl)	1.6	ug/L	0.5
10/5/2018	8:30	Chloroform (CHCl3)	3.0	ug/L	0.5
10/5/2018	8:30	Total Trihalomethanes (TTHMs)	4.6	ug/L	0.5
10/10/2018	9:35	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.5
10/10/2018	9:35	Chloroform (CHCl3)	2.0	ug/L	0.5
10/10/2018	9:35	Total Trihalomethanes (TTHMs)	2.9	ug/L	0.5
10/12/2018	8:10	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
10/12/2018	8:10	Chloroform (CHCl3)	1.8	ug/L	0.5
10/12/2018	8:10	Total Trihalomethanes (TTHMs)	2.6	ug/L	0.5
10/19/2018	8:00	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
10/19/2018	8:00	Chloroform (CHCl3)	1.6	ug/L	0.5
10/19/2018	8:00	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
10/19/2018	8:00	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5
10/26/2018	8:05	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
10/26/2018	8:05	Chloroform (CHCl3)	1.4	ug/L	0.5
10/26/2018	8:05	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
10/26/2018	8:05	Total Trihalomethanes (TTHMs)	2.1	ug/L	0.5
11/2/2018	8:05	Bromodichloromethane (CHBrCl)	1.4	ug/L	0.5
11/2/2018	8:05	Chloroform (CHCl3)	2.5	ug/L	0.5
11/2/2018	8:05	Total Trihalomethanes (TTHMs)	3.9	ug/L	0.5

GWRS-FPW
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
11/9/2018	8:15	Bromodichloromethane (CHBrCl)	1.4	ug/L	0.5
11/9/2018	8:15	Chloroform (CHCl3)	2.7	ug/L	0.5
11/9/2018	8:15	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
11/9/2018	8:15	Total Trihalomethanes (TTHMs)	4.0	ug/L	0.5
11/16/2018	8:10	Bromodichloromethane (CHBrCl)	1.3	ug/L	0.5
11/16/2018	8:10	Chloroform (CHCl3)	2.4	ug/L	0.5
11/16/2018	8:10	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
11/16/2018	8:10	Total Trihalomethanes (TTHMs)	3.8	ug/L	0.5
11/23/2018	8:15	Bromodichloromethane (CHBrCl)	1.1	ug/L	0.5
11/23/2018	8:15	Chloroform (CHCl3)	2.2	ug/L	0.5
11/23/2018	8:15	Total Trihalomethanes (TTHMs)	3.3	ug/L	0.5
11/30/2018	8:25	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
11/30/2018	8:25	Chloroform (CHCl3)	2.2	ug/L	0.5
11/30/2018	8:25	Total Trihalomethanes (TTHMs)	3.3	ug/L	0.5
12/7/2018	8:10	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.5
12/7/2018	8:10	Chloroform (CHCl3)	1.6	ug/L	0.5
12/7/2018	8:10	Total Trihalomethanes (TTHMs)	2.5	ug/L	0.5
12/14/2018	8:10	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.5
12/14/2018	8:10	Chloroform (CHCl3)	1.7	ug/L	0.5
12/14/2018	8:10	Total Trihalomethanes (TTHMs)	2.6	ug/L	0.5
12/21/2018	8:20	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
12/21/2018	8:20	Chloroform (CHCl3)	1.4	ug/L	0.5
12/21/2018	8:20	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.5
12/28/2018	8:00	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
12/28/2018	8:00	Chloroform (CHCl3)	1.1	ug/L	0.5
12/28/2018	8:00	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/10/2018	9:35	1,1-Dichloro-2-propanone (11DC2P)	0.1	ug/L	0.1
10/10/2018	9:35	Bromochloroacetonitrile (BCAN)	0.2	ug/L	0.1
10/10/2018	9:35	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.1
10/10/2018	9:35	Chloroform (CHCl3)	1.3	ug/L	0.1
10/10/2018	9:35	Dibromochloromethane (CHBr2C)	0.1	ug/L	0.1
10/10/2018	9:35	Dichloroacetonitrile (DCAN)	0.6	ug/L	0.1
10/10/2018	9:35	Total Trihalomethanes (TTHMs)	2.3	ug/L	0.1

GWRS-FPW
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 556

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/10/2018	9:35	Formaldehyde (FORALD)	19	ug/L	2

METHOD: NDMA-LOW

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/5/2018	8:30	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2
10/10/2018	9:35	n-Nitrosodimethylamine (NDMA)	3.3	ng/L	2
10/12/2018	8:10	n-Nitrosodimethylamine (NDMA)	2.8	ng/L	2
10/26/2018	8:05	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2
11/2/2018	8:05	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2
11/9/2018	8:15	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2
11/16/2018	8:10	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2
11/23/2018	8:15	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2
11/30/2018	8:25	n-Nitrosodimethylamine (NDMA)	3.0	ng/L	2
12/21/2018	8:20	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2

Appendix B

Laboratory Methods of Analysis

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

ORANGE COUNTY WATER DISTRICT
LABORATORY METHODS OF ANALYSES

Laboratory Method: 100.2

Laboratory: EUROFINS EATON ANALYTICAL

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Asbestos (ASBESTOS)	0.2	MFL

Laboratory Method: 14DIOX

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
1,2,3-Trichloropropane (123TCP)	0.005	ug/L
1,2-Dibromo-3-chloropropane (DBCP)	0.01	ug/L
1,2-Dibromoethane (EDB)	0.005	ug/L
1,4-Dioxane (14DIOX)	1	ug/L
2-Chloroethylvinyl ether (2ClEVE)	1	ug/L
Methylisothiocyanate (MITC)	0.1	ug/L

Laboratory Method: 1600

Laboratory: O.C. HEALTH CARE AGENCY

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Enterococcus(Membrane Filtration-CFU/100ml) (ENTRCC)	1	CFU/100

Laboratory Method: 1601

Laboratory: IEH-BIOVIR LABORATORIES

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Bacteriophage, Male Specific (BACTMLSP)	1	P/A PERL
Bacteriophage, Somatic (BACTSOMT)	1	P/A PERL

Laboratory Method: 1613B

Laboratory: TESTAMERICA SACRAMENTO

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	4.7 - 4.8	pg/L

Laboratory Method: 2120B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Apparent Color (unfiltered) (APCOLR)	3	UNITS
True Color (filtered) (TRCOLR)	3	UNITS

Laboratory Method: 2130B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Turbidity (TURB)	0.1	NTU

Laboratory Method: 2150B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Odor Range High (ODORHI)	0	TON
Odor Range Low (ODORLO)	0	TON
Threshold Odor Number (Median) (ODOR)	0	TON

Laboratory Method: 2320B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Alkalinity-Phenolphthalein (ALKPHE)	1	mg/L
Bicarbonate (as CaCO3) (HCO3Ca)	1	mg/L
Bicarbonate (as HCO3) (HCO3)	1.2	mg/L
Carbonate (as CaCO3) (CO3Ca)	1	mg/L
Carbonate (as CO3) (CO3)	0.6	mg/L
Hydroxide (as CaCO3) (OHCa)	1	mg/L
Hydroxide (as OH) (OH)	0.3	mg/L
Total Alkalinity (as CaCO3) (TOTALK)	1	mg/L

Laboratory Method: 2330B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Corrosivity (CORROS)	-100	S.I.

Laboratory Method: 2510B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Electrical Conductivity (EC)	1	um/cm

Laboratory Method: 2540C

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Dissolved Solids (TDS)	1 - 2.5	mg/L

Laboratory Method: 2540D

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Suspended Solids (SUSSOL)	1 - 2.5	mg/L

Laboratory Method: 300.1B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Bromate (BrO3)	5	ug/L
Bromide (Br)	0.01	mg/L
Chlorate (CLO3)	10	ug/L
Chlorite (CLO2)	10	ug/L

Laboratory Method: 332.0

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Perchlorate (CLO4)	2.5	ug/L

Laboratory Method: 350.1

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Ammonia Nitrogen (NH3-N)	0.1 - 0.4	mg/L

Laboratory Method: 365.1

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Phosphate Phosphorus (orthophosphate) (PO4-P)	0.01	mg/L

Laboratory Method: 4500CLD

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Free Res. Chlorine -- Amperometric Method (FRCL2A)	0.1	mg/L
Tot. Res. Chlorine -- Amperometric Method (TOTCLA)	0.1	mg/L

Laboratory Method: 4500CLF

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Free Chlorine (FRCL2)	0.1	mg/L
Total Chlorine (TOTCL2)	0.1	mg/L

Laboratory Method: 4500H+B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
pH (pH)	1	UNITS

Laboratory Method: 4500NO3F

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Nitrate (NO3)	0.4	mg/L
Nitrate + Nitrite Nitrogen (NO3NO2-N)	0.1	mg/L
Nitrate Nitrogen (NO3-N)	0.1	mg/L
Nitrite Nitrogen (NO2-N)	0.002	mg/L

Laboratory Method: 4500SIOC

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Silica (SIO2)	1	mg/L

Laboratory Method: 504.1

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
1,2,3-Trichloropropane (123TCP)	0.05	ug/L
1,2-Dibromo-3-chloropropane (DBCP)	0.01	ug/L
1,2-Dibromoethane (EDB)	0.01	ug/L

Laboratory Method: 508

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
4,4'-DDD (DDD)	0.01	ug/L
4,4'-DDE (DDE)	0.01	ug/L

Laboratory Method: 508

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
4,4'-DDT (DDT)	0.01	ug/L
Aldrin (ALDRIN)	0.03	ug/L
Chlordane (ClDANE)	0.1	ug/L
Chlordane-alpha (CLDA)	0.01	ug/L
Chlordane-gamma (CLDG)	0.01	ug/L
Chlorobenzilate (CLBZLA)	0.05	ug/L
DCPA-Dacthal (DCPA)	0.05	ug/L
Dieldrin (DIELDR)	0.02	ug/L
Endosulfan I (ENDOI)	0.05	ug/L
Endosulfan II (ENDOII)	0.01	ug/L
Endosulfan sulfate (ENDOSL)	0.05	ug/L
Endrin (ENDRIN)	0.03	ug/L
Endrin Aldehyde (ENDR-A)	0.1	ug/L
Endrin Ketone (ENDR-K)	0.1	ug/L
Etridiazole (ETRDZL)	0.05	ug/L
HCH-alpha (Alpha-BHC) (BHCa)	0.02	ug/L
HCH-beta (Beta-BHC) (BHCb)	0.02	ug/L
HCH-delta (Delta-BHC) (BHCd)	0.02	ug/L
HCH-gamma (Lindane) (LINDNE)	0.1	ug/L
Heptachlor (HEPTA)	0.01	ug/L
Heptachlor epoxide (HEPEPX)	0.01	ug/L
PCB-1016 (PCB16)	0.5	ug/L
PCB-1221 (PCB21)	0.5	ug/L
PCB-1232 (PCB32)	0.5	ug/L
PCB-1242 (PCB42)	0.5	ug/L
PCB-1248 (PCB48)	0.5	ug/L
PCB-1254 (PCB54)	0.5	ug/L
PCB-1260 (PCB60)	0.5	ug/L
Toxaphene Mixture (TOXA)	1	ug/L
Trifluralin (TRFLRN)	0.05	ug/L

Laboratory Method: 508

Laboratory: WECK LABORATORIES, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
4,4'-DDD (DDD)	0.01	ug/L
4,4'-DDE (DDE)	0.01	ug/L
4,4'-DDT (DDT)	0.01	ug/L
Aldrin (ALDRIN)	0.01	ug/L
Chlordane (ClDANE)	0.1	ug/L
Chlorothalonil (CLTNIL)	0.05	ug/L
Dieldrin (DIELDR)	0.01	ug/L
Endosulfan I (ENDOI)	0.01	ug/L
Endosulfan II (ENDOII)	0.01	ug/L
Endosulfan sulfate (ENDOSL)	0.01	ug/L
Endrin (ENDRIN)	0.01	ug/L
Endrin Aldehyde (ENDR-A)	0.01	ug/L
HCH-alpha (Alpha-BHC) (BHCa)	0.01	ug/L
HCH-beta (Beta-BHC) (BHCb)	0.01	ug/L
HCH-delta (Delta-BHC) (BHCd)	0.01	ug/L
HCH-gamma (Lindane) (LINDNE)	0.01	ug/L
Heptachlor (HEPTA)	0.01	ug/L
Heptachlor epoxide (HEPEPX)	0.01	ug/L
Hexachlorobenzene (HEXCLB)	0.05	ug/L
Hexachlorocyclopentadiene (HClCPD)	0.05	ug/L
Methoxychlor (METHOX)	0.01	ug/L
PCB-1016 (PCB16)	0.1	ug/L
PCB-1221 (PCB21)	0.1	ug/L
PCB-1232 (PCB32)	0.1	ug/L
PCB-1242 (PCB42)	0.1	ug/L
PCB-1248 (PCB48)	0.1	ug/L
PCB-1254 (PCB54)	0.1	ug/L
PCB-1260 (PCB60)	0.1	ug/L
PCBs, Total (TOTPCB)	0.5	ug/L
Propachlor (PROPCL)	0.05	ug/L
Toxaphene Mixture (TOXA)	1	ug/L
Trifluralin (TRFLRN)	0.01	ug/L

Laboratory Method: 515.3

Laboratory: WECK LABORATORIES, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,4,5-T (245T)	0.2	ug/L
2,4,5-TP (Silvex) (245TP)	0.2	ug/L
2,4-DB (24DB)	2	ug/L
2,4-Dichlorophenoxyacetic Acid (24D)	0.4	ug/L
3,5-Dichlorobenzoic Acid (35DBA)	1	ug/L
Acifluorfen (ACIFEN)	0.4	ug/L
Bentazon (BENTAZ)	2	ug/L
Dacthal Acid Metabolites (tDCPA)	0.1	ug/L
Dalapon (DALAPN)	0.4	ug/L
DCPA-Dacthal (DCPA)	0.1	ug/L
Dicamba (DICAMB)	0.6	ug/L
Dichlorprop (24DP)	0.3	ug/L
Dinoseb (DINOSB)	0.4	ug/L
Pentachlorophenol (PCP) (PCP)	0.2	ug/L
Picloram (PICLOR)	0.6	ug/L

Laboratory Method: 515.4

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,4,5-TP (Silvex) (245TP)	0.5	ug/L
2,4-Dichlorophenoxyacetic Acid (24D)	0.5	ug/L
Acifluorfen (ACIFEN)	0.5	ug/L
Bentazon (BENTAZ)	1	ug/L
Dacthal Acid Metabolites (tDCPA)	0.25	ug/L
Dalapon (DALAPN)	1	ug/L
Dicamba (DICAMB)	0.081	ug/L
Dinoseb (DINOSB)	0.5	ug/L
Pentachlorophenol (PCP) (PCP)	0.1	ug/L
Picloram (PICLOR)	0.5	ug/L

Laboratory Method: 5210B

Laboratory: TESTAMERICA IRVINE

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Biochemical Oxygen Demand (BOD)	2 - 12	mg/L

Laboratory Method: 524.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
1,1,1,2-Tetrachloroethane (1112PC)	0.5	ug/L
1,1,1-Trichloroethane (111TCA)	0.5	ug/L
1,1,2,2-Tetrachloroethane (1122PC)	0.5	ug/L
1,1,2-Trichloroethane (112TCA)	0.5	ug/L
1,1-Dichloroethane (11DCA)	0.5	ug/L
1,1-Dichloroethene (11DCE)	0.5	ug/L
1,1-Dichloropropene (11DCP)	0.5	ug/L
1,2,3-Trichlorobenzene (123TCB)	0.5 - 5	ug/L
1,2,3-Trichloropropane (123TCP)	0.5	ug/L
1,2,4-Trichlorobenzene (124TCB)	0.5 - 5	ug/L
1,2,4-Trimethylbenzene (124TMB)	0.5	ug/L
1,2-Dibromo-3-chloropropane (DBCP)	0.5	ug/L
1,2-Dibromoethane (EDB)	0.5	ug/L
1,2-Dichlorobenzene (12DCB)	0.5	ug/L
1,2-Dichloroethane (12DCA)	0.5	ug/L
1,2-Dichloropropane (12DCP)	0.5	ug/L
1,3,5-Trimethylbenzene (135TMB)	0.5	ug/L
1,3-Dichlorobenzene (13DCB)	0.5	ug/L
1,3-Dichloropropane (13DCP)	0.5	ug/L
1,4-Dichlorobenzene (14DCB)	0.5	ug/L
2,2-Dichloropropane (22DCP)	0.5	ug/L
2-Chlorotoluene (2CLTOL)	0.5	ug/L
4-Chlorotoluene (4CLTOL)	0.5	ug/L
4-Isopropyltoluene (4IPTOL)	0.5	ug/L
Acetone (ACETNE)	10 - 20	ug/L
Benzene (BENZ)	0.5	ug/L
bis (2-chloroethyl) ether (B2CLEE)	5 - 25	ug/L

Laboratory Method: 524.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Bromobenzene (BRBENZ)	0.5	ug/L
Bromochloromethane (CH2BrC)	0.5	ug/L
Bromodichloromethane (CHBrCl)	0.5	ug/L
Bromoform (CHBr3)	0.5	ug/L
Bromomethane (CH3Br)	0.5 - 5	ug/L
Carbon Disulfide (CS2)	0.5	ug/L
Carbon tetrachloride (CCl4)	0.5	ug/L
Chlorobenzene (CLBENZ)	0.5	ug/L
Chlorodifluoromethane (FREN22)	0.5	ug/L
Chloroethane (ClETHA)	0.5	ug/L
Chloroform (CHCl3)	0.5	ug/L
Chloromethane (CH3Cl)	0.5 - 5	ug/L
cis-1,2-Dichloroethene (c12DCE)	0.5	ug/L
cis-1,3-Dichloropropene (c13DCP)	0.5	ug/L
Dibromochloromethane (CHBr2C)	0.5	ug/L
Dibromomethane (CH2Br2)	0.5	ug/L
Dichlorodifluoromethane (CCl2F2)	0.5	ug/L
Diisopropyl ether (DIPE)	1	ug/L
Ethyl tert-butyl ether (ETBE)	1	ug/L
Ethylbenzene (EtBENZ)	0.5	ug/L
Freon 123a (FR123A)	0.5	ug/L
Hexachlorobutadiene (HClBut)	0.5	ug/L
Isopropylbenzene (ISPBNZ)	0.5	ug/L
m,p-Xylene (mp-XYL)	0.5	ug/L
Methyl Ethyl Ketone (MEK) (MEK)	5	ug/L
Methyl Isobutyl Ketone (MIBK) (MIBK)	5	ug/L
Methyl tert-butyl ether (MTBE)	0.2	ug/L
Methylene Chloride (CH2Cl2)	0.5	ug/L
Naphthalene (NAP)	0.5 - 5	ug/L
n-Butylbenzene (nBBENZ)	0.5	ug/L
o-Xylene (o-XYL)	0.5	ug/L
Propylbenzene (PRPBNZ)	0.5	ug/L
sec-Butylbenzene (sBBENZ)	0.5	ug/L
Styrene (STYR)	0.5	ug/L

Laboratory Method: 524.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Tert-amyl methyl ether (TAME)	1	ug/L
tert-butyl alcohol (TBA)	2 - 4	ug/L
tert-Butylbenzene (tBBENZ)	0.5	ug/L
Tetrachloroethene (PCE)	0.5	ug/L
Toluene (TOLU)	0.5	ug/L
Total 1,3-Dichloropropene (x13DCP)	0.5	ug/L
Total Trihalomethanes (TTHMs)	0.5	ug/L
Total Xylenes (m,p,&o) (TOTALX)	0.5	ug/L
trans-1,2 Dichloroethene (t12DCE)	0.5	ug/L
trans-1,3-Dichloropropene (t13DCP)	0.5	ug/L
Trichloroethene (TCE)	0.5	ug/L
Trichlorofluoromethane (Freon 11) (CCl3F)	0.5	ug/L
Trichlorotrifluoroethane (Freon 113) (Cl3F3E)	0.5	ug/L
Vinyl chloride (VNYLCL)	0.5	ug/L

Laboratory Method: 524M-TCP

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
1,2,3-Trichloropropane (123TCP)	0.005	ug/L
1,2-Dibromo-3-chloropropane (DBCP)	0.01	ug/L
1,2-Dibromoethane (EDB)	0.005	ug/L

Laboratory Method: 525.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,4-Dinitrotoluene (24DNT)	0.1 - 0.5	ug/L
2,6-Dinitrotoluene (26DNT)	0.1 - 0.5	ug/L
4,4'-DDD (DDD)	0.1 - 0.5	ug/L
4,4'-DDE (DDE)	0.1 - 0.5	ug/L
4,4'-DDT (DDT)	0.1 - 0.5	ug/L

Laboratory Method: 525.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Acenaphthene (ACNAPE)	0.1 - 0.5	ug/L
Acenaphthylene (ACENAP)	0.1 - 0.5	ug/L
Acetochlor (ACETOC)	0.1 - 0.5	ug/L
Alachlor (ALACHL)	0.1 - 0.5	ug/L
Aldrin (ALDRIN)	0.1 - 0.5	ug/L
Ametryn (AMERYN)	0.1 - 0.5	ug/L
Anthracene (ANTHRA)	0.1 - 0.5	ug/L
Atrazine (ATRAZ)	0.1 - 0.5	ug/L
Benzo(a)anthracene (BaANTH)	0.1 - 0.5	ug/L
Benzo(a)pyrene (BaPYRE)	0.1 - 0.5	ug/L
Benzo(b)fluoranthene (BbFLUR)	0.1 - 0.5	ug/L
Benzo(g,h,i)perylene (BghiPR)	0.1 - 0.5	ug/L
Benzo[k]fluoranthene (BkFLUR)	0.1 - 0.5	ug/L
bis (2-ethylhexyl) adipate (DEHA)	2 - 10	ug/L
bis (2-ethylhexyl) phthalate (DEHP)	2 - 10	ug/L
Bromacil (BROMAC)	0.1 - 0.5	ug/L
Butachlor (BUTACL)	0.1 - 0.5	ug/L
Butylate (BTYATE)	0.1 - 0.5	ug/L
Butylbenzyl phthalate (BBP)	2 - 10	ug/L
Caffeine (CAFFEI)	100 - 500	ng/L
Captan (CAPTAN)	0.1 - 0.5	ug/L
Chlordane-alpha (CLDA)	0.1 - 0.5	ug/L
Chlordane-gamma (CLDG)	0.1 - 0.5	ug/L
Chlorobenzilate (CLBZLA)	0.1 - 0.5	ug/L
Chloroneb (CLNEB)	0.1 - 0.5	ug/L
Chloropropham (CPRPHM)	0.1 - 0.5	ug/L
Chlorothalonil (CLTNIL)	0.1 - 0.5	ug/L
Chlorpyrifos (ClPYRI)	0.1 - 0.5	ug/L
Chrysene (CHRYS)	0.1 - 0.5	ug/L
DCPA-Dacthal (DCPA)	0.1 - 0.5	ug/L
Diazinon (DIAZI)	0.1 - 0.5	ug/L
Dibenzo(a,h)anthracene (DBahAN)	0.1 - 0.5	ug/L
Dichlorvos (DCLVOS)	0.1 - 0.5	ug/L
Dieldrin (DIELDR)	0.1 - 0.5	ug/L

Laboratory Method: 525.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Diethyl phthalate (DEP)	2 - 10	ug/L
Dimethoate (DMTH)	1 - 5	ug/L
Dimethyl phthalate (DMP)	2 - 10	ug/L
Di-n-butylphthalate (DnBP)	2 - 10	ug/L
Di-n-octyl phthalate (DnOP)	2 - 10	ug/L
Diphenamid (DPHNMD)	0.1 - 0.5	ug/L
Endosulfan I (ENDOI)	0.1 - 0.5	ug/L
Endosulfan II (ENDOII)	0.1 - 0.5	ug/L
Endosulfan sulfate (ENDOSL)	0.1 - 0.5	ug/L
Endrin (ENDRIN)	0.1 - 0.5	ug/L
Endrin Aldehyde (ENDR-A)	0.1 - 1	ug/L
EPTC (EPTC)	0.1 - 0.5	ug/L
Ethion (ETHION)	0.1 - 0.5	ug/L
Ethoprop (ETHPRP)	0.1 - 0.5	ug/L
Etridiazole (ETRDZL)	0.1 - 0.5	ug/L
Fluoranthene (FLANTH)	0.1 - 0.5	ug/L
Fluorene (FLUOR)	0.1 - 0.5	ug/L
HCH-alpha (Alpha-BHC) (BHCa)	0.1 - 0.5	ug/L
HCH-beta (Beta-BHC) (BHCb)	0.1 - 0.5	ug/L
HCH-delta (Delta-BHC) (BHCd)	0.1 - 0.5	ug/L
HCH-gamma (Lindane) (LINDNE)	0.1 - 0.5	ug/L
Heptachlor (HEPTA)	0.1 - 0.5	ug/L
Heptachlor epoxide (HEPEPX)	0.1 - 0.5	ug/L
Hexachlorobenzene (HEXCLB)	0.1 - 0.5	ug/L
Hexachlorocyclopentadiene (HClCPD)	0.1 - 0.5	ug/L
Hexazinone (HEXZON)	0.1 - 0.5	ug/L
Indeno(1,2,3-cd)pyrene (INDPYR)	0.1 - 0.5	ug/L
Isophorone (IPHOR)	0.1 - 0.5	ug/L
Malathion (MALATH)	2 - 10	ug/L
Methoxychlor (METHOX)	0.1 - 0.5	ug/L
methyl-Parathion (MPARA)	0.5 - 2.5	ug/L
Metolachlor (METOCL)	0.1 - 0.5	ug/L
Metribuzin (MTRBZN)	0.1 - 0.5	ug/L
Molinate (MOLINT)	0.1 - 0.5	ug/L

Laboratory Method: 525.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Naphthalene (NAP)	0.1 - 0.5	ug/L
Norflurazon (NORFLR)	1 - 5	ug/L
Parathion (PARA)	0.5 - 2.5	ug/L
Pentachlorophenol (PCP) (PCP)	1 - 5	ug/L
Permethrin-(total of cis/trans) (PMTHRN)	0.1 - 0.5	ug/L
Phenanthrene (PHENAN)	0.1 - 0.5	ug/L
Prometryn (PROMET)	0.1 - 0.5	ug/L
Pronamide (PROAMD)	0.1 - 0.5	ug/L
Propachlor (PROPCL)	0.1 - 0.5	ug/L
Propazine (PROPAZ)	0.1 - 0.5	ug/L
Pyrene (PYRENE)	0.1 - 0.5	ug/L
Simazine (SIMAZ)	0.1 - 0.5	ug/L
Tebuthiuron (TBTURN)	2 - 10	ug/L
Terbacil (TRBACL)	0.1 - 0.5	ug/L
Terbufos Sulfone (TERSUL)	0.1 - 0.5	ug/L
Thiobencarb (THIO)	0.1 - 0.5	ug/L
Trifluralin (TRFLRN)	0.1 - 0.5	ug/L
Trithion (TRTION)	0.1 - 0.5	ug/L

Laboratory Method: 525-R

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Alachlor (ALACHL)	0.1	ug/L
Atrazine (ATRAZ)	0.1	ug/L
Bromacil (BROMAC)	0.1	ug/L
Butachlor (BUTACL)	0.1	ug/L
Caffeine (CAFFEI)	100	ng/L
Diazinon (DIAZI)	0.1	ug/L
Dimethoate (DMTH)	1	ug/L
EPTC (EPTC)	0.1	ug/L
Ethion (ETHION)	0.1	ug/L
Malathion (MALATH)	2	ug/L

Laboratory Method: 525-R

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
methyl-Parathion (MPARA)	0.5	ug/L
Metolachlor (METOCL)	0.1	ug/L
Metribuzin (MTRBZN)	0.1	ug/L
Molinate (MOLINT)	0.1	ug/L
Norflurazon (NORFLR)	0.1	ug/L
Parathion (PARA)	0.5	ug/L
Prometryn (PROMET)	0.1	ug/L
Propachlor (PROPCL)	0.1	ug/L
Propazine (PROPAZ)	0.1	ug/L
Simazine (SIMAZ)	0.1	ug/L
Thiobencarb (THIO)	0.1	ug/L

Laboratory Method: 531

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
1-Naphthol (NPTHOL)	5	ug/L
3-Hydroxycarbofuran (HYDCFR)	2	ug/L
Aldicarb (ALDI)	1	ug/L
Aldicarb sulfone (ALDISN)	2	ug/L
Aldicarb sulfoxide (ALDISX)	2	ug/L
Baygon (BAYGON)	1	ug/L
Carbaryl (CARBAR)	2	ug/L
Carbofuran (CARBOF)	1	ug/L
Methiocarb (MTHCRB)	4	ug/L
Methomyl (MTHOMY)	1	ug/L
Oxamyl (OXAMYL)	2	ug/L

Laboratory Method: 5310C

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Organic Carbon (Unfiltered) (TOC)	0.05	mg/L

Laboratory Method: 537

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Perfluoro butane sulfonic acid (PFBS)	4	ng/L
Perfluoro heptanoic acid (PFHpA)	4	ng/L
Perfluoro hexane sulfonic acid (PFHxS)	4	ng/L
Perfluoro nonanoic acid (PFNA)	4	ng/L
Perfluoro octane sulfonic acid (PFOS)	4	ng/L
Perfluoro octanoic acid (PFOA)	4	ng/L
Perfluoro-2-propoxypropanoic acid (GenX)	4	ng/L
Perfluorodecanoic acid (PFDA)	4	ng/L
Perfluorododecanoic acid (PFDoA)	4	ng/L
Perfluorohexanoic acid (PFHxA)	4	ng/L
Perfluorotetradecanoic acid (PFTA)	4	ng/L
Perfluorotridecanoic acid (PFTrDA)	4	ng/L
Perfluoroundecanoic acid (PFUnA)	4	ng/L

Laboratory Method: 547

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Glyphosate (GLYPHO)	25	ug/L

Laboratory Method: 548.1

Laboratory: WECK LABORATORIES, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Endothall (ENDOTL)	45	ug/L

Laboratory Method: 549.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Diquat (DIQUAT)	4	ug/L
Paraquat (PARAQT)	4	ug/L

Laboratory Method: 551.1

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
1,1,1-Trichloroethane (111TCA)	0.1	ug/L
1,1,1-Trichloropropanone (111TCP)	0.1	ug/L
1,1,2-Trichloroethane (112TCA)	0.1	ug/L
1,1-Dichloro-2-propanone (11DC2P)	0.1	ug/L
1,2,3-Trichloropropane (123TCP)	0.1	ug/L
1,2-Dibromo-3-chloropropane (DBCP)	0.1	ug/L
1,2-Dibromoethane (EDB)	0.1	ug/L
Bromochloroacetonitrile (BCAN)	0.1	ug/L
Bromodichloromethane (CHBrCl)	0.1	ug/L
Bromoform (CHBr3)	0.1	ug/L
Carbon tetrachloride (CCl4)	0.1	ug/L
Chloroform (CHCl3)	0.1	ug/L
Chloropicrin (ClPICR)	0.1	ug/L
Dibromoacetonitrile (DBAN)	0.1	ug/L
Dibromochloromethane (CHBr2C)	0.1	ug/L
Dichloroacetonitrile (DCAN)	0.1	ug/L
Tetrachloroethene (PCE)	0.1	ug/L
Total Trihalomethanes (TTHMs)	0.1	ug/L
Trichloroacetonitrile (TCAN)	0.1	ug/L
Trichloroethene (TCE)	0.1	ug/L

Laboratory Method: 552.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Bromochloroacetic Acid (BCAA)	1	ug/L
Bromodichloroacetic Acid (BDCAA)	1	ug/L
Chlorodibromoacetic Acid (CDBAA)	1	ug/L
Dalapon (DALAPN)	1	ug/L
Dibromoacetic Acid (DBAA)	1	ug/L
Dichloroacetic Acid (DCAA)	1	ug/L
Monobromoacetic Acid (MBAA)	1	ug/L
Monochloroacetic Acid (MCAA)	1	ug/L
Tribromoacetic Acid (TBAA)	1	ug/L
Trichloroacetic Acid (TCAA)	1	ug/L

Laboratory Method: 5540C

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Surfactants (MBAS)	0.02	mg/L

Laboratory Method: 556

Laboratory: WECK LABORATORIES, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Acetaldehyde (ACEALD)	2	ug/L
Benzaldehyde (BENALD)	2	ug/L
Butanal (BUTAN)	2	ug/L
Crotonaldehyde (CRTALD)	2	ug/L
Cyclohexanone (CYCHXN)	2	ug/L
Decanal (DECNAL)	2	ug/L
Formaldehyde (FORALD)	2	ug/L
Glyoxal (GLYOXL)	2	ug/L
Heptanal (HEPNAL)	2 - 5	ug/L
Hexanal (HEXNAL)	2	ug/L
Methylglyoxal (MGLYOX)	2	ug/L

Laboratory Method: 556

Laboratory: WECK LABORATORIES, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Nonanal (NONNAL)	2	ug/L
Pentanal (PENTNL)	2	ug/L
Propanal (PROPNL)	2	ug/L

Laboratory Method: 5910B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Ultraviolet percent transmittance @254nm (UV%T-254)	0.1	%

Laboratory Method: 625

Laboratory: TESTAMERICA IRVINE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
1,2,4-Trichlorobenzene (124TCB)	9.8 - 10	ug/L
1,2-Dichlorobenzene (12DCB)	9.8 - 10	ug/L
1,2-Diphenylhydrazine (12DPH)	10 - 21	ug/L
1,3-Dichlorobenzene (13DCB)	9.8 - 10	ug/L
1,4-Dichlorobenzene (14DCB)	9.8 - 10	ug/L
2,4,5-Trichlorophenol (245TCP)	10 - 21	ug/L
2,4,6-Trichlorophenol (246TCP)	10 - 21	ug/L
2,4-Dichlorophenol (24DCPH)	9.8 - 10	ug/L
2,4-Dimethylphenol (24DMP)	10 - 21	ug/L
2,4-Dinitrophenol (24DNP)	20 - 42	ug/L
2,4-Dinitrotoluene (24DNT)	9.8 - 10	ug/L
2,6-Dinitrotoluene (26DNT)	9.8 - 10	ug/L
2-Chloronapthalene (2ClNAP)	9.8 - 10	ug/L
2-Chlorophenol (2ClPNL)	9.8 - 10	ug/L
2-Methyl naphthalene (2MNAP)	9.8 - 10	ug/L
2-Methyl-4,6-Dinitrophenol (2MDNP)	20 - 21	ug/L
2-Methylphenol (oCRESL)	9.8 - 10	ug/L
2-Nitroaniline (oNTANL)	10 - 21	ug/L

Laboratory Method: 625

Laboratory: TESTAMERICA IRVINE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2-Nitrophenol (2NPNL)	9.8 - 10	ug/L
3- & 4-Methylphenol (mpCRESL)	10	ug/L
3,3'-Dichlorobenzidine (DCBZDE)	20 - 21	ug/L
3-Nitroaniline (mNTANL)	20 - 21	ug/L
4-Bromophenyl phenyl ether (4BrPPE)	9.8 - 10	ug/L
4-Chloro-3-methylphenol (43CMP)	20 - 21	ug/L
4-Chloroaniline (pClANL)	9.8 - 10	ug/L
4-Chlorophenyl phenyl ether (4ClPPE)	9.8 - 10	ug/L
4-Methylphenol (pCRESL)	9.8 - 10	ug/L
4-Nitroaniline (pNTANL)	20 - 21	ug/L
4-Nitrophenol (4NPNL)	20 - 21	ug/L
Acenaphthene (ACNAPE)	9.8 - 10	ug/L
Acenaphthylene (ACENAP)	9.8 - 10	ug/L
Aniline (ANLN)	9.8 - 10	ug/L
Anthracene (ANTHRA)	9.8 - 10	ug/L
Benzidine (BNZDE)	39 - 42	ug/L
Benzo(a)anthracene (BaANTH)	9.8 - 10	ug/L
Benzo(a)pyrene (BaPYRE)	9.8 - 10	ug/L
Benzo(b)fluoranthene (BbFLUR)	9.8 - 10	ug/L
Benzo(g,h,i)perylene (BghiPR)	9.8 - 10	ug/L
Benzo[k]fluoranthene (BkFLUR)	9.8 - 10	ug/L
Benzoic Acid (BNZACD)	20 - 21	ug/L
Benzyl Alcohol (BNZALC)	20 - 21	ug/L
bis (2-chloroethoxy) methane (B2CEM)	9.8 - 10	ug/L
bis (2-chloroethyl) ether (B2CLEE)	9.8 - 10	ug/L
bis (2-chloroisopropyl) ether (B2CIPE)	9.8 - 10	ug/L
bis (2-ethylhexyl) phthalate (DEHP)	20 - 21	ug/L
Butylbenzyl phthalate (BBP)	20 - 21	ug/L
Chrysene (CHRYS)	9.8 - 10	ug/L
Dibenzo(a,h)anthracene (DBahAN)	20 - 21	ug/L
Dibenzofuran (DBFUR)	9.8 - 10	ug/L
Diethyl phthalate (DEP)	9.8 - 10	ug/L
Dimethyl phthalate (DMP)	9.8 - 10	ug/L
Di-n-butylphthalate (DnBP)	20 - 21	ug/L

Laboratory Method: 625

Laboratory: TESTAMERICA IRVINE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Di-n-octyl phthalate (DnOP)	20 - 21	ug/L
Fluoranthene (FLANTH)	9.8 - 10	ug/L
Fluorene (FLUOR)	9.8 - 10	ug/L
Hexachlorobenzene (HEXCLB)	9.8 - 10	ug/L
Hexachlorobutadiene (HClBut)	9.8 - 10	ug/L
Hexachlorocyclopentadiene (HClCPD)	20 - 21	ug/L
Hexachloroethane (HCE)	9.8 - 10	ug/L
Indeno(1,2,3-cd)pyrene (INDPYR)	20 - 21	ug/L
Isophorone (IPHOR)	9.8 - 10	ug/L
Naphthalene (NAP)	9.8 - 10	ug/L
Nitrobenzene (NBENZ)	20 - 21	ug/L
n-Nitroso-di-n-propylamine (NDPA)	9,800 - 10,000	ng/L
n-Nitrosodiphenylamine (NDPhA)	9,800 - 10,000	ng/L
Pentachlorophenol (PCP) (PCP)	20 - 21	ug/L
Phenanthrene (PHENAN)	9.8 - 10	ug/L
Phenol (PHENOL)	9.8 - 10	ug/L
Pyrene (PYRENE)	9.8 - 10	ug/L

Laboratory Method: 7110C

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Alpha (TOTa)	1.11 - 1.6	pCi/L
Total Alpha Counting Error (TOTaCE)	1.11 - 1.6	pCi/L

Laboratory Method: 900.0

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Beta (TOTb)	0.831 - 2.34	pCi/L
Total Beta Counting Error (TOTbCE)	0.831 - 2.34	pCi/L

Laboratory Method: 903.0

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Radium 226 (TRa226)	0.274 - 0.456	pCi/L
Total Radium 226 Counting Error (TRa6CE)	0.274 - 0.456	pCi/L

Laboratory Method: 905.0

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Strontium-90 (TS90)	0.546	pCi/L
Total Strontium-90 Counting Error (TS90CE)	0.546	pCi/L

Laboratory: TESTAMERICA ST LOUIS

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Strontium-90 (TS90)	0.395 - 0.396	pCi/L
Total Strontium-90 Counting Error (TS90CE)	0.395 - 0.396	pCi/L

Laboratory Method: 906.0

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Tritium (TTr)	434	pCi/L
Total Tritium Counting Error (TTrCE)	434	pCi/L

Laboratory Method: 908.0

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Natural Uranium (NTUr)	0.342 - 0.47	pCi/L
Natural Uranium Counting Error (NTUrCE)	0.342 - 0.47	pCi/L

Laboratory Method: 9221B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Total Coliform (Mult. Tube Fermentation) (TCOLIM)	1.1	MPN

Laboratory Method: 9221E

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Fecal Coliform (Mult. Tube Fermentation) (FCOLIM)	1.1	MPN

Laboratory Method: 9222B

Laboratory: O.C. HEALTH CARE AGENCY

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Total Coliform (Membrane Filtration-CFU/100ml) (TCOLIF)	1	CFU/100

Laboratory Method: 9223B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
E. Coli (Colilert - MPN/100mL) (ECOLIQ)	1 - 3,400	MPN
Total Coliform (Colilert - MPN/100mL) (TCOLIQ)	1 - 3,400	MPN

Laboratory Method: CEC

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
17a-Estradiol (aESTRA)	1	ng/L
17a-Ethynylestradiol (aETEST)	2	ng/L
17b-Estradiol (bESTRA)	2	ng/L
4-Androstene-3, 17-dione (ANDROS)	2	ng/L
4-n-Octylphenol (4nOCPH)	0.2	ug/L
4-tert-Octylphenol (4tOCPH)	0.2	ug/L

Laboratory Method: CEC

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Acetaminophen (ACTMNP)	5 - 50	ng/L
Aspartame (ASPATM)	100	ng/L
Atenolol (ATENOL)	5	ng/L
Atrazine (ATRAZ)	0.001	ug/L
Azithromycin (AZTMCN)	10 - 50	ng/L
Bisphenol A (BisPHA)	0.2	ug/L
Caffeine (CAFFEI)	3 - 30	ng/L
Carbamazepine (CBMAZP)	1	ng/L
Diclofenac (DICLFN)	5	ng/L
Diethylstilbestrol (DESTBL)	2	ng/L
Dilantin (DILANT)	10	ng/L
Diuron (DIURON)	0.005	ug/L
Epitestosterone (cis-Testosterone) (EPITES)	1	ng/L
Equilin (EQUILN)	5	ng/L
Erythromycin (ERYTHN)	1	ng/L
Estriol (ESTRIO)	2	ng/L
Estrone (ESTRON)	1	ng/L
Fluoxetine (FLUXET)	5 - 10	ng/L
Gemfibrozil (GMFIBZ)	1	ng/L
Ibuprofen (IBPRFN)	1 - 5	ng/L
Iohexol (IOHEXL)	20	ng/L
Iopromide (IOPRMD)	10	ng/L
Linuron (LINURN)	0.005	ug/L
Meprobamate (MEPROB)	5	ng/L
N,N-diethyl-m-toluamide (DEET)	1 - 5	ng/L
Naproxen (NAPRXN)	5	ng/L
Neotam (NEOTAM)	10	ng/L
Nonylphenol (NONYPH)	0.2	ug/L
para-Chlorobenzene sulfonic acid (pCBSA)	200	ng/L
Pentachlorophenol (PCP) (PCP)	0.2	ug/L
PhenylPhenol (PHNYPH)	0.2	ug/L
Primidone (PRIMDN)	1 - 10	ng/L
Progesterone (PRGSTR)	1	ng/L
Simazine (SIMAZ)	0.005	ug/L

Laboratory Method: CEC

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Sucralose (SUCRAL)	100	ng/L
Sulfamethoxazole (SULTHZ)	1	ng/L
Testosterone (trans-Testosterone) (TESTOR)	1	ng/L
Tetrabromobisphenol A (TBBISA)	0.2	ug/L
Triclosan (TRICLN)	1	ng/L
Trimethoprim (TRIMTP)	5 - 10	ng/L
Tris-2-chlorethyl phosphate (TCEP)	5	ng/L

Laboratory Method: H2O2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Hydrogen Peroxide (H2O2)	0.1	mg/L

Laboratory Method: M-TEC

Laboratory: O.C. HEALTH CARE AGENCY

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
E. Coli (Membrane Filtration - CFU/100ml) (ECOLI)	1	CFU/100

Laboratory Method: NDMA-LOW

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
N-Nitrosodiethylamine (NDEA)	2 - 10	ng/L
n-Nitrosodimethylamine (NDMA)	2 - 10	ng/L
n-Nitroso-di-n-propylamine (NDPA)	2 - 10	ng/L
N-Nitrosomorpholine (NMOR)	2 - 50	ng/L

Laboratory Method: RA-05

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Radium 228 (TRa228)	0.383 - 0.506	pCi/L
Total Radium 228 Counting Error (TRa8CE)	0.383 - 0.506	pCi/L

Laboratory Method: UNKWQAN

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Gross Alpha Excluding Uranium (TOTa-U)	1.11 - 1.6	pCi/L
Radium 226 + Radium 228 (Ra6Ra8)	0.383 - 0.506	pCi/L
Radium 226 + Radium 228 Counting Error (Ra68CE)	0.383 - 0.506	pCi/L

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Aggressive Index (AI)		A.I.
Bicarbonate (as HCO3) (HCO3)	1.2	mg/L
Cation-Anion meq balance (CATANI)		RATIO
Nitrate (NO3)	0.4	mg/L
Nitrate + Nitrite Nitrogen (NO3NO2-N)	0.1	mg/L
Nitrite (NO2)	0.007	mg/L
PFOA + PFOS (PFOAOS)	4	ng/L
Sum of five Haloacetic Acids (HAA5)	1	ug/L
Sum of nine Haloacetic Acids (HAA9)	1	ug/L
Sum of Six Brominated Haloacetic Acids (HAA6Br)	1	ug/L
Title 22 Cation-Anion Balance (T22CAB)		meq/L
Title 22 Total Anions (T22ANI)		meq/L
Title 22 Total Cations (T22CAT)		meq/L
Total Anions (TOTANI)		meq/L
Total Cations (TOTCAT)		meq/L
Total Nitrogen (TOT-N)	0.2 - 0.6	mg/L

Laboratory Method: X1-218.6

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Hexavalent Chromium (CrVI)	0.2	ug/L

Laboratory Method: X1-218.7

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Hexavalent Chromium (CrVI)	0.2 - 2	ug/L

Laboratory Method: X1-300.0

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Bromide (Br)	0.1	mg/L
Chloride (Cl)	0.5 - 2	mg/L
Fluoride (F)	0.1 - 0.4	mg/L
Nitrate Nitrogen (NO3-N)	0.1	mg/L
Sulfate (SO4)	0.5 - 2	mg/L

Laboratory Method: X1-335.4

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Cyanide (CN)	5	ug/L

Laboratory Method: X1-351.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Organic Nitrogen (ORG-N)	0.1	mg/L
Total Kjeldahl Nitrogen (TKN)	0.2 - 0.6	mg/L
Total Nitrogen (TOT-N)	0.3	mg/L

Laboratory Method: X200.7

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Boron (B)	0.1 - 0.2	mg/L
Boron (dissolved) (B-DIS)	0.1	mg/L
Calcium (Ca)	0.5 - 1	mg/L
Calcium (dissolved) (Ca-DIS)	0.5	mg/L
Calcium Hardness (CaHRD)	0.25	mg/L
Iron (Fe)	5 - 10	ug/L
Iron (dissolved) (Fe-DIS)	5	ug/L
Magnesium (Mg)	0.5 - 1	mg/L
Magnesium (dissolved) (Mg-DIS)	0.5	mg/L
Potassium (K)	0.5 - 1	mg/L
Potassium (dissolved) (K-DIS)	0.5	mg/L
Sodium (Na)	0.5 - 1	mg/L
Sodium (dissolved) (Na-DIS)	0.5	mg/L
Total Hardness (as CaCO3) (TOTHRD)	1	mg/L
Total Hardness (as CaCO3) (dissolved) (TOTHRD-D)	1	mg/L

Laboratory Method: X200.8

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Aluminum (Al)	1 - 5	ug/L
Aluminum (dissolved) (Al-DIS)	1	ug/L
Antimony (Sb)	1	ug/L
Antimony (dissolved) (Sb-DIS)	1	ug/L
Arsenic (As)	1	ug/L
Arsenic (dissolved) (As-DIS)	1	ug/L
Barium (Ba)	1 - 3	ug/L
Barium (dissolved) (Ba-DIS)	1 - 3	ug/L
Beryllium (Be)	1 - 3	ug/L
Beryllium (dissolved) (Be-DIS)	1 - 3	ug/L
Cadmium (Cd)	1	ug/L
Cadmium (dissolved) (Cd-DIS)	1	ug/L
Chromium (Cr)	1	ug/L

Laboratory Method: X200.8

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Chromium (dissolved) (Cr-DIS)	1	ug/L
Cobalt (Co)	1	ug/L
Cobalt (dissolved) (Co-DIS)	1	ug/L
Copper (Cu)	1	ug/L
Copper (dissolved) (Cu-DIS)	1	ug/L
Gadolinium (Gd)	10	ng/L
Gadolinium (dissolved) (Gd-DIS)	10	ng/L
Lead (Pb)	1 - 3	ug/L
Lead (dissolved) (Pb-DIS)	1 - 2	ug/L
Manganese (Mn)	1 - 2	ug/L
Manganese (dissolved) (Mn-DIS)	1	ug/L
Mercury (Hg)	1	ug/L
Mercury (dissolved) (Hg-DIS)	1	ug/L
Molybdenum (Mo)	1	ug/L
Nickel (Ni)	1	ug/L
Nickel (dissolved) (Ni-DIS)	1	ug/L
Selenium (Se)	1	ug/L
Selenium (dissolved) (Se-DIS)	1	ug/L
Silver (Ag)	1	ug/L
Silver (dissolved) (Ag-DIS)	1	ug/L
Thallium (Tl)	1	ug/L
Thallium (dissolved) (Tl-DIS)	1	ug/L
Trivalent Chromium (CrIII)	1	ug/L
Uranium (dissolved) (U-DIS)	1	ug/L
Vanadium (V)	1	ug/L
Vanadium (dissolved) (V-DIS)	1	ug/L
Zinc (Zn)	1	ug/L
Zinc (dissolved) (Zn-DIS)	1	ug/L

Laboratory Method: X200.8D

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Barium (dissolved) (Ba-DIS)	1	ug/L

Appendix C

Water Quality Constituents
With Laboratory Methods

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

ORANGE COUNTY WATER DISTRICT
Water Quality Constituents With Laboratory Methods

Constituent Type: BIOLOGICAL

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Bacteriophage, Male Specific (BACTMLSP)	1601	1	P/A PERL	BIOVIR
Bacteriophage, Somatic (BACTSOMT)	1601	1	P/A PERL	BIOVIR
E. Coli (Colilert - MPN/100mL) (ECOLIQ)	9223B	1 - 3,400	MPN	OCWD
E. Coli (Membrane Filtration - CFU/100ml) (ECOLI)	M-TEC	1	CFU/100	OCHCA
Enterococcus(Membrane Filtration-CFU/100ml) (ENTRCC)	1600	1	CFU/100	OCHCA
Fecal Coliform (Mult. Tube Fermentation) (FCOLIM)	9221E	1.1	MPN	OCWD
Total Coliform (Colilert - MPN/100mL) (TCOLIQ)	9223B	1 - 3,400	MPN	OCWD
Total Coliform (Membrane Filtration-CFU/100ml) (TCOLIF)	9222B	1	CFU/100	OCHCA
Total Coliform (Mult. Tube Fermentation) (TCOLIM)	9221B	1.1	MPN	OCWD

Constituent Type: INORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Aggressive Index (AI)	UNKWQAN		A.I.	OCWD
Alkalinity-Phenolphthalein (ALKPHE)	2320B	1	mg/L	OCWD
Aluminum (Al)	X200.8	1 - 5	ug/L	OCWD
Aluminum (dissolved) (Al-DIS)	X200.8	1	ug/L	OCWD
Ammonia Nitrogen (NH3-N)	350.1	0.1 - 0.4	mg/L	OCWD
Antimony (Sb)	X200.8	1	ug/L	OCWD
Antimony (dissolved) (Sb-DIS)	X200.8	1	ug/L	OCWD
Apparent Color (unfiltered) (APCOLR)	2120B	3	UNITS	OCWD
Arsenic (As)	X200.8	1	ug/L	OCWD
Arsenic (dissolved) (As-DIS)	X200.8	1	ug/L	OCWD
Asbestos (ASBESTOS)	100.2	0.2	MFL	EUROFINS

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ORANGE COUNTY WATER DISTRICT
Water Quality Constituents With Laboratory Methods

Constituent Type: INORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Barium (Ba)	X200.8	1 - 3	ug/L	OCWD
Barium (dissolved) (Ba-DIS)	X200.8	1 - 3	ug/L	OCWD
Barium (dissolved) (Ba-DIS)	X200.8D	1	ug/L	OCWD
Beryllium (Be)	X200.8	1 - 3	ug/L	OCWD
Beryllium (dissolved) (Be-DIS)	X200.8	1 - 3	ug/L	OCWD
Bicarbonate (as CaCO3) (HCO3Ca)	2320B	1	mg/L	OCWD
Bicarbonate (as HCO3) (HCO3)	2320B	1.2	mg/L	OCWD
Bicarbonate (as HCO3) (HCO3)	UNKWQAN	1.2	mg/L	OCWD
Biochemical Oxygen Demand (BOD)	5210B	2 - 12	mg/L	TESTAMER
Boron (B)	X200.7	0.1 - 0.2	mg/L	OCWD
Boron (dissolved) (B-DIS)	X200.7	0.1	mg/L	OCWD
Bromate (BrO3)	300.1B	5	ug/L	OCWD
Bromide (Br)	300.1B	0.01	mg/L	OCWD
Bromide (Br)	X1-300.0	0.1	mg/L	OCWD
Cadmium (Cd)	X200.8	1	ug/L	OCWD
Cadmium (dissolved) (Cd-DIS)	X200.8	1	ug/L	OCWD
Calcium (Ca)	X200.7	0.5 - 1	mg/L	OCWD
Calcium (dissolved) (Ca-DIS)	X200.7	0.5	mg/L	OCWD
Calcium Hardness (CaHRD)	X200.7	0.25	mg/L	OCWD
Carbonate (as CaCO3) (CO3Ca)	2320B	1	mg/L	OCWD
Carbonate (as CO3) (CO3)	2320B	0.6	mg/L	OCWD
Cation-Anion meq balance (CATANI)	UNKWQAN		RATIO	OCWD
Chlorate (CLO3)	300.1B	10	ug/L	OCWD
Chloride (Cl)	X1-300.0	0.5 - 2	mg/L	OCWD

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ORANGE COUNTY WATER DISTRICT
Water Quality Constituents With Laboratory Methods

Constituent Type: INORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Chlorite (CLO2)	300.1B	10	ug/L	OCWD
Chromium (Cr)	X200.8	1	ug/L	OCWD
Chromium (dissolved) (Cr-DIS)	X200.8	1	ug/L	OCWD
Cobalt (Co)	X200.8	1	ug/L	OCWD
Cobalt (dissolved) (Co-DIS)	X200.8	1	ug/L	OCWD
Copper (Cu)	X200.8	1	ug/L	OCWD
Copper (dissolved) (Cu-DIS)	X200.8	1	ug/L	OCWD
Corrosivity (CORROS)	2330B	-100	S.I.	OCWD
Cyanide (CN)	X1-335.4	5	ug/L	OCWD
Electrical Conductivity (EC)	2510B	1	um/cm	OCWD
Fluoride (F)	X1-300.0	0.1 - 0.4	mg/L	OCWD
Free Chlorine (FRCL2)	4500CLF	0.1	mg/L	OCWD
Free Res. Chlorine -- Amperometric Method (FRCL2A)	4500CLD	0.1	mg/L	OCWD
Gadolinium (Gd)	X200.8	10	ng/L	OCWD
Gadolinium (dissolved) (Gd-DIS)	X200.8	10	ng/L	OCWD
Hexavalent Chromium (CrVI)	X1-218.6	0.2	ug/L	OCWD
Hexavalent Chromium (CrVI)	X1-218.7	0.2 - 2	ug/L	OCWD
Hydrogen Peroxide (H2O2)	H2O2	0.1	mg/L	OCWD
Hydroxide (as CaCO3) (OHCa)	2320B	1	mg/L	OCWD
Hydroxide (as OH) (OH)	2320B	0.3	mg/L	OCWD
Iron (Fe)	X200.7	5 - 10	ug/L	OCWD
Iron (dissolved) (Fe-DIS)	X200.7	5	ug/L	OCWD
Lead (Pb)	X200.8	1 - 3	ug/L	OCWD

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Constituent Type: INORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Lead (dissolved) (Pb-DIS)	X200.8	1 - 2	ug/L	OCWD
Magnesium (Mg)	X200.7	0.5 - 1	mg/L	OCWD
Magnesium (dissolved) (Mg-DIS)	X200.7	0.5	mg/L	OCWD
Manganese (Mn)	X200.8	1 - 2	ug/L	OCWD
Manganese (dissolved) (Mn-DIS)	X200.8	1	ug/L	OCWD
Mercury (Hg)	X200.8	1	ug/L	OCWD
Mercury (dissolved) (Hg-DIS)	X200.8	1	ug/L	OCWD
Molybdenum (Mo)	X200.8	1	ug/L	OCWD
Nickel (Ni)	X200.8	1	ug/L	OCWD
Nickel (dissolved) (Ni-DIS)	X200.8	1	ug/L	OCWD
Nitrate (NO3)	4500NO3F	0.4	mg/L	OCWD
Nitrate (NO3)	UNKWQAN	0.4	mg/L	OCWD
Nitrate + Nitrite Nitrogen (NO3NO2-N)	4500NO3F	0.1	mg/L	OCWD
Nitrate + Nitrite Nitrogen (NO3NO2-N)	UNKWQAN	0.1	mg/L	OCWD
Nitrate Nitrogen (NO3-N)	4500NO3F	0.1	mg/L	OCWD
Nitrate Nitrogen (NO3-N)	X1-300.0	0.1	mg/L	OCWD
Nitrite (NO2)	UNKWQAN	0.007	mg/L	OCWD
Nitrite Nitrogen (NO2-N)	4500NO3F	0.002	mg/L	OCWD
Odor Range High (ODORHI)	2150B	0	TON	OCWD
Odor Range Low (ODORLO)	2150B	0	TON	OCWD
Organic Nitrogen (ORG-N)	X1-351.2	0.1	mg/L	OCWD
Perchlorate (CLO4)	332.0	2.5	ug/L	OCWD
pH (pH)	4500H+B	1	UNITS	OCWD
Phosphate Phosphorus (orthophosphate) (PO4-P)	365.1	0.01	mg/L	OCWD

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Constituent Type: INORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Potassium (K)	X200.7	0.5 - 1	mg/L	OCWD
Potassium (dissolved) (K-DIS)	X200.7	0.5	mg/L	OCWD
Selenium (Se)	X200.8	1	ug/L	OCWD
Selenium (dissolved) (Se-DIS)	X200.8	1	ug/L	OCWD
Silica (SIO2)	4500SIOC	1	mg/L	OCWD
Silver (Ag)	X200.8	1	ug/L	OCWD
Silver (dissolved) (Ag-DIS)	X200.8	1	ug/L	OCWD
Sodium (Na)	X200.7	0.5 - 1	mg/L	OCWD
Sodium (dissolved) (Na-DIS)	X200.7	0.5	mg/L	OCWD
Sulfate (SO4)	X1-300.0	0.5 - 2	mg/L	OCWD
Surfactants (MBAS)	5540C	0.02	mg/L	OCWD
Suspended Solids (SUSSOL)	2540D	1 - 2.5	mg/L	OCWD
Thallium (Tl)	X200.8	1	ug/L	OCWD
Thallium (dissolved) (Tl-DIS)	X200.8	1	ug/L	OCWD
Threshold Odor Number (Median) (ODOR)	2150B	0	TON	OCWD
Title 22 Cation-Anion Balance (T22CAB)	UNKWQAN		meq/L	OCWD
Title 22 Total Anions (T22ANI)	UNKWQAN		meq/L	OCWD
Title 22 Total Cations (T22CAT)	UNKWQAN		meq/L	OCWD
Tot. Res. Chlorine -- Amperometric Method (TOTCLA)	4500CLD	0.1	mg/L	OCWD
Total Alkalinity (as CaCO3) (TOTALK)	2320B	1	mg/L	OCWD
Total Anions (TOTANI)	UNKWQAN		meq/L	OCWD
Total Cations (TOTCAT)	UNKWQAN		meq/L	OCWD
Total Chlorine (TOTCL2)	4500CLF	0.1	mg/L	OCWD

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Constituent Type: INORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Total Dissolved Solids (TDS)	2540C	1 - 2.5	mg/L	OCWD
Total Hardness (as CaCO3) (TOTHRD)	X200.7	1	mg/L	OCWD
Total Hardness (as CaCO3) (dissolved) (TOTHRD-D)	X200.7	1	mg/L	OCWD
Total Kjeldahl Nitrogen (TKN)	X1-351.2	0.2 - 0.6	mg/L	OCWD
Total Nitrogen (TOT-N)	UNKWQAN	0.2 - 0.6	mg/L	OCWD
Total Nitrogen (TOT-N)	X1-351.2	0.3	mg/L	OCWD
Total Organic Carbon (Unfiltered) (TOC)	5310C	0.05	mg/L	OCWD
Trivalent Chromium (CrIII)	X200.8	1	ug/L	OCWD
True Color (filtered) (TRCOLR)	2120B	3	UNITS	OCWD
Turbidity (TURB)	2130B	0.1	NTU	OCWD
Ultraviolet percent transmittance @254nm (UV%T-254)	5910B	0.1	%	OCWD
Uranium (dissolved) (U-DIS)	X200.8	1	ug/L	OCWD
Vanadium (V)	X200.8	1	ug/L	OCWD
Vanadium (dissolved) (V-DIS)	X200.8	1	ug/L	OCWD
Zinc (Zn)	X200.8	1	ug/L	OCWD
Zinc (dissolved) (Zn-DIS)	X200.8	1	ug/L	OCWD

Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
1,1,1,2-Tetrachloroethane (1112PC)	524.2	0.5	ug/L	OCWD
1,1,1-Trichloroethane (111TCA)	524.2	0.5	ug/L	OCWD
1,1,1-Trichloroethane (111TCA)	551.1	0.1	ug/L	OCWD
1,1,1-Trichloropropanone (111TCP)	551.1	0.1	ug/L	OCWD

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ORANGE COUNTY WATER DISTRICT
Water Quality Constituents With Laboratory Methods

Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
1,1,2,2-Tetrachloroethane (1122PC)	524.2	0.5	ug/L	OCWD
1,1,2-Trichloroethane (112TCA)	524.2	0.5	ug/L	OCWD
1,1,2-Trichloroethane (112TCA)	551.1	0.1	ug/L	OCWD
1,1-Dichloro-2-propanone (11DC2P)	551.1	0.1	ug/L	OCWD
1,1-Dichloroethane (11DCA)	524.2	0.5	ug/L	OCWD
1,1-Dichloroethene (11DCE)	524.2	0.5	ug/L	OCWD
1,1-Dichloropropene (11DCP)	524.2	0.5	ug/L	OCWD
1,2,3-Trichlorobenzene (123TCB)	524.2	0.5 - 5	ug/L	OCWD
1,2,3-Trichloropropane (123TCP)	14DIOX	0.005	ug/L	OCWD
1,2,3-Trichloropropane (123TCP)	504.1	0.05	ug/L	OCWD
1,2,3-Trichloropropane (123TCP)	524.2	0.5	ug/L	OCWD
1,2,3-Trichloropropane (123TCP)	524M-TCP	0.005	ug/L	OCWD
1,2,3-Trichloropropane (123TCP)	551.1	0.1	ug/L	OCWD
1,2,4-Trichlorobenzene (124TCB)	524.2	0.5 - 5	ug/L	OCWD
1,2,4-Trichlorobenzene (124TCB)	625	9.8 - 10	ug/L	TESTAMER
1,2,4-Trimethylbenzene (124TMB)	524.2	0.5	ug/L	OCWD
1,2-Dibromo-3-chloropropane (DBCP)	14DIOX	0.01	ug/L	OCWD
1,2-Dibromo-3-chloropropane (DBCP)	504.1	0.01	ug/L	OCWD
1,2-Dibromo-3-chloropropane (DBCP)	524.2	0.5	ug/L	OCWD
1,2-Dibromo-3-chloropropane (DBCP)	524M-TCP	0.01	ug/L	OCWD
1,2-Dibromo-3-chloropropane (DBCP)	551.1	0.1	ug/L	OCWD
1,2-Dibromoethane (EDB)	14DIOX	0.005	ug/L	OCWD
1,2-Dibromoethane (EDB)	504.1	0.01	ug/L	OCWD
1,2-Dibromoethane (EDB)	524.2	0.5	ug/L	OCWD
1,2-Dibromoethane (EDB)	524M-TCP	0.005	ug/L	OCWD
1,2-Dibromoethane (EDB)	551.1	0.1	ug/L	OCWD
1,2-Dichlorobenzene (12DCB)	524.2	0.5	ug/L	OCWD
1,2-Dichlorobenzene (12DCB)	625	9.8 - 10	ug/L	TESTAMER

Laboratory Abbreviation Descriptions:

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
1,2-Dichloroethane (12DCA)	524.2	0.5	ug/L	OCWD
1,2-Dichloropropane (12DCP)	524.2	0.5	ug/L	OCWD
1,2-Diphenylhydrazine (12DPH)	625	10 - 21	ug/L	TESTAMER
1,3,5-Trimethylbenzene (135TMB)	524.2	0.5	ug/L	OCWD
1,3-Dichlorobenzene (13DCB)	524.2	0.5	ug/L	OCWD
1,3-Dichlorobenzene (13DCB)	625	9.8 - 10	ug/L	TESTAMER
1,3-Dichloropropane (13DCP)	524.2	0.5	ug/L	OCWD
1,4-Dichlorobenzene (14DCB)	524.2	0.5	ug/L	OCWD
1,4-Dichlorobenzene (14DCB)	625	9.8 - 10	ug/L	TESTAMER
1,4-Dioxane (14DIOX)	14DIOX	1	ug/L	OCWD
17a-Estradiol (aESTRA)	CEC	1	ng/L	OCWD
17a-Ethynylestradiol (aETEST)	CEC	2	ng/L	OCWD
17b-Estradiol (bESTRA)	CEC	2	ng/L	OCWD
2,2-Dichloropropane (22DCP)	524.2	0.5	ug/L	OCWD
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1613B	4.7 - 4.8	pg/L	TALSAC
2,4,5-Trichlorophenol (245TCP)	625	10 - 21	ug/L	TESTAMER
2,4,6-Trichlorophenol (246TCP)	625	10 - 21	ug/L	TESTAMER
2,4-Dichlorophenol (24DCPH)	625	9.8 - 10	ug/L	TESTAMER
2,4-Dimethylphenol (24DMP)	625	10 - 21	ug/L	TESTAMER
2,4-Dinitrophenol (24DNP)	625	20 - 42	ug/L	TESTAMER
2,4-Dinitrotoluene (24DNT)	525.2	0.1 - 0.5	ug/L	OCWD
2,4-Dinitrotoluene (24DNT)	625	9.8 - 10	ug/L	TESTAMER
2,6-Dinitrotoluene (26DNT)	525.2	0.1 - 0.5	ug/L	OCWD
2,6-Dinitrotoluene (26DNT)	625	9.8 - 10	ug/L	TESTAMER

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
2-Chloroethylvinyl ether (2ClEVE)	14DIOX	1	ug/L	OCWD
2-Chloronapthalene (2ClNAP)	625	9.8 - 10	ug/L	TESTAMER
2-Chlorophenol (2ClPNL)	625	9.8 - 10	ug/L	TESTAMER
2-Chlorotoluene (2CLTOL)	524.2	0.5	ug/L	OCWD
2-Methyl naphthalene (2MNAP)	625	9.8 - 10	ug/L	TESTAMER
2-Methyl-4,6-Dinitrophenol (2MDNP)	625	20 - 21	ug/L	TESTAMER
2-Methylphenol (oCRESL)	625	9.8 - 10	ug/L	TESTAMER
2-Nitroaniline (oNTANL)	625	10 - 21	ug/L	TESTAMER
2-Nitrophenol (2NPNL)	625	9.8 - 10	ug/L	TESTAMER
3- & 4-Methylphenol (mpCRESL)	625	10	ug/L	TESTAMER
3,3'-Dichlorobenzidine (DCBZDE)	625	20 - 21	ug/L	TESTAMER
3-Nitroaniline (mNTANL)	625	20 - 21	ug/L	TESTAMER
4-Androstene-3, 17-dione (ANDROS)	CEC	2	ng/L	OCWD
4-Bromophenyl phenyl ether (4BrPPE)	625	9.8 - 10	ug/L	TESTAMER
4-Chloro-3-methylphenol (43CMP)	625	20 - 21	ug/L	TESTAMER
4-Chloroaniline (pClANL)	625	9.8 - 10	ug/L	TESTAMER
4-Chlorophenyl phenyl ether (4ClPPE)	625	9.8 - 10	ug/L	TESTAMER
4-Chlorotoluene (4CLTOL)	524.2	0.5	ug/L	OCWD
4-Isopropyltoluene (4IPTOL)	524.2	0.5	ug/L	OCWD
4-Methylphenol (pCRESL)	625	9.8 - 10	ug/L	TESTAMER
4-Nitroaniline (pNTANL)	625	20 - 21	ug/L	TESTAMER
4-Nitrophenol (4NPNL)	625	20 - 21	ug/L	TESTAMER
4-n-Octylphenol (4nOCPH)	CEC	0.2	ug/L	OCWD

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ORANGE COUNTY WATER DISTRICT
Water Quality Constituents With Laboratory Methods

Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
4-tert-Octylphenol (4tOCPH)	CEC	0.2	ug/L	OCWD
Acetaldehyde (ACEALD)	556	2	ug/L	WECKLAB
Acetone (ACETNE)	524.2	10 - 20	ug/L	OCWD
Aniline (ANLN)	625	9.8 - 10	ug/L	TESTAMER
Aspartame (ASPATM)	CEC	100	ng/L	OCWD
Atenolol (ATENOL)	CEC	5	ng/L	OCWD
Benzaldehyde (BENALD)	556	2	ug/L	WECKLAB
Benzene (BENZ)	524.2	0.5	ug/L	OCWD
Benzidine (BNZDE)	625	39 - 42	ug/L	TESTAMER
Benzoic Acid (BNZACD)	625	20 - 21	ug/L	TESTAMER
Benzyl Alcohol (BNZALC)	625	20 - 21	ug/L	TESTAMER
bis (2-chloroethoxy) methane (B2CEM)	625	9.8 - 10	ug/L	TESTAMER
bis (2-chloroethyl) ether (B2CLEE)	524.2	5 - 25	ug/L	OCWD
bis (2-chloroethyl) ether (B2CLEE)	625	9.8 - 10	ug/L	TESTAMER
bis (2-chloroisopropyl) ether (B2CIPE)	625	9.8 - 10	ug/L	TESTAMER
Bisphenol A (BisPHA)	CEC	0.2	ug/L	OCWD
Bromobenzene (BRBENZ)	524.2	0.5	ug/L	OCWD
Bromochloroacetic Acid (BCAA)	552.2	1	ug/L	OCWD
Bromochloroacetonitrile (BCAN)	551.1	0.1	ug/L	OCWD
Bromochloromethane (CH2BrC)	524.2	0.5	ug/L	OCWD
Bromodichloroacetic Acid (BDCAA)	552.2	1	ug/L	OCWD
Bromodichloromethane (CHBrCl)	524.2	0.5	ug/L	OCWD
Bromodichloromethane (CHBrCl)	551.1	0.1	ug/L	OCWD
Bromoform (CHBr3)	524.2	0.5	ug/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Bromoform (CHBr3)	551.1	0.1	ug/L	OCWD
Bromomethane (CH3Br)	524.2	0.5 - 5	ug/L	OCWD
Carbon Disulfide (CS2)	524.2	0.5	ug/L	OCWD
Carbon tetrachloride (CCl4)	524.2	0.5	ug/L	OCWD
Carbon tetrachloride (CCl4)	551.1	0.1	ug/L	OCWD
Chlorobenzene (CLBENZ)	524.2	0.5	ug/L	OCWD
Chlorodibromoacetic Acid (CDBAA)	552.2	1	ug/L	OCWD
Chlorodifluoromethane (FREN22)	524.2	0.5	ug/L	OCWD
Chloroethane (ClETHA)	524.2	0.5	ug/L	OCWD
Chloroform (CHCl3)	524.2	0.5	ug/L	OCWD
Chloroform (CHCl3)	551.1	0.1	ug/L	OCWD
Chloromethane (CH3Cl)	524.2	0.5 - 5	ug/L	OCWD
Chloropicrin (ClPICR)	551.1	0.1	ug/L	OCWD
cis-1,2-Dichloroethene (c12DCE)	524.2	0.5	ug/L	OCWD
cis-1,3-Dichloropropene (c13DCP)	524.2	0.5	ug/L	OCWD
Crotonaldehyde (CRTALD)	556	2	ug/L	WECKLAB
Cyclohexanone (CYCHXN)	556	2	ug/L	WECKLAB
Dacthal Acid Metabolites (tDCPA)	515.3	0.1	ug/L	WECKLAB
Dacthal Acid Metabolites (tDCPA)	515.4	0.25	ug/L	OCWD
Decanal (DECNAL)	556	2	ug/L	WECKLAB
Dibenzofuran (DBFUR)	625	9.8 - 10	ug/L	TESTAMER
Dibromoacetic Acid (DBAA)	552.2	1	ug/L	OCWD
Dibromoacetonitrile (DBAN)	551.1	0.1	ug/L	OCWD
Dibromochloromethane (CHBr2C)	524.2	0.5	ug/L	OCWD
Dibromochloromethane (CHBr2C)	551.1	0.1	ug/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Dibromomethane (CH2Br2)	524.2	0.5	ug/L	OCWD
Dichloroacetic Acid (DCAA)	552.2	1	ug/L	OCWD
Dichloroacetonitrile (DCAN)	551.1	0.1	ug/L	OCWD
Dichlorodifluoromethane (CCl2F2)	524.2	0.5	ug/L	OCWD
Diclofenac (DICLFN)	CEC	5	ng/L	OCWD
Diethylstilbestrol (DESTBL)	CEC	2	ng/L	OCWD
Diisopropyl ether (DIPE)	524.2	1	ug/L	OCWD
Dilantin (DILANT)	CEC	10	ng/L	OCWD
Endosulfan II (ENDOII)	508	0.01	ug/L	OCWD
Endosulfan II (ENDOII)	508	0.01	ug/L	WECKLAB
Endosulfan II (ENDOII)	525.2	0.1 - 0.5	ug/L	OCWD
Epitestosterone (cis-Testosterone) (EPITES)	CEC	1	ng/L	OCWD
Equilin (EQUILN)	CEC	5	ng/L	OCWD
Estriol (ESTRIO)	CEC	2	ng/L	OCWD
Estrone (ESTRON)	CEC	1	ng/L	OCWD
Ethyl tert-butyl ether (ETBE)	524.2	1	ug/L	OCWD
Ethylbenzene (EtBENZ)	524.2	0.5	ug/L	OCWD
Fluoxetine (FLUXET)	CEC	5 - 10	ng/L	OCWD
Formaldehyde (FORALD)	556	2	ug/L	WECKLAB
Freon 123a (FR123A)	524.2	0.5	ug/L	OCWD
Glyoxal (GLYOXL)	556	2	ug/L	WECKLAB
HCH-alpha (Alpha-BHC) (BHCa)	508	0.02	ug/L	OCWD
HCH-alpha (Alpha-BHC) (BHCa)	508	0.01	ug/L	WECKLAB
HCH-alpha (Alpha-BHC) (BHCa)	525.2	0.1 - 0.5	ug/L	OCWD

Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
HCH-beta (Beta-BHC) (BHCb)	508	0.02	ug/L	OCWD
HCH-beta (Beta-BHC) (BHCb)	508	0.01	ug/L	WECKLAB
HCH-beta (Beta-BHC) (BHCb)	525.2	0.1 - 0.5	ug/L	OCWD
HCH-delta (Delta-BHC) (BHCd)	508	0.01	ug/L	WECKLAB
HCH-delta (Delta-BHC) (BHCd)	508	0.02	ug/L	OCWD
HCH-delta (Delta-BHC) (BHCd)	525.2	0.1 - 0.5	ug/L	OCWD
Heptanal (HEPNAL)	556	2 - 5	ug/L	WECKLAB
Hexachlorobutadiene (HClBut)	524.2	0.5	ug/L	OCWD
Hexachlorobutadiene (HClBut)	625	9.8 - 10	ug/L	TESTAMER
Hexachloroethane (HCE)	625	9.8 - 10	ug/L	TESTAMER
Hexanal (HEXNAL)	556	2	ug/L	WECKLAB
Iohexol (IOHEXL)	CEC	20	ng/L	OCWD
Iopromide (IOPRMD)	CEC	10	ng/L	OCWD
Isophorone (IPHOR)	525.2	0.1 - 0.5	ug/L	OCWD
Isophorone (IPHOR)	625	9.8 - 10	ug/L	TESTAMER
Isopropylbenzene (ISPBNZ)	524.2	0.5	ug/L	OCWD
Linuron (LINURN)	CEC	0.005	ug/L	OCWD
m,p-Xylene (mp-XYL)	524.2	0.5	ug/L	OCWD
Meprobamate (MEPROB)	CEC	5	ng/L	OCWD
Methyl Ethyl Ketone (MEK) (MEK)	524.2	5	ug/L	OCWD
Methyl Isobutyl Ketone (MIBK) (MIBK)	524.2	5	ug/L	OCWD
Methyl tert-butyl ether (MTBE)	524.2	0.2	ug/L	OCWD
Methylene Chloride (CH2Cl2)	524.2	0.5	ug/L	OCWD
Methylglyoxal (MGLYOX)	556	2	ug/L	WECKLAB
Methylisothiocyanate (MITC)	14DIOX	0.1	ug/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Metolachlor (METOCL)	525.2	0.1 - 0.5	ug/L	OCWD
Metolachlor (METOCL)	525-R	0.1	ug/L	OCWD
Monobromoacetic Acid (MBAA)	552.2	1	ug/L	OCWD
Monochloroacetic Acid (MCAA)	552.2	1	ug/L	OCWD
Naphthalene (NAP)	524.2	0.5 - 5	ug/L	OCWD
Naphthalene (NAP)	525.2	0.1 - 0.5	ug/L	OCWD
Naphthalene (NAP)	625	9.8 - 10	ug/L	TESTAMER
Naproxen (NAPRXN)	CEC	5	ng/L	OCWD
n-Butylbenzene (nBBENZ)	524.2	0.5	ug/L	OCWD
Neotam (NEOTAM)	CEC	10	ng/L	OCWD
Nitrobenzene (NBENZ)	625	20 - 21	ug/L	TESTAMER
N-Nitrosodiethylamine (NDEA)	NDMA-LOW	2 - 10	ng/L	OCWD
n-Nitrosodimethylamine (NDMA)	NDMA-LOW	2 - 10	ng/L	OCWD
n-Nitroso-di-n-propylamine (NDPA)	625	9,800 - 10,000	ng/L	TESTAMER
n-Nitroso-di-n-propylamine (NDPA)	NDMA-LOW	2 - 10	ng/L	OCWD
n-Nitrosodiphenylamine (NDPhA)	625	9,800 - 10,000	ng/L	TESTAMER
N-Nitrosomorpholine (NMOR)	NDMA-LOW	2 - 50	ng/L	OCWD
Nonanal (NONNAL)	556	2	ug/L	WECKLAB
Nonylphenol (NONYPH)	CEC	0.2	ug/L	OCWD
o-Xylene (o-XYL)	524.2	0.5	ug/L	OCWD
para-Chlorobenzene sulfonic acid (pCBSA)	CEC	200	ng/L	OCWD
PCB-1016 (PCB16)	508	0.5	ug/L	OCWD
PCB-1016 (PCB16)	508	0.1	ug/L	WECKLAB
PCB-1221 (PCB21)	508	0.5	ug/L	OCWD
PCB-1221 (PCB21)	508	0.1	ug/L	WECKLAB

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
PCB-1232 (PCB32)	508	0.5	ug/L	OCWD
PCB-1232 (PCB32)	508	0.1	ug/L	WECKLAB
PCB-1242 (PCB42)	508	0.1	ug/L	WECKLAB
PCB-1242 (PCB42)	508	0.5	ug/L	OCWD
PCB-1248 (PCB48)	508	0.1	ug/L	WECKLAB
PCB-1248 (PCB48)	508	0.5	ug/L	OCWD
PCB-1254 (PCB54)	508	0.5	ug/L	OCWD
PCB-1254 (PCB54)	508	0.1	ug/L	WECKLAB
PCB-1260 (PCB60)	508	0.5	ug/L	OCWD
PCB-1260 (PCB60)	508	0.1	ug/L	WECKLAB
PCBs, Total (TOTPCB)	508	0.5	ug/L	WECKLAB
Perfluoro butane sulfonic acid (PFBS)	537	4	ng/L	OCWD
Perfluoro heptanoic acid (PFHpA)	537	4	ng/L	OCWD
Perfluoro hexane sulfonic acid (PFHxS)	537	4	ng/L	OCWD
Perfluoro nonanoic acid (PFNA)	537	4	ng/L	OCWD
Perfluoro octane sulfonic acid (PFOS)	537	4	ng/L	OCWD
Perfluoro octanoic acid (PFOA)	537	4	ng/L	OCWD
Perfluoro-2-propoxypropanoic acid (GenX)	537	4	ng/L	OCWD
Perfluorodecanoic acid (PFDA)	537	4	ng/L	OCWD
Perfluorododecanoic acid (PFDoA)	537	4	ng/L	OCWD
Perfluorohexanoic acid (PFHxA)	537	4	ng/L	OCWD
Perfluorotetradecanoic acid (PFTA)	537	4	ng/L	OCWD
Perfluorotridecanoic acid (PFTrDA)	537	4	ng/L	OCWD
Perfluoroundecanoic acid (PFUnA)	537	4	ng/L	OCWD
PFOA + PFOS (PFOAOS)	UNKWQAN	4	ng/L	OCWD

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ORANGE COUNTY WATER DISTRICT
Water Quality Constituents With Laboratory Methods

Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Phenol (PHENOL)	625	9.8 - 10	ug/L	TESTAMER
PhenylPhenol (PHNYPH)	CEC	0.2	ug/L	OCWD
Progesterone (PRGSTR)	CEC	1	ng/L	OCWD
Propylbenzene (PRPBNZ)	524.2	0.5	ug/L	OCWD
sec-Butylbenzene (sBBENZ)	524.2	0.5	ug/L	OCWD
Styrene (STYR)	524.2	0.5	ug/L	OCWD
Sucralose (SUCRAL)	CEC	100	ng/L	OCWD
Sum of five Haloacetic Acids (HAA5)	UNKWQAN	1	ug/L	OCWD
Sum of nine Haloacetic Acids (HAA9)	UNKWQAN	1	ug/L	OCWD
Sum of Six Brominated Haloacetic Acids (HAA6Br)	UNKWQAN	1	ug/L	OCWD
Terbufos Sulfone (TERSUL)	525.2	0.1 - 0.5	ug/L	OCWD
Tert-amyl methyl ether (TAME)	524.2	1	ug/L	OCWD
tert-butyl alcohol (TBA)	524.2	2 - 4	ug/L	OCWD
tert-Butylbenzene (tBBENZ)	524.2	0.5	ug/L	OCWD
Testosterone (trans-Testosterone) (TESTOR)	CEC	1	ng/L	OCWD
Tetrabromobisphenol A (TBBISA)	CEC	0.2	ug/L	OCWD
Tetrachloroethene (PCE)	524.2	0.5	ug/L	OCWD
Tetrachloroethene (PCE)	551.1	0.1	ug/L	OCWD
Toluene (TOLU)	524.2	0.5	ug/L	OCWD
Total 1,3-Dichloropropene (x13DCP)	524.2	0.5	ug/L	OCWD
Total Trihalomethanes (TTHMs)	524.2	0.5	ug/L	OCWD
Total Trihalomethanes (TTHMs)	551.1	0.1	ug/L	OCWD
Total Xylenes (m,p,&o) (TOTALX)	524.2	0.5	ug/L	OCWD
trans-1,2 Dichloroethene (t12DCE)	524.2	0.5	ug/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
trans-1,3-Dichloropropene (t13DCP)	524.2	0.5	ug/L	OCWD
Tribromoacetic Acid (TBAA)	552.2	1	ug/L	OCWD
Trichloroacetic Acid (TCAA)	552.2	1	ug/L	OCWD
Trichloroacetonitrile (TCAN)	551.1	0.1	ug/L	OCWD
Trichloroethene (TCE)	524.2	0.5	ug/L	OCWD
Trichloroethene (TCE)	551.1	0.1	ug/L	OCWD
Trichlorofluoromethane (Freon 11) (CCl3F)	524.2	0.5	ug/L	OCWD
Trichlorotrifluoroethane (Freon 113) (Cl3F3E)	524.2	0.5	ug/L	OCWD
Trimethoprim (TRIMTP)	CEC	5 - 10	ng/L	OCWD
Tris-2-chlorethyl phosphate (TCEP)	CEC	5	ng/L	OCWD
Vinyl chloride (VNYLCL)	524.2	0.5	ug/L	OCWD

Constituent Type: RADIOLOGICALS

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Gross Alpha Excluding Uranium (TOTa-U)	UNKWQAN	1.11 - 1.6	pCi/L	FGL
Natural Uranium (NTUr)	908.0	0.342 - 0.47	pCi/L	FGL
Natural Uranium Counting Error (NTUrCE)	908.0	0.342 - 0.47	pCi/L	FGL
Radium 226 + Radium 228 (Ra6Ra8)	UNKWQAN	0.383 - 0.506	pCi/L	FGL
Radium 226 + Radium 228 Counting Error (Ra68CE)	UNKWQAN	0.383 - 0.506	pCi/L	FGL
Total Alpha (TOTa)	7110C	1.11 - 1.6	pCi/L	FGL
Total Alpha Counting Error (TOTaCE)	7110C	1.11 - 1.6	pCi/L	FGL
Total Beta (TOTb)	900.0	0.831 - 2.34	pCi/L	FGL
Total Beta Counting Error (TOTbCE)	900.0	0.831 - 2.34	pCi/L	FGL

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Constituent Type: RADIOLOGICALS

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Total Radium 226 (TRa226)	903.0	0.274 - 0.456	pCi/L	FGL
Total Radium 226 Counting Error (TRa6CE)	903.0	0.274 - 0.456	pCi/L	FGL
Total Radium 228 (TRa228)	RA-05	0.383 - 0.506	pCi/L	FGL
Total Radium 228 Counting Error (TRa8CE)	RA-05	0.383 - 0.506	pCi/L	FGL
Total Strontium-90 (TS90)	905.0	0.546	pCi/L	FGL
Total Strontium-90 (TS90)	905.0	0.395 - 0.396	pCi/L	TAMSL
Total Strontium-90 Counting Error (TS90CE)	905.0	0.546	pCi/L	FGL
Total Strontium-90 Counting Error (TS90CE)	905.0	0.395 - 0.396	pCi/L	TAMSL
Total Tritium (TTr)	906.0	434	pCi/L	FGL
Total Tritium Counting Error (TTrCE)	906.0	434	pCi/L	FGL

Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
1-Naphthol (NPTHOL)	531	5	ug/L	OCWD
2,4,5-T (245T)	515.3	0.2	ug/L	WECKLAB
2,4,5-TP (Silvex) (245TP)	515.3	0.2	ug/L	WECKLAB
2,4,5-TP (Silvex) (245TP)	515.4	0.5	ug/L	OCWD
2,4-DB (24DB)	515.3	2	ug/L	WECKLAB
2,4-Dichlorophenoxyacetic Acid (24D)	515.3	0.4	ug/L	WECKLAB
2,4-Dichlorophenoxyacetic Acid (24D)	515.4	0.5	ug/L	OCWD
3,5-Dichlorobenzoic Acid (35DBA)	515.3	1	ug/L	WECKLAB
3-Hydroxycarbofuran (HYDCFR)	531	2	ug/L	OCWD
4,4'-DDD (DDD)	508	0.01	ug/L	OCWD
4,4'-DDD (DDD)	508	0.01	ug/L	WECKLAB

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
4,4'-DDD (DDD)	525.2	0.1 - 0.5	ug/L	OCWD
4,4'-DDE (DDE)	508	0.01	ug/L	WECKLAB
4,4'-DDE (DDE)	508	0.01	ug/L	OCWD
4,4'-DDE (DDE)	525.2	0.1 - 0.5	ug/L	OCWD
4,4'-DDT (DDT)	508	0.01	ug/L	WECKLAB
4,4'-DDT (DDT)	508	0.01	ug/L	OCWD
4,4'-DDT (DDT)	525.2	0.1 - 0.5	ug/L	OCWD
Acenaphthene (ACNAPE)	525.2	0.1 - 0.5	ug/L	OCWD
Acenaphthene (ACNAPE)	625	9.8 - 10	ug/L	TESTAMER
Acenaphthylene (ACENAP)	525.2	0.1 - 0.5	ug/L	OCWD
Acenaphthylene (ACENAP)	625	9.8 - 10	ug/L	TESTAMER
Acetaminophen (ACTMNP)	CEC	5 - 50	ng/L	OCWD
Acetochlor (ACETOC)	525.2	0.1 - 0.5	ug/L	OCWD
Acifluorfen (ACIFEN)	515.3	0.4	ug/L	WECKLAB
Acifluorfen (ACIFEN)	515.4	0.5	ug/L	OCWD
Alachlor (ALACHL)	525.2	0.1 - 0.5	ug/L	OCWD
Alachlor (ALACHL)	525-R	0.1	ug/L	OCWD
Aldicarb (ALDI)	531	1	ug/L	OCWD
Aldicarb sulfone (ALDISN)	531	2	ug/L	OCWD
Aldicarb sulfoxide (ALDISX)	531	2	ug/L	OCWD
Aldrin (ALDRIN)	508	0.03	ug/L	OCWD
Aldrin (ALDRIN)	508	0.01	ug/L	WECKLAB
Aldrin (ALDRIN)	525.2	0.1 - 0.5	ug/L	OCWD
Ametryn (AMERYN)	525.2	0.1 - 0.5	ug/L	OCWD
Anthracene (ANTHRA)	525.2	0.1 - 0.5	ug/L	OCWD
Anthracene (ANTHRA)	625	9.8 - 10	ug/L	TESTAMER
Atrazine (ATRAZ)	525.2	0.1 - 0.5	ug/L	OCWD

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Atrazine (ATRAZ)	525-R	0.1	ug/L	OCWD
Atrazine (ATRAZ)	CEC	0.001	ug/L	OCWD
Azithromycin (AZTMCN)	CEC	10 - 50	ng/L	OCWD
Baygon (BAYGON)	531	1	ug/L	OCWD
Bentazon (BENTAZ)	515.3	2	ug/L	WECKLAB
Bentazon (BENTAZ)	515.4	1	ug/L	OCWD
Benzo(a)anthracene (BaANTH)	525.2	0.1 - 0.5	ug/L	OCWD
Benzo(a)anthracene (BaANTH)	625	9.8 - 10	ug/L	TESTAMER
Benzo(a)pyrene (BaPYRE)	525.2	0.1 - 0.5	ug/L	OCWD
Benzo(a)pyrene (BaPYRE)	625	9.8 - 10	ug/L	TESTAMER
Benzo(b)fluoranthene (BbFLUR)	525.2	0.1 - 0.5	ug/L	OCWD
Benzo(b)fluoranthene (BbFLUR)	625	9.8 - 10	ug/L	TESTAMER
Benzo(g,h,i)perylene (BghiPR)	525.2	0.1 - 0.5	ug/L	OCWD
Benzo(g,h,i)perylene (BghiPR)	625	9.8 - 10	ug/L	TESTAMER
Benzo[k]fluoranthene (BkFLUR)	525.2	0.1 - 0.5	ug/L	OCWD
Benzo[k]fluoranthene (BkFLUR)	625	9.8 - 10	ug/L	TESTAMER
bis (2-ethylhexyl) adipate (DEHA)	525.2	2 - 10	ug/L	OCWD
bis (2-ethylhexyl) phthalate (DEHP)	525.2	2 - 10	ug/L	OCWD
bis (2-ethylhexyl) phthalate (DEHP)	625	20 - 21	ug/L	TESTAMER
Bromacil (BROMAC)	525.2	0.1 - 0.5	ug/L	OCWD
Bromacil (BROMAC)	525-R	0.1	ug/L	OCWD
Butachlor (BUTACL)	525.2	0.1 - 0.5	ug/L	OCWD
Butachlor (BUTACL)	525-R	0.1	ug/L	OCWD
Butanal (BUTAN)	556	2	ug/L	WECKLAB
Butylate (BTYATE)	525.2	0.1 - 0.5	ug/L	OCWD
Butylbenzyl phthalate (BBP)	525.2	2 - 10	ug/L	OCWD
Butylbenzyl phthalate (BBP)	625	20 - 21	ug/L	TESTAMER

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Caffeine (CAFFEI)	525.2	100 - 500	ng/L	OCWD
Caffeine (CAFFEI)	525-R	100	ng/L	OCWD
Caffeine (CAFFEI)	CEC	3 - 30	ng/L	OCWD
Captan (CAPTAN)	525.2	0.1 - 0.5	ug/L	OCWD
Carbamazepine (CBMAZP)	CEC	1	ng/L	OCWD
Carbaryl (CARBAR)	531	2	ug/L	OCWD
Carbofuran (CARBOF)	531	1	ug/L	OCWD
Chlordane (ClDANE)	508	0.1	ug/L	OCWD
Chlordane (ClDANE)	508	0.1	ug/L	WECKLAB
Chlordane-alpha (CLDA)	508	0.01	ug/L	OCWD
Chlordane-alpha (CLDA)	525.2	0.1 - 0.5	ug/L	OCWD
Chlordane-gamma (CLDG)	508	0.01	ug/L	OCWD
Chlordane-gamma (CLDG)	525.2	0.1 - 0.5	ug/L	OCWD
Chlorobenzilate (CLBZLA)	508	0.05	ug/L	OCWD
Chlorobenzilate (CLBZLA)	525.2	0.1 - 0.5	ug/L	OCWD
Chloroneb (CLNEB)	525.2	0.1 - 0.5	ug/L	OCWD
Chloropropham (CPRPHM)	525.2	0.1 - 0.5	ug/L	OCWD
Chlorothalonil (CLTNIL)	508	0.05	ug/L	WECKLAB
Chlorothalonil (CLTNIL)	525.2	0.1 - 0.5	ug/L	OCWD
Chlorpyrifos (ClPYRI)	525.2	0.1 - 0.5	ug/L	OCWD
Chrysene (CHRYS)	525.2	0.1 - 0.5	ug/L	OCWD
Chrysene (CHRYS)	625	9.8 - 10	ug/L	TESTAMER
Dalapon (DALAPN)	515.3	0.4	ug/L	WECKLAB
Dalapon (DALAPN)	515.4	1	ug/L	OCWD
Dalapon (DALAPN)	552.2	1	ug/L	OCWD
DCPA-Dacthal (DCPA)	508	0.05	ug/L	OCWD

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
DCPA-Dacthal (DCPA)	515.3	0.1	ug/L	WECKLAB
DCPA-Dacthal (DCPA)	525.2	0.1 - 0.5	ug/L	OCWD
Diazinon (DIAZI)	525.2	0.1 - 0.5	ug/L	OCWD
Diazinon (DIAZI)	525-R	0.1	ug/L	OCWD
Dibenzo(a,h)anthracene (DBahAN)	525.2	0.1 - 0.5	ug/L	OCWD
Dibenzo(a,h)anthracene (DBahAN)	625	20 - 21	ug/L	TESTAMER
Dicamba (DICAMB)	515.3	0.6	ug/L	WECKLAB
Dicamba (DICAMB)	515.4	0.081	ug/L	OCWD
Dichlorprop (24DP)	515.3	0.3	ug/L	WECKLAB
Dichlorvos (DCLVOS)	525.2	0.1 - 0.5	ug/L	OCWD
Dieldrin (DIELDR)	508	0.01	ug/L	WECKLAB
Dieldrin (DIELDR)	508	0.02	ug/L	OCWD
Dieldrin (DIELDR)	525.2	0.1 - 0.5	ug/L	OCWD
Diethyl phthalate (DEP)	525.2	2 - 10	ug/L	OCWD
Diethyl phthalate (DEP)	625	9.8 - 10	ug/L	TESTAMER
Dimethoate (DMTH)	525.2	1 - 5	ug/L	OCWD
Dimethoate (DMTH)	525-R	1	ug/L	OCWD
Dimethyl phthalate (DMP)	525.2	2 - 10	ug/L	OCWD
Dimethyl phthalate (DMP)	625	9.8 - 10	ug/L	TESTAMER
Di-n-butylphthalate (DnBP)	525.2	2 - 10	ug/L	OCWD
Di-n-butylphthalate (DnBP)	625	20 - 21	ug/L	TESTAMER
Di-n-octyl phthalate (DnOP)	525.2	2 - 10	ug/L	OCWD
Di-n-octyl phthalate (DnOP)	625	20 - 21	ug/L	TESTAMER
Dinoseb (DINOSB)	515.3	0.4	ug/L	WECKLAB
Dinoseb (DINOSB)	515.4	0.5	ug/L	OCWD
Diphenamid (DPHNMD)	525.2	0.1 - 0.5	ug/L	OCWD
Diquat (DIQUAT)	549.2	4	ug/L	OCWD

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Diuron (DIURON)	CEC	0.005	ug/L	OCWD
Endosulfan I (ENDOI)	508	0.05	ug/L	OCWD
Endosulfan I (ENDOI)	508	0.01	ug/L	WECKLAB
Endosulfan I (ENDOI)	525.2	0.1 - 0.5	ug/L	OCWD
Endosulfan sulfate (ENDOSL)	508	0.05	ug/L	OCWD
Endosulfan sulfate (ENDOSL)	508	0.01	ug/L	WECKLAB
Endosulfan sulfate (ENDOSL)	525.2	0.1 - 0.5	ug/L	OCWD
Endothall (ENDOTL)	548.1	45	ug/L	WECKLAB
Endrin (ENDRIN)	508	0.03	ug/L	OCWD
Endrin (ENDRIN)	508	0.01	ug/L	WECKLAB
Endrin (ENDRIN)	525.2	0.1 - 0.5	ug/L	OCWD
Endrin Aldehyde (ENDR-A)	508	0.1	ug/L	OCWD
Endrin Aldehyde (ENDR-A)	508	0.01	ug/L	WECKLAB
Endrin Aldehyde (ENDR-A)	525.2	0.1 - 1	ug/L	OCWD
Endrin Ketone (ENDR-K)	508	0.1	ug/L	OCWD
EPTC (EPTC)	525.2	0.1 - 0.5	ug/L	OCWD
EPTC (EPTC)	525-R	0.1	ug/L	OCWD
Erythromycin (ERYTHN)	CEC	1	ng/L	OCWD
Ethion (ETHION)	525.2	0.1 - 0.5	ug/L	OCWD
Ethion (ETHION)	525-R	0.1	ug/L	OCWD
Ethoprop (ETHPRP)	525.2	0.1 - 0.5	ug/L	OCWD
Etridiazole (ETRDZL)	508	0.05	ug/L	OCWD
Etridiazole (ETRDZL)	525.2	0.1 - 0.5	ug/L	OCWD
Fluoranthene (FLANTH)	525.2	0.1 - 0.5	ug/L	OCWD
Fluoranthene (FLANTH)	625	9.8 - 10	ug/L	TESTAMER
Fluorene (FLUOR)	525.2	0.1 - 0.5	ug/L	OCWD
Fluorene (FLUOR)	625	9.8 - 10	ug/L	TESTAMER

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Gemfibrozil (GMFIBZ)	CEC	1	ng/L	OCWD
Glyphosate (GLYPHO)	547	25	ug/L	OCWD
HCH-gamma (Lindane) (LINDNE)	508	0.1	ug/L	OCWD
HCH-gamma (Lindane) (LINDNE)	508	0.01	ug/L	WECKLAB
HCH-gamma (Lindane) (LINDNE)	525.2	0.1 - 0.5	ug/L	OCWD
Heptachlor (HEPTA)	508	0.01	ug/L	OCWD
Heptachlor (HEPTA)	508	0.01	ug/L	WECKLAB
Heptachlor (HEPTA)	525.2	0.1 - 0.5	ug/L	OCWD
Heptachlor epoxide (HEPEPX)	508	0.01	ug/L	OCWD
Heptachlor epoxide (HEPEPX)	508	0.01	ug/L	WECKLAB
Heptachlor epoxide (HEPEPX)	525.2	0.1 - 0.5	ug/L	OCWD
Hexachlorobenzene (HEXCLB)	508	0.05	ug/L	WECKLAB
Hexachlorobenzene (HEXCLB)	525.2	0.1 - 0.5	ug/L	OCWD
Hexachlorobenzene (HEXCLB)	625	9.8 - 10	ug/L	TESTAMER
Hexachlorocyclopentadiene (HClCPD)	508	0.05	ug/L	WECKLAB
Hexachlorocyclopentadiene (HClCPD)	525.2	0.1 - 0.5	ug/L	OCWD
Hexachlorocyclopentadiene (HClCPD)	625	20 - 21	ug/L	TESTAMER
Hexazinone (HEXZON)	525.2	0.1 - 0.5	ug/L	OCWD
Ibuprofen (IBPRFN)	CEC	1 - 5	ng/L	OCWD
Indeno(1,2,3-cd)pyrene (INDPYR)	525.2	0.1 - 0.5	ug/L	OCWD
Indeno(1,2,3-cd)pyrene (INDPYR)	625	20 - 21	ug/L	TESTAMER
Malathion (MALATH)	525.2	2 - 10	ug/L	OCWD
Malathion (MALATH)	525-R	2	ug/L	OCWD
Methiocarb (MTHCRB)	531	4	ug/L	OCWD
Methomyl (MTHOMY)	531	1	ug/L	OCWD
Methoxychlor (METHOX)	508	0.01	ug/L	WECKLAB
Methoxychlor (METHOX)	525.2	0.1 - 0.5	ug/L	OCWD

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
methyl-Parathion (MPARA)	525.2	0.5 - 2.5	ug/L	OCWD
methyl-Parathion (MPARA)	525-R	0.5	ug/L	OCWD
Metribuzin (MTRBZN)	525.2	0.1 - 0.5	ug/L	OCWD
Metribuzin (MTRBZN)	525-R	0.1	ug/L	OCWD
Molinate (MOLINT)	525.2	0.1 - 0.5	ug/L	OCWD
Molinate (MOLINT)	525-R	0.1	ug/L	OCWD
N,N-diethyl-m-toluamide (DEET)	CEC	1 - 5	ng/L	OCWD
Norflurazon (NORFLR)	525.2	1 - 5	ug/L	OCWD
Norflurazon (NORFLR)	525-R	0.1	ug/L	OCWD
Oxamyl (OXAMYL)	531	2	ug/L	OCWD
Paraquat (PARAQT)	549.2	4	ug/L	OCWD
Parathion (PARA)	525.2	0.5 - 2.5	ug/L	OCWD
Parathion (PARA)	525-R	0.5	ug/L	OCWD
Pentachlorophenol (PCP) (PCP)	515.3	0.2	ug/L	WECKLAB
Pentachlorophenol (PCP) (PCP)	515.4	0.1	ug/L	OCWD
Pentachlorophenol (PCP) (PCP)	525.2	1 - 5	ug/L	OCWD
Pentachlorophenol (PCP) (PCP)	625	20 - 21	ug/L	TESTAMER
Pentachlorophenol (PCP) (PCP)	CEC	0.2	ug/L	OCWD
Pentanal (PENTNL)	556	2	ug/L	WECKLAB
Permethrin-(total of cis/trans) (PMTHRN)	525.2	0.1 - 0.5	ug/L	OCWD
Phenanthrene (PHENAN)	525.2	0.1 - 0.5	ug/L	OCWD
Phenanthrene (PHENAN)	625	9.8 - 10	ug/L	TESTAMER
Picloram (PICLOR)	515.3	0.6	ug/L	WECKLAB
Picloram (PICLOR)	515.4	0.5	ug/L	OCWD
Primidone (PRIMDN)	CEC	1 - 10	ng/L	OCWD
Prometryn (PROMET)	525.2	0.1 - 0.5	ug/L	OCWD
Prometryn (PROMET)	525-R	0.1	ug/L	OCWD

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Pronamide (PROAMD)	525.2	0.1 - 0.5	ug/L	OCWD
Propachlor (PROPCL)	508	0.05	ug/L	WECKLAB
Propachlor (PROPCL)	525.2	0.1 - 0.5	ug/L	OCWD
Propachlor (PROPCL)	525-R	0.1	ug/L	OCWD
Propanal (PROPNL)	556	2	ug/L	WECKLAB
Propazine (PROPAZ)	525.2	0.1 - 0.5	ug/L	OCWD
Propazine (PROPAZ)	525-R	0.1	ug/L	OCWD
Pyrene (PYRENE)	525.2	0.1 - 0.5	ug/L	OCWD
Pyrene (PYRENE)	625	9.8 - 10	ug/L	TESTAMER
Simazine (SIMAZ)	525.2	0.1 - 0.5	ug/L	OCWD
Simazine (SIMAZ)	525-R	0.1	ug/L	OCWD
Simazine (SIMAZ)	CEC	0.005	ug/L	OCWD
Sulfamethoxazole (SULTHZ)	CEC	1	ng/L	OCWD
Tebuthiuron (TBTURN)	525.2	2 - 10	ug/L	OCWD
Terbacil (TRBACL)	525.2	0.1 - 0.5	ug/L	OCWD
Thiobencarb (THIO)	525.2	0.1 - 0.5	ug/L	OCWD
Thiobencarb (THIO)	525-R	0.1	ug/L	OCWD
Toxaphene Mixture (TOXA)	508	1	ug/L	OCWD
Toxaphene Mixture (TOXA)	508	1	ug/L	WECKLAB
Triclosan (TRICLN)	CEC	1	ng/L	OCWD
Trifluralin (TRFLRN)	508	0.05	ug/L	OCWD
Trifluralin (TRFLRN)	508	0.01	ug/L	WECKLAB
Trifluralin (TRFLRN)	525.2	0.1 - 0.5	ug/L	OCWD
Trithion (TRTION)	525.2	0.1 - 0.5	ug/L	OCWD

Laboratory Abbreviation Descriptions:

BIOVIR: IEH-Biovir Laboratories; EUROFINS: Eurofins Eaton Analytical; FGL: Fruit Growers Laboratory, Inc.; OCHCA: O.C. Health Care Agency; OCWD: Orange County Water District; TALSAC: TestAmerica Sacramento; TAMSL: TestAmerica St. Louis, TESTAMER: TestAmerica Irvine; WECKLAB: Weck Laboratories, Inc.

Appendix D

Operator Certifications, Operations and Maintenance Summary and Calibration Records

Orange County Water District Groundwater Replenishment System 2018 Annual Report

Orange County Water District
Groundwater Replenishment System
Advanced Water Purification Facility

Operations Certification Levels
(As of December 2018)

Listed according to level of WWTP Operator Certification level, high-to-low

Operator	Job Title	Shift	Cert. Level	Cert. No.
Tyson Neely	Operations Manager	M - F	5	V-27698
Steve Clark	Shift Supervisor	D2	5	V-8430
Scott Hollender	Sr. Plant Operator III	N2	5	V-8794
Russell Sutton	Shift Supervisor	N1	5	V-5143
Mario Manriquez	Lead Plant Operator	N2	5	V-10397
Derrick Mansell	Sr. Plant Operator III	M - F	5	V-28340
John Souza	Shift Supervisor	D1	4	IV-3998
Anthony Carreira	Shift Supervisor	N2	4	IV-27787
Heinz Roehler	Sr. Plant Operator III	D1	3	III-3534
Mike Ewing	Lead Plant Operator	D1	3	III-10199
Luis Torres	Lead Plant Operator	N1	3	III-28285
Don Supernaw	Sr. Plant Operator III	D2	3	III-28038
Thomas Nicholson	Sr. Plant Operator III	D2	3	III-9446
Chris Vu	Plant Operator II	D1	3	III-10630
Curtis Sanders	Sr. Plant Operator III	N2	3	III-28461
Craig Liebzeit Jr.	Plant Operator II	N2	3	III-43546
Jacob Bermudez	Plant Operator I	N2	3	III-43637
Charles Spade	Plant Operator II	N1	2	II-7966
Eric Gautier	Plant Operator II	D1	2	II-10135
Philip Jacobs	Plant Operator II	N1	2	II-42110
*Bryan Bushay	Plant Operator I	D2	T-2	35438
Christopher Owens	Plant Operator II	N1	T-4	29560

* Bryan Bushay received his SWRCB WWTP Operator Grade II certificate on January 2, 2019: II-43759

Plant Shutdown Summary for Advanced Water Purification Facility
2018 Groundwater Replenishment System Annual Report

Cause of AWPF Shutdown		Hours Offline per Month												Annual Total
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
1	SCE Power Interruption (Unscheduled)	4.50			1.00		5.00	10.05	6.25		1.00			27.80
2	Inadvertent I&E Programming Maintenance Error		1.75											1.75
3	Scheduled Maintenance on Multiple Processes				57.50					201.00				258.50
4	Operational Coordination Issues with OCSD Plant 1				0.75									0.75
5	Super Chlorination to Correct FPW Positive Total Coliform Results										8.00			8.00
Total Hours Offline		**4.50**	**1.75**	**0.00**	**59.25**	**0.00**	**5.00**	**10.05**	**6.25**	**201.00**	**9.00**	**0.00**	**0.00**	**296.80**
Total Days Offline		**0.19**	**0.07**	**0.00**	**2.47**	**0.00**	**0.21**	**0.42**	**0.26**	**8.38**	**0.38**	**0.00**	**0.00**	**12.37**

Appendix D
Plant Shutdown Summary

D.1 January 2018

January 1 - 31: Total Downtime 4.5 hours (0.6%)

The AWPF/GWRS experienced one shutdown and no process interruptions during the month of January.

January 28-29: The GWRS experienced an unexpected 4.5 hour shutdown (1/28 2150 hours – 1/29 0220 hours) due to a Southern California Edison (SCE) power interruption. 0.32 MG of MWD OC-44 potable water was used to maintain the barrier system pressures until normal finished product water (FPW) injection resumed.

D.2 February 2018

February 1 — 28: Total Down time 1.75 hours (0.3%)

The AWPF/GWRS experienced one process interruption and no shutdowns during the month of February.

February 21: The GWRS experienced an unexpected 1.5 hour process interruption (1415 – 1600 hours). While operating at 100 MGD, an instrumentation and electrical (I&E) programmer pulled an A840 communication card which caused the GWR pipeline to go into a false low pressure alarm condition. The pipeline low pressure alarms are indicators of a pipe break and cause the Product Water Pump Station (PWPS) to shut down instantly and simultaneously close all three GWR pipeline valve vaults. When this occurred the PWPS went from a pumping rate of 82 MGD to zero almost instantly. The GWR pipeline and PWPS alarm conditions could not be reset and restarted before the plant (RO) automatically shut down due to high RO flush tank and FPW Channel level alarms.

FPW distribution to the Talbert Barrier injection system remained online until the plant was restarted and resumed normal production. However, 0.03 MGD of MWD OC-44 potable water was used until normal AWPF production resumed in case the Barrier Pump Station shutdown before the plant could be restarted.

D.3 March 2018

March 1 - 31: Total Downtime 0.0 hours (0.0%)

The AWPF / GWRS experienced no shutdowns or process interruptions during the month of March.

D.4 April 2018

April 1 — 30: Total Downtime 59.25 hours (8.2%)

April 9 – 11: A scheduled 57.5 hour GWRS shutdown began on April 9 at 0500 hours to perform maintenance activities including: annual preventive maintenance (PM) inspections of medium voltage electrical equipment; CCTV inspections of the 84” RO feed (ROF) pretreatment static mixer; inspection and repair on the backwash supply piping to MF train A; tie-in of new piping and valves on the polymer system (saturated lime process); and plant-wide process control system controller updates (PCS/SCADA). The GWRS was brought back online April 11 with initial production flows routed to OCSD interplant ocean outfall systems to allow the plant and FPW water quality to stabilize before resuming normal FPW distribution at 1430 hours. 1.61 MG of MWD OC-44 potable water was used during the shutdown period to maintain barrier system pressures until normal FPW injection resumed.

April 14: The GWRS experienced a one-hour shutdown due to an unexpected SCE power interruption (1215 – 1315 hours). 0.03 MG of MWD OC-44 potable water was used during the brief shutdown period to maintain barrier system pressures until the plant could be restarted to resume normal FPW injection.

April 19: The GWRS experienced a 45-minute shutdown due to an unexpected chain of events (1706 – 1751 hours). The situation began with OCSD Plant 1 began performing extensive secondary clarifier weir washings that in turn blinded the GWRS influent roto-band screens and caused them to fail due to overload. With the GWRS operating at 100 MGD, the production rate could not be lowered quickly enough before the GWRS was starved of feed flow, resulting in the RO transfer pump station to fail on low tank levels. 0.12 MG of MWD OC-44 potable water was used during the brief shutdown period to maintain barrier system pressures until the plant could be restarted to resume normal FPW injection.

D.5 May 2018

May 1 — 31: Total Downtime 0.0 hours (0.0%)

The AWPF/GWRS experienced no shutdowns or process interruptions during the month of May.

D.6 June 2018

June 1 — 30: Total Downtime 5.0 hours (0.7%)

June 2: The GWRS experience a five-hour shutdown due to an unexpected SCE power interruption (1735 – 2235 hours). 0.22 MG of MWD OC-44 potable water was used during the shutdown period to maintain barrier system pressures until the plant could be restarted to resume normal FPW injection.

D.7 July 2018

July 1 —31: Total Downtime 10.05 hours (1.4%)

July 6: The GWRS experienced a 2.75 hour shutdown (0300 – 0545 hours) due to an unexpected SCE power interruption. 0.20 MG of MWD OC-44 potable water was used during the brief shutdown period to maintain barrier system pressures until the plant could be restarted to resume normal FPW injection.

July 14: The GWRS experienced a 4.3 hour shutdown (0535 – 0955 hours) due to an unexpected SCE power interruption. 0.67 MG of MWD OC-44 potable water was used during the brief shutdown period to maintain barrier system pressures until the plant could be restarted to resume normal FPW injection.

July 15: The GWRS experienced a 2.25 hour shutdown (0210 – 0425 hours) due to an unexpected SCE power interruption. 0.34 MG of MWD OC-44 potable water was used during the brief shutdown period to maintain barrier system pressures until the plant could be restarted to resume normal FPW injection.

July 31: The GWRS experienced a 7.0 hour shutdown (7/31 @ 2315 hours – 8/1 @ 0615 hours) due to an unexpected SCE power interruption. Only 0.75 hours of the shutdown period occurred during July 31 and has been added to the month's shutdown time accrual. During this 0.75 hour period, 0.03 MG of MWD OC-44 potable water was used to maintain barrier system pressures. An additional 1.27 MG of MWD OC-44 potable was used on August 1 before resuming production at 0615 hours on August 1.

D.8 August 2018

August 1 — 31: Total Downtime 6.25 hours (0.8%)

August 1: The GWRS began August in a shutdown state after experiencing an unexpected SCE power interruption on July 31 at 2315 hours. The GWRS remained offline until resuming production on August 1 at 0615 hours. During this period 1.27 MG of MWD OC-44 potable water was used to maintain barrier system pressures until plant production and injection resumed.

D.9 September 2018

September 1 —30: Total Downtime 201.0 hours (0.8%)

September 17 – 25: The GWRS was offline 201 hours for scheduled maintenance. The GWRS was taken offline 9/17 at 0305 hours and returned to service on 9/25 at 1205 hours. The GWRS shutdown was scheduled to begin in coordination with OCSD bringing Santa Ana River Interceptor (SARI) flows into Plant 1 the morning of 9/17. On 9/18 OCSD notified OCWD that their project had been completed and SARI flows had been diverted back to Plant 2. However, the GWRS was kept offline until 9/25 while scheduled maintenance activities that could only be done during a full plant outage could be completed. These activities included adding restraining rods to seven of the eight product water and barrier pumps' suction lines (the eighth had already been completed during a previous shutdown), internal inspections of the RO flush tanks and the FPW channels; and cleaning and inspections of lime saturated water diffusion orifices in the FPW channels. 0.88 MG of MWD OC-44 imported water was used to restart GWRS and the seawater barrier injection system after the September 17 – 15 scheduled shutdown period was completed.

D.10 October 2018

October 1 – 31: Total Downtime 9.0 hours (1.2%)

October 2: The GWRS was purposefully shutdown and production was offline for a total of 8.0 hours (0730 – 1530 hrs) to complete a super chlorination project on Post Treatment systems. During the project the plant was operated at 15 - 25 mgd while injecting SHC into the combined UVP stream to chlorinate decarb process piping, decarbonator towers, RO Flush Tanks, and FPW channels in effort to correct recent FPW positive total coliform results. The project was completed while keeping the lime system off, and all super chlorinated discharge flows were routed to OCSD's interplant effluent piping. The lime system was kept offline during the project to prevent the highly-chlorinated DPW from upsetting lime slurry and saturator processes.

October 12: The GWRS experienced a one-hour process interruption due to an unexpected SCE power interruption (2110 – 2210 hours). 0.02 MG of MWD OC-44 potable water was used during the process interruption period to maintain barrier system pressures in case the plant could not be started up before the Barrier Pump Station shutdown due to low FPW channel levels.

D.11 November 2018

November 1 — 30: Total Downtime 0.0 hours (0.0%)

The GWRS / AWPF experienced no shutdowns or process interruptions during the month of November.

D.12 December 2018

December 1 - 31: Total Downtime 0.0 hours (0.0%)

The GWRS / AWPF experienced no shutdowns or process interruptions during the month of December.

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit A01

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/5/18	21.0	5.40	3.53	3.61
	1/31/18	21.0	5.19	3.14	2.95
February	2/26/18	21.1	4.67	3.21	3.43
March	3/25/18	21.2	5.47	3.12	3.34
April	4/22/18	21.0	5.58	3.35	3.18
May	5/18/18	21.0	5.61	3.63	3.20
June	6/14/18	21.0	5.53	3.44	3.08
July	7/3/18	21.0	4.86	3.19	3.06
	7/10/18	21.0	4.77	3.00	3.06
August	8/5/18	21.0	4.88	3.51	3.25
September	9/10/18	19.5	4.54	2.97	2.90
October	10/12/18	10.4	4.54	3.50	3.79
November	11/9/18	21.0	6.01	3.78	3.52
December	12/5/18	21.0	5.44	4.02	3.63
	12/31/18	21.0	7.05	4.02	3.78

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit A02

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/23/18	21.0	5.51	2.89	2.85
February	2/11/18	15.3	4.33	2.75	2.79
March	3/9/18	21.0	5.05	2.91	2.67
April	4/3/18	21.0	6.04	3.04	2.92
May	5/1/18	21.0	6.08	3.11	2.65
	5/27/18	21.0	5.23	2.88	2.69
June	6/22/18	21.2	4.86	2.53	2.50
July	7/18/18	21.0	4.80	2.80	2.43
August	8/13/18	21.0	4.71	2.64	2.55
September	9/10/18	13.7	3.39	2.33	2.56
October	10/11/18	9.5	3.85	2.61	2.61
November	11/5/18	21.0	5.00	3.04	2.81
December	12/1/18	21.0	5.05	2.77	2.74
	12/26/18	21.0	5.95	3.07	3.39

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit A03

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/16/18	21.0	6.12	2.90	2.62
February	2/7/18	18.4	5.93	2.94	2.72
March	3/5/18	21.0	5.19	3.23	2.95
	3/31/18	21.0	6.32	3.10	2.84
April	4/29/18	21.3	6.69	2.85	3.12
May	5/27/18	21.0	5.83	2.69	2.66
June	6/22/18	21.0	4.88	2.73	2.66
July	7/19/18	21.2	5.53	2.82	2.56
August	8/14/18	21.0	5.40	2.84	2.66
September	9/11/18	12.8	3.67	2.63	2.36
October	10/13/18	10.8	4.57	2.80	2.50
November	11/8/18	21.0	6.36	2.97	3.06
December	12/4/18	21.0	6.04	6.14	2.80
	12/30/18	21.0	8.80	3.54	3.48

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit A04

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/6/18	21.0	6.41	3.50	3.49
February	2/1/18	21.0	6.59	3.60	3.39
	2/27/18	21.1	6.37	3.57	3.29
March	3/24/18	21.0	6.68	3.86	3.56
April	4/21/18	21.0	6.00	3.46	3.22
May	5/17/18	21.0	8.27	3.34	3.72
June	6/12/18	21.0	5.62	3.11	5.10
July	7/8/18	21.0	5.73	2.85	2.92
August	8/3/18	21.0	6.02	3.59	3.20
September	9/7/18	21.0	4.45	3.30	2.90
	9/11/18	1.8	2.47	2.90	3.28
October	10/10/18	8.7	4.82	2.91	3.01
November	11/4/18	21.0	6.84	3.61	3.76
	11/29/18	21.0	5.70	2.36	3.29
December	12/25/18	21.0	6.42	3.13	3.40

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit A05

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/11/18	21.0	5.14	3.08	3.27
February	2/5/18	21.0	5.10	3.49	3.79
March	3/2/18	21.0	4.89	3.61	3.28
	3/28/18	21.0	5.57	3.61	3.19
April	4/25/18	21.0	5.71	3.64	4.06
May	5/20/18	21.0	5.82	3.75	3.38
June	6/14/18	21.0	4.76	3.62	2.98
July	7/10/18	21.0	4.72	3.27	3.01
August	8/5/18	21.2	4.92	3.08	2.94
September	9/11/18	20.8	4.22	2.92	2.87
October	10/14/18	11.6	4.30	2.97	3.54
November	11/8/18	21.2	5.60	3.42	3.16
December	12/3/18	21.0	5.83	3.53	3.62
	12/28/18	21.0	6.46	3.80	3.29

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit A06

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/16/18	21.1	5.26	3.25	3.27
February	2/8/18	18.9	5.55	3.21	2.87
March	3/6/18	21.0	5.40	3.60	3.16
	3/31/18	21.0	5.97	3.63	3.51
April	4/28/18	21.2	5.92	3.26	2.99
May	5/24/18	21.0	5.81	3.02	3.22
June	6/18/18	21.0	4.95	3.02	2.90
July	7/14/18	21.0	4.65	3.11	2.84
August	8/9/18	20.9	4.88	3.26	3.27
September	9/11/18	17.5	4.08	3.02	2.95
October	10/15/18	12.4	4.75	3.09	3.27
November	11/9/18	22.5	5.50	3.01	3.15
December	12/5/18	21.3	5.80	3.78	3.80
	12/30/18	21.0	6.22	3.70	3.26

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit A07

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/4/18	21.0	5.36	3.69	3.73
	1/30/18	21.0	5.77	4.31	3.35
February	2/25/18	21.1	5.30	4.14	3.80
March	3/24/18	21.0	6.32	4.09	3.53
April	4/21/18	21.0	6.23	4.44	3.53
May	5/17/18	21.0	6.23	4.35	3.53
June	6/12/18	21.1	5.14	3.63	3.81
July	7/8/18	21.0	5.41	3.52	3.36
August	8/4/18	21.0	4.93	3.51	3.51
September	9/12/18	21.7	4.71	3.55	3.33
October	10/16/18	12.8	5.07	3.60	3.23
November	11/10/18	21.0	5.58	3.60	3.61
December	12/6/18	21.0	6.27	3.92	3.59

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit A08

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/9/18	21.0	5.11	3.50	3.10
February	2/4/18	21.0	5.59	3.50	4.01
March	3/2/18	21.0	4.99	3.35	3.91
	3/28/18	21.0	5.36	3.78	3.50
April	4/25/18	21.0	5.53	3.68	3.85
May	5/21/18	21.0	5.92	3.58	3.25
June	6/17/18	21.0	5.22	3.43	3.47
July	7/13/18	21.0	4.93	3.20	3.06
August	8/9/18	21.1	5.51	3.13	3.24
September	9/12/18	18.3	4.54	3.24	2.99
October	10/16/18	13.0	4.83	3.37	3.50
November	11/11/18	21.0	5.70	3.82	3.47
December	12/7/18	21.0	5.85	3.91	3.67

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit B01

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/19/18	21.0	7.10	3.31	2.96
February	2/12/18	19.7	5.70	3.32	3.37
March	3/9/18	20.9	5.98	3.41	3.53
April	4/3/18	21.0	6.34	4.08	3.41
May	5/2/18	21.0	6.86	3.84	2.97
	5/27/18	21.0	6.30	3.29	3.10
June	6/23/18	21.0	5.19	3.12	2.90
July	7/19/18	21.0	5.69	3.34	2.84
August	8/15/18	21.4	6.61	3.58	3.19
September	9/14/18	14.1	4.08	2.92	2.75
October	10/12/18	9.7	4.56	3.24	2.87
November	11/6/18	21.0	6.26	3.48	3.15
December	12/2/18	21.0	5.79	3.14	3.32
	12/28/18	21.0	6.49	3.52	3.25

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit B02

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/26/18	21.0	5.92	3.68	3.18
February	2/20/18	21.0	5.35	3.97	3.45
March	3/17/18	21.0	6.01	3.75	3.78
April	4/15/18	21.0	6.46	3.62	3.47
May	5/10/18	21.1	8.10	3.73	3.25
June	6/5/18	21.0	6.35	3.39	3.07
	6/30/18	21.0	6.14	3.23	3.30
July	7/26/18	21.0	6.09	3.55	3.17
August	8/21/18	21.0	5.06	3.44	2.90
September	9/14/18	9.6	3.52	2.86	2.95
October	10/14/18	11.8	4.75	3.61	3.20
November	11/9/18	20.9	6.29	3.41	3.25
December	12/4/18	21.0	6.12	3.98	3.70
	12/30/18	21.1	8.81	4.06	3.58

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit B03

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/16/18	21.2	5.37	3.31	3.23
February	2/11/18	21.0	4.94	3.34	3.28
March	3/9/18	21.1	5.15	3.61	3.46
April	4/4/18	21.0	6.23	3.97	3.47
May	5/3/18	21.0	6.08	3.96	3.48
	5/29/18	21.0	5.49	3.64	3.40
June	6/25/18	21.0	5.26	3.25	3.14
July	7/21/18	21.0	5.32	3.54	3.13
August	8/17/18	21.2	4.93	3.40	3.36
September	9/14/18	12.0	3.37	3.11	3.11
October	10/16/18	12.9	4.13	3.60	3.14
November	11/11/18	21.1	5.44	3.48	3.32
December	12/7/18	21.0	5.60	3.50	3.34

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit B04

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/30/18	21.0	5.79	3.39	3.06
February	2/24/18	21.0	4.75	3.25	3.31
March	3/22/18	21.0	4.71	3.28	3.14
April	4/19/18	21.0	6.24	3.47	3.20
May	5/14/18	21.0	6.21	3.40	3.44
June	6/9/18	21.0	4.96	3.17	3.06
July	7/4/18	21.0	5.18	3.09	2.92
	7/31/18	21.5	4.76	3.09	2.80
September	9/6/18	21.0	3.88	3.06	2.80
	9/15/18	8.0	3.37	2.89	2.76
October	10/23/18	18.0	4.67	3.00	3.00
November	11/18/18	21.1	5.64	3.18	3.17
December	12/13/18	21.0	5.35	3.39	3.38

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit B05

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/15/18	21.0	5.71	3.72	3.41
February	2/9/18	19.6	5.45	3.06	3.28
March	3/7/18	21.0	5.91	3.50	3.64
April	4/2/18	21.0	6.46	3.65	3.55
	4/30/18	21.0	6.94	4.05	3.89
May	5/26/18	21.0	6.24	3.84	3.31
June	6/21/18	21.0	5.46	3.07	2.81
July	7/18/18	21.2	6.32	3.48	3.31
August	8/14/18	21.0	5.91	3.22	2.96
September	9/15/18	14.0	4.44	3.16	3.37
October	10/25/18	19.5	5.45	3.79	3.45
November	11/20/18	21.0	5.56	3.37	3.07
December	12/16/18	21.0	6.81	3.51	3.26

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit B06

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/1/18	21.0	5.39	3.20	3.20
	1/27/18	21.0	5.89	3.49	3.32
February	2/22/18	21.0	5.34	3.28	3.39
March	3/19/18	21.1	5.97	3.63	3.37
April	4/16/18	21.0	6.15	3.62	3.17
May	5/12/18	21.0	7.28	3.80	3.22
June	6/7/18	21.0	5.12	3.03	2.68
July	7/4/18	21.0	4.86	3.19	3.06
	7/30/18	21.0	5.15	2.99	2.86
September	9/5/18	21.0	4.03	2.86	2.62
	9/16/18	5.0	3.18	2.60	2.71
October	10/20/18	16.0	4.44	2.72	2.85
November	11/15/18	21.0	5.88	3.16	2.74
December	12/11/18	21.0	5.90	3.37	2.95

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit B07

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/22/18	21.0	6.68	4.04	3.78
February	2/13/18	17.6	5.53	3.96	3.89
March	3/10/18	21.0	5.99	4.20	3.94
April	4/5/18	21.1	7.22	4.25	3.84
May	5/3/18	21.0	7.58	4.24	3.74
	5/28/18	21.0	6.09	3.96	3.63
June	6/24/18	21.0	5.70	3.76	3.26
July	7/21/18	21.0	6.03	3.67	3.93
August	8/17/18	21.0	5.63	3.50	3.34
September	9/16/18	11.5	4.42	3.77	3.45
October	10/17/18	13.8	5.26	4.10	3.70
November	11/12/18	21.0	5.91	4.15	3.58
December	12/8/18	21.0	6.32	3.90	3.90

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit B08

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/1/18	21.0	5.40	3.87	3.90
	1/27/18	21.0	6.17	3.72	3.75
February	2/22/18	21.0	6.54	3.80	3.80
March	3/20/18	21.0	5.67	3.80	3.70
April	4/17/18	21.0	7.08	4.00	4.04
May	5/13/18	21.0	6.77	4.40	3.86
June	6/8/18	21.1	6.30	3.43	3.30
July	7/4/18	21.1	5.39	3.43	3.14
	7/30/18	21.2	5.45	3.55	3.24
August	9/6/18	21.0	4.77	3.45	3.15
	9/16/18	5.2	4.25	3.21	0.00
October	10/27/18	21.1	5.12	3.48	3.10
November	11/23/18	21.0	5.89	3.53	3.58
December	12/19/18	21.0	7.03	4.05	4.22

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit C01

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/3/18	21.0	6.11	3.81	3.53
	1/30/18	21.0	6.70	3.85	3.36
February	2/25/18	21.0	5.56	3.52	3.41
March	3/23/18	21.0	7.24	3.98	3.61
April	4/21/18	21.0	7.28	3.99	3.61
May	5/17/18	21.0	6.33	3.20	2.16
June	6/12/18	21.0	5.01	2.50	2.23
July	7/9/18	21.0	4.31	2.27	2.11
August	8/5/18	21.0	4.69	2.25	2.08
September	9/10/18	17.7	3.70	2.44	2.18
October	10/19/18	15.2	4.25	2.60	2.28
November	11/14/18	21.0	5.75	2.85	2.64
December	12/10/18	21.0	5.66	2.88	2.80

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit C02

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/15/18	21.0	6.79	3.58	3.19
February	2/8/18	19.5	7.25	3.45	3.35
March	3/5/18	21.2	6.48	3.94	3.69
	3/31/18	21.0	8.43	4.06	3.65
April	4/28/18	21.1	6.70	4.17	4.19
May	5/24/18	21.1	7.62	3.39	3.20
June	6/19/18	21.1	4.91	3.23	3.08
July	7/16/18	21.0	5.69	3.03	2.89
August	8/11/18	21.0	5.85	3.05	2.69
September	9/10/18	12.6	3.48	2.57	2.56
October	10/21/18	16.8	4.87	2.97	2.63
November	11/16/18	21.0	6.73	3.12	2.79
December	12/12/18	21.0	8.43	3.57	2.84

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit C03

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/8/18	21.3	6.96	3.68	3.82
February	2/3/18	21.1	7.14	3.53	3.71
March	3/1/18	21.1	7.28	3.51	3.51
	3/27/18	21.0	7.62	3.87	3.20
April	4/24/18	21.0	8.35	3.91	3.40
May	5/19/18	21.0	8.56	3.90	3.20
June	6/14/18	21.0	6.41	3.09	3.00
July	7/10/18	21.1	5.79	3.02	2.78
August	8/5/18	21.1	5.59	3.30	2.94
September	9/11/18	17.8	4.06	2.64	2.52
October	10/21/18	16.5	5.00	2.89	2.61
November	11/16/18	21.0	6.56	3.26	2.80
December	12/14/18	21.0	6.54	3.70	3.16

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit C04

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/13/18	21.0	7.23	3.86	3.64
February	2/7/18	21.0	8.06	3.57	2.42
March	3/5/18	21.0	6.87	3.91	3.38
	3/30/18	21.0	8.23	3.96	3.52
April	4/27/18	21.0	8.61	3.58	3.38
May	5/23/18	21.2	7.45	3.67	3.05
June	6/18/18	21.0	6.26	3.43	2.81
July	7/14/18	21.0	5.87	3.12	2.93
August	8/9/18	21.0	6.55	3.07	2.67
September	9/11/18	14.8	2.43	2.80	2.49
October	10/20/18	15.7	4.78	2.92	2.54
November	11/14/18	21.1	6.67	3.44	2.94
December	12/10/18	21.2	7.58	3.53	3.21

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit C05

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/4/18	21.0	7.05	3.94	3.79
	1/30/18	21.0	7.77	3.97	3.44
February	2/26/18	21.4	6.65	3.25	3.25
March	3/24/18	21.0	7.65	3.74	3.34
April	4/22/18	21.2	9.38	3.57	3.27
May	5/18/18	21.2	8.04	3.27	2.65
June	6/13/18	21.0	5.87	2.74	2.43
July	7/10/18	21.1	4.92	2.87	2.43
August	8/5/18	21.3	5.48	2.32	1.95
September	9/11/18	18.0	3.97	2.68	2.41
October	10/23/18	18.2	5.79	2.47	3.07
November	11/18/18	21.0	6.26	3.25	2.78
December	12/15/18	21.2	7.32	7.32	3.46

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit C06

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/5/18	21.0	7.91	3.59	3.08
February	2/1/18	21.0	6.54	3.56	3.39
	2/26/18	21.2	5.69	3.53	3.38
March	3/25/18	21.0	7.25	3.65	3.88
April	4/22/18	21.1	8.40	3.80	3.39
May	5/17/18	21.0	7.84	3.77	3.66
June	6/11/18	21.0	5.91	3.22	3.18
July	7/7/18	21.0	5.58	2.72	2.71
August	8/3/18	21.0	5.10	2.65	2.40
September	9/11/18	20.3	4.16	2.93	2.69
October	10/18/18	14.6	5.06	2.94	2.80
November	11/13/18	21.0	5.97	3.31	3.61
December	12/8/18	21.0	7.63	3.37	3.03

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit C07

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/8/18	21.0	7.35	3.55	3.35
February	2/2/18	21.3	7.16	3.58	3.32
	2/28/18	21.0	6.05	3.40	3.77
March	3/25/18	21.0	7.88	3.81	3.75
April	4/22/18	21.0	7.26	3.63	3.24
May	5/17/18	21.1	7.23	3.75	3.35
June	6/12/18	21.0	6.11	3.32	2.72
July	7/7/18	21.0	5.10	3.02	3.07
August	8/2/18	21.0	5.20	3.14	3.18
September	9/12/18	21.5	4.13	2.62	2.56
October	10/17/18	13.4	4.77	2.70	2.73
November	11/11/18	21.1	6.03	3.24	3.00
December	12/7/18	21.0	6.26	3.55	3.12

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit C08

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/8/18	21.0	6.64	3.18	3.53
February	2/2/18	21.0	6.25	3.55	3.36
	2/28/18	21.1	5.51	3.08	2.87
March	3/26/18	21.0	6.90	3.47	3.47
April	4/23/18	21.0	7.03	3.68	3.79
May	5/19/18	21.0	7.35	3.42	3.08
June	6/14/18	21.0	5.55	3.38	2.62
July	7/10/18	21.3	4.80	2.61	2.48
August	8/6/18	21.4	5.12	2.66	2.28
September	9/12/18	18.5	4.81	2.76	2.63
October	10/22/18	17.5	5.09	2.87	2.47
November	11/17/18	21.0	5.97	2.92	2.63
December	12/14/18	20.6	5.64	2.84	2.41

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit D01

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/16/18	21.0	5.14	3.16	2.93
February	2/9/18	19.8	5.16	3.39	3.13
March	3/7/18	21.0	4.89	3.20	3.12
April	4/1/18	21.0	5.61	3.17	2.78
	4/30/18	21.0	5.32	3.10	2.92
May	5/25/18	21.0	4.39	3.12	2.73
June	6/21/18	21.0	4.64	2.85	3.12
July	7/16/18	21.0	4.85	2.81	2.80
August	8/12/18	21.0	5.56	2.87	2.87
September	9/10/18	13.6	3.37	2.58	2.26
October	10/13/18	10.7	4.33	2.62	2.56
November	11/8/18	21.0	5.36	3.18	2.87
December	12/4/18	21.0	4.90	3.21	3.04
	12/30/18	21.1	5.68	3.35	2.85

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit D02

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/12/18	21.0	6.40	3.47	3.22
February	2/6/18	21.0	5.68	3.60	3.36
March	3/3/18	21.1	5.08	3.43	3.65
	3/29/18	21.0	5.88	3.32	3.28
April	4/25/18	21.0	6.03	3.39	3.10
May	5/21/18	21.0	5.64	3.39	2.80
June	6/16/18	21.0	5.22	3.31	3.18
July	7/11/18	21.0	5.41	3.45	3.09
August	8/7/18	21.0	5.21	5.32	2.94
September	9/10/18	17.4	4.24	2.86	2.80
October	10/17/18	14.2	4.39	3.28	3.07
November	11/12/18	21.0	5.88	3.57	3.42
December	12/8/18	21.0	6.28	3.76	3.22

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit D03

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/20/18	21.0	6.29	3.24	3.20
February	2/13/18	19.3	4.86	3.33	3.49
March	3/12/18	21.0	6.49	3.84	3.96
April	4/7/18	21.0	4.48	3.72	3.67
May	5/5/18	21.0	6.41	4.09	3.87
	5/31/18	21.0	5.99	3.38	3.42
June	6/27/18	21.0	6.11	3.46	3.51
July	7/23/18	21.0	5.51	3.64	3.49
August	8/19/18	21.0	5.62	3.71	3.46
September	9/11/18	7.4	4.06	3.23	3.09
October	10/26/18	20.1	6.21	3.69	3.41
November	11/21/18	21.0	6.04	3.90	3.96
December	12/17/18	21.0	6.64	3.98	3.85

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit D04

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/18/18	21.0	5.65	4.10	3.58
February	2/12/18	20.4	5.33	3.70	3.77
March	3/10/18	21.0	4.92	3.45	3.25
April	4/4/18	21.0	6.16	3.40	3.13
May	5/3/18	21.0	7.90	3.31	3.40
	5/29/18	21.0	7.16	3.16	3.08
June	6/24/18	21.0	5.70	3.25	3.25
July	7/20/18	21.0	5.28	3.22	3.01
August	8/16/18	21.0	5.32	3.11	2.80
September	9/11/18	10.2	3.61	2.70	2.70
October	10/24/18	19.1	4.64	3.06	3.14
November	11/20/18	21.0	5.04	3.03	3.40
December	12/16/18	21.0	5.79	3.24	3.07

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit D05

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/22/18	21.0	5.71	3.40	3.27
February	2/14/18	18.8	5.35	3.79	3.86
March	3/12/18	21.0	5.33	3.87	4.01
April	4/7/18	21.0	6.20	3.50	3.38
May	5/6/18	21.1	6.35	3.45	3.52
June	6/1/18	21.1	5.42	3.09	2.82
	6/27/18	21.2	4.57	2.80	3.19
July	7/23/18	21.1	4.89	2.97	3.04
August	8/19/18	21.1	4.94	3.32	3.01
September	9/11/18	6.7	3.34	3.12	2.93
October	10/24/18	18.6	4.84	2.73	2.83
November	11/19/18	21.0	5.64	3.08	2.55
December	12/16/18	21.1	5.31	3.45	3.44

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit D06

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/13/18	21.3	5.15	5.18	3.21
February	2/8/18	21.0	5.04	3.51	2.91
March	3/6/18	21.1	5.20	3.15	3.10
	3/31/18	21.1	5.15	3.36	3.39
April	4/28/18	21.0	5.40	3.67	3.11
May	5/24/18	21.0	5.30	3.45	3.26
June	6/19/18	21.0	4.45	2.87	2.70
July	7/16/18	21.1	4.56	3.00	2.75
August	8/12/18	21.0	4.66	3.04	3.03
September	9/11/18	13.8	4.02	2.97	2.72
October	10/19/18	15.1	4.80	2.75	2.76
November	11/15/18	21.0	5.41	3.22	3.05
December	12/10/18	21.0	5.35	3.52	3.57

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit D07

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/13/18	21.1	5.93	3.39	3.39
February	2/7/18	20.6	5.70	3.24	3.20
March	3/5/18	21.0	5.42	3.56	3.41
	3/30/18	21.0	5.73	3.54	3.56
April	4/27/18	21.0	6.50	4.00	3.66
May	5/23/18	21.0	5.80	3.74	3.18
June	6/18/18	21.0	4.69	3.10	3.00
July	7/14/18	21.0	4.82	3.01	3.32
August	8/10/18	21.0	4.92	2.95	2.89
September	9/12/18	15.3	4.02	2.88	2.78
October	10/27/18	21.0	4.83	3.04	3.37
November	11/22/18	21.0	5.43	3.47	2.93
December	12/18/18	21.0	5.80	3.85	3.34

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit D08

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/16/18	21.1	5.52	2.96	2.98
February	2/9/18	20.0	5.49	2.85	3.00
March	3/7/18	21.0	5.86	3.33	3.26
April	4/1/18	21.0	5.86	3.28	3.08
	4/29/18	21.0	7.07	3.08	3.34
May	5/24/18	21.2	6.10	3.43	3.44
June	6/19/18	21.3	5.25	2.98	3.04
July	7/16/18	21.2	5.42	2.98	2.66
August	8/12/18	21.2	5.45	3.06	2.63
September	9/12/18	13.8	3.77	3.11	2.87
October	10/19/18	14.8	4.80	2.90	3.03
November	11/14/18	21.0	5.85	3.10	2.82
December	12/9/18	21.0	5.78	3.57	3.71

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit E01

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/20/18	21.0	6.26	4.46	4.02
February	2/13/18	19.5	5.80	4.22	3.99
March	3/11/18	21.1	6.69	4.72	4.17
April	4/5/18	21.0	6.91	4.85	4.58
May	5/3/18	21.3	7.70	5.03	4.17
	5/28/18	21.0	6.64	4.56	4.44
June	6/23/18	21.0	5.76	4.15	3.90
July	7/19/18	21.1	6.52	4.60	3.99
August	8/14/18	21.3	5.97	4.35	4.23
September	9/8/18	21.0	4.67	3.86	3.79
	9/14/18	4.3	4.46	3.73	3.75
October	10/22/18	23.1	7.97	4.14	4.09
November	11/9/18	14.5	9.00	4.10	5.20
	11/27/18	15.4	8.10	5.81	5.09
December	12/22/18	21.0	12.11	5.45	5.27

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit E02

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/1/18	21.0	5.05	3.42	3.36
	1/27/18	21.0	5.51	3.44	3.24
February	2/23/18	21.0	4.63	2.99	2.72
March	3/21/18	21.0	5.16	3.12	3.02
April	4/18/18	21.0	4.91	3.08	2.78
May	5/14/18	21.0	5.63	3.26	3.02
June	6/9/18	21.0	4.92	2.69	2.52
July	7/5/18	21.0	4.30	2.48	2.30
August	8/1/18	21.0	4.25	2.66	2.57
September	9/14/18	19.2	5.01	3.93	3.25
October	10/9/18	8.9	4.66	3.62	3.23
November	11/4/18	21.0	5.73	3.58	3.20
	11/30/18	21.0	5.20	2.96	2.73
December	12/26/18	21.0	5.79	3.95	3.63

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit E03

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/6/18	21.0	9.28	4.10	4.02
	1/31/18	21.0	9.29	4.40	4.28
February	2/27/18	21.3	7.35	4.22	3.94
March	3/24/18	21.0	9.43	4.27	4.26
April	4/21/18	21.0	11.03	5.12	4.18
May	5/10/18	16.1	9.71	4.52	3.88
June	6/5/18	21.0	7.96	3.80	3.30
July	7/1/18	21.0	7.03	3.65	3.46
	7/26/18	21.0	6.76	3.52	3.42
August	8/22/18	21.1	5.80	3.36	3.08
September	9/14/18	19.5	4.03	3.20	3.03
October	10/10/18	9.5	5.03	3.16	3.16
November	11/5/18	21.0	6.60	3.42	3.67
December	12/1/18	21.1	7.35	4.15	3.48
	12/26/18	21.0	8.38	4.09	3.93

Microfiltration Plant Clean-In-Place (CIP) / Runtime Summary

Unit E04

Month	Date of CIP	Runtime Between CIP (Days)	TMP Before CIP (psi)	TMP After Caustic CIP (psi)	TMP After Citric CIP (psi)
January	1/20/18	21.1	8.84	4.20	3.87
February	2/14/18	18.0	6.57	3.06	3.19
March	3/12/18	21.0	8.70	3.69	3.33
April	4/7/18	21.0	9.44	4.54	3.79
May	5/5/18	21.0	10.22	3.61	3.56
	5/30/18	21.0	7.63	3.32	3.78
June	6/26/18	21.0	5.80	2.87	2.91
July	7/22/18	21.0	6.57	2.89	2.65
August	8/2/18	7.2	3.92	2.92	2.85
	8/14/18	New PVDF UF filters brought online (See Note 1).			
September	9/13/18	30.1	10.30	2.02	1.71
October	10/22/18	21.3	9.10	2.40	2.14
November	11/9/18	14.1	7.67	2.40	2.06
	11/27/18	14.7	12.60	2.63	2.48
December	12/27/18	24.1	13.00	3.57	2.21

1 MF E04 taken out-of-service on 8/2 for scheduled replacement of its Evoqua CMF-S filter modules, with new Scinor PVDF UF filters. The new filters were brought online on 8/14.

Reverse Osmosis Plant Cleaning Summary

Unit A01

Date of Cleaning	Treatment Performed
2018	None.

Reverse Osmosis Plant Cleaning Summary

Unit A02

Date of Cleaning	Treatment Performed
2018	None.

Reverse Osmosis Plant Cleaning Summary

Unit A03

Date of Cleaning	Treatment Performed
2018	None.

Reverse Osmosis Plant Cleaning Summary

Unit B01

Date of Cleaning	Treatment Performed
5/14/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.0 CIP at 94-97^{o}F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 11.0 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 6.0 gals. caustic during full unit CIPs to maintain pH 11.0. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit B02

Date of Cleaning	Treatment Performed
5/13/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.0 CIP at 95-96^{o}F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 11.0 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 7.0 gals. caustic during full unit CIPs to maintain pH 11.0. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit B03

Date of Cleaning	Treatment Performed
5/12/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.0 CIP at 94-96°F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 11.0 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 3.5 gals. caustic during full unit CIPs to maintain pH 11.0. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit C01

Date of Cleaning	Treatment Performed
5/15/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 93-96°F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 4.7 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit C02

Date of Cleaning	Treatment Performed
5/17/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 93-96^{o}F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 2.5 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit C03

Date of Cleaning	Treatment Performed
5/18/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 94-96°F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 5.35 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit D01

Date of Cleaning	Treatment Performed
5/21/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 92-96^{o}F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 6.0 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit D02

Date of Cleaning	Treatment Performed
5/20/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 92-96°F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 6.0 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit D03

Date of Cleaning	Treatment Performed
5/19/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 94-95^{o}F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 5.0 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit E01

Date of Cleaning	Treatment Performed
5/25/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 95-96°F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 4.4 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit E02

Date of Cleaning	Treatment Performed
5/22/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 92-96°F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 5.4 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit E03

Date of Cleaning	Treatment Performed
5/23-24/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 10.5 CIP at 95-96^{o}F: Filled entire unit with ambient temp. full strength generic solution without caustic. Heated and adjusted solution to pH 10.5 while unit soaked in generic solution. Then recirculated 1A-1B-2nd-3rd stages 3 hours each, followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 4.5 gals. caustic during full unit CIPs to maintain pH 10.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit F01

Date of Cleaning	Treatment Performed
5/6/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.5 CIP at 93-95^{o}F: Filled entire unit with ambient temp. generic solution. After unit was filled it was left soaking. While membranes were soaking the tank was reirculated around the loop and tank heaters were started and caustic was added to bring solution up to 11.5 pH. After solution was up to proper pH & temperature, began 3 hour recirculations through each 1A-1B-2nd-3rd sub-stage, one sub-stage at a time. When completed the CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 8.5 gals. caustic to maintain pH 11.5. All recirculation flows through 1 micron CFs.
6/10/2018	3rd stage only CIP using 2% C-227 (AWC): 11 pH and no heat first hour, then start heaters & add caustic to target 95°F (93^{o} - 95^{o}F actual) / 12 pH remaining 5 hours of CIP. Ending with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 25 gals caustic to bring pH up from 11 to 12. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit F02

Date of Cleaning	Treatment Performed
5/4/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95-96°F: Filled entire unit with ambient temp. generic solution. After unit was filled it was left soaking. While membranes were soaking the tank was reirculated around the loop and tank heaters were started and caustic was added to bring solution up to 11.5 pH. After solution was up to proper pH & temperature, began 3 hour recirculations through each 1A-1B-2nd-3rd sub-stage, one sub-stage at a time. When completed the CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 9.0 gals. caustic to maintain pH 11.5. All recirculation flows through 1 micron CFs.
6/11/2018	3rd stage only CIP using 2% C-227 (AWC): 11 pH and no heat first hour, then start heaters & add caustic to target 95°F (93°F actual) / 12 pH remaining 5 hours of CIP. Ending with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 25 gals caustic to bring pH up from 11 to 12. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit F03

Date of Cleaning	Treatment Performed
5/3/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95-96^{o}F: Filled entire unit with ambient temp. generic solution. After unit was filled it was left soaking. While membranes were soaking the tank was reirculated around the loop and tank heaters were started and caustic was added to bring solution up to 11.5 pH. After solution was up to proper pH & temperature, began 3 hour recirculations through each 1A-1B-2nd-3rd sub-stage, one sub-stage at a time. When completed the CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 8.4 gals. caustic to maintain pH 11.5. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit G01

Date of Cleaning	Treatment Performed
5/7/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.5 CIP at 93-95^{o}F: Filled entire unit with ambient temp. generic solution. After unit was filled it was left soaking. While membranes were soaking the tank was reirculated around the loop and tank heaters were started and caustic was added to bring solution up to 11.5 pH. After solution was up to proper pH & temperature, began 3 hour recirculations through each 1A-1B-2nd-3rd sub-stage, one sub-stage at a time. When completed the CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 8.5 gals. caustic to maintain pH 11.5. All recirculation flows through 1 micron CFs.
6/12/2018	3rd stage only CIP using 2% C-227 (AWC): 11 pH and no heat first hour, then start heaters & add caustic to target 95°F (95^{o} - 96^{o} F actual) / 12 pH remaining 5 hours of CIP. Ending with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 26 gals caustic to bring pH up from 11 to 12. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit G02

Date of Cleaning	Treatment Performed
5/8-9/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.5 CIP at 94-96^{o}F: Filled entire unit with ambient temp. generic solution. After unit was filled it was left soaking. While membranes were soaking the tank was reirculated around the loop and tank heaters were started and caustic was added to bring solution up to 11.5 pH. After solution was up to proper pH & temperature, began 3 hour recirculations through each 1A-1B-2nd-3rd sub-stage, one sub-stage at a time. When completed the CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 8.5 gals. caustic to maintain pH 11.5. All recirculation flows through 1 micron CFs.
6/13/2018	3rd stage only CIP using 2% C-227 (AWC): 11 pH and no heat first hour, then start heaters & add caustic to target 95°F (95^{o} - 96^{o} F actual) / 12 pH remaining 5 hours of CIP. Ending with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 26 gals caustic to bring pH up from 11 to 12. All recirculation flows through 1 micron CFs.
12/17/2018	3rd stage only CIP using 2% C-227 (AWC): 11 pH and no heat first hour, then start heaters & add caustic to target 95°F (95^{o} F actual) / 12 pH remaining 5 hours of CIP. Ending with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 25 gals caustic to bring pH up from 11 to 12. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit G03

Date of Cleaning	Treatment Performed
5/9-10/2018	Used "full strength" 2% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95°F: Filled entire unit with ambient temp. generic solution. After unit was filled it was left soaking. While membranes were soaking the tank was reirculated around the loop and tank heaters were started and caustic was added to bring solution up to 11.5 pH. After solution was up to proper pH & temperature, began 3 hour recirculations through each 1A-1B-2nd-3rd sub-stage, one sub-stage at a time. When completed the CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 7.0 gals. caustic to maintain pH 11.5. All recirculation flows through 1 micron CFs.
6/14/2018	3rd stage only CIP using 2% C-227 (AWC): 11 pH and no heat first hour, then start heaters & add caustic to target 95°F (93° - 95° F actual) / 12 pH remaining 5 hours of CIP. Ending with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 25 gals caustic to bring pH up from 11 to 12. All recirculation flows through 1 micron CFs.
12/18/2018	3rd stage only CIP using 2% C-227 (AWC): 11 pH and no heat first hour, then start heaters & add caustic to target 95°F (93° - 95° F actual) / 12 pH remaining 5 hours of CIP. Ending with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 25 gals caustic to bring pH up from 11 to 12. All recirculation flows through 1 micron CFs.

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
3056	AVFM Enclosure PM on 100-FIT-5500-160 Bldg South Wall	Transmitter Flow Indicating - south side of 160 building	100-PIP-SD-SITE-MAIN	18-Sep-18	6	MONTHS	16-Mar-19
3053	AVFM Enclosure PM on 100-FIT-5530-910 Bldg. North Wall	Transmitter Flow Indicating - north side 910 building	100-PIP-SD-SITE-MAIN	18-Sep-18	6	MONTHS	15-Mar-19
3055	AVFM Enclosure PM 100-FIT-5020-East MF CIP Tank E01	Transmitter Flow Indicating - East MF CIP Tank E01	100-PIP-SW	18-Sep-18	6	MONTHS	14-Mar-19
9307	Inspect and Clean SEFE Tank A01-LSH-130 Warrick	Switch Level High	142-A01-TNK-0130	22-Jan-19	1	YEARS	14-Jan-20
9302	SEFE Tank A01 Flush & Clean LIT-0130A Transmitter	Transmitter Level Indicating	142-A01-TNK-0130		1	YEARS	05-Nov-19
9303	SEFE Tank A01 Flush & Clean LIT-0130B Transmitter	Transmitter Level Indicating	142-A01-TNK-0130		1	YEARS	05-Nov-19
9304	SEFE Tank A02 Flush & Clean LIT-0130A Transmitter	Transmitter Level Indicating	142-A02-TNK-0130		1	YEARS	05-Nov-19
9305	SEFE Tank A02 Flush & Clean LIT-0130B Transmitter	Transmitter Level Indicating	142-A02-TNK-0130		1	YEARS	05-Nov-19
9308	Inspect and Clean SEFE Tank A02-LSH-130 Warrick	Switch Level High	142-A02-TNK-0130	22-Jan-19	1	YEARS	14-Jan-20
2316	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 1 MFE	Transmitter Level Indicating	210-A01-TNK-0340	16-Jan-19	1	YEARS	18-Jan-20
7390	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 1 MFE	Transmitter Level Indicating	210-A01-TNK-0340	08-Mar-18	1	YEARS	09-Mar-19
7391	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 2 MFE	Transmitter Level Indicating	210-A02-TNK-0340	08-Mar-18	1	YEARS	09-Mar-19
2317	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 2 MFE	Transmitter Level Indicating	210-A02-TNK-0340	16-Jan-19	1	YEARS	18-Jan-20
7392	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 3 MFE	Transmitter Level Indicating	210-A03-TNK-0340	08-Mar-18	1	YEARS	09-Mar-19
2318	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 3 MFE	Transmitter Level Indicating	210-A03-TNK-0340	16-Jan-19	1	YEARS	18-Jan-20
7393	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 4 MFE	Transmitter Level Indicating	210-A04-TNK-0340	08-Mar-18	1	YEARS	09-Mar-19
2319	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 4 MFE	Transmitter Level Indicating	210-A04-TNK-0340	16-Jan-19	1	YEARS	18-Jan-20
7394	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 5 MFE	Transmitter Level Indicating	210-A05-TNK-0340	20-Mar-18	1	YEARS	16-Mar-19
2320	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 5 MFE	Transmitter Level Indicating	210-A05-TNK-0340	28-Jan-19	1	YEARS	25-Jan-20
7395	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 6 MFE	Transmitter Level Indicating	210-A06-TNK-0340	20-Mar-18	1	YEARS	16-Mar-19
2321	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 6 MFE	Transmitter Level Indicating	210-A06-TNK-0340	28-Jan-19	1	YEARS	25-Jan-20
7396	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 7 MFE	Transmitter Level Indicating	210-A07-TNK-0340	20-Mar-18	1	YEARS	16-Mar-19
2322	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 7 MFE	Transmitter Level Indicating	210-A07-TNK-0340	28-Jan-19	1	YEARS	25-Jan-20
7397	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 8 MFE	Transmitter Level Indicating	210-A08-TNK-0340	20-Mar-18	1	YEARS	16-Mar-19
2324	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 8 MFE	Transmitter Level Indicating	210-A08-TNK-0340	28-Jan-19	1	YEARS	25-Jan-20
2244	Rosemount pH analyzer annual-Element Analyzer pH - MF Train A CIP-A02-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400A	11-Jan-19	1	YEARS	29-Dec-19
2243	Rosemount pH analyzer annual-Element Analyzer pH - MF Train A CIP-A01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400A	07-Nov-18	1	YEARS	03-Nov-19
2245	Rosemount pH analyzer annual-Element Analyzer pH - MF Train B CIP-B01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400B	07-Nov-18	1	YEARS	04-Nov-19
2246	Rosemount pH analyzer annual-Element Analyzer pH - MF Train B CIP-B02-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400B	11-Jan-19	1	YEARS	12-Jan-20
3596	Rosemount pH analyzer Annual Element Analyzer pH MF Train C02-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400C	06-Jun-18	1	YEARS	01-Jun-19
3595	Rosemount pH Analyzer Annual Element Analyzer pH MF Train C CIP-C01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400C	07-Jun-18	1	YEARS	06-Jun-19
2247	Rosemount pH analyzer annual-Element Analyzer pH - MF Train D CIP-D01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400D	28-Jan-19	1	YEARS	26-Jan-20
2248	Rosemount pH analyzer annual-Element Analyzer pH - MF Train D CIP-D02-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400D	09-Feb-18	1	YEARS	09-Feb-20
2249	Rosemount pH analyzer annual-Element Analyzer pH - MF Train E CIP-E01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400E	22-Feb-18	1	YEARS	23-Feb-19
2326	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 1 MFE	Transmitter Level Indicating	210-B01-TNK-0340	29-Jan-18	1	YEARS	01-Feb-20
7398	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 1 MFE	Transmitter Level Indicating	210-B01-TNK-0340	22-Mar-18	1	YEARS	23-Mar-19
2327	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 2 MFE	Transmitter Level Indicating	210-B02-TNK-0340	29-Jan-18	1	YEARS	01-Feb-20
7399	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 2 MFE	Transmitter Level Indicating	210-B02-TNK-0340	22-Mar-18	1	YEARS	23-Mar-19
2328	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 3 MFE	Transmitter Level Indicating	210-B03-TNK-0340	29-Jan-18	1	YEARS	01-Feb-20
7400	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 3 MFE	Transmitter Level Indicating	210-B03-TNK-0340	22-Mar-18	1	YEARS	23-Mar-19
2329	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 4 MFE	Transmitter Level Indicating	210-B04-TNK-0340	29-Jan-18	1	YEARS	01-Feb-20
7401	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 4 MFE	Transmitter Level Indicating	210-B04-TNK-0340	23-Mar-18	1	YEARS	23-Mar-19
7402	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 5 MFE	Transmitter Level Indicating	210-B05-TNK-0340	03-Apr-18	1	YEARS	30-Mar-19
2330	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 5 MFE	Transmitter Level Indicating	210-B05-TNK-0340	23-Feb-18	1	YEARS	15-Feb-19
7403	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 6 MFE	Transmitter Level Indicating	210-B06-TNK-0340	03-Apr-18	1	YEARS	30-Mar-19
2331	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 6 MFE	Transmitter Level Indicating	210-B06-TNK-0340	23-Feb-18	1	YEARS	15-Feb-19
2332	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 7 MFE	Transmitter Level Indicating	210-B07-TNK-0340	23-Feb-18	1	YEARS	15-Feb-19
7404	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 7 MFE	Transmitter Level Indicating	210-B07-TNK-0340	03-Apr-18	1	YEARS	30-Mar-19
2333	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 8 MFE	Transmitter Level Indicating	210-B08-TNK-0340	23-Feb-18	1	YEARS	15-Feb-19
7405	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 8 MFE	Transmitter Level Indicating	210-B08-TNK-0340	03-Apr-18	1	YEARS	30-Mar-19
2335	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 1 MFW	Transmitter Level Indicating	210-B08-TNK-0340	22-Feb-18	1	YEARS	22-Feb-19
3537	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 1 MFE	Transmitter Level Indicating	210-C01-TNK-0340	23-Mar-18	1	YEARS	14-Mar-19
3587	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 1	Transmitter Level Indicating	210-C01-TNK-0340	01-Jun-18	1	YEARS	01-Jun-19
3538	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 2 MFE	Transmitter Level Indicating	210-C02-TNK-0340	23-Mar-18	1	YEARS	14-Mar-19
3588	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 2	Transmitter Level Indicating	210-C02-TNK-0340	01-Jun-18	1	YEARS	01-Jun-19
3539	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 3 MFE	Transmitter Level Indicating	210-C03-TNK-0340	23-Mar-18	1	YEARS	14-Mar-19
3589	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 3	Transmitter Level Indicating	210-C03-TNK-0340	01-Jun-18	1	YEARS	01-Jun-19
3540	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 4 MFE	Transmitter Level Indicating	210-C04-TNK-0340	23-Mar-18	1	YEARS	14-Mar-19
3590	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 4	Transmitter Level Indicating	210-C04-TNK-0340	01-Jun-18	1	YEARS	01-Jun-19
3541	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 5 MFE	Transmitter Level Indicating	210-C05-TNK-0340	14-Mar-18	1	YEARS	14-Mar-19
3591	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 5	Transmitter Level Indicating	210-C05-TNK-0340	01-Jun-18	1	YEARS	01-Jun-19
3542	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell6 MFE	Transmitter Level Indicating	210-C06-TNK-0340	14-Mar-18	1	YEARS	14-Mar-19
3592	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 6	Transmitter Level Indicating	210-C06-TNK-0340	01-Jun-18	1	YEARS	01-Jun-19

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
3543	Check Calibration of Cell Level transmitter LIT-0345 Train C Cell 7 MFE	Transmitter Level Indicating	210-C07-TNK-0340	14-Mar-18	1	YEARS	14-Mar-19
3593	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 7	Transmitter Level Indicating	210-C07-TNK-0340	01-Jun-18	1	YEARS	01-Jun-19
3594	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 8	Transmitter Level Indicating	210-C08-TNK-0340	01-Jun-18	1	YEARS	01-Jun-19
3544	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 8 MFE	Transmitter Level Indicating	210-C08-TNK-0340	14-Mar-18	1	YEARS	14-Mar-19
7406	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 1 MFW	Transmitter Level Indicating	210-D01-TNK-0340	16-Apr-18	1	YEARS	07-Apr-19
2334	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 1 MFW	Transmitter Level Indicating	210-D01-TNK-0340	23-Feb-18	1	YEARS	15-Feb-19
7407	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 2 MFW	Transmitter Level Indicating	210-D02-TNK-0340	16-Apr-18	1	YEARS	07-Apr-19
2336	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 2 MFW	Transmitter Level Indicating	210-D02-TNK-0340	22-Feb-18	1	YEARS	22-Feb-19
7408	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 3 MFW	Transmitter Level Indicating	210-D03-TNK-0340	20-Apr-18	1	YEARS	07-Apr-19
2337	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 3 MFW	Transmitter Level Indicating	210-D03-TNK-0340	22-Feb-18	1	YEARS	22-Feb-19
7409	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 4 MFW	Transmitter Level Indicating	210-D04-TNK-0340	16-Apr-18	1	YEARS	07-Apr-19
2338	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 4 MFW	Transmitter Level Indicating	210-D04-TNK-0340	22-Feb-18	1	YEARS	22-Feb-19
2339	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 5 MFW	Transmitter Level Indicating	210-D05-TNK-0340	08-Mar-18	1	YEARS	01-Mar-19
7410	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 5 MFW	Transmitter Level Indicating	210-D05-TNK-0340	03-May-18	1	YEARS	14-Apr-19
2340	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 6 MFW	Transmitter Level Indicating	210-D06-TNK-0340	08-Mar-18	1	YEARS	01-Mar-19
7411	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 6 MFW	Transmitter Level Indicating	210-D06-TNK-0340	03-May-18	1	YEARS	14-Apr-19
2341	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 7 MFW	Transmitter Level Indicating	210-D07-TNK-0340	08-Mar-18	1	YEARS	01-Mar-19
7412	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 7 MFW	Transmitter Level Indicating	210-D07-TNK-0340	03-May-18	1	YEARS	14-Apr-19
7413	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 8 MFW	Transmitter Level Indicating	210-D08-TNK-0340	03-May-18	1	YEARS	14-Apr-19
2342	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 8 MFW	Transmitter Level Indicating	210-D08-TNK-0340	08-Mar-18	1	YEARS	01-Mar-19
2343	Flush Feed Tubing Transmitter LIT-0345 Train E Cell 1 MFW	Transmitter Level Indicating	210-E01-TNK-0340	08-Mar-18	1	YEARS	01-Mar-19
7414	Check calibration of Cell Level Transmitter LIT-0345 Train E Cell 1 MFW	Transmitter Level Indicating	210-E01-TNK-0340	02-May-18	1	YEARS	21-Apr-19
2344	Flush Feed Tubing Transmitter LIT-0345 Train E Cell 2 MFW	Transmitter Level Indicating	210-E02-TNK-0340	08-Mar-18	1	YEARS	01-Mar-19
7415	Check calibration of Cell Level Transmitter LIT-0345 Train E Cell 2 MFW	Transmitter Level Indicating	210-E02-TNK-0340	02-May-18	1	YEARS	21-Apr-19
3648	Check Calibration of Cell Level Transmitter LIT-0345 Train E Cell 3	Transmitter Level Indicating	210-E03-TNK-0340	28-Jun-18	1	YEARS	06-Jun-19
3650	Flush Feed Tubing Transmitter LIT-0345 Train E Cell 3	Transmitter Level Indicating	210-E03-TNK-0340	07-Jun-18	1	YEARS	06-Jun-19
3651	Flush Feed Tubing Transmitter LIT-0345 Train E Cell 4	Transmitter Level Indicating	210-E04-TNK-0340	07-Jun-18	1	YEARS	06-Jun-19
3649	Check Calibration of Cell Level Transmitter LIT-0345 Train E Cell 4	Transmitter Level Indicating	210-E04-TNK-0340	28-Jun-18	1	YEARS	06-Jun-19
7270	Annual rebuild W&T Chlorine Analyzer A01-AIT-0475	Transmitter Analyzer Indicating Chlorine	210-FTS-0470A	13-Jul-18	1	YEARS	07-Jul-19
7271	Annual rebuild W&T Chlorine Analyzer A02-AIT-0475	Transmitter Analyzer Indicating Chlorine	210-FTS-0470A	13-Jul-18	1	YEARS	07-Jul-19
7273	Annual rebuild W&T Chlorine Analyzer B02-AIT-0475	Transmitter Analyzer Indicating Chlorine	210-FTS-0470B	17-Jul-18	1	YEARS	14-Jul-19
7272	Annual rebuild W&T Chlorine Analyzer B01-AIT-0475	Transmitter Analyzer Indicating Chlorine	210-FTS-0470B	17-Jul-18	1	YEARS	14-Jul-19
7275	Annual rebuild W&T Chlorine Analyzer D02-AIT-0475	Transmitter Analyzer Indicating Chlorine	210-FTS-0470D	18-Jul-18	1	YEARS	21-Jul-19
7274	Annual rebuild W&T Chlorine Analyzer D01-AIT-0475	Transmitter Analyzer Indicating Chlorine	210-FTS-0470D	18-Jul-18	1	YEARS	21-Jul-19
7276	Annual rebuild W&T Chlorine Analyzer E01-AIT-0475	Transmitter Analyzer Indicating Chlorine	210-FTS-0470E	27-Jul-18	1	YEARS	28-Jul-19
7551	Check Calibration of PIT-0471, MF Filtrate Header Train A Cells 5-8	Transmitter Pressure Indicating	210-PIP-MFE-MEMA	30-Nov-17	2	YEARS	27-Nov-19
7550	Check Calibration of PIT-0471, MF Filtrate Header Train A Cells 1-4	Transmitter Pressure Indicating	210-PIP-MFE-MEMA	30-Nov-17	2	YEARS	27-Nov-19
7595	Check Calibration of TIT-0420, MF Filtrate Train A Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEMA1	16-Jan-19	6	MONTHS	07-Jul-19
7560	Check Calibration of BFV-0460, MF Filtrate Train A Cell 1	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA1	26-Oct-18	1	YEARS	17-Oct-19
7515	Check Calibration of PIT-0454, MF Effluent Train A Cell 1	Transmitter Pressure Indicating	210-PIP-MFE-MEMA1	31-Oct-17	2	YEARS	04-Nov-19
7596	Check Calibration of TIT-0420, MF Filtrate Train A Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEMA2	07-Sep-18	6	MONTHS	09-Mar-19
7561	Check Calibration of BFV-0460, MF Filtrate Train A Cell 2	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA2	26-Oct-18	1	YEARS	17-Oct-19
7516	Check Calibration of PIT-0454, MF Effluent Train A Cell 2	Transmitter Pressure Indicating	210-PIP-MFE-MEMA2	31-Oct-17	2	YEARS	04-Nov-19
7597	Check Calibration of TIT-0420, MF Filtrate Train A Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEMA3	07-Sep-18	6	MONTHS	09-Mar-19
7562	Check Calibration of BFV-0460, MF Filtrate Train A Cell 3	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA3	26-Oct-18	1	YEARS	17-Oct-19
7517	Check Calibration of PIT-0454, MF Effluent Train A Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMA3	31-Oct-17	2	YEARS	04-Nov-19
7518	Check Calibration of PIT-0454, MF Effluent Train A Cell 4	Transmitter Pressure Indicating	210-PIP-MFE-MEMA4	31-Oct-17	2	YEARS	04-Nov-19
7563	Check Calibration of BFV-0460, MF Filtrate Train A Cell 4	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA4	26-Oct-18	1	YEARS	17-Oct-19
7598	Check Calibration of TIT-0420, MF Filtrate Train A Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEMA4	07-Sep-18	6	MONTHS	09-Mar-19
7564	Check Calibration of BFV-0460, MF Filtrate Train A Cell 5	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA5	01-Nov-18	1	YEARS	23-Oct-19
7519	Check Calibration of PIT-0454, MF Effluent Train A Cell 5	Transmitter Pressure Indicating	210-PIP-MFE-MEMA5	13-Nov-17	2	YEARS	11-Nov-19
7599	Check Calibration of TIT-0420, MF Filtrate Train A Cell 5	Transmitter Temperature Indicating	210-PIP-MFE-MEMA5	11-Sep-18	6	MONTHS	16-Mar-19
7565	Check Calibration of BFV-0460, MF Filtrate Train A Cell 6	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA6	01-Nov-18	1	YEARS	23-Oct-19
7600	Check Calibration of TIT-0420, MF Filtrate Train A Cell 6	Transmitter Temperature Indicating	210-PIP-MFE-MEMA6	11-Sep-18	6	MONTHS	16-Mar-19
7520	Check Calibration of PIT-0454, MF Effluent Train A Cell 6	Transmitter Pressure Indicating	210-PIP-MFE-MEMA6	13-Nov-17	2	YEARS	11-Nov-19
7601	Check Calibration of TIT-0420, MF Filtrate Train A Cell 7	Transmitter Temperature Indicating	210-PIP-MFE-MEMA7	14-Sep-18	6	MONTHS	16-Mar-19
7566	Check Calibration of BFV-0460, MF Filtrate Train A Cell 7	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA7	01-Nov-18	1	YEARS	23-Oct-19
7521	Check Calibration of PIT-0454, MF Effluent Train A Cell 7	Transmitter Pressure Indicating	210-PIP-MFE-MEMA7	13-Nov-17	2	YEARS	11-Nov-19
7567	Check Calibration of BFV-0460, MF Filtrate Train A Cell 8	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA8	01-Nov-18	1	YEARS	23-Oct-19
7602	Check Calibration of TIT-0420, MF Filtrate Train A Cell 8	Transmitter Temperature Indicating	210-PIP-MFE-MEMA8	14-Sep-18	6	MONTHS	16-Mar-19
7522	Check Calibration of PIT-0454, MF Effluent Train A Cell 8	Transmitter Pressure Indicating	210-PIP-MFE-MEMA8	13-Nov-17	2	YEARS	11-Nov-19
7552	Check Calibration of PIT-0471, MF Filtrate Header Train B Cells 1-4	Transmitter Pressure Indicating	210-PIP-MFE-MEMB	01-Dec-17	2	YEARS	27-Nov-19
7553	Check Calibration of PIT-0471, MF Filtrate Header Train B Cells 5-8	Transmitter Pressure Indicating	210-PIP-MFE-MEMB	01-Dec-17	2	YEARS	27-Nov-19

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
7568	Check Calibration of BFV-0460, MF Filtrate Train B Cell 1	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB1	05-Nov-18	1	YEARS	03-Nov-19
7523	Check Calibration of PIT-0454, MF Effluent Train B Cell 1	Transmitter Pressure Indicating	210-PIP-MFE-MEMB1	17-Nov-17	2	YEARS	18-Nov-19
7603	Check Calibration of TIT-0420, MF Filtrate Train B Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEMB1	27-Sep-18	6	MONTHS	23-Mar-19
7569	Check Calibration of BFV-0460, MF Filtrate Train B Cell 2	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB2	05-Nov-18	1	YEARS	03-Nov-19
7524	Check Calibration of PIT-0454, MF Effluent Train B Cell 2	Transmitter Pressure Indicating	210-PIP-MFE-MEMB2	17-Nov-17	2	YEARS	18-Nov-19
7604	Check Calibration of TIT-0420, MF Filtrate Train B Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEMB2	27-Sep-18	6	MONTHS	23-Mar-19
7605	Check Calibration of TIT-0420, MF Filtrate Train B Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEMB3	27-Sep-18	6	MONTHS	23-Mar-19
7570	Check Calibration of BFV-0460, MF Filtrate Train B Cell 3	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB3	05-Nov-18	1	YEARS	03-Nov-19
7525	Check Calibration of PIT-0454, MF Effluent Train B Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMB3	17-Nov-17	2	YEARS	18-Nov-19
7606	Check Calibration of TIT-0420, MF Filtrate Train B Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEMB4	27-Sep-18	6	MONTHS	23-Mar-19
7526	Check Calibration of PIT-0454, MF Effluent Train B Cell 4	Transmitter Pressure Indicating	210-PIP-MFE-MEMB4	17-Nov-17	2	YEARS	18-Nov-19
7571	Check Calibration of BFV-0460, MF Filtrate Train B Cell 4	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB4	05-Nov-18	1	YEARS	03-Nov-19
7527	Check Calibration of PIT-0454, MF Effluent Train B Cell 5	Transmitter Pressure Indicating	210-PIP-MFE-MEMB5	30-Nov-17	2	YEARS	25-Nov-19
7607	Check Calibration of TIT-0420, MF Filtrate Train B Cell 5	Transmitter Temperature Indicating	210-PIP-MFE-MEMB5	28-Sep-18	6	MONTHS	30-Mar-19
7572	Check Calibration of BFV-0460, MF Filtrate Train B Cell 5	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB5	28-Nov-18	1	YEARS	19-Nov-19
7608	Check Calibration of TIT-0420, MF Filtrate Train B Cell 6	Transmitter Temperature Indicating	210-PIP-MFE-MEMB6	28-Sep-18	6	MONTHS	30-Mar-19
7573	Check Calibration of BFV-0460, MF Filtrate Train B Cell 6	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB6	28-Nov-18	1	YEARS	19-Nov-19
7528	Check Calibration of PIT-0454, MF Effluent Train B Cell 6	Transmitter Pressure Indicating	210-PIP-MFE-MEMB6	30-Nov-17	2	YEARS	25-Nov-19
7529	Check Calibration of PIT-0454, MF Effluent Train B Cell 7	Transmitter Pressure Indicating	210-PIP-MFE-MEMB7	30-Nov-17	2	YEARS	25-Nov-19
7574	Check Calibration of BFV-0460, MF Filtrate Train B Cell 7	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB7	28-Nov-18	1	YEARS	19-Nov-19
7609	Check Calibration of TIT-0420, MF Filtrate Train B Cell 7	Transmitter Temperature Indicating	210-PIP-MFE-MEMB7	28-Sep-18	6	MONTHS	30-Mar-19
7538	Check Calibration of PIT-0454, MF Effluent Train B Cell 8	Transmitter Pressure Indicating	210-PIP-MFE-MEMB8	30-Nov-17	2	YEARS	25-Nov-19
7610	Check Calibration of TIT-0420, MF Filtrate Train B Cell 8	Transmitter Temperature Indicating	210-PIP-MFE-MEMB8	16-Jan-19	6	MONTHS	07-Jul-19
7575	Check Calibration of BFV-0460, MF Filtrate Train B Cell 8	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB8	28-Nov-18	1	YEARS	19-Nov-19
3552	Check Calibration of PIT-0454, MF Effluent Train C Cell 1	Transmitter Pressure Indication	210-PIP-MFE-MEMC1	18-Aug-17	2	YEARS	01-Aug-19
3560	Check Calibration of BFV-0460 MF Filtrate Train C Cell1	Actuator	210-PIP-MFE-MEMC1	05-Jun-18	1	YEARS	01-Jun-19
3515	Check Calibration of TIT-0420 MF Filtrate Train C Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEMC1	16-Aug-18	6	MONTHS	10-Aug-19
3516	Check Calibration of TIT-0420 MF Filtrate Train C Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEMC2	16-Aug-18	6	MONTHS	10-Aug-19
3561	Check Calibration of BFV-0460 MF Filtrate Train C Cell 2	Actuator	210-PIP-MFE-MEMC2	05-Jun-18	1	YEARS	01-Jun-19
3553	Check Calibration of PIT-0454, MF Effluent Train C Cell 2	Transmitter Pressure Indication	210-PIP-MFE-MEMC2	18-Aug-17	2	YEARS	01-Aug-19
3554	Ckeck Calibration of PIT-0454, MF Effluent Train C Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMC3	18-Aug-17	2	YEARS	01-Aug-19
3517	Check Calibration of TIT-0420 MF Filtrate Train C Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEMC3	16-Aug-18	6	MONTHS	10-Aug-19
3562	Check Calibration of BFV-0460 MF Filtrate Train C Cell 3	Actuator	210-PIP-MFE-MEMC3	05-Jun-18	1	YEARS	01-Jun-19
3568	Check Calibration of PIT-0454 MF Effluent Train C Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMC3	18-Aug-17	2	YEARS	01-Aug-19
3563	Check Calibration of BFV-0460 MF Filtrate Train C Cell 4	Actuator	210-PIP-MFE-MEMC4	05-Jun-18	1	YEARS	01-Jun-19
3518	Check Calibration of TIT-0420 MF Filtrate Train C Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEMC4	16-Aug-18	6	MONTHS	10-Aug-19
3555	Check Calibration of PIT-0454, MF Effluent Train C Cell 4	Transmitter Pressure Indicating	210-PIP-MFE-MEMC4	18-Aug-17	2	YEARS	01-Aug-19
3564	Check Calibration of BFV-0460 MF Filtrate Train C Cell 5	Actuator	210-PIP-MFE-MEMC5	05-Jun-18	1	YEARS	01-Jun-19
3519	Check Calibration of TIT-0420 MF Filtrate Train C Cell 5	Transmitter Temperature Indicating	210-PIP-MFE-MEMC5	15-Aug-18	6	MONTHS	10-Aug-19
3556	Check Calibration of PIT-0454, MF Effluent Train C Cell 5	Transmitter Pressure Indicating	210-PIP-MFE-MEMC5	09-Aug-17	2	YEARS	01-Aug-19
3565	Check Calibration of BFV-0460 MF Filtrate Train C Cell 6	Actuator	210-PIP-MFE-MEMC6	05-Jun-18	1	YEARS	01-Jun-19
3520	Check Calibration of TIT-0420 MF Filtrate Train C Cell 6	Transmitter Temperature Indicating	210-PIP-MFE-MEMC6	15-Aug-18	6	MONTHS	10-Aug-19
3557	Check Calibration of PIT-0454, MF Effluent Train C Cell 6	Transmitter Pressure Indicating	210-PIP-MFE-MEMC6	09-Aug-17	2	YEARS	01-Aug-19
3521	Check Calibration of TIT-0420 MF Filtrate Train C Cell 7	Transmitter Temperature Indicating	210-PIP-MFE-MEMC7	15-Aug-18	6	MONTHS	10-Aug-19
3558	Check Calibration of PIT-0454, MF Effluent Train C Cell 7	Transmitter Pressure Indicating	210-PIP-MFE-MEMC7	09-Aug-17	2	YEARS	01-Aug-19
3566	Check Calibration of BFV-0460 MF Filtrate Train C Cell 7	Valve Butterfly 12"	210-PIP-MFE-MEMC7	05-Jun-18	1	YEARS	01-Jun-19
3567	Check Calibration of BFV-0460 MF Filtrate Train C Cell 8	Valve Butterfly 12"	210-PIP-MFE-MEMC8	05-Jun-18	1	YEARS	01-Jun-19
3522	Check Calibration of TIT-0420 MF Filtrate Train C Cell 8	Transmitter Temperature Indicating	210-PIP-MFE-MEMC8	15-Aug-18	6	MONTHS	10-Aug-19
3559	Check Calibration of PIT-0454, MF Effluent Train C Cell 8	Transmitter Pressure Indicating	210-PIP-MFE-MEMC8	09-Aug-17	2	YEARS	01-Aug-19
7556	Check Calibration of PIT-0471, MF Filtrate Header Train D Cells 5-8	Transmitter Pressure Indicating	210-PIP-MFE-MEMD	30-Nov-17	2	YEARS	27-Nov-19
7554	Check Calibration of PIT-0471, MF Filtrate Header Train D Cells 1-4	Transmitter Pressure Indicating	210-PIP-MFE-MEMD	30-Nov-17	2	YEARS	27-Nov-19
7611	Check Calibration of TIT-0420, MF Filtrate Train D Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEMD1	04-Oct-18	6	MONTHS	07-Apr-19
7530	Check Calibration of PIT-0454, MF Effluent Train D Cell 1	Transmitter Pressure Indicating	210-PIP-MFE-MEMD1	29-Nov-17	2	YEARS	02-Dec-19
7576	Check Calibration of BFV-0460, MF Filtrate Train D Cell 1	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD1	28-Nov-18	1	YEARS	26-Nov-19
7577	Check Calibration of BFV-0460, MF Filtrate Train D Cell 2	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD2	28-Nov-18	1	YEARS	26-Nov-19
7531	Check Calibration of PIT-0454, MF Effluent Train D Cell 2	Transmitter Pressure Indicating	210-PIP-MFE-MEMD2	29-Nov-17	2	YEARS	02-Dec-19
7612	Check Calibration of TIT-0420, MF Filtrate Train D Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEMD2	04-Oct-18	6	MONTHS	07-Apr-19
7613	Check Calibration of TIT-0420, MF Filtrate Train D Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEMD3	05-Oct-18	6	MONTHS	07-Apr-19
7578	Check Calibration of BFV-0460, MF Filtrate Train D Cell 3	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD3	28-Nov-18	1	YEARS	26-Nov-19
7532	Check Calibration of PIT-0454, MF Effluent Train D Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMD3	29-Nov-17	2	YEARS	02-Dec-19
7579	Check Calibration of BFV-0460, MF Filtrate Train D Cell 4	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD4	28-Nov-18	1	YEARS	26-Nov-19
7614	Check Calibration of TIT-0420, MF Filtrate Train D Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEMD4	05-Oct-18	6	MONTHS	07-Apr-19
7533	Check Calibration of PIT-0454, MF Effluent Train D Cell 4	Transmitter Pressure Indicating	210-PIP-MFE-MEMD4	29-Nov-17	2	YEARS	02-Dec-19

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
7615	Check Calibration of TIT-0420, MF Filtrate Train D Cell 5	Transmitter Temperature Indicating	210-PIP-MFE-MEMD5	12-Oct-18	6	MONTHS	14-Apr-19
7580	Check Calibration of BFV-0460, MF Filtrate Train D Cell 5	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD5	14-Dec-18	1	YEARS	09-Dec-19
7534	Check Calibration of PIT-0454, MF Effluent Train D Cell 5	Transmitter Pressure Indicating	210-PIP-MFE-MEMD5	13-Dec-17	2	YEARS	09-Dec-19
7535	Check Calibration of PIT-0454, MF Effluent Train D Cell 6	Transmitter Pressure Indicating	210-PIP-MFE-MEMD6	13-Dec-17	2	YEARS	09-Dec-19
7581	Check Calibration of BFV-0460, MF Filtrate Train D Cell 6	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD6	14-Dec-18	1	YEARS	09-Dec-19
7616	Check Calibration of TIT-0420, MF Filtrate Train D Cell 6	Transmitter Temperature Indicating	210-PIP-MFE-MEMD6	12-Oct-18	6	MONTHS	14-Apr-19
7582	Check Calibration of BFV-0460, MF Filtrate Train D Cell 7	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD7	14-Dec-18	1	YEARS	09-Dec-19
7536	Check Calibration of PIT-0454, MF Effluent Train D Cell 7	Transmitter Pressure Indicating	210-PIP-MFE-MEMD7	13-Dec-17	2	YEARS	09-Dec-19
7617	Check Calibration of TIT-0420, MF Filtrate Train D Cell 7	Transmitter Temperature Indicating	210-PIP-MFE-MEMD7	12-Oct-18	6	MONTHS	14-Apr-19
7537	Check Calibration of PIT-0454, MF Effluent Train D Cell 8	Transmitter Pressure Indicating	210-PIP-MFE-MEMD8	13-Dec-17	2	YEARS	09-Dec-19
7618	Check Calibration of TIT-0420, MF Filtrate Train D Cell 8	Transmitter Temperature Indicating	210-PIP-MFE-MEMD8	12-Oct-18	6	MONTHS	14-Apr-19
7583	Check Calibration of BFV-0460, MF Filtrate Train D Cell 8	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD8	14-Dec-18	1	YEARS	09-Dec-19
7557	Check Calibration of PIT-0471, MF Filtrate Header Train E Cells 1-4	Transmitter Pressure Indicating	210-PIP-MFE-MEME	30-Nov-17	2	YEARS	27-Nov-19
7619	Check Calibration of TIT-0420, MF Filtrate Train E Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEME1	19-Oct-18	6	MONTHS	21-Apr-19
7539	Check Calibration of PIT-0454, MF Effluent Train E Cell 1	Transmitter Pressure Indicating	210-PIP-MFE-MEME1	14-Dec-17	2	YEARS	16-Dec-19
7584	Check Calibration of BFV-0460, MF Filtrate Train E Cell 1	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEME1	20-Dec-18	1	YEARS	17-Dec-19
7620	Check Calibration of TIT-0420, MF Filtrate Train E Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEME2	19-Oct-18	6	MONTHS	21-Apr-19
7540	Check Calibration of PIT-0454, MF Effluent Train E Cell 2	Transmitter Pressure Indicating	210-PIP-MFE-MEME2	14-Dec-17	2	YEARS	16-Dec-19
7585	Check Calibration of BFV-0460, MF Filtrate Train E Cell 2	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEME2	20-Dec-18	1	YEARS	17-Dec-19
3644	Check Calibration of PIT-0454 MF Effluent Train E Cell 3	Transmitter Pressure Indication	210-PIP-MFE-MEME3	15-Jun-17	2	YEARS	05-Jun-19
3640	Check Calibration of TIT-0420 MF Filtrate Train E Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEME3	27-Nov-18	6	MONTHS	23-May-19
3642	Check Calibration of BFV-0460 MF Filtrate Train E Cell 3	Actuator	210-PIP-MFE-MEME3	12-Jul-18	1	YEARS	04-Jul-19
3643	Check Calibration of BFV-0460 MF Filtrate Train E Cell 4	Actuator	210-PIP-MFE-MEME4	18-Jul-18	1	YEARS	04-Jul-19
3641	Check Calibration of TIT-0420 MF Flitrate Train E Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEME4	27-Nov-18	6	MONTHS	23-May-19
3645	Check Calibration of PIT-0454 MF Effluent Train E Cell 4	Transmitter Pressure Indication	210-PIP-MFE-MEME4	13-Jun-17	2	YEARS	05-Jun-19
7510	Check Calibration of Train Feed Valve A02-BFV-0320 MFE	Valve Butterfly 60"	210-PIP-MFF-MEM	25-Jun-18	12	MONTHS	11-Jun-19
7513	Check Calibration of Train Feed Valve E01-E02-BFV-0320 MFW	Valve Butterfly 36"	210-PIP-MFF-MEM	25-Jun-18	12	MONTHS	11-Jun-19
7512	Check Calibration of Train Feed Valve D02-BFV-0320 MFW	Valve Butterfly 60"	210-PIP-MFF-MEM	25-Jun-18	12	MONTHS	11-Jun-19
7511	Check Calibration of Train Feed Valve B02-BFV-0320 MFE	Valve Butterfly 60"	210-PIP-MFF-MEM	25-Jun-18	12	MONTHS	11-Jun-19
3577	Check Calibration of Train Feed Valve C02-BFV-0320	Actuator	210-PIP-MFF-MEM	05-Jun-18	1	YEARS	01-Jun-19
2290	Block, Bleed and Check Zero - A01-DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA1	14-Jan-19	6	MONTHS	07-Jul-19
7470	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 1 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA1	07-Mar-18	12	MONTHS	09-Mar-19
7350	Check calibration of DPIT-0405, Train A Cell 1 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA1	13-Dec-18	1	YEARS	07-Dec-19
7471	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 2 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA2	07-Mar-18	12	MONTHS	09-Mar-19
2291	Block, Bleed and Check Zero -A02- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA2	24-Jul-18	1	YEARS	07-Jul-19
7351	Check calibration of DPIT-0405, Train A Cell 2 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA2	13-Dec-18	1	YEARS	07-Dec-19
7352	Check calibration of DPIT-0405, Train A Cell 3 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA3	13-Dec-18	1	YEARS	07-Dec-19
7472	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 3 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA3	07-Mar-18	12	MONTHS	09-Mar-19
2292	Block, Bleed and Check Zero -A03- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA3	24-Jul-18	1	YEARS	07-Jul-19
7353	Check calibration of DPIT-0405, Train A Cell 4 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA4	13-Dec-18	1	YEARS	07-Dec-19
7473	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 4 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA4	07-Mar-18	12	MONTHS	09-Mar-19
2293	Block, Bleed and Check Zero -A04- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA4	24-Jul-18	1	YEARS	07-Jul-19
7354	Check calibration of DPIT-0405, Train A Cell 5 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA5	07-Jan-19	1	YEARS	04-Jan-20
7474	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 5 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA5	22-Mar-18	12	MONTHS	16-Mar-19
2294	Block, Bleed and Check Zero -A05- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA5	24-Jul-18	1	YEARS	21-Jul-19
2295	Block, Bleed and Check Zero -A06- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA6	24-Jul-18	1	YEARS	21-Jul-19
7355	Check calibration of DPIT-0405, Train A Cell 6 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA6	07-Jan-19	1	YEARS	04-Jan-20
7475	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 6 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA6	22-Mar-18	12	MONTHS	16-Mar-19
7476	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 7 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA7	22-Mar-18	12	MONTHS	16-Mar-19
7356	Check calibration of DPIT-0405, Train A Cell 7 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA7	07-Jan-19	1	YEARS	04-Jan-20
2296	Block, Bleed and Check Zero -A07- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA7	24-Jul-18	1	YEARS	21-Jul-19
7357	Check calibration of DPIT-0405, Train A Cell 8 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA8	07-Jan-19	1	YEARS	04-Jan-20
7477	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 8 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA8	22-Mar-18	12	MONTHS	16-Mar-19
2297	Block, Bleed and Check Zero -A08- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA8	24-Jul-18	1	YEARS	21-Jul-19
2298	Block, Bleed and Check Zero -B01- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB1	08-Aug-18	1	YEARS	03-Aug-19
7358	Check calibration of DPIT-0405, Train B Cell 1 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB1	16-Jan-19	1	YEARS	18-Jan-20
7478	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 1 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB1	23-Mar-18	12	MONTHS	23-Mar-19
7479	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 2 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB2	23-Mar-18	12	MONTHS	23-Mar-19
7359	Check calibration of DPIT-0405, Train B Cell 2 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB2	16-Jan-19	1	YEARS	18-Jan-20
2299	Block, Bleed and Check Zero -B02- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB2	08-Aug-18	1	YEARS	03-Aug-19
7480	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 3 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB3	23-Mar-18	12	MONTHS	23-Mar-19
2300	Block, Bleed and Check Zero -B03- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB3	08-Aug-18	1	YEARS	03-Aug-19
7360	Check calibration of DPIT-0405, Train B Cell 3 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB3	17-Jan-19	1	YEARS	18-Jan-20

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
7361	Check calibration of DPIT-0405, Train B Cell 4 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB4	17-Jan-19	1	YEARS	18-Jan-20
7481	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 4 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB4	23-Mar-18	12	MONTHS	23-Mar-19
7362	Check calibration of DPIT-0405, Train B Cell 5 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB5	23-Feb-18	1	YEARS	08-Feb-20
7482	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 5 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB5	06-Apr-18	12	MONTHS	30-Mar-19
2302	Block, Bleed and Check Zero -B05- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB5	27-Aug-18	1	YEARS	17-Aug-19
7483	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 6 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB6	06-Apr-18	12	MONTHS	30-Mar-19
2303	Block, Bleed and Check Zero -B06- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB6	27-Aug-18	1	YEARS	17-Aug-19
7363	Check calibration of DPIT-0405, Train B Cell 6 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB6	23-Feb-18	1	YEARS	08-Feb-20
7364	Check calibration of DPIT-0405, Train B Cell 7 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB7	23-Feb-18	1	YEARS	08-Feb-20
2304	Block, Bleed and Check Zero -B07- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB7	27-Aug-18	1	YEARS	17-Aug-19
7484	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 7 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB7	06-Apr-18	12	MONTHS	30-Mar-19
7485	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 8 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB8	06-Apr-18	12	MONTHS	30-Mar-19
7365	Check calibration of DPIT-0405, Train B Cell 8 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB8	23-Feb-18	1	YEARS	08-Feb-20
2305	Block, Bleed and Check Zero -B08- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB8	27-Aug-18	1	YEARS	17-Aug-19
3569	Check Calibration of DPIT-0405 Train C Cell 1	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC1	01-May-18	1	YEARS	02-May-19
3507	Block, Bleed, and Check Zero - C01-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC1	30-Aug-18	1	YEARS	01-Sep-19
3579	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 1	Actuator	210-PIP-MFF-MEMC1	25-Jun-18	1	YEARS	01-Jul-19
3508	Block, Bleed, and Check Zero - C02-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC2	30-Aug-18	1	YEARS	01-Sep-19
3570	Check Calibration of DPIT-0405 Train C Cell 2	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC2	01-May-18	1	YEARS	02-May-19
3580	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 2	Actuator	210-PIP-MFF-MEMC2	25-Jun-18	1	YEARS	01-Jul-19
3509	Block, Bleed, and Check Zero C03-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC3	30-Aug-18	1	YEARS	01-Sep-19
3571	Check Calibration of DPIT-0405 Train C Cell 3	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC3	01-May-18	1	YEARS	02-May-19
3581	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 3	Actuator	210-PIP-MFF-MEMC3	27-Jun-18	1	YEARS	01-Jul-19
3510	Block, Bleed, and Check Zero - C04-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC4	30-Aug-18	1	YEARS	01-Sep-19
3572	Check Calibration of DPIT-0405 Train C Cell 4	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC4	09-May-18	1	YEARS	02-May-19
3583	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell5	Actuator	210-PIP-MFF-MEMC5	27-Jun-18	1	YEARS	01-Jul-19
3573	Check Calibration of DPIT-0405 Train C Cell 5	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC5	09-May-18	1	YEARS	02-May-19
3511	Block, Bleed, and Check Zero - C05-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC5	30-Aug-18	1	YEARS	01-Sep-19
3584	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 6	Actuator	210-PIP-MFF-MEMC6	27-Jun-18	1	YEARS	01-Jul-19
3512	Block, Bleed, and Check Zero - C06-PDIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC6	30-Aug-18	1	YEARS	01-Sep-19
3574	Check Calibration of DPIT-0405 Train C Cell 6	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC6	09-May-18	1	YEARS	02-May-19
3585	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 7	Actuator	210-PIP-MFF-MEMC7	27-Jun-18	1	YEARS	01-Jul-19
3513	Block, Bleed, and Check Zero C07-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC7	30-Aug-18	1	YEARS	01-Sep-19
3575	Check Calibration of DPIT-0405 Train C Cell 7	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC7	09-May-18	1	YEARS	02-May-19
3586	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 8	Actuator	210-PIP-MFF-MEMC8	27-Jun-18	1	YEARS	01-Jul-19
3514	Block, Bleed, and Check Zero C08-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC8	30-Aug-18	1	YEARS	01-Sep-19
3576	Check Calibration of DPIT-0405 Train C Cell 8	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC8	09-May-18	1	YEARS	02-May-19
2306	Block, Bleed and Check Zero -D01- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD1	08-Aug-18	1	YEARS	03-Aug-19
7366	Check calibration of DPIT-0405, Train D Cell 1 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD1	02-Mar-18	1	YEARS	22-Feb-19
7486	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 1 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD1	17-Apr-18	12	MONTHS	07-Apr-19
7487	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 2 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD2	17-Apr-18	12	MONTHS	07-Apr-19
7367	Check calibration of DPIT-0405, Train D Cell 2 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD2	02-Mar-18	1	YEARS	22-Feb-19
2307	Block, Bleed and Check Zero -D02- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD2	08-Aug-18	1	YEARS	03-Aug-19
7488	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 3 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD3	17-Apr-18	12	MONTHS	07-Apr-19
2308	Block, Bleed and Check Zero -D03- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD3	08-Aug-18	1	YEARS	03-Aug-19
7368	Check calibration of DPIT-0405, Train D Cell 3 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD3	02-Mar-18	1	YEARS	22-Feb-19
2309	Block, Bleed and Check Zero -D04- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD4	08-Aug-18	1	YEARS	03-Aug-19
7369	Check calibration of DPIT-0405, Train D Cell 4 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD4	02-Mar-18	1	YEARS	22-Feb-19
7489	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 4 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD4	17-Apr-18	12	MONTHS	07-Apr-19
7370	Check calibration of DPIT-0405, Train D Cell 5 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD5	07-Mar-18	1	YEARS	08-Mar-19
7490	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 5 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD5	17-Apr-18	12	MONTHS	14-Apr-19
2310	Block, Bleed and Check Zero -D05- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD5	17-Aug-18	1	YEARS	17-Aug-19
7491	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 6 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD6	17-Apr-18	12	MONTHS	14-Apr-19
2311	Block, Bleed and Check Zero -D06- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD6	17-Aug-18	1	YEARS	17-Aug-19
7371	Check calibration of DPIT-0405, Train D Cell 6 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD6	07-Mar-18	1	YEARS	08-Mar-19
7372	Check calibration of DPIT-0405, Train D Cell 7 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD7	07-Mar-18	1	YEARS	08-Mar-19
2312	Block, Bleed and Check Zero -D07- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD7	17-Aug-18	1	YEARS	17-Aug-19
7492	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 7 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD7	17-Apr-18	12	MONTHS	14-Apr-19
2313	Block, Bleed and Check Zero -D08- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD8	17-Aug-18	1	YEARS	17-Aug-19
7493	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 8 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD8	17-Apr-18	12	MONTHS	14-Apr-19
7373	Check calibration of DPIT-0405, Train D Cell 8 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD8	07-Mar-18	1	YEARS	08-Mar-19
7374	Check calibration of DPIT-0405, Train E Cell 1 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME1	07-Mar-18	1	YEARS	08-Mar-19
2314	Block, Bleed and Check Zero -E01- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME1	17-Aug-18	1	YEARS	17-Aug-19

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
7494	Check Calibration of Unit Feed Valve BFV-0330 Train E Cell 1 MFW	Valve Butterfly 24"	210-PIP-MFF-MEME1	18-Apr-18	12	MONTHS	21-Apr-19
2315	Block, Bleed and Check Zero -E02- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME2	17-Aug-18	1	YEARS	17-Aug-19
7375	Check calibration of DPIT-0405, Train E Cell 2 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME2	07-Mar-18	1	YEARS	08-Mar-19
7495	Check Calibration of Unit Feed Valve BFV-0330 Train E Cell 2 MFW	Valve Butterfly 24"	210-PIP-MFF-MEME2	20-Apr-18	12	MONTHS	21-Apr-19
3646	Check Calibration of Unit Feed Valve BFV-0330 Train E Cell 3	Actuator	210-PIP-MFF-MEME3	25-Jun-18	1	YEARS	06-Jun-19
3652	Check Calibration of DPIT-0405 Train E Cell 3	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME3	01-Jun-18	1	YEARS	01-Jun-19
3647	Check Calibration of Unit Feed Valve BFV-0330 Train E Cell 4	Actuator	210-PIP-MFF-MEME4	25-Jun-18	1	YEARS	06-Jun-19
3653	Check Calibration of DPIT-0405 Train E Cell 4	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME4	01-Jun-18	1	YEARS	01-Jun-19
2301	Block, Bleed and Check Zero -B04- DPIT-0405 Every 6 MO	Valve Ball 1/2"	216-PIP-PA-MEMDE	08-Aug-18	1	YEARS	03-Aug-19
7721	Test Overtemperature Thermocouple, TIT-1226 Train A01	Transmitter Temperature Indicating	220-A01-TNK-1200	12-Jul-18	1	YEARS	09-Jul-19
7713	Check Calibration of LIT-1207, MF CIP Tank A01	Transmitter Level Indicating 0 - 12 FT	220-A01-TNK-1200	13-Jul-18	1	YEARS	09-Jul-19
7714	Check Calibration of LIT-1207, MF CIP Tank B01	Transmitter Level Indicating 0 - 12 FT	220-B01-TNK-1200	13-Jul-18	1	YEARS	09-Jul-19
7722	Test Overtemperature Thermocouple, TIT-1226 Train B01	Transmitter Temperature Indicating	220-B01-TNK-1200	12-Jul-18	1	YEARS	09-Jul-19
7723	Test Overtemperature Thermocouple, TIT-1226 Train D01	Transmitter Temperature Indicating	220-D01-TNK-1200	12-Jul-18	1	YEARS	09-Jul-19
7715	Check Calibration of LIT-1207, MF CIP Tank D01	Transmitter Level Indicating 0 - 12 FT	220-D01-TNK-1200	13-Jul-18	1	YEARS	09-Jul-19
7724	Test Overtemperature Thermocouple, TIT-1226 Train E01	Transmitter Temperature Indicating	220-E01-TNK-1200	12-Jul-18	1	YEARS	09-Jul-19
7716	Check Calibration of LIT-1207, MF CIP Tank E01	Transmitter Level Indicating 0 - 12 FT	220-E01-TNK-1200	13-Jul-18	1	YEARS	09-Jul-19
9242	MF Effluent Trubidity Wet Calibration HACH FT 660SC	MF Process Effluent Turbidity	250-PIP-MFE	24-Jan-19	3	MONTHS	16-Apr-19
7712	Check Calibration of PIT-0750, MF backwash - Do during plant shutdown	Transmitter Pressure Indicating 0 - 60 psi	255-PIP-BW	09-Apr-18	1	YEARS	24-Nov-19
2238	Rosemount pH analyzer annual- MF Feedwater-B B01-AIT-0305	Transmitter Analyzer Indicating pH - MF Feedwater B	255-PIP-MFF-WQAS	24-Aug-18	1	YEARS	26-Aug-19
3255	MF CIP CRITIC DRAIN SECONDARY CONTAINMENT PIPE	Switch Event Status High (MF CIP leak detector)	440-PIP-CIT	26-Oct-18	1	YEARS	01-Oct-19
2234	Rosemount pH Analyzer 9 Month RO Feed: 450-AIT-2140	Transmitter Analyzer Indicating pH	450-CPF-0001	10-Aug-18	9	MONTHS	10-May-19
3253	Ammonia Sensor Replacement 1 YR 145-AE-5000	Element Analyzer Ammonia	450-CPF-0001	22-Jun-18	9	MONTHS	01-Apr-19
9149	Replace Consumables ROF TOC M5310 Analyzer 3 MO.	Analyzer Total Organic Compound	450-CPF-0001	10-Jan-19	3	MONTHS	09-Apr-19
7343	3 Mo. Rosemount Chlorine Analyzer Maintenance 450-AE-2164	Element Analyzer Total Chlorine - RO Feed	450-CPF-0001	24-Jan-19	3	MONTHS	21-Apr-19
2231	Rosemount pH Analyzer 9 Month RO Feed: 450-AIT-2120	Transmitter Analyzer Indicating pH	450-CPF-0001	10-Aug-18	9	MONTHS	12-May-19
7342	Rosemount Free Chlorine Maintenance 450-AE-2162	Element Analyzer Free Chlorine and pH- RO Feed	450-CPF-0001	29-Jan-19	3	MONTHS	11-Apr-19
9239	Replace Consumables ROF TOC M5310 Analyzer 3 MO.	RO Feed TOC Analyzer	450-PIP-ROF	22-Jan-19	3	MONTHS	09-Apr-19
7345	3 Mo. Rosemount Chlorine Analyzer Maintenance 460-AE-0314	Element Analyzer Total Chlorine - MF Feedwater	460-CPF-0001	16-Jan-19	3	MONTHS	14-Apr-19
7344	3 Mo. Rosemount Chlorine Analyzer Maintenance 460-AE-0312	Element Analyzer Total Chlorine - MF Feedwater	460-CPF-0001	16-Jan-19	3	MONTHS	14-Apr-19
2055	Element Analyzer Conductivity - RO Concentrate Train A Unit 1	Element Analyzer Conductivity - RO Concentrate Train A Unit 1	510-A01-CPF-5101	27-Dec-18	3	MONTHS	27-Mar-19
2057	Element Analyzer Conductivity - RO Concentrate Train A Unit 2	Element Analyzer Conductivity - RO Concentrate Train A Unit 2	510-A02-CPF-5101	15-Nov-18	3	MONTHS	14-Feb-19
2059	Element Analyzer Conductivity - RO Concentrate Train A Unit 3	Element Analyzer Conductivity - RO Concentrate Train A Unit 2	510-A02-CPF-5101	15-Nov-18	3	MONTHS	14-Feb-19
2061	Element Analyzer Conductivity - RO Concentrate Train B Unit 1	Element Analyzer Conductivity - RO Concentrate Train B Unit 1	510-B01-CPF-5101	27-Dec-18	3	MONTHS	27-Mar-19
2063	Element Analyzer Conductivity - RO Concentrate Train B Unit 2	Element Analyzer Conductivity - RO Concentrate Train B Unit 2	510-B02-CPF-5101	15-Nov-18	3	MONTHS	14-Feb-19
2067	Element Analyzer Conductivity - RO Concentrate Train C Unit 1	Element Analyzer Conductivity - RO Concentrate Train C Unit 1	510-C01-CPF-5101	10-Jan-19	3	MONTHS	10-Apr-19
2069	Element Analyzer Conductivity - RO Concentrate Train C Unit 2	Element Analyzer Conductivity - RO Concentrate Train C Unit 2	510-C02-CPF-5101	07-Dec-18	3	MONTHS	07-Mar-19
2071	Element Analyzer Conductivity - RO Concentrate Train C Unit 3	Element Analyzer Conductivity - RO Concentrate Train C Unit 3	510-C03-CPF-5101	21-Nov-18	3	MONTHS	14-Feb-19
9044	ROP/UVP CL2 ANALYZER 1 YR	ROP/UVP CL2 510-AIT-2250 Analyzer	510-CPF-0010	20-Apr-18	1	YEARS	04-Apr-19
9240	Replace Consumables ROP TOC M5310 Analyzer 3 MO.	RO Permate TOC Analyzer	510-CPF-0010	16-Nov-18	3	MONTHS	15-Feb-19
3467	Prominent H2O2 Sensor Calibration Method 1 YR	UV FEED PROMINENT PEROXIDE ANALYZER	510-CPF-0010	30-May-18	1	YEARS	16-May-19
3463	Prominent H2O2 Sensor Standardization Method	UV FEED PROMINENT PEROXIDE ANALYZER	510-CPF-0010	31-Jan-19	2	WEEKS	13-Feb-19
9241	UV Transmittance Calibration Check 1 Yr. 610-AE-2240	UV Transmittance Analyzer	510-CPF-0010		1	YEARS	22-Apr-19
9150	Replace Consumables ROP TOC M5310 Analyzer 3 MO.	Analyzer Total Organic Compound	510-CPF-0010	22-Jan-19	3	MONTHS	09-Apr-19
3135	ROP / UVP CL2 Analyzer Weekly Calibration	ROP/UVP CL2 510-AIT-2250 Analyzer	510-CPF-0010	31-Jan-19	1	WEEKS	12-Feb-19
2235	Rosemount pH analyzer annual-RO PW: 510-AIT-2241	Transmitter Analyzer Indicating pH	510-CPF-0010	10-Aug-18	1	YEARS	12-Aug-19
9296	UVT 2240 Optiview Cleaning & Transmittance Monthly	UV Transmittance Analyzer	510-CPF-0010	07-Jan-19	1	MONTHS	01-Mar-19
2073	Element Analyzer Conductivity - RO Concentrate Train D Unit 1	Element Analyzer Conductivity - RO Concentrate Train D Unit 1	510-D01-CPF-5101	16-Nov-18	3	MONTHS	14-Feb-19
2075	Element Analyzer Conductivity - RO Concentrate Train D Unit 2	Element Analyzer Conductivity - RO Concentrate Train D Unit 2	510-D02-CPF-5101	07-Dec-18	3	MONTHS	07-Mar-19
2077	Element Analyzer Conductivity - RO Concentrate Train D Unit 3	Element Analyzer Conductivity - RO Concentrate Train D Unit 3	510-D03-CPF-5101	27-Nov-18	3	MONTHS	27-Feb-19
2079	Element Analyzer Conductivity - RO Concentrate Train E Unit 1	Element Analyzer Conductivity - RO Concentrate Train E Unit 1	510-E01-CPF-5101	27-Nov-18	3	MONTHS	27-Feb-19
2081	Element Analyzer Conductivity - RO Concentrate Train E Unit 2	Element Analyzer Conductivity - RO Concentrate Train E Unit 2	510-E02-CPF-5101	13-Nov-18	3	MONTHS	14-Feb-19
2083	Element Analyzer Conductivity - RO Concentrate Train E Unit 3	Element Analyzer Conductivity - RO Concentrate Train E Unit 3	510-E03-CPF-5101	14-Nov-18	3	MONTHS	14-Feb-19
3471	Element Analyzer Conductivity - RO Concentrate Train F Unit 1	Element Analyzer Conductivity - RO Concentrate Train F Unit 1	510-F01-CPF-5101	15-Jan-19	3	MONTHS	16-Apr-19
3472	Element Analyzer Conductivity - RO Concentrate Train F Unit 2	Element Analyzer Conductivity - RO Concentrate Train F Unit 2	510-F02-CPF-5101	15-Jan-19	3	MONTHS	16-Apr-19
3474	Element Analyzer Conductivity - RO Concentrate Train F Unit 3	Element Analyzer Conductivity - RO Concentrate Train F Unit 3	510-F03-CPF-5101	15-Jan-19	3	MONTHS	16-Apr-19
3479	Element Analyzer Conductivity - RO Concentrate Train G Unit 1	Element Analyzer Conductivity - RO Concentrate Train G Unit 1	510-G01-CPF-5101	15-Jan-19	3	MONTHS	16-Apr-19
3480	Element Analyzer Conductivity - RO Concentrate Train G Unit 2	Element Analyzer Conductivity - RO Concentrate Train G Unit 2	510-G02-CPF-5101	15-Jan-19	3	MONTHS	16-Apr-19
3481	Element Analyzer Conductivity - RO Concentrate Train G Unit 3	Element Analyzer Conductivity - RO Concentrate Train G Unit 3	510-G03-CPF-5101	15-Jan-19	3	MONTHS	16-Apr-19
2983	RO CIP TANK HEATER CONTROL PANEL A01-5201 PM	Panel Control CIP TANK HEATER CP A01	520-A01-CPE-5201	30-May-18	1	YEARS	03-May-19
2984	RO CIP TANK HEATER CONTROL PANEL A02-5201 PM	Panel Control CIP TANK HEATER CP A02	520-A02-CPE-5201	18-May-18	1	YEARS	10-May-19
2985	RO CIP TANK HEATER CONTROL PANEL B01-5201 PM	Panel Control CIP TANK HEATER CP B01	520-B01-CPE-5201	21-May-18	1	YEARS	17-May-19
2986	RO CIP TANK HEATER CONTROL PANEL B02-5201 PM	Panel Control CIP TANK HEATER CP B02	520-B02-CPE-5201	05-Jun-18	1	YEARS	24-May-19

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
9284	540-SWGR-125VDC Inspect Batteries & Monitor	540 RO Electric 12KV Switchgear 125 VDC Battery Syst	540-SWG12000		1	YEARS	04-Jun-19
9179	Planner Order Trojan UV 100% T Standard Solution	Element Analyzer UV Transmittance - Infeed	610-UVT-2220	31-May-18	1	YEARS	04-Jun-19
7339	UV Transmittance Calibration Check 1 Yr. 610-AE-2220	Element Analyzer UV Transmittance - Infeed	610-UVT-2220	07-Jun-18	1	YEARS	15-May-19
2237	Rosemount pH analyzer annual-DPW 710-AIT-3310	Transmitter Analyzer Indicating pH	710-CPF-0008	15-Aug-18	1	YEARS	19-Aug-19
2232	Rosemount pH analyzer annual-FPW: 710-AIT-3410	Transmitter Analyzer Indicating pH	710-CPF-0009	02-Aug-18	1	YEARS	05-Aug-19
7346	3 Mo. Rosemount Chlorine Analyzer Maintenance 710-AE-3425	Element Analyzer Chlorine - Finished Product Water to PWPS	710-CPF-0009	30-Jan-19	3	MONTHS	28-Apr-19
3114	Lime Silo A01 Dust Collector Air Coils Inspection	Collector Dust Train A01	730-A01-BWR-5235	05-Dec-18	6	MONTHS	05-Jun-19
2982	Polymer Blend Controller 730-A01-FDR-7200 6 mo. PM	Polymer Blend and Feed System Train A	730-A01-FDR-7200	24-Aug-18	6	MONTHS	23-Feb-19
3116	Lime Silo A03 Dust Collector Air Coils Inspection	Collector Dust Train A03	730-A03-BWR-5235	05-Dec-18	6	MONTHS	06-Jun-19
3117	Lime Silo B01 Dust Collector Air Coils Inspection	Collector Dust Train B01	730-B01-BWR-5235	05-Dec-18	6	MONTHS	07-Jun-19
2981	Polymer Blend Controller 730-B01-FDR-7200 6 mo. PM	Polymer Blend and Feed System Train B	730-B01-FDR-7200	18-Sep-18	6	MONTHS	13-Mar-19
3118	Lime Silo B02 Dust Collector Air Coils Inspection	Collector Dust Train B02	730-B02-BWR-5235	05-Dec-18	6	MONTHS	08-Jun-19
2980	Polymer Blend Controller 730-C01-FDR-7200 - 6 mo. PM	Polymer Blend and Feed System Train C	730-C01-FDR-7200	18-Oct-18	6	MONTHS	19-Apr-19
3633	Polymer Blend Controller 730-D01-FDR-7200 6 MO. PM	Polymer Blend and Feed System Train D	730-D01-FDR-7200	08-Aug-18	6	MONTHS	08-Aug-19
2866	Calibration of O2 Analyzer 750- AE-4040	Element Analyzer Oxygen - North Building	750-CPF-0030	24-Aug-18	6	MONTHS	22-Feb-19
2869	Calibration of O2 Analyzer 750- AE-4055	Element Analyzer Oxygen - South Trench	750-CPF-0030	24-Aug-18	6	MONTHS	22-Feb-19
2867	Calibration of O2 Analyzer 750- AE-4045	Element Analyzer Oxygen - South Building	750-CPF-0030	24-Aug-18	6	MONTHS	22-Feb-19
2868	Calibration of O2 Analyzer 750- AE-4050	Element Analyzer Oxygen - North Trench	750-CPF-0030	24-Aug-18	6	MONTHS	22-Feb-19
2236	Rosemount pH analyzer annual-SAR Bypass: 805-AIT-3580	Transmitter Analyzer Indicating pH	805-CPD-0002	25-Apr-18	1	YEARS	28-Apr-19
2116	Transmitter Analyzer Indicating Chlorine	Element Analyzer Chlorine - SAR Bypass	805-CPD-0002	31-Jan-19	1	WEEKS	12-Feb-19
3466	Prominent H2O2 Sensor Calibration Method 1 YR	UV PRODUCT PROMINET PEROXIDE ANALYZER	805-CPD-0002	30-May-18	1	YEARS	16-May-19
3465	Prominent H2O2 Sensor Standardization Method	UV PRODUCT PROMINET PEROXIDE ANALYZER	805-CPD-0002	31-Jan-19	2	WEEKS	13-Feb-19
9283	815-SWGR-125VDC Inspect Batteries & Monitor	815 12KV Switchgear 125 VDC Battery System	815-SWG-8001B		1	YEARS	03-Jun-19
3017	Surge tank level control functional check - 830-A01-TNK-3410	Tank steel 30430 gal	830-A01-TNK-3410	25-Apr-18	1	YEARS	29-Apr-19
2960	Surge tank level control functional check - 830-A02-TNK-3410	Tank steel 30430 gal	830-A02-TNK-3410	25-Apr-18	1	YEARS	29-Apr-19
2961	Surge tank level control functional check - 830-A03-TNK-3410	Tank steel 30430 gal	830-A03-TNK-3410	25-Apr-18	1	YEARS	29-Apr-19
2962	Surge tank level control functional check - 830-A04-TNK-3410	Tank steel 30430 gal	830-A04-TNK-3410	25-Apr-18	1	YEARS	29-Apr-19
2963	Surge tank level control functional check - 830-B01-TNK-3410	Tank steel 5984 gal	830-B01-TNK-3410	25-Apr-18	1	YEARS	29-Apr-19
7003	Replace pH probe of I&E handheld	pH meter, handheld (s/n 003366)	TOOLS	21-Sep-18	1	YEARS	22-Sep-19
7004	Replace pH probe of I&E handheld	pH meter, handheld (s/n C03416)	TOOLS	21-Sep-18	1	YEARS	22-Sep-19

Appendix E

Critical Control Points

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

Figure E-1
MFF Chlorine Residual

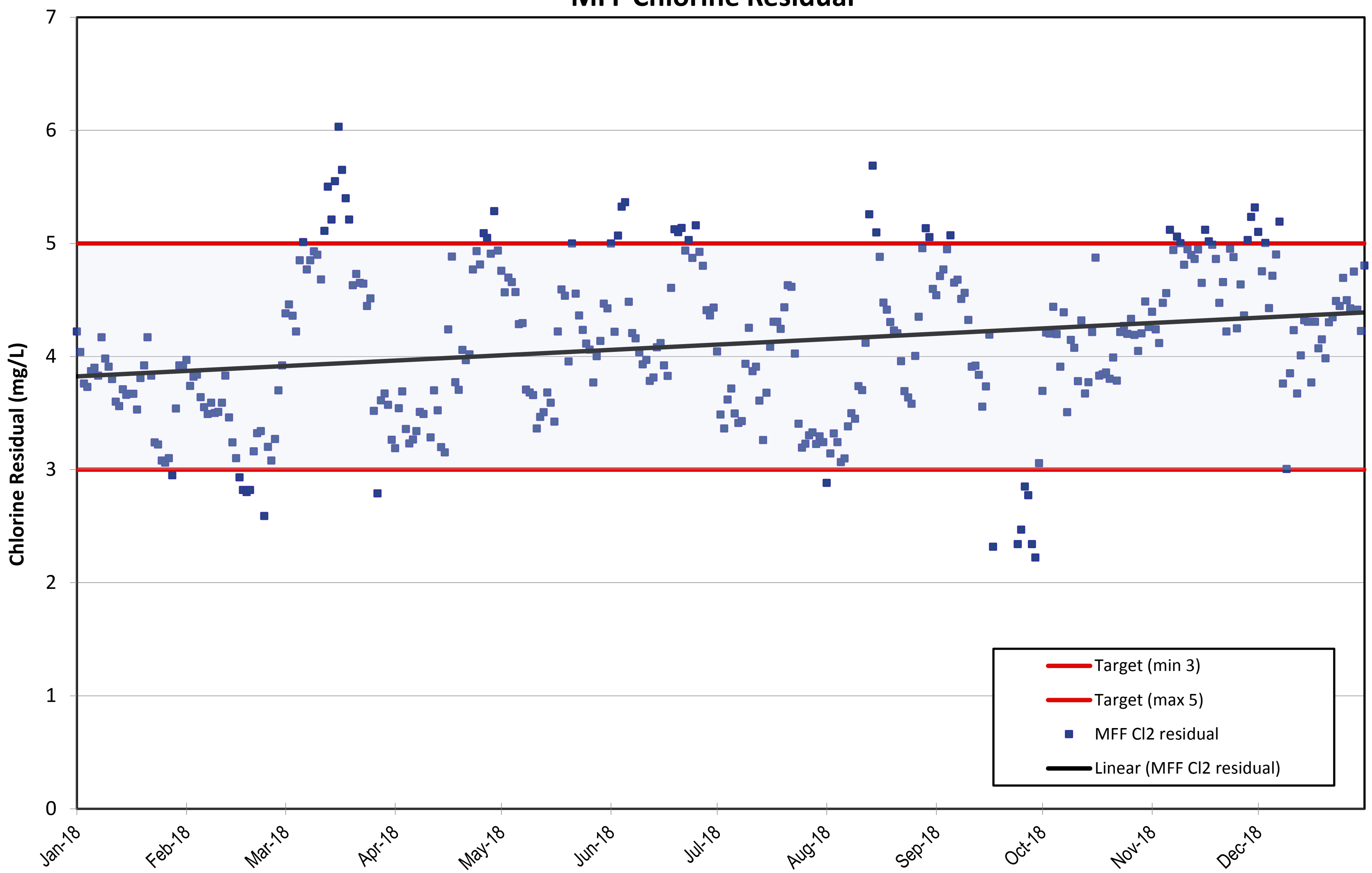


Figure E-2
ROF Chlorine Residual

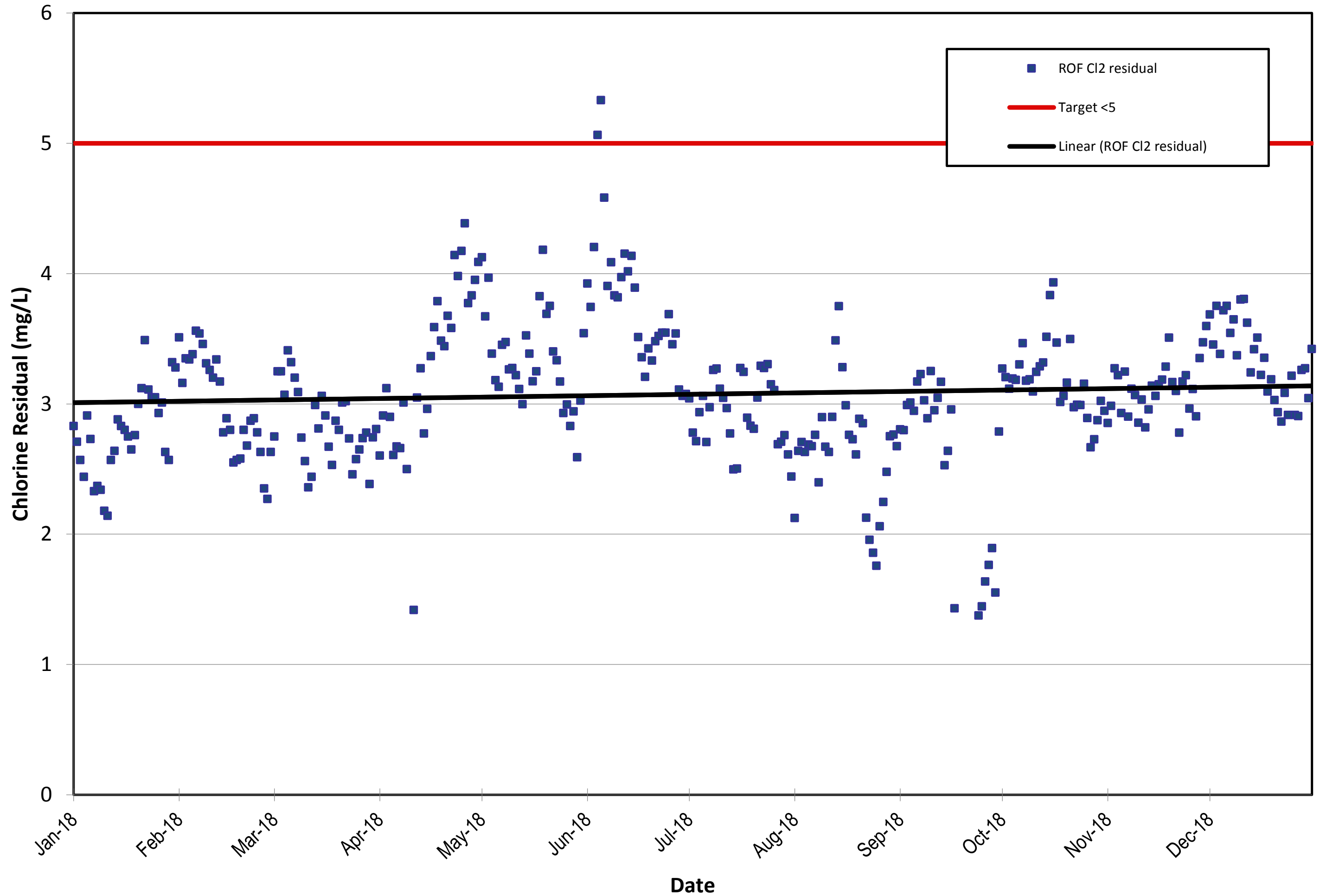


Figure E-3
MFF Turbidity

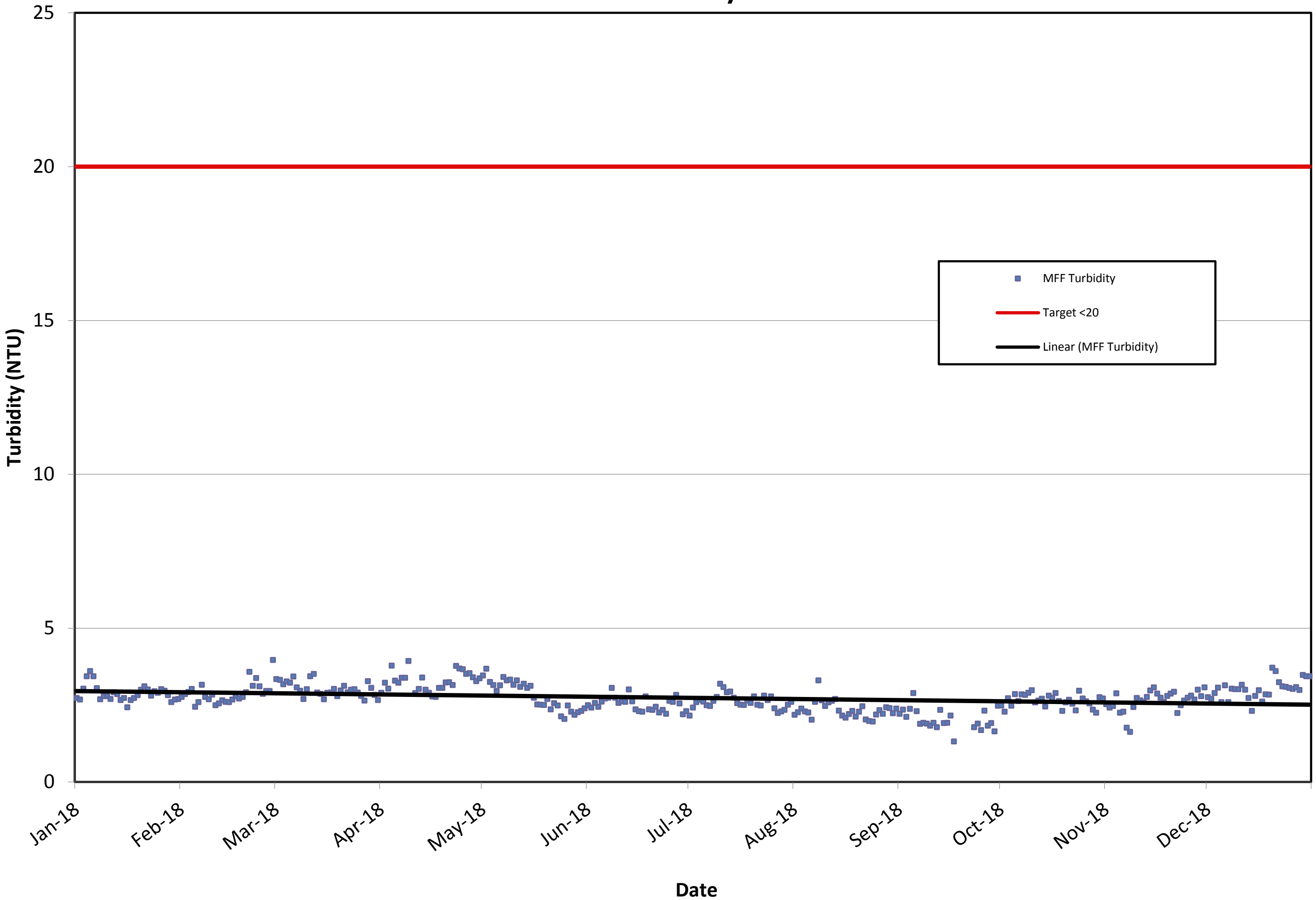


Figure E-4
MFE Turbidity

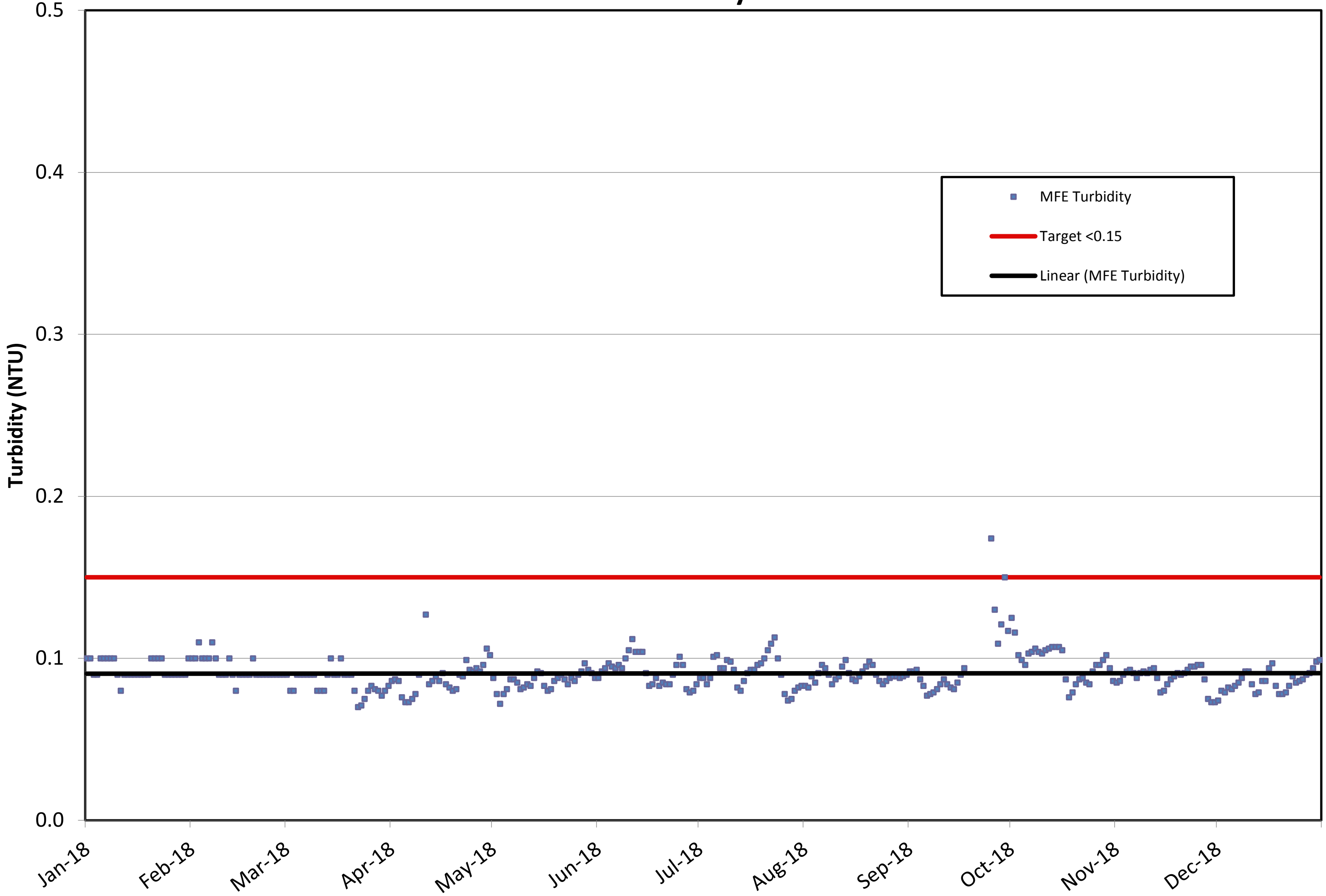
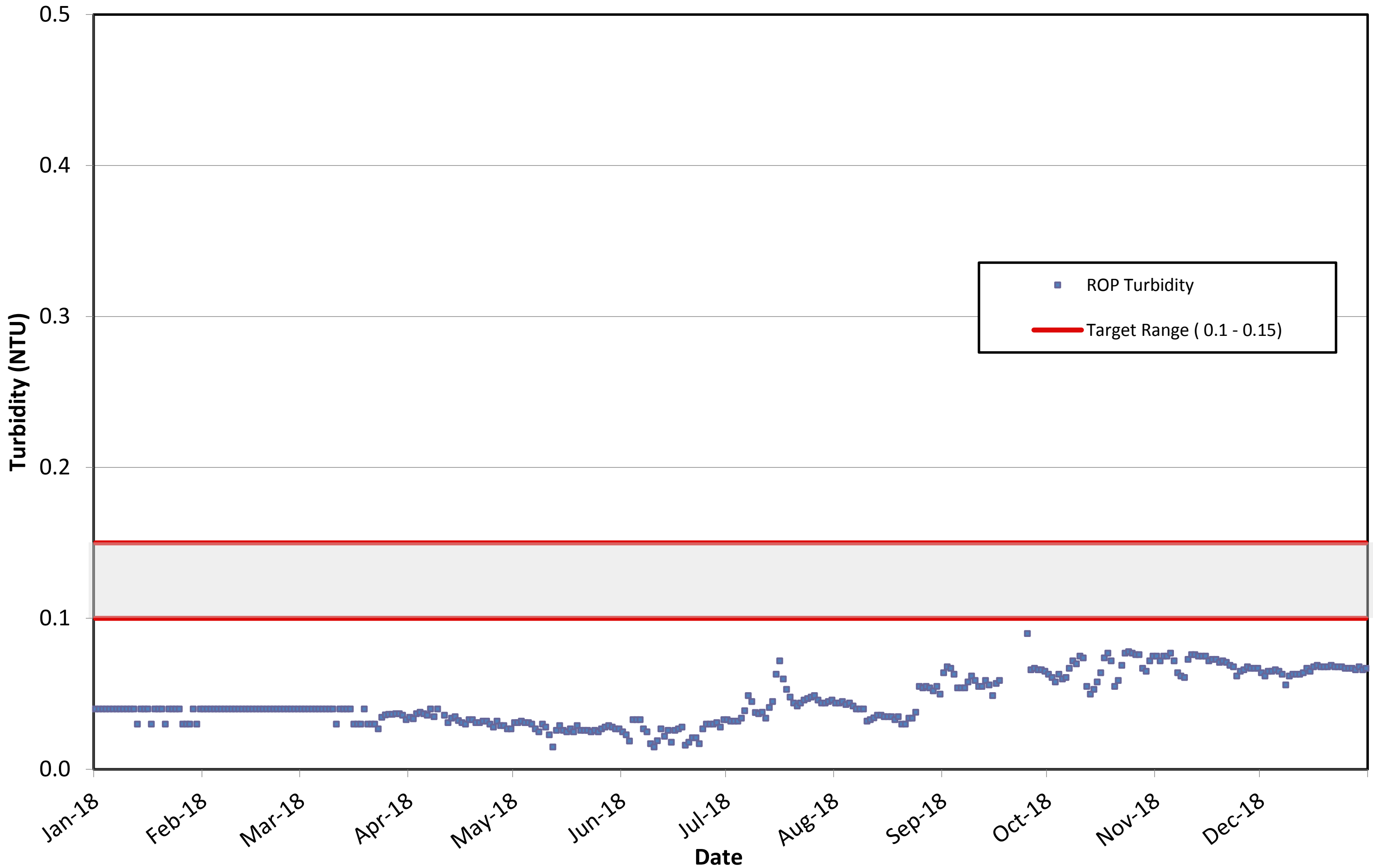


Figure E-5
ROP Turbidity[1]



[1] Turbidity shown for UVF, which is effectively ROP downstream of hydrogen peroxide addition.

Figure E-6
MF Transmembrane Pressure (TMP)
All Operating Cells A01-E04
Average of All Operational Cells with TMP > 0

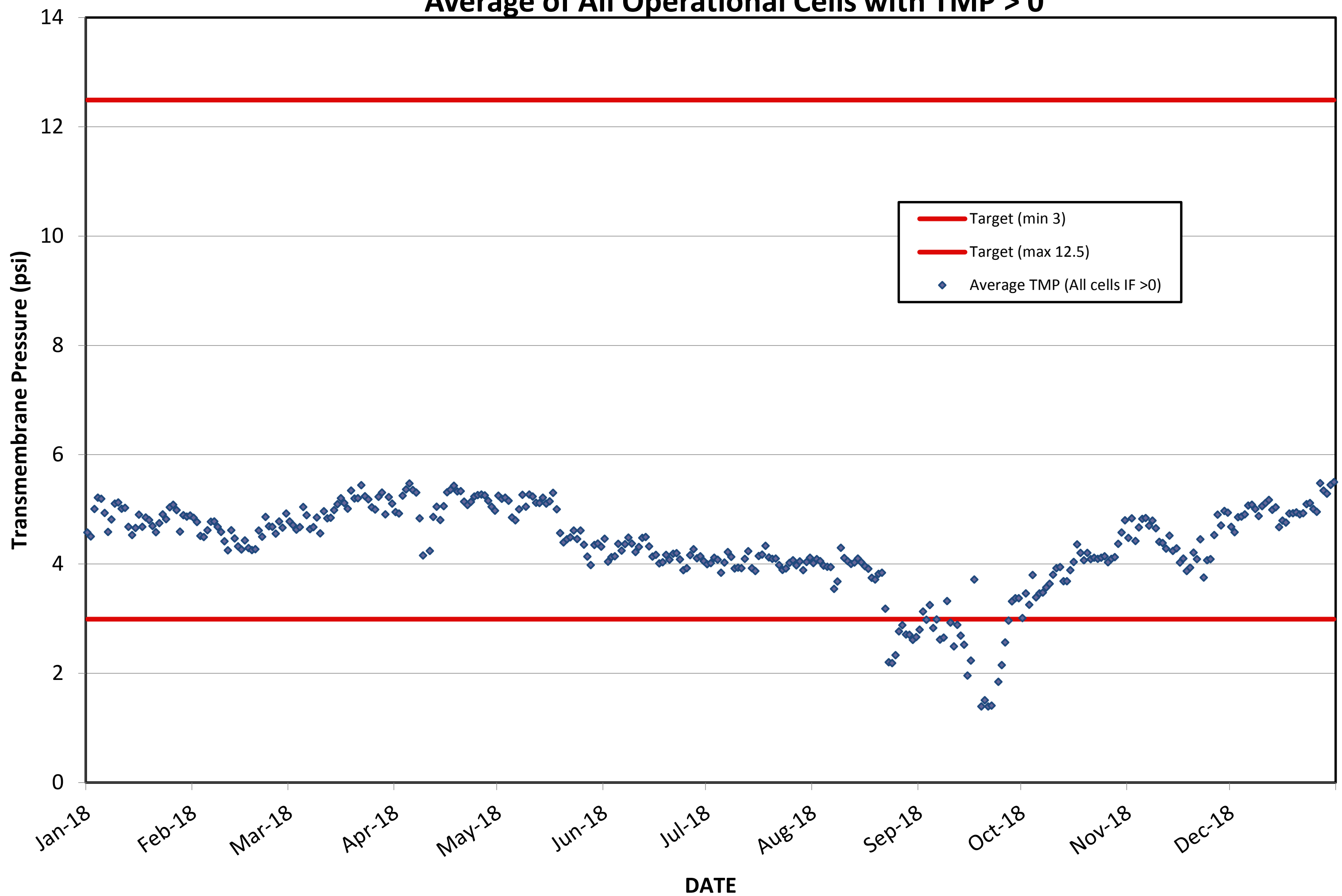


Figure E-7
MF Pressure Decay Test (PDT)
All Cells A01-E04

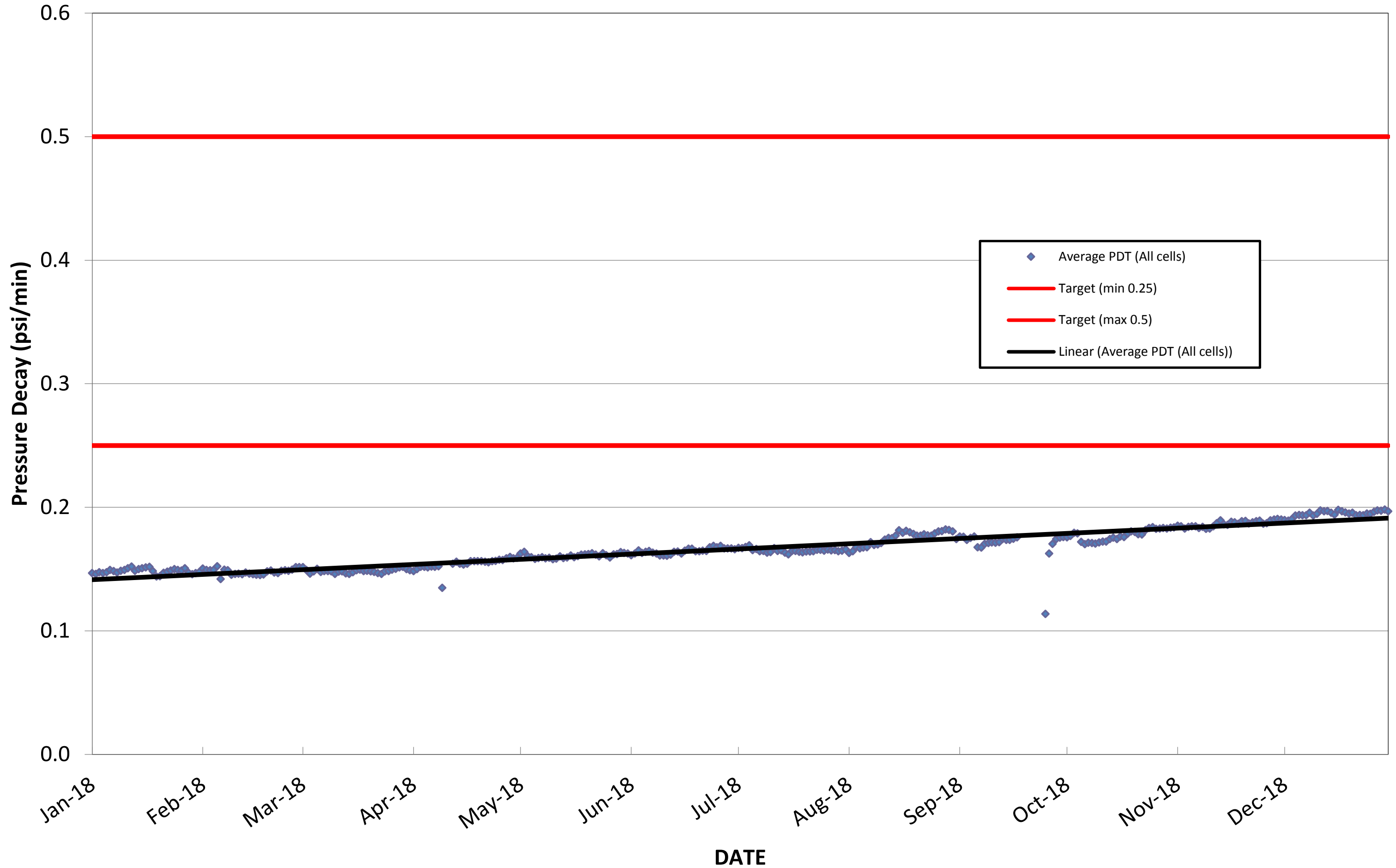


Figure E-8
ROP Conductivity[1]

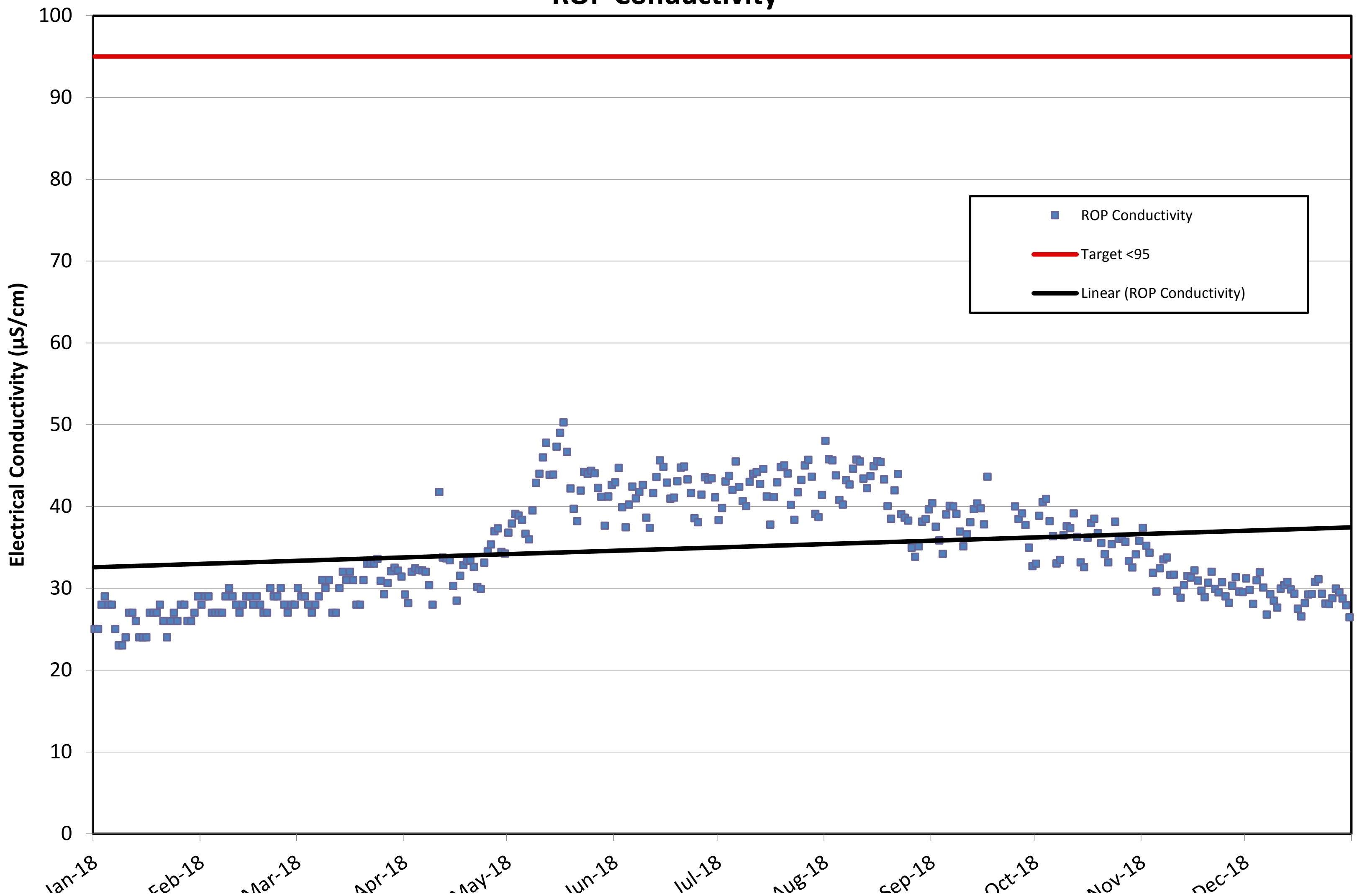


Figure E-9
ROP Total Organic Carbon (TOC)

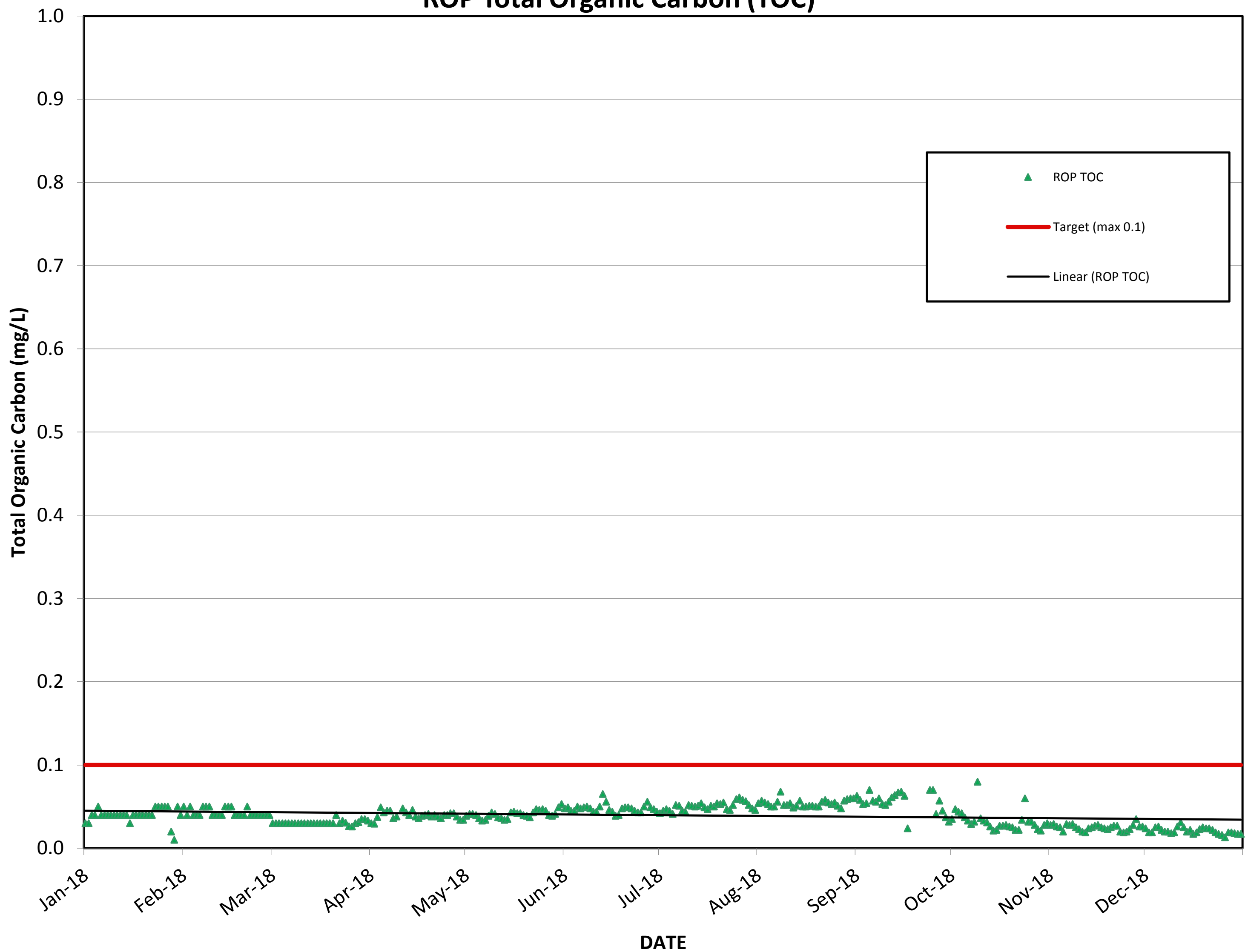
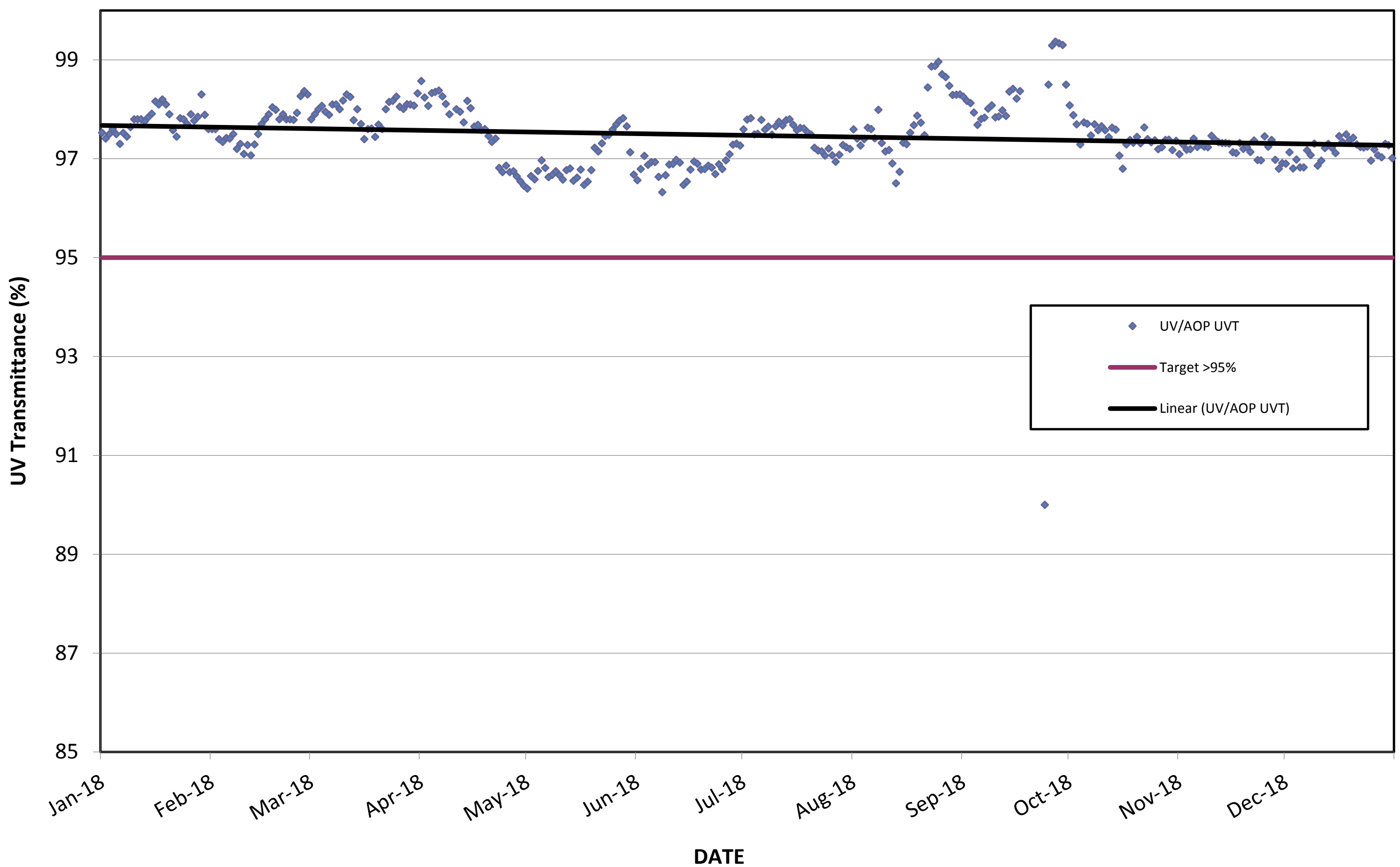


Figure E-10
UV/AOP UV Transmittance[1]



[1] UV Transmittance shown for UVF, which is effectively ROP downstream of hydrogen peroxide addition

Figure E-11
UV/AOP Electrical Energy Dose (EED)

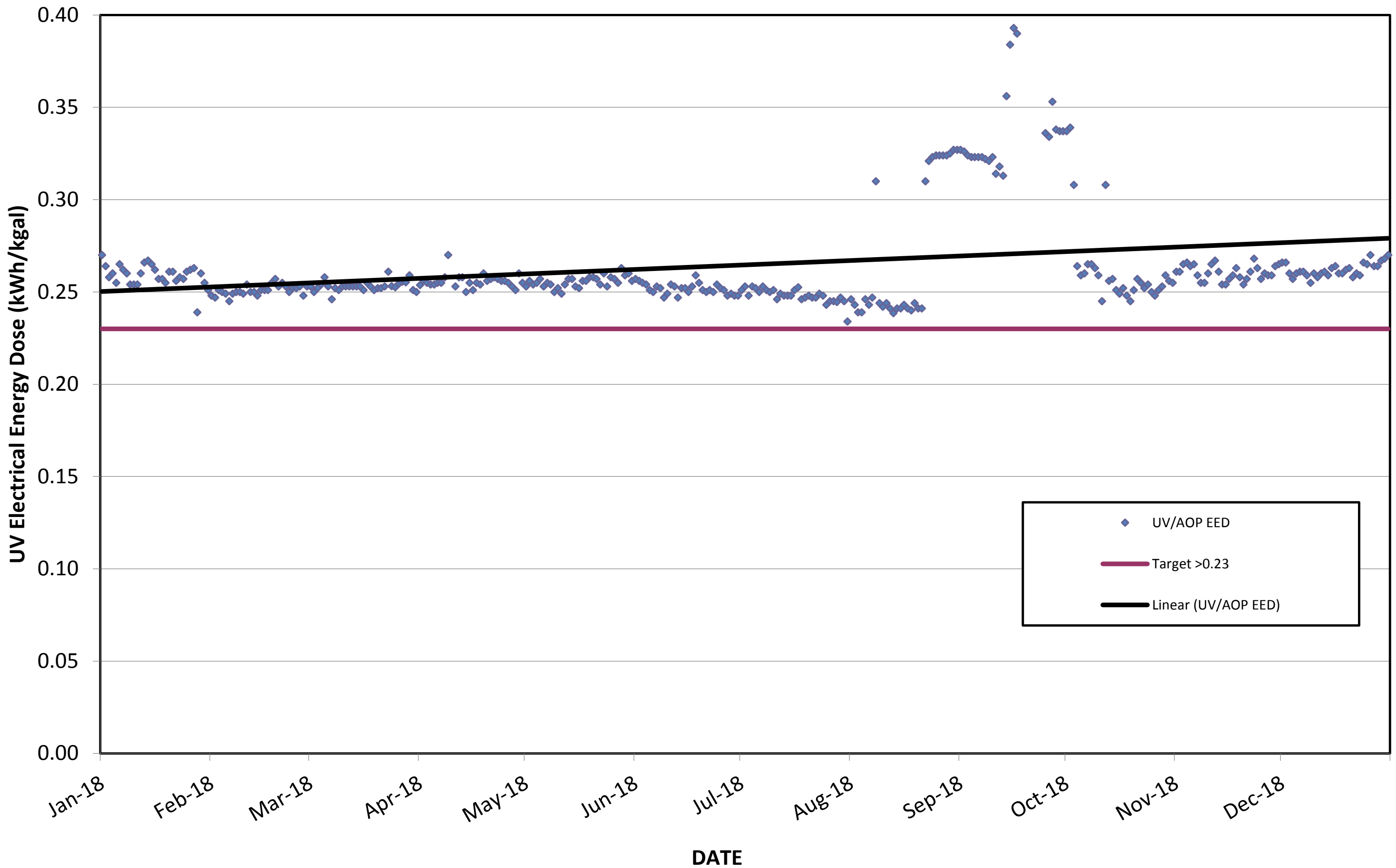


Figure E-12
UV Train Power Consumption - Average All Trains

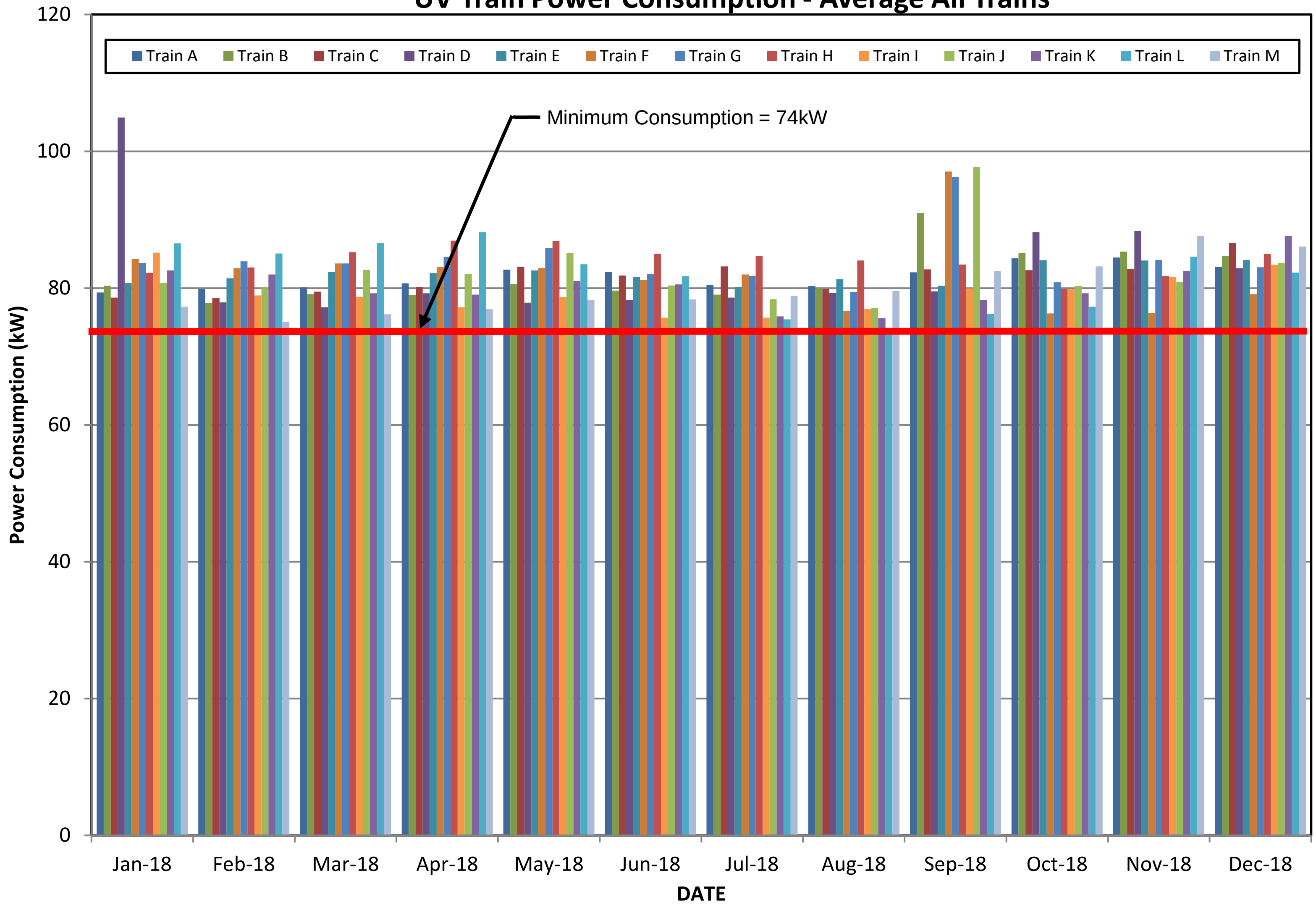


Figure E-13
UV/AOP CALCULATED UV DOSAGE PER TRAIN

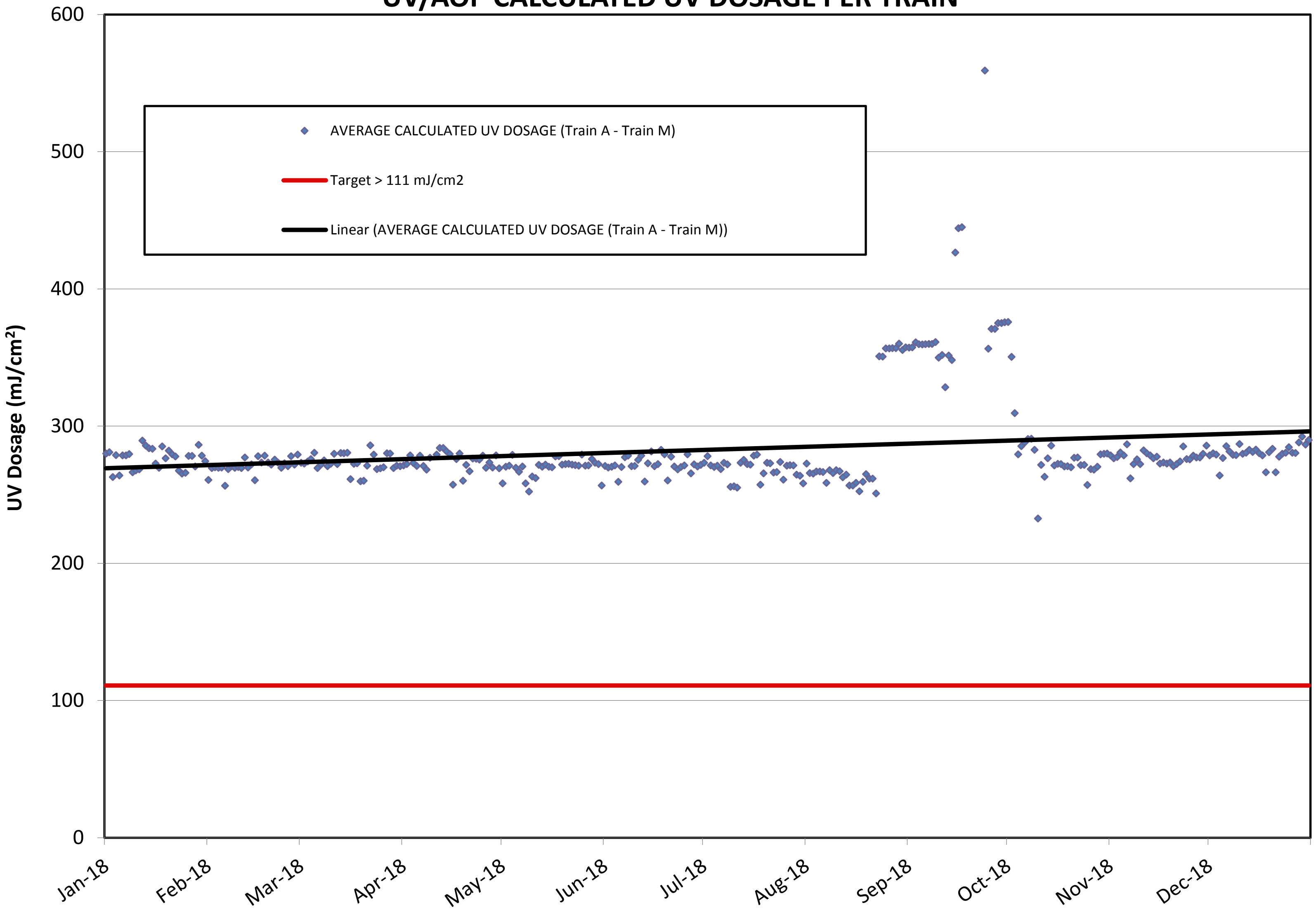
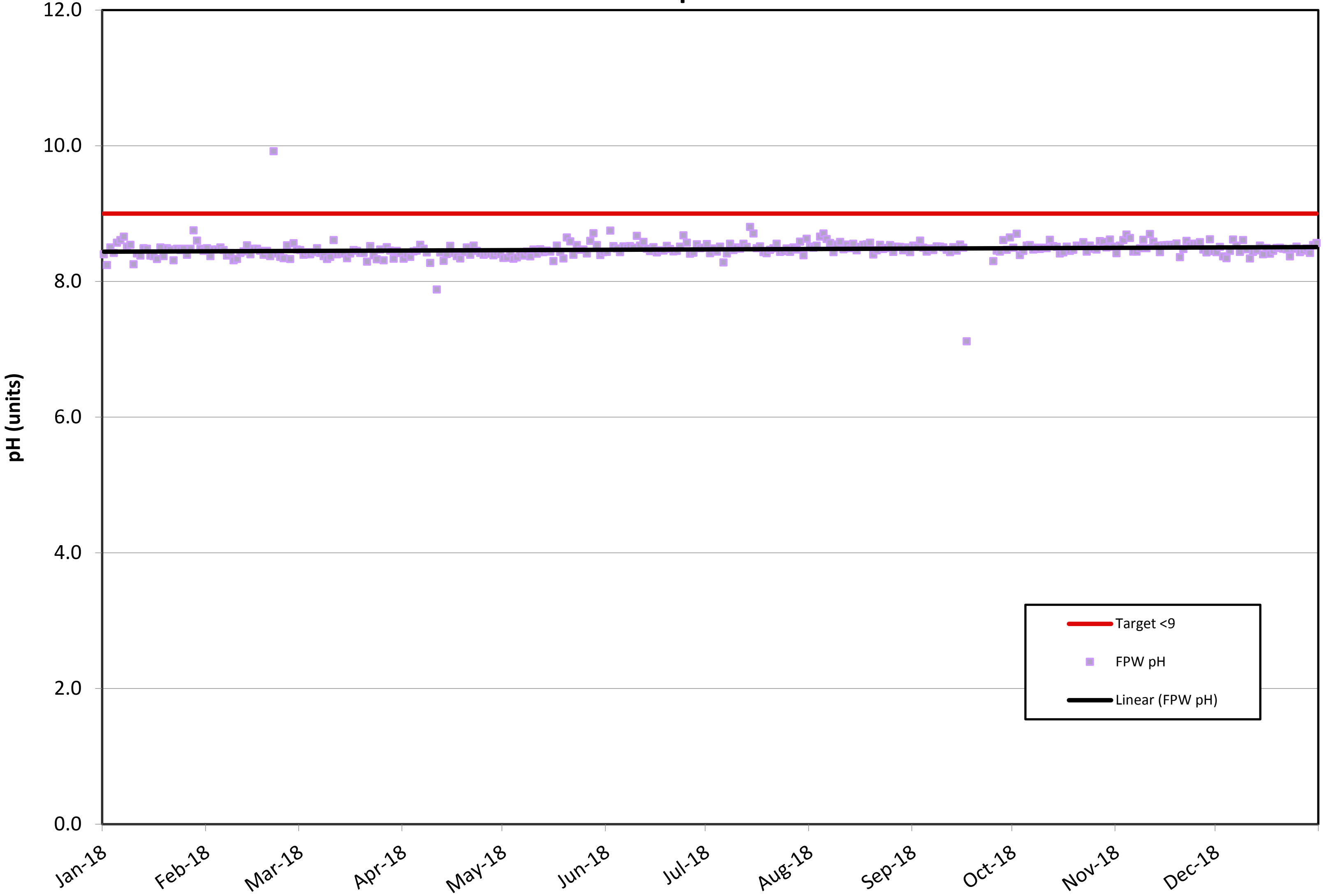


Figure E-14
FPW pH



Appendix F

Pathogenic Microorganism Reduction Reports

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
01/01/18	12.93	12.93	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/02/18	12.95	12.95	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/03/18	12.79	12.79	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/04/18	12.72	12.72	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/05/18	12.72	12.72	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/06/18	12.80	12.80	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/07/18	12.89	12.89	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/08/18	12.88	12.88	12.33	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/09/18	12.81	12.81	12.30	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/10/18	12.84	12.84	12.33	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/11/18	12.81	12.81	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/12/18	12.76	12.76	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/13/18	12.80	12.80	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/14/18	12.80	12.80	12.33	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/15/18	12.86	12.86	12.38	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/16/18	12.80	12.80	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/17/18	12.74	12.74	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/18/18	12.71	12.71	12.30	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/19/18	12.66	12.66	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/20/18	12.70	12.70	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/21/18	12.81	12.81	12.33	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/22/18	12.88	12.88	12.33	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/23/18	12.83	12.83	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/24/18	12.77	12.77	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/25/18	12.75	12.75	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/26/18	12.75	12.75	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/27/18	12.72	12.72	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/28/18	12.70	12.70	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/29/18	12.82	12.82	12.39	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/30/18	12.65	12.65	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/31/18	12.67	12.67	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
01/01/18	0.00	4.57	2.36	6.00	0.00	12.93
01/02/18	0.00	4.58	2.36	6.00	0.00	12.95
01/03/18	0.00	4.48	2.31	6.00	0.00	12.79
01/04/18	0.00	4.43	2.29	6.00	0.00	12.72
01/05/18	0.00	4.46	2.26	6.00	0.00	12.72
01/06/18	0.00	4.48	2.32	6.00	0.00	12.80
01/07/18	0.00	4.54	2.35	6.00	0.00	12.89
01/08/18	0.00	4.56	2.33	6.00	0.00	12.88
01/09/18	0.00	4.52	2.30	6.00	0.00	12.81
01/10/18	0.00	4.51	2.33	6.00	0.00	12.84
01/11/18	0.00	4.50	2.31	6.00	0.00	12.81
01/12/18	0.00	4.47	2.29	6.00	0.00	12.76
01/13/18	0.00	4.48	2.32	6.00	0.00	12.80
01/14/18	0.00	4.47	2.33	6.00	0.00	12.80
01/15/18	0.00	4.48	2.38	6.00	0.00	12.86
01/16/18	0.00	4.47	2.32	6.00	0.00	12.80
01/17/18	0.00	4.45	2.29	6.00	0.00	12.74
01/18/18	0.00	4.41	2.30	6.00	0.00	12.71
01/19/18	0.00	4.38	2.29	6.00	0.00	12.66
01/20/18	0.00	4.41	2.29	6.00	0.00	12.70
01/21/18	0.00	4.48	2.33	6.00	0.00	12.81
01/22/18	0.00	4.55	2.33	6.00	0.00	12.88
01/23/18	0.00	4.57	2.26	6.00	0.00	12.83
01/24/18	0.00	4.53	2.24	6.00	0.00	12.77
01/25/18	0.00	4.49	2.26	6.00	0.00	12.75
01/26/18	0.00	4.49	2.27	6.00	0.00	12.75
01/27/18	0.00	4.47	2.25	6.00	0.00	12.72
01/28/18	0.00	4.42	2.28	6.00	0.00	12.70
01/29/18	0.00	4.43	2.39	6.00	0.00	12.82
01/30/18	0.00	4.39	2.26	6.00	0.00	12.65
01/31/18	0.00	4.40	2.27	6.00	0.00	12.67

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Documented Virus Reduction Achieved					
	OCSD	MF+Cl_2	RO	UV/AOP	Underground travel time (1)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
01/01/18	0.00	0.00	2.36	6.00	4.00	12.36
01/02/18	0.00	0.00	2.36	6.00	4.00	12.36
01/03/18	0.00	0.00	2.31	6.00	4.00	12.31
01/04/18	0.00	0.00	2.29	6.00	4.00	12.29
01/05/18	0.00	0.00	2.26	6.00	4.00	12.26
01/06/18	0.00	0.00	2.32	6.00	4.00	12.32
01/07/18	0.00	0.00	2.35	6.00	4.00	12.35
01/08/18	0.00	0.00	2.33	6.00	4.00	12.33
01/09/18	0.00	0.00	2.30	6.00	4.00	12.30
01/10/18	0.00	0.00	2.33	6.00	4.00	12.33
01/11/18	0.00	0.00	2.31	6.00	4.00	12.31
01/12/18	0.00	0.00	2.29	6.00	4.00	12.29
01/13/18	0.00	0.00	2.32	6.00	4.00	12.32
01/14/18	0.00	0.00	2.33	6.00	4.00	12.33
01/15/18	0.00	0.00	2.38	6.00	4.00	12.38
01/16/18	0.00	0.00	2.32	6.00	4.00	12.32
01/17/18	0.00	0.00	2.29	6.00	4.00	12.29
01/18/18	0.00	0.00	2.30	6.00	4.00	12.30
01/19/18	0.00	0.00	2.29	6.00	4.00	12.29
01/20/18	0.00	0.00	2.29	6.00	4.00	12.29
01/21/18	0.00	0.00	2.33	6.00	4.00	12.33
01/22/18	0.00	0.00	2.33	6.00	4.00	12.33
01/23/18	0.00	0.00	2.26	6.00	4.00	12.26
01/24/18	0.00	0.00	2.24	6.00	4.00	12.24
01/25/18	0.00	0.00	2.26	6.00	4.00	12.26
01/26/18	0.00	0.00	2.27	6.00	4.00	12.27
01/27/18	0.00	0.00	2.25	6.00	4.00	12.25
01/28/18	0.00	0.00	2.28	6.00	4.00	12.28
01/29/18	0.00	0.00	2.39	6.00	4.00	12.39
01/30/18	0.00	0.00	2.26	6.00	4.00	12.26
01/31/18	0.00	0.00	2.27	6.00	4.00	12.27

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
01/01/18	4.97	5.01	5.09	4.77	4.96	4.94	4.75	5.04	4.91	4.87	5.01	4.92	4.88	4.78	4.57	4.69
01/02/18	4.99	4.98	5.03	4.75	4.97	4.94	4.73	5.07	4.90	4.91	4.99	4.94	4.86	4.77	4.58	4.76
01/03/18	4.99	5.07	5.09	4.77	5.01	4.92	4.77	5.05	4.92	4.89	5.00	4.95	4.85	4.73	4.57	4.80
01/04/18	4.96	4.99	5.00	4.78	5.00	4.90	4.89	5.02	4.89	4.84	5.00	4.92	4.84	4.65	4.56	4.77
01/05/18	5.00	4.93	5.05	4.74	5.02	4.95	4.87	5.02	4.88	4.87	4.97	5.05	4.80	4.65	4.55	4.72
01/06/18	5.02	4.93	4.95	4.68	5.02	4.93	4.82	4.94	4.86	4.87	4.98	5.06	4.80	4.63	4.54	4.70
01/07/18	5.04	5.02	5.02	4.94	4.99	4.95	4.88	4.97	4.88	4.86	4.96	5.05	4.80	4.61	4.54	4.72
01/08/18	5.04	4.98	5.01	4.93	5.00	4.92	4.86	5.00	4.90	4.85	4.98	5.03	4.79	4.63	4.56	4.73
01/09/18	5.00	5.00	5.00	4.86	4.94	4.91	4.83	5.04	4.88	4.83	4.98	5.03	4.79	4.61	4.55	4.71
01/10/18	5.06	4.95	4.98	4.79	4.95	4.93	4.77	5.08	4.87	4.81	4.95	5.00	4.74	4.61	4.51	4.72
01/11/18	5.04	4.97	4.99	4.78	4.94	4.91	4.80	5.13	4.88	4.81	4.95	4.98	4.70	4.62	4.50	4.74
01/12/18	5.02	4.97	5.05	4.85	5.06	4.92	4.82	5.09	4.84	4.77	4.93	4.98	4.68	4.56	4.48	4.72
01/13/18	4.98	5.01	5.00	4.85	5.02	4.92	4.85	5.12	4.86	4.83	4.96	5.00	4.69	4.58	4.48	4.71
01/14/18	5.02	4.90	5.05	4.88	5.01	4.95	4.79	5.11	4.83	4.79	4.95	4.99	4.69	4.63	4.47	4.72
01/15/18	5.05	4.96	5.01	4.87	5.03	4.93	4.80	5.07	4.87	4.79	4.96	4.98	4.69	4.59	4.48	4.73
01/16/18	5.07	4.96	4.99	4.83	5.04	4.93	4.81	5.02	4.84	4.80	4.95	4.95	4.79	4.61	4.47	4.73
01/17/18	5.04	4.91	5.10	4.81	5.03	5.11	4.76	5.03	4.84	4.79	5.05	4.94	4.83	4.59	4.45	4.72
01/18/18	4.99	4.99	5.13	4.85	5.03	5.06	4.79	5.02	4.81	4.79	5.03	4.95	4.82	4.66	4.48	4.70
01/19/18	5.04	4.99	5.20	4.84	5.05	5.04	4.80	5.08	4.81	4.74	5.02	4.93	4.88	4.90	4.59	4.69
01/20/18	4.99	4.97	5.13	4.81	5.01	5.03	4.75	5.04	4.95	4.78	5.02	4.94	4.91	4.87	4.63	4.70
01/21/18	4.93	4.90	5.09	4.76	5.04	4.98	4.72	5.01	4.97	4.78	5.00	4.94	4.91	4.83	4.61	4.68
01/22/18	5.03	4.94	5.07	4.76	5.07	4.95	4.72	4.97	4.92	4.74	5.00	4.94	4.90	4.84	4.73	4.65
01/23/18	4.96	4.91	5.09	4.79	5.04	4.97	4.74	5.02	4.94	4.74	5.00	4.93	4.89	4.80	4.76	4.68
01/24/18	5.04	5.12	5.08	4.77	5.03	4.94	4.70	5.02	4.92	4.71	5.01	4.95	4.87	4.79	4.74	4.66
01/25/18	5.02	5.06	5.03	4.78	5.06	4.91	4.73	4.99	4.96	4.73	4.97	4.92	4.86	4.79	4.74	4.65
01/26/18	4.95	5.06	5.04	4.72	5.00	4.95	4.70	4.95	4.88	4.91	4.99	4.90	4.86	4.78	4.71	4.65
01/27/18	4.99	5.10	5.07	4.78	4.98	4.95	4.68	4.96	4.88	4.87	5.01	4.89	4.84	4.95	4.69	4.64
01/28/18	4.98	5.04	5.10	4.77	4.98	4.99	4.71	5.00	4.93	4.85	5.01	4.90	4.87	4.98	4.70	4.75
01/29/18	5.07	5.14	5.16	4.77	5.00	4.97	4.73	4.99	4.95	4.91	5.02	4.92	4.88	4.92	4.70	4.77
01/30/18	5.00	5.05	5.06	4.72	4.97	4.92	4.68	4.96	4.93	4.87	5.03	5.09	4.86	4.91	4.70	4.81
01/31/18	5.03	4.99	5.00	4.74	5.00	4.93	4.78	4.98	4.92	4.84	4.99	5.09	4.84	4.88	4.70	4.80

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
01/01/18	4.68	4.77	4.84	4.66	4.69	4.67	4.75	4.78	5.03	5.08	5.01	4.94	5.04	4.92	4.88	5.05
01/02/18	4.69	4.80	4.82	4.65	4.68	4.67	4.75	4.77	5.01	5.07	5.02	4.94	5.08	4.95	4.91	5.06
01/03/18	4.67	4.79	4.83	4.64	4.68	4.66	4.72	4.75	4.98	5.05	5.00	4.91	5.06	4.92	4.92	5.04
01/04/18	4.79	4.76	4.80	4.62	4.67	4.62	4.66	4.77	4.98	5.08	4.96	4.92	5.06	4.91	4.90	5.00
01/05/18	4.84	4.72	4.78	4.60	4.80	4.57	4.66	4.75	4.95	5.06	4.95	4.95	5.08	4.90	4.89	4.96
01/06/18	4.80	4.73	4.79	4.59	4.89	4.71	4.70	4.70	4.94	5.04	4.94	4.99	5.06	4.88	4.89	4.96
01/07/18	4.80	4.71	4.78	4.59	4.86	4.81	4.70	4.70	4.94	5.04	4.98	4.92	5.03	4.86	4.90	4.97
01/08/18	4.77	4.67	4.75	4.60	4.87	4.77	4.81	4.81	4.96	5.05	4.97	4.88	5.00	4.86	4.86	4.97
01/09/18	4.77	4.66	4.87	4.56	4.85	4.72	4.85	4.89	4.93	5.02	4.93	4.94	4.98	4.89	4.85	4.97
01/10/18	4.77	4.67	4.93	4.55	4.80	4.75	4.78	4.87	4.92	4.98	4.94	4.92	4.96	4.86	4.85	4.93
01/11/18	4.77	4.67	4.93	4.57	4.82	4.79	4.78	4.89	4.92	5.01	4.94	4.92	4.99	4.84	4.86	4.96
01/12/18	4.77	4.67	4.91	4.57	4.82	4.72	4.78	4.90	4.93	5.07	4.93	4.88	4.98	4.81	4.83	4.93
01/13/18	4.76	4.68	4.93	4.72	4.79	4.76	4.77	4.89	4.98	5.11	4.95	4.89	4.98	4.87	4.90	4.94
01/14/18	4.76	4.72	4.97	4.83	4.81	4.78	4.79	4.88	4.96	5.13	4.97	4.90	4.98	4.99	4.98	4.97
01/15/18	4.77	4.81	4.96	4.79	4.80	4.76	4.79	4.86	4.94	5.14	4.95	4.89	4.98	4.93	4.94	4.96
01/16/18	4.77	4.88	4.92	4.76	4.79	4.73	4.80	4.84	4.98	5.12	4.94	4.88	4.97	4.91	4.93	5.01
01/17/18	4.75	4.84	4.86	4.73	4.78	4.72	4.80	4.83	5.05	5.09	4.92	4.86	4.98	4.90	4.93	5.18
01/18/18	4.74	4.83	4.86	4.73	4.77	4.70	4.78	4.81	5.05	5.07	4.93	4.93	5.00	4.88	4.92	5.05
01/19/18	4.74	4.81	4.86	4.73	4.76	4.70	4.75	4.84	5.03	5.05	4.92	5.02	4.96	4.88	4.92	5.01
01/20/18	4.72	4.82	4.86	4.73	4.74	4.73	4.74	4.83	5.01	5.06	4.90	4.99	4.94	4.86	4.90	5.02
01/21/18	4.70	4.81	4.87	4.75	4.72	4.75	4.76	4.79	5.00	5.05	4.98	4.99	4.98	4.87	4.91	5.03
01/22/18	4.69	4.81	4.83	4.74	4.74	4.74	4.75	4.78	5.00	5.06	5.03	4.97	5.05	4.91	4.94	5.05
01/23/18	4.67	4.81	4.79	4.72	4.77	4.70	4.71	4.77	5.00	5.09	5.02	4.97	5.12	4.91	4.90	5.04
01/24/18	4.68	4.78	4.80	4.69	4.75	4.69	4.68	4.80	4.97	5.08	5.01	4.94	5.10	4.92	4.88	5.01
01/25/18	4.68	4.77	4.82	4.69	4.73	4.69	4.69	4.80	4.94	5.08	4.99	4.92	5.10	4.95	4.87	5.01
01/26/18	4.66	4.74	4.81	4.68	4.71	4.68	4.69	4.76	4.95	5.04	4.97	4.92	5.06	4.91	4.87	5.02
01/27/18	4.66	4.74	4.77	4.67	4.66	4.64	4.69	4.74	4.95	5.01	4.96	4.93	5.05	4.90	4.87	5.02
01/28/18	4.66	4.77	4.80	4.69	4.67	4.66	4.72	4.75	4.93	5.03	4.99	4.93	5.07	4.91	4.87	5.00
01/29/18	4.66	4.77	4.80	4.68	4.68	4.66	4.70	4.74	4.96	5.02	5.00	4.98	5.10	4.90	4.89	5.04
01/30/18	4.64	4.77	4.79	4.66	4.68	4.64	4.69	4.71	4.98	5.04	4.97	5.00	5.05	4.91	4.92	5.04
01/31/18	4.76	4.76	4.77	4.65	4.83	4.62	4.67	4.70	4.98	5.01	4.94	4.97	5.01	4.89	4.89	5.00

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

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	MicroFiltration Process online monitoring results Log Removal Value															
	E01	**E02**	**E03**	**E04**												
Date	LRV	LRV	LRV	LRV												
01/01/18	4.97	4.91	4.57	4.59												
01/02/18	4.96	5.00	4.61	4.62												
01/03/18	4.98	5.04	4.48	4.59												
01/04/18	4.99	5.04	4.43	4.62												
01/05/18	4.94	5.01	4.46	4.60												
01/06/18	4.93	5.01	4.48	4.56												
01/07/18	4.90	4.97	4.69	4.59												
01/08/18	4.89	4.99	4.71	4.57												
01/09/18	4.93	5.02	4.64	4.52												
01/10/18	4.96	4.96	4.56	4.54												
01/11/18	4.93	4.99	4.61	4.52												
01/12/18	4.91	4.93	4.60	4.47												
01/13/18	4.90	4.98	4.55	4.57												
01/14/18	4.93	5.04	4.51	4.59												
01/15/18	4.90	4.98	4.55	4.57												
01/16/18	4.88	4.97	4.63	4.50												
01/17/18	4.86	4.96	4.61	4.45												
01/18/18	4.89	4.95	4.58	4.41												
01/19/18	4.86	4.92	4.57	4.38												
01/20/18	4.92	4.93	4.56	4.41												
01/21/18	5.04	4.95	4.52	4.48												
01/22/18	4.97	4.96	4.55	4.63												
01/23/18	4.98	4.91	4.58	4.57												
01/24/18	4.92	4.91	4.54	4.53												
01/25/18	4.94	4.90	4.50	4.49												
01/26/18	4.93	4.91	4.49	4.51												
01/27/18	4.88	4.90	4.47	4.50												
01/28/18	4.90	4.94	4.44	4.42												
01/29/18	4.96	5.02	4.44	4.43												
01/30/18	4.97	5.03	4.39	4.43												
01/31/18	4.92	5.03	4.45	4.40												

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Effluent Turbidity - NTU

Date	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
01/01/18	0.09	0.09	0.13	0.13	0.09	0.09	0.13	0.14	0.12	0.12	0.07	0.08	0.07	0.08	0.12	0.13	0.05	0.10	0.10
01/02/18	0.09	0.10	0.13	0.13	0.09	0.09	0.13	0.14	0.10	0.12	0.08	0.08	0.07	0.08	0.12	0.13	0.05	0.07	0.10
01/03/18	0.09	0.10	0.13	0.13	0.09	0.09	0.13	0.14	0.07	0.07	0.07	0.08	0.08	0.09	0.12	0.13	0.06	0.09	0.09
01/04/18	0.09	0.10	0.13	0.14	0.08	0.09	0.12	0.13	0.07	0.08	0.08	0.09	0.07	0.08	0.12	0.13	0.06	0.08	0.09
01/05/18	0.09	0.10	0.13	0.14	0.08	0.09	0.13	0.14	0.08	0.08	0.08	0.09	0.08	0.08	0.12	0.13	0.06	0.08	0.10
01/06/18	0.10	0.10	0.14	0.14	0.09	0.09	0.13	0.14	0.09	0.09	0.10	0.11	0.08	0.09	0.12	0.13	0.06	0.14	0.10
01/07/18	0.10	0.10	0.14	0.14	0.09	0.09	0.13	0.14	0.09	0.09	0.10	0.10	0.08	0.09	0.12	0.13	0.06	0.10	0.10
01/08/18	0.10	0.11	0.14	0.14	0.09	0.09	0.13	0.14	0.09	0.10	0.10	0.11	0.08	0.09	0.13	0.21	0.05	0.08	0.10
01/09/18	0.09	0.10	0.14	0.16	0.08	0.09	0.12	0.13	0.07	0.10	0.08	0.11	0.07	0.08	0.12	0.12	0.05	0.08	0.09
01/10/18	0.08	0.09	0.13	0.17	0.08	0.08	0.12	0.12	0.06	0.06	0.07	0.07	0.07	0.08	0.12	0.13	0.05	0.08	0.09
01/11/18	0.08	0.09	0.11	0.14	0.08	0.09	0.11	0.12	0.06	0.07	0.07	0.11	0.07	0.08	0.11	0.12	0.06	0.10	0.08
01/12/18	0.07	0.08	0.11	0.11	0.09	0.09	0.12	0.12	0.07	0.07	0.08	0.09	0.08	0.08	0.11	0.11	0.06	0.10	0.09
01/13/18	0.07	0.08	0.11	0.11	0.09	0.09	0.12	0.13	0.07	0.08	0.09	0.09	0.08	0.09	0.11	0.12	0.05	0.06	0.09
01/14/18	0.07	0.08	0.11	0.11	0.09	0.09	0.12	0.12	0.08	0.08	0.09	0.10	0.08	0.09	0.12	0.12	0.06	0.10	0.09
01/15/18	0.08	0.09	0.11	0.12	0.09	0.09	0.12	0.13	0.08	0.09	0.10	0.11	0.08	0.09	0.12	0.12	0.06	0.08	0.09
01/16/18	0.08	0.09	0.11	0.12	0.09	0.10	0.12	0.13	0.09	0.09	0.11	0.11	0.08	0.09	0.12	0.12	0.05	0.07	0.09
01/17/18	0.08	0.09	0.11	0.12	0.09	0.10	0.09	0.12	0.09	0.10	0.11	0.12	0.08	0.10	0.12	0.12	0.06	0.11	0.09
01/18/18	0.07	0.08	0.11	0.12	0.09	0.09	0.11	0.12	0.10	0.10	0.12	0.13	0.08	0.09	0.12	0.13	0.06	0.08	0.09
01/19/18	0.08	0.08	0.11	0.12	0.09	0.09	0.11	0.12	0.10	0.11	0.12	0.13	0.08	0.09	0.12	0.12	0.05	0.06	0.09
01/20/18	0.08	0.09	0.11	0.12	0.09	0.09	0.11	0.12	0.10	0.11	0.13	0.14	0.08	0.09	0.12	0.13	0.06	0.12	0.10
01/21/18	0.08	0.09	0.11	0.12	0.09	0.10	0.12	0.13	0.11	0.12	0.14	0.14	0.08	0.10	0.12	0.13	0.05	0.10	0.10
01/22/18	0.08	0.09	0.11	0.12	0.09	0.10	0.12	0.13	0.12	0.12	0.14	0.15	0.09	0.09	0.13	0.13	0.06	0.09	0.10
01/23/18	0.08	0.09	0.12	0.12	0.09	0.09	0.12	0.13	0.12	0.12	0.14	0.14	0.08	0.10	0.13	0.13	0.05	0.08	0.10
01/24/18	0.07	0.08	0.11	0.12	0.09	0.09	0.11	0.12	0.10	0.12	0.12	0.14	0.08	0.09	0.12	0.13	0.05	0.10	0.09
01/25/18	0.06	0.07	0.10	0.11	0.09	0.09	0.12	0.12	0.09	0.09	0.09	0.10	0.08	0.09	0.12	0.13	0.05	0.08	0.09
01/26/18	0.06	0.07	0.10	0.12	0.09	0.09	0.11	0.12	0.09	0.10	0.10	0.11	0.07	0.08	0.12	0.13	0.06	0.12	0.09
01/27/18	0.07	0.08	0.11	0.11	0.09	0.09	0.12	0.12	0.10	0.11	0.11	0.12	0.07	0.07	0.12	0.13	0.06	0.10	0.09
01/28/18	0.08	0.08	0.11	0.11	0.09	0.09	0.12	0.12	0.10	0.11	0.12	0.13	0.06	0.07	0.12	0.13	0.06	0.08	0.09
01/29/18	0.08	0.11	0.11	0.12	0.09	0.09	0.12	0.13	0.11	0.11	0.12	0.13	0.07	0.08	0.12	0.13	0.05	0.07	0.10
01/30/18	0.08	0.08	0.11	0.12	0.09	0.09	0.11	0.12	0.11	0.12	0.12	0.13	0.07	0.08	0.12	0.13	0.05	0.07	0.10
01/31/18	0.08	0.09	0.12	0.12	0.09	0.09	0.12	0.12	0.11	0.12	0.13	0.13	0.08	0.08	0.13	0.13	0.05	0.06	0.10

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
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	Reverse Osmosis Process online monitoring results																			
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)						Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	ROP		ROF			ROP			ROF			ROP						
Date	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
01/01/18	0.043	0.043	7.738	7.068	8.598	0.034	0.028	0.038	1,460	1,414	1,503	25	23	27	99.56	2.36	98.27	1.76
01/02/18	0.043	0.043	7.939	7.196	9.158	0.034	0.031	0.038	1,452	1,357	1,629	25	20	29	99.57	2.36	98.27	1.76
01/03/18	0.044	0.044	8.552	7.884	9.401	0.041	0.037	0.048	1,609	1,524	1,686	28	24	32	99.52	2.31	98.26	1.76
01/04/18	0.043	0.044	8.714	7.955	9.441	0.045	0.041	0.056	1,670	1,599	1,745	29	26	32	99.49	2.29	98.28	1.76
01/05/18	0.042	0.046	8.584	7.729	9.532	0.047	0.041	0.057	1,676	1,607	1,771	28	24	32	99.45	2.26	98.32	1.78
01/06/18	0.043	0.043	8.773	8.107	9.554	0.042	0.034	0.050	1,626	1,539	1,699	29	27	31	99.52	2.32	98.25	1.76
01/07/18	0.043	0.043	8.300	7.607	9.435	0.037	0.033	0.043	1,463	1,411	1,515	25	23	28	99.55	2.35	98.28	1.76
01/08/18	0.042	0.042	7.867	7.678	8.736	0.037	0.033	0.041	1,403	1,328	1,497	23	21	26	99.53	2.33	98.34	1.78
01/09/18	0.042	0.042	7.996	7.660	8.962	0.040	0.035	0.048	1,481	1,431	1,535	23	22	25	99.49	2.30	98.44	1.81
01/10/18	0.042	0.042	8.299	7.660	9.002	0.039	0.035	0.043	1,519	1,436	1,656	24	21	29	99.53	2.33	98.41	1.80
01/11/18	0.041	0.041	8.373	7.841	9.106	0.041	0.036	0.047	1,600	1,542	1,657	27	24	30	99.51	2.31	98.33	1.78
01/12/18	0.037	0.046	8.573	7.965	9.251	0.044	0.038	0.051	1,630	1,558	1,708	27	23	30	99.48	2.29	98.35	1.78
01/13/18	0.030	0.035	8.565	7.896	9.460	0.041	0.033	0.056	1,630	1,555	1,684	26	23	28	99.52	2.32	98.40	1.80
01/14/18	0.038	0.041	8.143	7.317	11.673	0.038	0.029	0.045	1,496	1,427	1,558	24	22	28	99.53	2.33	98.38	1.79
01/15/18	0.040	0.041	8.156	7.432	10.509	0.034	0.030	0.041	1,486	1,384	1,606	24	21	27	99.58	2.38	98.39	1.79
01/16/18	0.037	0.040	8.303	7.666	8.993	0.039	0.036	0.043	1,582	1,497	1,735	24	21	29	99.52	2.32	98.46	1.81
01/17/18	0.033	0.036	8.295	7.893	8.931	0.043	0.038	0.050	1,703	1,652	1,758	27	24	31	99.49	2.29	98.41	1.80
01/18/18	0.037	0.038	8.112	7.552	8.749	0.041	0.036	0.050	1,681	1,606	1,772	27	23	29	99.50	2.30	98.41	1.80
01/19/18	0.038	0.038	8.252	7.661	9.058	0.042	0.038	0.047	1,710	1,625	1,809	27	24	32	99.49	2.29	98.41	1.80
01/20/18	0.036	0.037	8.488	7.884	9.269	0.043	0.038	0.052	1,698	1,644	1,773	28	25	31	99.49	2.29	98.37	1.79
01/21/18	0.028	0.034	8.309	7.683	9.396	0.039	0.036	0.045	1,585	1,528	1,630	26	23	30	99.53	2.33	98.38	1.79
01/22/18	0.035	0.039	8.028	7.419	8.779	0.038	0.030	0.045	1,494	1,415	1,570	24	20	27	99.53	2.33	98.43	1.80
01/23/18	0.038	0.039	8.294	7.527	10.771	0.046	0.037	0.061	1,624	1,510	1,767	26	22	30	99.45	2.26	98.42	1.80
01/24/18	0.038	0.038	8.331	7.770	9.144	0.048	0.042	0.059	1,716	1,654	1,773	27	23	31	99.42	2.24	98.43	1.80
01/25/18	0.038	0.038	8.432	7.966	9.132	0.046	0.041	0.052	1,726	1,669	1,778	26	24	29	99.45	2.26	98.47	1.82
01/26/18	0.035	0.038	8.321	7.705	9.098	0.045	0.041	0.051	1,763	1,672	1,868	27	25	31	99.46	2.27	98.44	1.81
01/27/18	0.031	0.038	8.195	7.628	8.899	0.046	0.038	0.055	1,763	1,688	1,838	28	26	32	99.44	2.25	98.41	1.80
01/28/18	0.032	0.035	7.708	7.089	8.612	0.040	0.035	0.047	1,637	1,589	1,687	26	23	30	99.48	2.28	98.42	1.80
01/29/18	0.037	0.040	7.822	6.997	8.770	0.032	0.000	0.100	1,606	1,491	1,732	25	21	29	99.59	2.39	98.44	1.81
01/30/18	0.035	0.036	8.139	7.481	8.918	0.045	0.038	0.051	1,723	1,645	1,860	27	24	32	99.45	2.26	98.42	1.80
01/31/18	0.035	0.036	8.354	7.866	9.057	0.045	0.040	0.051	1,822	1,768	1,873	29	27	31	99.47	2.27	98.39	1.79

Notes:

Date	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
01/01/18	97.54	91.084	23,946.2	0.26	3.0	6
01/02/18	97.43	91.452	24,562.8	0.27	3.0	6
01/03/18	97.54	91.807	24,163.1	0.26	3.0	6
01/04/18	97.61	97.677	25,183.2	0.26	3.0	6
01/05/18	97.49	98.424	25,549.6	0.26	3.0	6
01/06/18	97.28	99.246	25,402.1	0.26	3.0	6
01/07/18	97.50	95.198	25,108.1	0.26	3.0	6
01/08/18	97.46	92.107	24,074.6	0.26	3.0	6
01/09/18	97.59	97.527	25,103.8	0.26	3.0	6
01/10/18	97.85	99.494	25,327.9	0.25	3.0	6
01/11/18	97.78	99.121	25,106.1	0.25	3.0	6
01/12/18	97.77	99.491	25,240.7	0.25	3.0	6
01/13/18	97.76	99.937	25,869.5	0.26	3.0	6
01/14/18	97.87	95.018	25,345.2	0.27	3.0	6
01/15/18	97.90	94.336	24,969.0	0.26	3.0	6
01/16/18	98.16	95.352	25,104.7	0.26	3.0	6
01/17/18	98.09	99.165	25,957.9	0.26	3.0	6
01/18/18	98.16	97.934	25,183.5	0.26	3.0	6
01/19/18	98.10	99.763	25,494.8	0.26	3.0	6
01/20/18	97.95	96.964	24,935.8	0.26	3.0	6
01/21/18	97.59	93.564	24,435.2	0.26	3.0	6
01/22/18	97.45	93.733	24,415.0	0.26	3.0	6
01/23/18	97.84	95.782	24,612.8	0.26	3.0	6
01/24/18	97.75	99.592	25,627.0	0.26	3.0	6
01/25/18	97.70	96.488	24,944.2	0.26	3.0	6
01/26/18	97.87	98.951	25,859.0	0.26	3.0	6
01/27/18	97.79	97.792	25,695.4	0.26	3.0	6
01/28/18	97.92	91.490	24,031.3	0.26	3.0	6
01/29/18	98.27	84.316	22,271.1	0.26	3.0	6
01/30/18	97.98	87.234	22,874.1	0.26	3.0	6
01/31/18	97.63	95.305	24,013.7	0.25	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)
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system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
02/01/18	12.67	12.67	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/02/18	12.65	12.65	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/03/18	12.71	12.71	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/04/18	12.65	12.65	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/05/18	12.64	12.64	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/06/18	12.74	12.74	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/07/18	12.73	12.73	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/08/18	12.68	12.68	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/09/18	12.88	12.88	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/10/18	12.86	12.86	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/11/18	12.86	12.86	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/12/18	12.88	12.88	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/13/18	12.91	12.91	12.30	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/14/18	12.92	12.92	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/15/18	12.84	12.84	12.23	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/16/18	12.81	12.81	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/17/18	12.86	12.86	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/18/18	12.90	12.90	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/19/18	12.87	12.87	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/20/18	12.93	12.93	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/21/18	12.94	12.94	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/22/18	12.90	12.90	12.23	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/23/18	12.89	12.89	12.30	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/24/18	12.96	12.96	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/25/18	12.94	12.94	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/26/18	12.94	12.94	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/27/18	12.90	12.90	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/28/18	12.95	12.95	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
02/01/18	0.00	4.40	2.27	6.00	0.00	12.67
02/02/18	0.00	4.40	2.25	6.00	0.00	12.65
02/03/18	0.00	4.45	2.27	6.00	0.00	12.71
02/04/18	0.00	4.41	2.24	6.00	0.00	12.65
02/05/18	0.00	4.36	2.28	6.00	0.00	12.64
02/06/18	0.00	4.46	2.28	6.00	0.00	12.74
02/07/18	0.00	4.45	2.27	6.00	0.00	12.73
02/08/18	0.00	4.49	2.19	6.00	0.00	12.68
02/09/18	0.00	4.63	2.24	6.00	0.00	12.88
02/10/18	0.00	4.60	2.25	6.00	0.00	12.86
02/11/18	0.00	4.59	2.27	6.00	0.00	12.86
02/12/18	0.00	4.62	2.26	6.00	0.00	12.88
02/13/18	0.00	4.62	2.30	6.00	0.00	12.91
02/14/18	0.00	4.66	2.26	6.00	0.00	12.92
02/15/18	0.00	4.61	2.23	6.00	0.00	12.84
02/16/18	0.00	4.56	2.25	6.00	0.00	12.81
02/17/18	0.00	4.61	2.24	6.00	0.00	12.86
02/18/18	0.00	4.64	2.26	6.00	0.00	12.90
02/19/18	0.00	4.60	2.27	6.00	0.00	12.87
02/20/18	0.00	4.63	2.31	6.00	0.00	12.93
02/21/18	0.00	4.64	2.29	6.00	0.00	12.94
02/22/18	0.00	4.66	2.23	6.00	0.00	12.90
02/23/18	0.00	4.59	2.30	6.00	0.00	12.89
02/24/18	0.00	4.64	2.32	6.00	0.00	12.96
02/25/18	0.00	4.58	2.36	6.00	0.00	12.94
02/26/18	0.00	4.59	2.35	6.00	0.00	12.94
02/27/18	0.00	4.56	2.35	6.00	0.00	12.90
02/28/18	0.00	4.64	2.31	6.00	0.00	12.95

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Documented Virus Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
	LRV	LRV	LRV	LRV	LRV	LRV
02/01/18	0.00	0.00	2.27	6.00	4.00	12.27
02/02/18	0.00	0.00	2.25	6.00	4.00	12.25
02/03/18	0.00	0.00	2.27	6.00	4.00	12.27
02/04/18	0.00	0.00	2.24	6.00	4.00	12.24
02/05/18	0.00	0.00	2.28	6.00	4.00	12.28
02/06/18	0.00	0.00	2.28	6.00	4.00	12.28
02/07/18	0.00	0.00	2.27	6.00	4.00	12.27
02/08/18	0.00	0.00	2.19	6.00	4.00	12.19
02/09/18	0.00	0.00	2.24	6.00	4.00	12.24
02/10/18	0.00	0.00	2.25	6.00	4.00	12.25
02/11/18	0.00	0.00	2.27	6.00	4.00	12.27
02/12/18	0.00	0.00	2.26	6.00	4.00	12.26
02/13/18	0.00	0.00	2.30	6.00	4.00	12.30
02/14/18	0.00	0.00	2.26	6.00	4.00	12.26
02/15/18	0.00	0.00	2.23	6.00	4.00	12.23
02/16/18	0.00	0.00	2.25	6.00	4.00	12.25
02/17/18	0.00	0.00	2.24	6.00	4.00	12.24
02/18/18	0.00	0.00	2.26	6.00	4.00	12.26
02/19/18	0.00	0.00	2.27	6.00	4.00	12.27
02/20/18	0.00	0.00	2.31	6.00	4.00	12.31
02/21/18	0.00	0.00	2.29	6.00	4.00	12.29
02/22/18	0.00	0.00	2.23	6.00	4.00	12.23
02/23/18	0.00	0.00	2.30	6.00	4.00	12.30
02/24/18	0.00	0.00	2.32	6.00	4.00	12.32
02/25/18	0.00	0.00	2.36	6.00	4.00	12.36
02/26/18	0.00	0.00	2.35	6.00	4.00	12.35
02/27/18	0.00	0.00	2.35	6.00	4.00	12.35
02/28/18	0.00	0.00	2.31	6.00	4.00	12.31

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
02/01/18	5.11	5.01	5.04	4.87	5.02	4.92	4.79	5.00	4.86	4.80	5.02	5.01	4.82	4.87	4.67	4.76
02/02/18	5.13	5.03	5.04	4.92	5.02	4.97	4.80	4.98	4.88	4.81	4.97	4.99	4.81	4.87	4.67	4.76
02/03/18	5.06	4.98	5.03	4.91	4.94	4.95	4.78	4.95	4.88	4.80	4.97	5.01	4.80	4.85	4.68	4.74
02/04/18	5.02	4.98	5.00	4.91	5.03	4.98	4.80	4.97	4.85	4.76	4.95	4.96	4.83	4.85	4.67	4.76
02/05/18	5.11	4.96	5.03	4.88	4.97	4.99	4.80	5.08	4.86	4.80	4.96	4.99	4.81	4.84	4.66	4.74
02/06/18	5.13	4.99	5.05	4.86	5.07	4.94	4.77	5.08	4.84	4.82	4.98	5.02	4.79	4.85	4.67	4.71
02/07/18	5.05	5.01	4.98	4.86	5.05	4.89	4.79	5.05	4.86	4.78	4.95	5.02	4.83	4.88	4.66	4.72
02/08/18	5.06	5.07	5.24	4.88	5.05	4.91	4.80	5.07	4.84	4.77	4.95	4.98	4.78	4.86	4.64	4.71
02/09/18	5.09	5.00	5.13	4.90	5.12	5.13	4.79	5.07	4.81	4.77	4.92	4.97	4.95	4.83	4.64	4.71
02/10/18	5.06	5.02	5.15	4.84	5.05	5.10	4.78	5.06	4.81	4.79	4.94	4.99	4.96	4.84	4.62	4.73
02/11/18	5.06	4.98	5.13	4.82	5.05	4.99	4.79	5.02	4.85	4.77	4.95	4.99	4.92	4.87	4.60	4.74
02/12/18	5.02	5.07	5.21	4.86	5.05	5.04	4.80	5.05	5.04	4.81	5.04	5.01	4.92	4.93	4.62	4.71
02/13/18	5.06	4.99	5.15	4.83	5.01	5.00	4.78	5.02	5.01	4.78	5.03	4.98	4.90	4.88	4.76	4.69
02/14/18	5.08	5.09	5.15	4.87	5.01	5.01	4.97	5.03	4.95	4.76	5.04	4.97	4.90	4.89	4.75	4.69
02/15/18	5.07	5.08	5.15	4.83	5.05	5.01	4.99	5.02	4.95	4.74	4.99	4.96	4.87	4.90	4.70	4.70
02/16/18	5.08	5.00	5.09	4.79	5.02	5.06	5.01	5.06	4.86	4.80	4.99	5.07	4.85	4.89	4.70	4.72
02/17/18	5.05	5.04	5.13	4.82	5.00	5.04	4.96	5.00	4.86	4.79	4.96	5.08	4.88	4.90	4.68	4.76
02/18/18	5.04	5.08	5.12	4.85	5.02	5.02	4.91	5.03	4.78	4.79	4.95	5.10	4.92	4.85	4.67	4.74
02/19/18	5.07	5.07	5.12	4.85	5.04	5.04	4.94	5.01	4.79	4.78	4.94	5.08	4.92	4.92	4.67	4.73
02/20/18	5.05	4.95	5.10	4.83	4.99	5.01	4.96	5.02	4.76	4.80	4.93	5.05	4.91	4.86	4.65	4.71
02/21/18	5.04	5.00	5.10	4.82	4.97	5.01	4.92	5.04	4.72	4.88	4.91	5.06	4.87	4.89	4.66	4.72
02/22/18	5.02	4.95	5.06	4.81	5.02	4.96	4.95	4.99	4.79	4.86	4.92	5.07	4.84	5.07	4.66	4.71
02/23/18	4.98	4.97	5.04	4.78	4.96	4.95	4.91	5.03	4.74	4.84	4.91	5.02	4.84	5.05	4.65	4.76
02/24/18	5.09	4.97	5.09	4.80	5.00	5.01	4.94	4.98	4.78	4.83	4.91	5.02	4.83	4.98	4.67	4.80
02/25/18	5.01	4.96	5.04	4.82	4.94	4.96	4.95	4.97	4.72	4.83	4.89	5.14	4.83	5.02	4.69	4.79
02/26/18	5.03	4.98	5.05	4.77	4.95	4.95	5.08	5.00	4.73	4.82	4.89	5.13	4.80	4.95	4.69	4.78
02/27/18	5.08	4.98	5.10	4.93	4.97	4.99	5.03	4.98	4.78	4.85	4.87	5.13	4.83	4.88	4.67	4.80
02/28/18	5.13	4.96	5.08	4.88	4.91	4.97	4.98	4.98	4.73	4.80	4.84	5.13	4.78	4.91	4.64	4.74

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	C01	**C02**	**C03**	**C04**	**C05**	**C06**	**C07**	**C08**	**D01**	**D02**	**D03**	**D04**	**D05**	**D06**	**D07**	**D08**
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
02/01/18	4.82	4.73	4.75	4.62	4.94	4.77	4.64	4.71	4.95	4.98	4.92	4.91	5.01	4.86	4.85	4.95
02/02/18	4.81	4.72	4.75	4.60	4.88	4.85	4.63	4.70	4.95	5.00	4.91	4.90	5.04	4.87	4.85	4.95
02/03/18	4.82	4.73	4.89	4.60	4.86	4.79	4.77	4.81	4.97	4.97	4.92	4.92	5.07	4.86	4.86	4.97
02/04/18	4.79	4.70	5.00	4.60	4.86	4.79	4.87	4.94	4.97	4.95	4.93	4.93	5.06	4.87	4.87	4.94
02/05/18	4.78	4.70	4.98	4.61	4.84	4.80	4.82	4.95	4.96	4.98	4.94	4.94	5.06	4.87	4.86	4.96
02/06/18	4.79	4.71	4.93	4.60	4.84	4.78	4.78	4.93	4.96	5.10	4.91	4.95	5.02	4.86	4.83	4.92
02/07/18	4.79	4.70	4.94	4.60	4.83	4.76	4.77	4.89	4.94	5.18	4.91	4.92	5.01	4.85	4.88	4.96
02/08/18	4.78	4.83	4.92	4.71	4.79	4.76	4.78	4.88	4.94	5.12	4.91	4.91	5.04	4.89	5.02	4.96
02/09/18	4.78	4.89	4.90	4.78	4.79	4.76	4.77	4.88	5.01	5.11	4.88	4.90	5.01	4.99	4.98	4.94
02/10/18	4.76	4.86	4.93	4.76	4.79	4.76	4.75	4.88	5.06	5.08	4.89	4.92	5.00	4.92	4.94	4.96
02/11/18	4.77	4.86	4.96	4.77	4.79	4.79	4.78	4.87	5.00	5.11	4.91	4.89	5.02	4.92	4.94	5.04
02/12/18	4.77	4.86	4.90	4.76	4.79	4.76	4.77	4.87	5.02	5.09	4.90	4.85	4.99	4.94	4.91	5.07
02/13/18	4.74	4.83	4.88	4.74	4.76	4.73	4.74	4.88	5.02	5.07	4.86	4.87	4.97	4.93	4.87	5.05
02/14/18	4.73	4.84	4.89	4.74	4.76	4.73	4.77	4.86	5.00	5.08	4.91	4.92	5.01	4.91	4.93	5.04
02/15/18	4.75	4.83	4.87	4.74	4.78	4.72	4.74	4.86	5.03	5.08	4.95	4.95	5.06	4.90	4.95	5.02
02/16/18	4.75	4.81	4.87	4.72	4.78	4.71	4.72	4.86	5.08	5.11	4.94	4.93	5.13	4.92	4.95	5.01
02/17/18	4.76	4.80	4.87	4.70	4.78	4.71	4.74	4.85	5.07	5.09	4.94	4.89	5.12	4.93	4.91	4.99
02/18/18	4.75	4.78	4.89	4.71	4.78	4.73	4.76	4.84	5.07	5.04	4.94	4.93	5.10	4.94	4.88	5.03
02/19/18	4.76	4.80	4.91	4.71	4.77	4.73	4.76	4.84	5.06	5.04	4.94	4.89	5.07	4.92	4.89	5.03
02/20/18	4.74	4.78	4.87	4.70	4.77	4.70	4.73	4.86	5.04	5.06	4.91	4.91	5.08	4.89	4.87	5.00
02/21/18	4.73	4.77	4.85	4.71	4.75	4.67	4.67	4.83	5.04	5.06	4.94	4.93	5.05	4.90	4.90	5.01
02/22/18	4.71	4.77	4.82	4.71	4.72	4.67	4.67	4.77	5.02	5.02	4.96	4.91	4.99	4.91	4.94	5.05
02/23/18	4.71	4.73	4.83	4.69	4.68	4.67	4.71	4.78	5.00	5.00	4.94	4.90	4.98	4.88	4.85	4.96
02/24/18	4.71	4.72	4.86	4.70	4.68	4.67	4.71	4.83	5.00	5.00	4.95	4.92	4.99	4.89	4.87	5.00
02/25/18	4.71	4.76	4.85	4.72	4.70	4.68	4.72	4.82	5.02	5.00	4.94	4.92	5.01	4.90	4.85	5.01
02/26/18	4.80	4.74	4.83	4.71	4.84	4.67	4.71	4.81	5.02	5.01	4.92	4.93	5.03	4.90	4.85	4.98
02/27/18	4.80	4.71	4.78	4.65	4.93	4.75	4.68	4.79	4.98	5.04	4.91	4.89	5.00	4.87	4.89	4.92
02/28/18	4.77	4.69	4.75	4.64	4.85	4.77	4.78	4.76	4.96	5.02	4.92	4.89	5.01	4.85	4.87	4.92

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Log Removal Value

Date	E01 LRV	E02 LRV	E03 LRV	E04 LRV
02/01/18	4.94	5.02	4.51	4.40
02/02/18	4.93	4.98	4.69	4.40
02/03/18	4.96	5.01	4.71	4.45
02/04/18	4.99	4.98	4.68	4.41
02/05/18	4.93	4.99	4.62	4.36
02/06/18	4.90	4.98	4.67	4.46
02/07/18	4.92	4.97	4.67	4.45
02/08/18	4.89	4.96	4.60	4.49
02/09/18	4.89	4.99	4.69	4.63
02/10/18	4.93	4.99	4.60	4.74
02/11/18	4.91	4.99	4.59	4.75
02/12/18	4.91	4.99	4.68	4.67
02/13/18	4.91	4.95	4.62	4.68
02/14/18	4.97	4.97	4.66	4.77
02/15/18	4.98	4.97	4.61	4.92
02/16/18	4.93	4.97	4.56	4.84
02/17/18	4.92	4.97	4.61	4.87
02/18/18	4.95	4.98	4.64	4.84
02/19/18	4.97	4.96	4.60	4.82
02/20/18	4.95	4.91	4.63	4.79
02/21/18	4.94	4.92	4.64	4.80
02/22/18	4.95	4.94	4.67	4.79
02/23/18	4.94	4.98	4.59	4.75
02/24/18	4.92	5.07	4.64	4.73
02/25/18	4.94	5.00	4.58	4.75
02/26/18	4.94	5.02	4.59	4.75
02/27/18	4.93	4.95	4.56	4.77
02/28/18	4.91	4.92	4.67	4.73

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

Date	MicroFiltration Process online monitoring results Effluent Turbidity - NTU A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
02/01/18	0.08	0.08	0.12	0.12	0.09	0.09	0.11	0.12	0.12	0.12	0.14	0.15	0.08	0.09	0.13	0.13	0.05	0.08	0.10
02/02/18	0.08	0.09	0.11	0.12	0.09	0.09	0.11	0.12	0.12	0.12	0.14	0.15	0.08	0.09	0.13	0.16	0.06	0.12	0.10
02/03/18	0.08	0.09	0.12	0.13	0.09	0.09	0.12	0.12	0.12	0.13	0.14	0.15	0.09	0.09	0.13	0.13	0.06	0.08	0.11
02/04/18	0.09	0.10	0.12	0.13	0.09	0.10	0.12	0.13	0.13	0.13	0.15	0.15	0.09	0.10	0.13	0.13	0.07	0.17	0.11
02/05/18	0.08	0.09	0.12	0.13	0.09	0.10	0.12	0.13	0.13	0.14	0.15	0.15	0.09	0.10	0.13	0.14	0.06	0.12	0.11
02/06/18	0.07	0.08	0.13	0.15	0.09	0.09	0.12	0.13	0.13	0.13	0.15	0.15	0.09	0.10	0.13	0.13	0.06	0.11	0.10
02/07/18	0.08	0.08	0.12	0.13	0.09	0.09	0.12	0.12	0.13	0.13	0.15	0.15	0.08	0.09	0.13	0.13	0.06	0.13	0.11
02/08/18	0.07	0.09	0.12	0.13	0.08	0.09	0.12	0.12	0.09	0.13	0.11	0.15	0.08	0.09	0.13	0.14	0.06	0.17	0.10
02/09/18	0.07	0.08	0.12	0.13	0.08	0.08	0.12	0.12	0.06	0.07	0.07	0.07	0.07	0.08	0.12	0.14	0.05	0.10	0.09
02/10/18	0.07	0.08	0.12	0.13	0.08	0.09	0.12	0.13	0.06	0.07	0.07	0.08	0.07	0.08	0.12	0.13	0.05	0.07	0.09
02/11/18	0.09	0.10	0.12	0.13	0.08	0.09	0.12	0.13	0.06	0.07	0.07	0.07	0.07	0.08	0.12	0.12	0.05	0.06	0.09
02/12/18	0.09	0.10	0.13	0.13	0.09	0.09	0.12	0.13	0.06	0.07	0.07	0.07	0.08	0.08	0.12	0.21	0.05	0.11	0.09
02/13/18	0.09	0.09	0.12	0.13	0.08	0.09	0.12	0.12	0.06	0.07	0.07	0.08	0.07	0.09	0.11	0.12	0.05	0.17	0.08
02/14/18	0.09	0.09	0.12	0.13	0.08	0.09	0.11	0.12	0.06	0.07	0.07	0.07	0.07	0.08	0.11	0.11	0.05	0.06	0.08
02/15/18	0.09	0.09	0.12	0.13	0.09	0.09	0.11	0.12	0.10	1.06	0.07	0.18	0.07	0.07	0.12	0.15	0.05	0.06	0.09
02/16/18	0.09	0.09	0.12	0.13	0.09	0.09	0.11	0.12	0.06	0.07	0.08	0.09	0.07	0.08	0.12	0.12	0.04	0.05	0.09
02/17/18	0.09	0.10	0.13	0.13	0.09	0.09	0.12	0.12	0.07	0.07	0.09	0.09	0.07	0.08	0.12	0.12	0.05	0.06	0.09
02/18/18	0.09	0.10	0.13	0.13	0.09	0.09	0.12	0.12	0.07	0.08	0.09	0.10	0.07	0.08	0.12	0.18	0.05	0.08	0.09
02/19/18	0.10	0.10	0.13	0.13	0.09	0.10	0.12	0.13	0.08	0.09	0.10	0.11	0.07	0.08	0.12	0.13	0.05	0.06	0.10
02/20/18	0.09	0.10	0.12	0.14	0.09	0.10	0.12	0.13	0.08	0.09	0.11	0.12	0.07	0.08	0.12	0.13	0.06	0.11	0.10
02/21/18	0.08	0.10	0.11	0.14	0.09	0.11	0.11	0.12	0.08	0.09	0.09	0.12	0.07	0.09	0.12	0.13	0.05	0.08	0.09
02/22/18	0.07	0.08	0.10	0.11	0.09	0.09	0.11	0.12	0.08	0.08	0.08	0.09	0.07	0.07	0.12	0.12	0.05	0.10	0.09
02/23/18	0.07	0.08	0.11	0.25	0.09	0.09	0.11	0.12	0.08	0.09	0.09	0.10	0.07	0.07	0.12	0.13	0.05	0.06	0.09
02/24/18	0.08	0.08	0.11	0.11	0.09	0.10	0.11	0.12	0.09	0.10	0.10	0.11	0.07	0.08	0.12	0.12	0.05	0.07	0.09
02/25/18	0.09	0.09	0.11	0.14	0.09	0.10	0.12	0.12	0.10	0.11	0.11	0.12	0.07	0.08	0.12	0.13	0.05	0.09	0.09
02/26/18	0.09	0.10	0.11	0.13	0.09	0.10	0.12	0.12	0.11	0.11	0.12	0.12	0.07	0.08	0.12	0.13	0.05	0.07	0.10
02/27/18	0.09	0.10	0.11	0.12	0.09	0.09	0.11	0.12	0.10	0.11	0.12	0.12	0.06	0.07	0.12	0.12	0.05	0.06	0.09
02/28/18	0.08	0.09	0.11	0.13	0.09	0.09	0.11	0.11	0.11	0.11	0.13	0.14	0.06	0.07	0.12	0.12	0.05	0.07	0.09

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Reverse Osmosis Process online monitoring results														Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)									
	ROP		ROF			ROP			ROF			ROP						
	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
02/01/18	0.035	0.036	8.354	7.866	9.057	0.045	0.040	0.051	1,822	1,768	1,873	29	27	31	99.47	2.27	98.39	1.79
02/02/18	0.037	0.038	8.057	7.512	8.759	0.045	0.040	0.054	1,811	1,728	1,880	28	26	32	99.44	2.25	98.43	1.80
02/03/18	0.039	0.042	7.996	7.537	8.740	0.043	0.038	0.054	1,802	1,738	1,857	29	26	33	99.46	2.27	98.38	1.79
02/04/18	0.040	0.040	8.086	7.455	8.747	0.047	0.042	0.054	1,778	1,720	1,856	29	26	32	99.42	2.24	98.35	1.78
02/05/18	0.041	0.041	7.985	7.402	8.702	0.042	0.038	0.048	1,673	1,610	1,727	28	25	31	99.48	2.28	98.35	1.78
02/06/18	0.041	0.042	7.762	7.067	8.696	0.041	0.037	0.043	1,596	1,501	1,697	27	24	31	99.48	2.28	98.30	1.77
02/07/18	0.041	0.041	8.058	7.498	8.922	0.043	0.038	0.047	1,710	1,626	1,829	27	23	29	99.47	2.27	98.43	1.80
02/08/18	0.041	0.041	8.468	8.039	8.909	0.054	0.041	0.065	1,745	1,676	1,804	27	24	30	99.36	2.19	98.44	1.81
02/09/18	0.042	0.042	8.178	7.630	9.014	0.047	0.042	0.058	1,776	1,708	1,836	29	25	33	99.43	2.24	98.36	1.79
02/10/18	0.043	0.044	8.162	7.586	8.937	0.046	0.038	0.051	1,772	1,701	1,829	30	28	33	99.44	2.25	98.29	1.77
02/11/18	0.043	0.044	8.142	7.586	8.842	0.044	0.038	0.050	1,742	1,693	1,793	29	27	32	99.46	2.27	98.31	1.77
02/12/18	0.043	0.043	8.100	7.591	8.862	0.045	0.037	0.051	1,624	1,571	1,679	28	24	32	99.45	2.26	98.29	1.77
02/13/18	0.044	0.044	8.145	7.514	9.882	0.041	0.038	0.047	1,588	1,502	1,727	27	24	30	99.50	2.30	98.32	1.78
02/14/18	0.044	0.045	8.184	7.455	10.468	0.045	0.041	0.051	1,709	1,637	1,815	28	25	32	99.45	2.26	98.37	1.79
02/15/18	0.044	0.044	8.388	7.672	10.271	0.049	0.042	0.053	1,792	1,729	1,847	29	26	32	99.41	2.23	98.37	1.79
02/16/18	0.043	0.043	8.283	7.590	11.269	0.047	0.036	0.057	1,778	1,713	1,838	29	26	31	99.44	2.25	98.39	1.79
02/17/18	0.043	0.044	8.062	7.395	8.886	0.046	0.041	0.055	1,785	1,723	1,859	28	26	32	99.43	2.24	98.41	1.80
02/18/18	0.044	0.044	8.142	7.623	8.854	0.045	0.041	0.054	1,766	1,708	1,820	29	27	31	99.45	2.26	98.37	1.79
02/19/18	0.043	0.043	7.999	7.480	8.757	0.043	0.036	0.048	1,687	1,628	1,741	28	26	32	99.46	2.27	98.33	1.78
02/20/18	0.042	0.042	8.035	7.420	9.059	0.040	0.037	0.042	1,587	1,512	1,672	27	23	29	99.51	2.31	98.31	1.77
02/21/18	0.042	0.042	8.602	7.935	9.248	0.044	0.038	0.052	1,705	1,607	1,828	27	24	30	99.49	2.29	98.42	1.80
02/22/18	0.042	0.043	8.862	8.135	9.689	0.052	0.045	0.065	1,763	1,708	1,827	30	24	57	99.42	2.23	98.32	1.77
02/23/18	0.045	0.046	8.469	7.969	9.166	0.042	0.036	0.051	1,785	1,723	1,846	29	27	32	99.50	2.30	98.38	1.79
02/24/18	0.043	0.046	8.389	7.735	9.041	0.040	0.032	0.047	1,804	1,720	1,890	29	26	33	99.53	2.32	98.39	1.79
02/25/18	0.041	0.041	8.473	7.808	9.075	0.037	0.032	0.042	1,807	1,741	1,867	30	27	33	99.56	2.36	98.34	1.78
02/26/18	0.040	0.041	8.271	7.700	9.177	0.037	0.032	0.042	1,689	1,629	1,745	28	25	32	99.55	2.35	98.33	1.78
02/27/18	0.038	0.041	8.300	7.646	9.158	0.037	0.028	0.051	1,627	1,524	1,751	27	23	30	99.55	2.35	98.37	1.79
02/28/18	0.041	0.042	8.870	8.367	9.499	0.044	0.036	0.050	1,751	1,669	1,873	28	25	30	99.51	2.31	98.42	1.80

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
02/01/18	97.59	97.658	24,434.6	0.25	3.0	6
02/02/18	97.62	98.352	24,416.9	0.25	3.0	6
02/03/18	97.40	96.064	23,868.7	0.25	3.0	6
02/04/18	97.33	94.964	23,743.7	0.25	3.0	6
02/05/18	97.40	95.652	23,840.6	0.25	3.0	6
02/06/18	97.44	97.144	24,012.9	0.25	3.0	6
02/07/18	97.49	97.945	24,261.6	0.25	3.0	6
02/08/18	97.18	96.854	24,176.7	0.25	3.0	6
02/09/18	97.27	98.224	24,583.8	0.25	3.0	6
02/10/18	97.09	97.511	24,283.6	0.25	3.0	6
02/11/18	97.29	96.072	24,002.2	0.25	3.0	6
02/12/18	97.07	95.992	24,169.3	0.25	3.0	6
02/13/18	97.27	98.551	24,648.2	0.25	3.0	6
02/14/18	97.56	96.424	24,040.9	0.25	3.0	6
02/15/18	97.66	97.549	24,272.4	0.25	3.0	6
02/16/18	97.75	96.833	24,474.8	0.25	3.0	6
02/17/18	97.87	100.062	24,979.3	0.25	3.0	6
02/18/18	98.05	96.426	24,207.4	0.25	3.0	6
02/19/18	98.00	94.590	24,128.5	0.26	3.0	6
02/20/18	97.81	94.301	24,184.6	0.26	3.0	6
02/21/18	97.80	96.383	24,479.3	0.25	3.0	6
02/22/18	97.75	87.912	22,407.4	0.25	3.0	6
02/23/18	97.76	99.576	24,987.0	0.25	3.0	6
02/24/18	97.77	97.014	24,349.9	0.25	3.0	6
02/25/18	97.94	94.947	23,898.9	0.25	3.0	6
02/26/18	98.26	95.858	24,220.8	0.25	3.0	6
02/27/18	98.34	95.462	24,215.3	0.25	3.0	6
02/28/18	98.30	96.562	24,004.4	0.25	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
03/01/18	13.06	13.06	12.42	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/02/18	13.06	13.06	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/03/18	13.10	13.10	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/04/18	13.13	13.13	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/05/18	13.13	13.13	12.49	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/06/18	13.05	13.05	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/07/18	13.06	13.06	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/08/18	12.98	12.98	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/09/18	13.01	13.01	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/10/18	13.04	13.04	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/11/18	13.04	13.04	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/12/18	12.96	12.96	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/13/18	12.94	12.94	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/14/18	13.06	13.06	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/15/18	12.95	12.95	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/16/18	12.91	12.91	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/17/18	12.89	12.89	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/18/18	12.92	12.92	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/19/18	12.94	12.94	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/20/18	12.87	12.87	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/21/18	12.82	12.82	12.38	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/22/18	12.80	12.80	12.40	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/23/18	12.75	12.75	12.40	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/24/18	12.88	12.88	12.42	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/25/18	13.06	13.06	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/26/18	13.04	13.04	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/27/18	12.97	12.97	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/28/18	12.94	12.94	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/29/18	12.92	12.92	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/30/18	12.90	12.90	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/31/18	12.86	12.86	12.39	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
03/01/18	0.00	4.64	2.42	6.00	0.00	13.06
03/02/18	0.00	4.62	2.44	6.00	0.00	13.06
03/03/18	0.00	4.64	2.45	6.00	0.00	13.10
03/04/18	0.00	4.65	2.48	6.00	0.00	13.13
03/05/18	0.00	4.65	2.49	6.00	0.00	13.13
03/06/18	0.00	4.62	2.44	6.00	0.00	13.05
03/07/18	0.00	4.61	2.45	6.00	0.00	13.06
03/08/18	0.00	4.57	2.41	6.00	0.00	12.98
03/09/18	0.00	4.56	2.45	6.00	0.00	13.01
03/10/18	0.00	4.59	2.45	6.00	0.00	13.04
03/11/18	0.00	4.58	2.47	6.00	0.00	13.04
03/12/18	0.00	4.51	2.45	6.00	0.00	12.96
03/13/18	0.00	4.53	2.41	6.00	0.00	12.94
03/14/18	0.00	4.60	2.46	6.00	0.00	13.06
03/15/18	0.00	4.51	2.44	6.00	0.00	12.95
03/16/18	0.00	4.48	2.43	6.00	0.00	12.91
03/17/18	0.00	4.43	2.46	6.00	0.00	12.89
03/18/18	0.00	4.42	2.51	6.00	0.00	12.92
03/19/18	0.00	4.43	2.51	6.00	0.00	12.94
03/20/18	0.00	4.43	2.44	6.00	0.00	12.87
03/21/18	0.00	4.44	2.38	6.00	0.00	12.82
03/22/18	0.00	4.40	2.40	6.00	0.00	12.80
03/23/18	0.00	4.35	2.40	6.00	0.00	12.75
03/24/18	0.00	4.46	2.42	6.00	0.00	12.88
03/25/18	0.00	4.59	2.47	6.00	0.00	13.06
03/26/18	0.00	4.56	2.48	6.00	0.00	13.04
03/27/18	0.00	4.54	2.43	6.00	0.00	12.97
03/28/18	0.00	4.53	2.41	6.00	0.00	12.94
03/29/18	0.00	4.56	2.36	6.00	0.00	12.92
03/30/18	0.00	4.54	2.36	6.00	0.00	12.90
03/31/18	0.00	4.47	2.39	6.00	0.00	12.86

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	Documented Virus Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
03/01/18	0.00	0.00	2.42	6.00	4.00	12.42
03/02/18	0.00	0.00	2.44	6.00	4.00	12.44
03/03/18	0.00	0.00	2.45	6.00	4.00	12.45
03/04/18	0.00	0.00	2.48	6.00	4.00	12.48
03/05/18	0.00	0.00	2.49	6.00	4.00	12.49
03/06/18	0.00	0.00	2.44	6.00	4.00	12.44
03/07/18	0.00	0.00	2.45	6.00	4.00	12.45
03/08/18	0.00	0.00	2.41	6.00	4.00	12.41
03/09/18	0.00	0.00	2.45	6.00	4.00	12.45
03/10/18	0.00	0.00	2.45	6.00	4.00	12.45
03/11/18	0.00	0.00	2.47	6.00	4.00	12.47
03/12/18	0.00	0.00	2.45	6.00	4.00	12.45
03/13/18	0.00	0.00	2.41	6.00	4.00	12.41
03/14/18	0.00	0.00	2.46	6.00	4.00	12.46
03/15/18	0.00	0.00	2.44	6.00	4.00	12.44
03/16/18	0.00	0.00	2.43	6.00	4.00	12.43
03/17/18	0.00	0.00	2.46	6.00	4.00	12.46
03/18/18	0.00	0.00	2.51	6.00	4.00	12.51
03/19/18	0.00	0.00	2.51	6.00	4.00	12.51
03/20/18	0.00	0.00	2.44	6.00	4.00	12.44
03/21/18	0.00	0.00	2.38	6.00	4.00	12.38
03/22/18	0.00	0.00	2.40	6.00	4.00	12.40
03/23/18	0.00	0.00	2.40	6.00	4.00	12.40
03/24/18	0.00	0.00	2.42	6.00	4.00	12.42
03/25/18	0.00	0.00	2.47	6.00	4.00	12.47
03/26/18	0.00	0.00	2.48	6.00	4.00	12.48
03/27/18	0.00	0.00	2.43	6.00	4.00	12.43
03/28/18	0.00	0.00	2.41	6.00	4.00	12.41
03/29/18	0.00	0.00	2.36	6.00	4.00	12.36
03/30/18	0.00	0.00	2.36	6.00	4.00	12.36
03/31/18	0.00	0.00	2.39	6.00	4.00	12.39

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
03/01/18	5.05	4.98	5.08	4.84	4.88	4.93	4.99	4.99	4.67	4.82	4.85	5.12	4.80	4.92	4.64	4.71
03/02/18	5.09	4.96	4.99	4.81	4.93	4.96	4.94	5.08	4.81	4.80	4.84	5.12	4.83	4.93	4.65	4.74
03/03/18	5.13	4.96	5.05	4.84	5.06	4.94	5.00	5.12	4.83	4.78	4.96	5.13	4.81	4.89	4.67	4.76
03/04/18	5.06	4.90	5.01	4.83	5.02	4.96	4.95	4.97	4.86	4.84	4.97	5.09	4.80	4.92	4.65	4.73
03/05/18	5.03	4.90	4.96	4.82	4.98	4.96	4.94	4.97	4.83	4.81	4.94	5.11	4.79	4.90	4.65	4.74
03/06/18	5.04	4.92	5.27	4.87	4.96	4.90	4.96	5.04	4.80	4.81	4.94	5.08	4.75	4.85	4.62	4.74
03/07/18	5.11	4.95	5.14	4.82	4.97	5.03	4.92	4.98	4.79	4.77	4.93	5.07	4.87	4.86	4.61	4.72
03/08/18	5.01	4.91	5.12	4.84	5.02	5.01	4.93	5.01	4.84	4.79	4.94	5.08	4.90	4.88	4.62	4.73
03/09/18	4.99	4.95	5.07	4.82	4.96	4.97	4.89	4.98	4.78	4.79	4.93	5.05	4.88	4.89	4.63	4.74
03/10/18	5.01	5.04	5.12	4.83	4.99	5.03	4.90	5.00	4.90	4.75	5.06	5.04	4.89	4.88	4.60	4.71
03/11/18	5.01	5.03	5.06	4.82	5.02	5.00	4.90	5.07	4.89	4.76	5.05	5.06	4.87	4.88	4.69	4.70
03/12/18	5.00	5.00	5.06	4.80	4.99	4.98	4.89	4.99	4.85	4.73	5.04	5.04	4.84	4.89	4.72	4.68
03/13/18	5.00	4.95	5.03	4.75	4.98	4.97	4.94	4.96	4.89	4.73	5.03	5.05	4.87	4.87	4.70	4.69
03/14/18	5.02	5.02	5.07	4.78	4.98	4.98	4.92	5.03	4.90	4.71	5.01	5.04	4.84	4.85	4.67	4.69
03/15/18	5.05	4.97	5.10	4.78	4.98	5.00	4.91	5.05	4.88	4.71	5.00	5.03	4.84	4.81	4.64	4.68
03/16/18	5.02	4.93	5.09	4.78	4.96	4.96	4.92	4.99	4.87	4.70	4.98	4.99	4.80	4.80	4.64	4.65
03/17/18	4.99	4.93	5.07	4.74	5.00	4.96	4.94	5.02	4.84	4.71	4.98	4.99	4.84	4.82	4.65	4.63
03/18/18	4.99	5.00	5.10	4.76	5.03	4.97	4.90	5.02	4.86	4.82	4.99	5.02	4.85	4.84	4.67	4.65
03/19/18	4.95	4.98	5.03	4.75	4.96	4.97	4.90	5.01	4.88	4.82	4.99	5.02	4.82	4.80	4.69	4.64
03/20/18	5.01	4.95	5.01	4.76	4.95	4.92	4.93	5.01	4.83	4.78	4.99	4.97	4.82	4.95	4.66	4.78
03/21/18	4.98	4.93	5.03	4.76	4.97	4.93	4.96	4.98	4.84	4.74	5.01	4.95	4.81	4.99	4.64	4.81
03/22/18	4.98	4.93	4.96	4.78	4.95	4.92	4.88	4.92	4.83	4.75	4.97	5.11	4.81	4.94	4.63	4.77
03/23/18	4.94	4.89	5.05	4.72	4.91	4.93	4.90	5.00	4.80	4.78	4.96	5.13	4.80	4.94	4.64	4.74
03/24/18	4.92	4.94	4.98	4.71	4.93	4.92	5.03	4.96	4.82	4.79	4.95	5.09	4.76	4.91	4.64	4.74
03/25/18	4.97	4.94	5.01	4.90	4.93	4.96	4.97	4.97	4.81	4.74	4.96	5.10	4.76	4.90	4.60	4.72
03/26/18	5.07	4.83	4.94	4.86	4.94	4.96	4.95	5.01	4.78	4.75	4.94	5.10	4.75	4.91	4.59	4.71
03/27/18	5.07	4.91	4.91	4.88	4.93	4.92	5.01	4.93	4.79	4.76	4.89	5.07	4.77	4.86	4.60	4.68
03/28/18	5.10	4.89	4.94	4.87	5.04	4.91	4.90	4.88	4.73	4.76	4.90	5.07	4.76	4.86	4.60	4.69
03/29/18	5.06	4.90	4.99	4.83	5.04	4.87	4.99	5.06	4.74	4.72	4.89	5.09	4.77	4.88	4.61	4.72
03/30/18	5.08	4.87	4.91	4.87	5.03	4.90	4.95	5.00	4.79	4.75	4.90	5.08	4.75	4.87	4.61	4.73
03/31/18	5.08	4.84	4.91	4.81	5.02	4.92	4.99	4.99	4.80	4.75	4.94	5.11	4.75	4.84	4.61	4.70

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
03/01/18	4.78	4.69	4.94	4.64	4.83	4.72	4.88	4.81	4.99	4.97	4.89	4.90	5.02	4.82	4.83	4.90
03/02/18	4.79	4.70	5.00	4.62	4.82	4.75	4.79	4.88	4.97	5.00	4.85	4.92	5.00	4.81	4.84	4.93
03/03/18	4.76	4.71	4.93	4.64	4.80	4.74	4.76	4.86	4.96	5.00	4.83	4.95	5.02	4.85	4.84	4.91
03/04/18	4.75	4.68	4.92	4.66	4.81	4.74	4.77	4.86	4.94	5.03	4.81	4.93	4.99	4.83	4.85	4.92
03/05/18	4.75	4.67	4.91	4.73	4.82	4.70	4.78	4.85	4.93	5.05	4.83	4.94	4.97	4.81	4.89	4.89
03/06/18	4.75	4.79	4.89	4.76	4.81	4.64	4.76	4.81	4.93	5.04	4.81	4.91	4.99	4.84	4.97	4.90
03/07/18	4.74	4.81	4.87	4.75	4.79	4.67	4.73	4.78	4.98	5.03	4.79	4.88	5.00	4.88	4.97	4.98
03/08/18	4.74	4.77	4.86	4.71	4.78	4.69	4.74	4.78	5.04	5.07	4.84	4.91	4.99	4.86	4.95	5.07
03/09/18	4.74	4.79	4.85	4.69	4.76	4.70	4.74	4.81	5.05	5.10	4.83	4.90	4.94	4.91	4.92	5.06
03/10/18	4.73	4.81	4.85	4.73	4.76	4.70	4.75	4.80	5.06	5.07	4.82	4.96	4.95	4.89	4.91	5.01
03/11/18	4.71	4.77	4.84	4.70	4.75	4.70	4.73	4.78	5.02	5.04	4.80	5.06	4.97	4.89	4.87	4.96
03/12/18	4.71	4.76	4.83	4.64	4.73	4.67	4.72	4.79	5.03	5.00	4.82	5.01	4.98	4.87	4.86	4.96
03/13/18	4.67	4.75	4.83	4.64	4.73	4.65	4.69	4.80	5.03	5.00	4.86	4.98	5.01	4.85	4.92	5.00
03/14/18	4.65	4.72	4.78	4.64	4.71	4.63	4.65	4.77	5.01	4.99	4.84	4.93	5.06	4.85	4.92	4.97
03/15/18	4.68	4.73	4.79	4.66	4.70	4.60	4.65	4.74	4.97	4.95	4.85	4.95	5.05	4.85	4.89	4.94
03/16/18	4.66	4.73	4.81	4.66	4.70	4.61	4.67	4.74	4.99	4.94	4.85	4.96	4.99	4.85	4.84	4.96
03/17/18	4.65	4.71	4.81	4.64	4.67	4.61	4.67	4.73	4.98	4.95	4.83	4.91	5.03	4.85	4.84	4.99
03/18/18	4.66	4.71	4.78	4.65	4.63	4.63	4.68	4.73	4.97	4.95	4.85	4.88	5.07	4.86	4.86	4.99
03/19/18	4.66	4.71	4.78	4.64	4.65	4.63	4.65	4.72	5.02	4.97	4.84	4.92	5.02	4.86	4.87	4.97
03/20/18	4.64	4.72	4.76	4.61	4.66	4.60	4.63	4.70	5.02	4.98	4.85	4.94	5.01	4.85	4.86	4.97
03/21/18	4.63	4.67	4.75	4.61	4.64	4.56	4.63	4.68	5.01	4.98	4.85	4.93	5.06	4.82	4.84	5.00
03/22/18	4.62	4.65	4.72	4.62	4.63	4.55	4.60	4.67	4.99	4.98	4.83	4.96	5.06	4.83	4.81	4.97
03/23/18	4.63	4.67	4.73	4.60	4.65	4.57	4.59	4.67	4.97	4.98	4.82	4.95	5.03	4.83	4.84	4.95
03/24/18	4.75	4.66	4.75	4.60	4.81	4.57	4.60	4.67	4.97	4.94	4.84	4.91	5.01	4.80	4.85	4.94
03/25/18	4.80	4.63	4.74	4.61	4.87	4.67	4.59	4.67	4.95	4.91	4.84	4.92	4.98	4.80	4.81	4.89
03/26/18	4.77	4.62	4.71	4.56	4.81	4.72	4.68	4.79	4.92	4.87	4.81	4.94	4.97	4.82	4.81	4.94
03/27/18	4.76	4.63	4.86	4.54	4.82	4.69	4.73	4.95	4.92	4.87	4.81	4.92	4.97	4.78	4.82	4.91
03/28/18	4.73	4.62	4.92	4.53	4.78	4.68	4.71	4.89	4.94	4.89	4.79	4.90	4.97	4.77	4.81	4.90
03/29/18	4.72	4.58	4.87	4.56	4.77	4.70	4.78	4.86	4.95	4.92	4.78	4.89	5.01	4.76	4.82	4.87
03/30/18	4.72	4.59	4.88	4.54	4.81	4.68	4.79	4.84	4.94	4.99	4.79	4.88	5.01	4.77	4.87	4.88
03/31/18	4.72	4.76	4.88	4.65	4.79	4.65	4.74	4.83	4.92	4.94	4.77	4.87	5.00	4.83	4.99	4.88

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	MicroFiltration Process online monitoring results Log Removal Value															
	E01	**E02**	**E03**	**E04**												
	LRV	LRV	LRV	LRV												
03/01/18	4.93	4.95	4.65	4.70												
03/02/18	4.89	4.97	4.66	4.74												
03/03/18	4.89	4.97	4.66	4.72												
03/04/18	4.88	4.96	4.67	4.69												
03/05/18	4.86	4.96	4.67	4.67												
03/06/18	4.86	5.00	4.65	4.65												
03/07/18	4.81	4.95	4.63	4.66												
03/08/18	4.86	4.90	4.57	4.65												
03/09/18	4.85	4.96	4.56	4.58												
03/10/18	4.87	4.96	4.59	4.61												
03/11/18	4.93	4.90	4.58	4.63												
03/12/18	4.91	4.91	4.51	4.68												
03/13/18	4.89	4.91	4.53	4.84												
03/14/18	4.92	4.90	4.60	4.83												
03/15/18	4.94	4.86	4.51	4.78												
03/16/18	4.93	4.85	4.48	4.73												
03/17/18	4.91	4.90	4.43	4.70												
03/18/18	4.89	4.88	4.42	4.71												
03/19/18	4.90	4.84	4.43	4.67												
03/20/18	4.89	4.87	4.43	4.71												
03/21/18	4.92	4.90	4.44	4.73												
03/22/18	4.95	5.03	4.40	4.68												
03/23/18	4.94	5.04	4.35	4.63												
03/24/18	4.87	5.01	4.46	4.71												
03/25/18	4.91	4.96	4.72	4.66												
03/26/18	4.89	4.97	4.66	4.60												
03/27/18	4.91	4.99	4.57	4.66												
03/28/18	4.87	4.97	4.56	4.63												
03/29/18	4.86	4.98	4.56	4.59												
03/30/18	4.87	4.98	4.55	4.59												
03/31/18	4.87	4.98	4.47	4.59												

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Effluent Turbidity - NTU

Date	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
03/01/18	0.07	0.09	0.12	0.17	0.08	0.09	0.11	0.11	0.08	0.12	0.10	0.14	0.07	0.08	0.12	0.13	0.05	0.05	0.09
03/02/18	0.07	0.08	0.11	0.12	0.08	0.08	0.11	0.11	0.07	0.09	0.08	0.09	0.07	0.08	0.12	0.12	0.05	0.05	0.08
03/03/18	0.07	0.08	0.11	0.13	0.08	0.08	0.11	0.11	0.07	0.08	0.09	0.09	0.06	0.08	0.11	0.12	0.05	0.08	0.08
03/04/18	0.08	0.09	0.11	0.12	0.08	0.09	0.11	0.12	0.07	0.08	0.10	0.11	0.06	0.06	0.11	0.11	0.05	0.07	0.09
03/05/18	0.09	0.11	0.12	0.24	0.09	0.09	0.12	0.12	0.08	0.09	0.11	0.12	0.06	0.06	0.12	0.12	0.05	0.06	0.09
03/06/18	0.08	0.09	0.12	0.14	0.08	0.09	0.12	0.12	0.09	0.10	0.12	0.13	0.06	0.06	0.12	0.12	0.05	0.06	0.09
03/07/18	0.07	0.09	0.09	0.12	0.09	0.09	0.10	0.12	0.09	0.10	0.13	0.13	0.06	0.08	0.12	0.15	0.05	0.07	0.09
03/08/18	0.06	0.07	0.06	0.07	0.09	0.09	0.11	0.11	0.10	0.10	0.13	0.14	0.06	0.07	0.12	0.12	0.05	0.06	0.09
03/09/18	0.07	0.08	0.07	0.07	0.09	0.10	0.11	0.11	0.10	0.12	0.14	0.15	0.06	0.06	0.12	0.12	0.05	0.06	0.09
03/10/18	0.07	0.08	0.07	0.07	0.09	0.11	0.11	0.11	0.11	0.12	0.14	0.15	0.06	0.07	0.12	0.12	0.05	0.06	0.09
03/11/18	0.07	0.08	0.07	0.07	0.09	0.09	0.11	0.11	0.11	0.11	0.14	0.15	0.06	0.07	0.12	0.12	0.05	0.05	0.09
03/12/18	0.08	0.09	0.08	0.08	0.09	0.09	0.11	0.11	0.11	0.12	0.15	0.15	0.06	0.07	0.12	0.13	0.05	0.09	0.09
03/13/18	0.09	0.09	0.08	0.09	0.09	0.09	0.11	0.11	0.11	0.13	0.15	0.15	0.06	0.07	0.12	0.13	0.05	0.07	0.10
03/14/18	0.09	0.09	0.08	0.08	0.09	0.09	0.11	0.11	0.12	0.12	0.15	0.16	0.06	0.07	0.12	0.12	0.05	0.05	0.10
03/15/18	0.07	0.09	0.08	0.12	0.09	0.09	0.10	0.11	0.11	0.12	0.15	0.16	0.06	0.08	0.12	0.13	0.05	0.06	0.09
03/16/18	0.07	0.07	0.08	0.09	0.09	0.09	0.10	0.11	0.11	0.12	0.16	0.16	0.06	0.07	0.12	0.12	0.05	0.11	0.09
03/17/18	0.08	0.09	0.08	0.10	0.09	0.10	0.10	0.11	0.12	0.12	0.16	0.16	0.06	0.07	0.12	0.13	0.05	0.06	0.10
03/18/18	0.09	0.10	0.09	0.10	0.09	0.10	0.11	0.11	0.12	0.12	0.16	0.17	0.06	0.07	0.13	0.13	0.05	0.05	0.10
03/19/18	0.10	0.11	0.10	0.12	0.10	0.10	0.11	0.11	0.12	0.14	0.16	0.16	0.06	0.07	0.13	0.13	0.05	0.05	0.10
03/20/18	0.09	0.10	0.09	0.11	0.09	0.10	0.11	0.11	0.09	0.12	0.11	0.16	0.06	0.06	0.13	0.13	0.05	0.05	0.09
03/21/18	0.09	0.09	0.10	0.11	0.09	0.09	0.10	0.11	0.06	0.07	0.07	0.07	0.07	0.08	0.09	0.13	0.04	0.05	0.08
03/22/18	0.09	0.09	0.10	0.10	0.09	0.09	0.10	0.11	0.05	0.07	0.07	0.08	0.06	0.07	0.06	0.07	0.04	0.06	0.07
03/23/18	0.08	0.10	0.09	0.12	0.09	0.09	0.09	0.10	0.05	0.07	0.07	0.07	0.06	0.07	0.06	0.07	0.04	0.06	0.07
03/24/18	0.08	0.09	0.10	0.10	0.09	0.09	0.08	0.09	0.06	0.06	0.07	0.08	0.07	0.07	0.07	0.07	0.04	0.05	0.07
03/25/18	0.09	0.10	0.10	0.11	0.09	0.10	0.08	0.09	0.06	0.07	0.07	0.08	0.06	0.08	0.07	0.07	0.05	0.06	0.08
03/26/18	0.10	0.11	0.11	0.11	0.10	0.10	0.09	0.09	0.06	0.07	0.08	0.11	0.06	0.07	0.07	0.07	0.05	0.05	0.08
03/27/18	0.10	0.11	0.11	0.11	0.09	0.10	0.09	0.09	0.06	0.09	0.08	0.10	0.07	0.08	0.07	0.07	0.05	0.07	0.08
03/28/18	0.09	0.10	0.11	0.12	0.09	0.10	0.08	0.09	0.06	0.08	0.08	0.09	0.06	0.08	0.07	0.13	0.05	0.07	0.08
03/29/18	0.10	0.10	0.11	0.13	0.09	0.10	0.08	0.09	0.06	0.07	0.08	0.10	0.06	0.07	0.07	0.07	0.05	0.06	0.08
03/30/18	0.10	0.10	0.11	0.11	0.09	0.10	0.08	0.09	0.07	0.07	0.08	0.08	0.07	0.08	0.07	0.08	0.05	0.06	0.08
03/31/18	0.10	0.10	0.11	0.12	0.09	0.10	0.09	0.09	0.08	0.08	0.09	0.09	0.07	0.07	0.08	0.08	0.05	0.06	0.08

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Reverse Osmosis Process online monitoring results																		
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)						Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	ROP		ROF			ROP			ROF			ROP						
	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
03/01/18	0.041	0.041	8.642	8.073	9.518	0.033	0.031	0.038	1,806	1,732	1,860	29	26	33	99.62	2.42	98.37	1.79
03/02/18	0.040	0.042	8.663	8.088	9.451	0.032	0.029	0.037	1,802	1,745	1,870	29	27	32	99.63	2.44	98.39	1.79
03/03/18	0.039	0.040	8.861	8.247	9.503	0.031	0.029	0.036	1,772	1,725	1,846	29	27	32	99.65	2.45	98.35	1.78
03/04/18	0.040	0.040	8.799	8.171	9.571	0.029	0.025	0.033	1,689	1,637	1,766	28	25	31	99.67	2.48	98.36	1.78
03/05/18	0.038	0.039	8.580	7.987	9.284	0.028	0.024	0.034	1,597	1,514	1,711	27	25	29	99.67	2.49	98.33	1.78
03/06/18	0.038	0.039	8.642	6.639	9.446	0.032	0.028	0.036	1,712	1,620	1,827	28	25	31	99.64	2.44	98.39	1.79
03/07/18	0.040	0.041	8.602	8.026	9.426	0.030	0.027	0.033	1,775	1,708	1,865	29	26	33	99.65	2.45	98.35	1.78
03/08/18	0.041	0.041	8.543	7.976	9.159	0.033	0.028	0.036	1,816	1,726	1,900	31	27	36	99.61	2.41	98.31	1.77
03/09/18	0.038	0.040	8.514	7.923	9.286	0.031	0.026	0.035	1,817	1,721	1,896	30	27	34	99.64	2.45	98.32	1.78
03/10/18	0.039	0.040	8.797	8.372	9.345	0.031	0.027	0.036	1,787	1,724	1,853	31	29	34	99.64	2.45	98.24	1.75
03/11/18	0.038	0.039	8.806	8.113	9.417	0.030	0.028	0.033	1,623	1,560	1,699	27	25	30	99.66	2.47	98.31	1.77
03/12/18	0.037	0.039	8.793	8.263	9.491	0.031	0.028	0.035	1,572	1,466	1,744	27	23	32	99.64	2.45	98.30	1.77
03/13/18	0.037	0.038	8.699	8.231	9.434	0.034	0.031	0.038	1,733	1,647	1,872	30	27	35	99.61	2.41	98.26	1.76
03/14/18	0.036	0.037	8.586	8.100	9.126	0.030	0.028	0.034	1,813	1,762	1,855	32	29	34	99.65	2.46	98.24	1.75
03/15/18	0.036	0.036	8.329	7.837	8.892	0.030	0.026	0.036	1,781	1,711	1,845	31	27	33	99.64	2.44	98.28	1.76
03/16/18	0.034	0.035	8.589	8.162	9.132	0.032	0.028	0.036	1,790	1,718	1,881	32	29	35	99.63	2.43	98.24	1.75
03/17/18	0.029	0.033	8.598	8.057	9.103	0.030	0.027	0.033	1,779	1,719	1,844	31	29	34	99.65	2.46	98.25	1.76
03/18/18	0.026	0.031	8.403	7.805	9.143	0.026	0.023	0.029	1,629	1,557	1,694	29	25	31	99.69	2.51	98.25	1.76
03/19/18	0.037	0.038	8.299	7.700	8.905	0.026	0.021	0.032	1,587	1,491	1,744	28	25	32	99.69	2.51	98.22	1.75
03/20/18	0.033	0.039	8.528	7.980	9.158	0.031	0.027	0.038	1,745	1,644	1,924	31	27	37	99.64	2.44	98.24	1.75
03/21/18	0.031	0.034	8.706	7.858	9.747	0.036	0.030	0.047	1,864	1,823	1,912	33	30	38	99.58	2.38	98.22	1.75
03/22/18	0.030	0.032	8.204	7.715	8.881	0.033	0.029	0.038	1,839	1,781	1,910	33	30	37	99.60	2.40	98.20	1.74
03/23/18	0.026	0.033	8.132	7.511	9.008	0.033	0.029	0.036	1,814	1,735	1,895	33	30	37	99.60	2.40	98.19	1.74
03/24/18	0.035	0.036	8.055	7.520	8.565	0.031	0.028	0.036	1,813	1,762	1,879	34	31	37	99.62	2.42	98.15	1.73
03/25/18	0.036	0.036	7.716	7.176	8.447	0.026	0.023	0.030	1,717	1,652	1,778	31	28	34	99.66	2.47	98.19	1.74
03/26/18	0.036	0.037	7.688	7.213	8.355	0.026	0.022	0.031	1,619	1,522	1,734	29	26	34	99.67	2.48	98.20	1.74
03/27/18	0.037	0.037	7.956	7.465	8.616	0.030	0.025	0.033	1,733	1,653	1,844	31	27	34	99.63	2.43	98.24	1.75
03/28/18	0.037	0.037	8.006	7.434	8.848	0.031	0.028	0.037	1,817	1,754	1,888	32	29	36	99.61	2.41	98.23	1.75
03/29/18	0.037	0.038	7.933	7.403	8.671	0.035	0.032	0.041	1,790	1,726	1,863	33	30	56	99.56	2.36	98.14	1.73
03/30/18	0.037	0.037	7.905	7.478	8.764	0.035	0.032	0.037	1,790	1,717	1,885	32	29	36	99.56	2.36	98.20	1.74
03/31/18	0.036	0.037	8.010	7.422	8.703	0.033	0.030	0.036	1,763	1,716	1,831	31	29	36	99.59	2.39	98.21	1.75

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	UltraViolet / AOP Process online monitoring results UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
03/01/18	97.90	99.707	25,256.4	0.25	3.0	6
03/02/18	97.90	99.948	25,001.0	0.25	3.0	6
03/03/18	98.06	95.647	23,980.7	0.25	3.0	6
03/04/18	98.09	95.030	24,074.9	0.25	3.0	6
03/05/18	97.95	94.412	24,184.5	0.26	3.0	6
03/06/18	97.88	96.817	24,904.9	0.26	3.0	6
03/07/18	98.14	99.913	25,267.1	0.25	3.0	6
03/08/18	98.10	94.633	23,482.4	0.25	3.0	6
03/09/18	97.90	97.109	24,471.2	0.25	3.0	6
03/10/18	98.22	96.504	24,478.0	0.25	3.0	6
03/11/18	98.34	92.770	23,444.0	0.25	3.0	6
03/12/18	98.25	95.905	24,220.3	0.25	3.0	6
03/13/18	97.78	97.912	24,771.0	0.25	3.0	6
03/14/18	97.97	99.485	25,160.5	0.25	3.0	6
03/15/18	97.72	99.510	25,157.0	0.25	3.0	6
03/16/18	97.40	100.195	25,190.9	0.25	3.0	6
03/17/18	97.58	99.306	24,998.4	0.25	3.0	6
03/18/18	97.60	97.716	24,841.5	0.25	3.0	6
03/19/18	97.43	96.654	24,419.7	0.25	3.0	6
03/20/18	97.67	99.497	25,013.7	0.25	3.0	6
03/21/18	97.70	95.545	24,116.7	0.25	3.0	6
03/22/18	98.04	95.738	24,175.4	0.25	3.0	6
03/23/18	98.12	99.269	25,176.7	0.25	3.0	6
03/24/18	98.16	95.734	24,805.2	0.26	3.0	6
03/25/18	98.26	94.760	23,935.5	0.25	3.0	6
03/26/18	98.04	95.776	24,289.6	0.25	3.0	6
03/27/18	98.02	97.177	24,860.9	0.26	3.0	6
03/28/18	98.05	99.406	25,418.8	0.26	3.0	6
03/29/18	98.07	97.317	24,825.9	0.26	3.0	6
03/30/18	98.05	93.342	23,770.4	0.25	3.0	6
03/31/18	98.31	97.263	24,323.7	0.25	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	MFE NTU		ROP NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
04/01/18	12.94	12.94	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/02/18	13.01	13.01	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/03/18	12.93	12.93	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/04/18	12.79	12.79	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/05/18	12.73	12.73	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/06/18	12.69	12.69	12.27	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/07/18	12.72	12.72	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/08/18	12.79	12.79	12.37	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/09/18	10.20 (3)	10.20 (3)	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	N/A (3)	N/A (3)	12.27	N/A (3)	N/A (3)	Y	0.0	0.0	0.0	0.0	0.0
04/12/18	12.76	12.76	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/13/18	12.74	12.74	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/14/18	12.73	12.73	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/15/18	12.76	12.76	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/16/18	12.70	12.70	12.38	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/17/18	12.72	12.72	12.34	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/18/18	12.71	12.71	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/19/18	12.70	12.70	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/20/18	12.69	12.69	12.34	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/21/18	12.77	12.77	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/22/18	12.89	12.89	12.34	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/23/18	12.91	12.91	12.37	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/24/18	12.88	12.88	12.34	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/25/18	12.84	12.84	12.33	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/26/18	12.81	12.81	12.30	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/27/18	12.78	12.78	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/28/18	12.87	12.87	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/29/18	12.87	12.87	12.39	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/30/18	12.83	12.83	12.40	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.
2. GWRS plant offline for routine maintenance activities
3. GWRS plant only online for part of the day due to routine maintenance activity & process controller upgrades, resulting in some or all cell PDT values not being available for the day. Turbidity and other operational data used to determine MF process running normally with no membrane integrity issues.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
04/01/18	0.00	4.53	2.41	6.00	0.00	12.94
04/02/18	0.00	4.58	2.43	6.00	0.00	13.01
04/03/18	0.00	4.57	2.36	6.00	0.00	12.93
04/04/18	0.00	4.52	2.27	6.00	0.00	12.79
04/05/18	0.00	4.42	2.31	6.00	0.00	12.73
04/06/18	0.00	4.42	2.27	6.00	0.00	12.69
04/07/18	0.00	4.43	2.29	6.00	0.00	12.72
04/08/18	0.00	4.42	2.37	6.00	0.00	12.79
04/09/18	0.00	1.75 (3)	2.45	6.00	0.00	10.20
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	0.00	0.59	2.27	6.00	0.00	8.86
04/12/18	0.00	4.47	2.29	6.00	0.00	12.76
04/13/18	0.00	4.42	2.32	6.00	0.00	12.74
04/14/18	0.00	4.44	2.28	6.00	0.00	12.73
04/15/18	0.00	4.44	2.32	6.00	0.00	12.76
04/16/18	0.00	4.31	2.38	6.00	0.00	12.70
04/17/18	0.00	4.38	2.34	6.00	0.00	12.72
04/18/18	0.00	4.39	2.32	6.00	0.00	12.71
04/19/18	0.00	4.39	2.31	6.00	0.00	12.70
04/20/18	0.00	4.35	2.34	6.00	0.00	12.69
04/21/18	0.00	4.45	2.32	6.00	0.00	12.77
04/22/18	0.00	4.55	2.34	6.00	0.00	12.89
04/23/18	0.00	4.55	2.37	6.00	0.00	12.91
04/24/18	0.00	4.54	2.34	6.00	0.00	12.88
04/25/18	0.00	4.51	2.33	6.00	0.00	12.84
04/26/18	0.00	4.50	2.30	6.00	0.00	12.81
04/27/18	0.00	4.48	2.31	6.00	0.00	12.78
04/28/18	0.00	4.51	2.35	6.00	0.00	12.87
04/29/18	0.00	4.48	2.39	6.00	0.00	12.87
04/30/18	0.00	4.43	2.40	6.00	0.00	12.83

Notes:

2. GWRS plant offline for routine maintenance activities
3. GWRS plant only online for part of the day due to routine maintenance activity & process controller upgrades, resulting in some or all cell PDT values not being available for the day. Turbidity and other operational data used to determine MF process running normally with no membrane integrity issues.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	Documented Virus Reduction Achieved					
Date	OCSD LRV	$MF+Cl_2$ LRV	RO LRV	UV/AOP LRV	Underground travel time (1) LRV	Total LRV
04/01/18	0.00	0.00	2.41	6.00	4.00	12.41
04/02/18	0.00	0.00	2.43	6.00	4.00	12.43
04/03/18	0.00	0.00	2.36	6.00	4.00	12.36
04/04/18	0.00	0.00	2.27	6.00	4.00	12.27
04/05/18	0.00	0.00	2.31	6.00	4.00	12.31
04/06/18	0.00	0.00	2.27	6.00	4.00	12.27
04/07/18	0.00	0.00	2.29	6.00	4.00	12.29
04/08/18	0.00	0.00	2.37	6.00	4.00	12.37
04/09/18	0.00	0.00	2.45	6.00	4.00	12.45
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	0.00	0.00	2.27	6.00	4.00	12.27
04/12/18	0.00	0.00	2.29	6.00	4.00	12.29
04/13/18	0.00	0.00	2.32	6.00	4.00	12.32
04/14/18	0.00	0.00	2.28	6.00	4.00	12.28
04/15/18	0.00	0.00	2.32	6.00	4.00	12.32
04/16/18	0.00	0.00	2.38	6.00	4.00	12.38
04/17/18	0.00	0.00	2.34	6.00	4.00	12.34
04/18/18	0.00	0.00	2.32	6.00	4.00	12.32
04/19/18	0.00	0.00	2.31	6.00	4.00	12.31
04/20/18	0.00	0.00	2.34	6.00	4.00	12.34
04/21/18	0.00	0.00	2.32	6.00	4.00	12.32
04/22/18	0.00	0.00	2.34	6.00	4.00	12.34
04/23/18	0.00	0.00	2.37	6.00	4.00	12.37
04/24/18	0.00	0.00	2.34	6.00	4.00	12.34
04/25/18	0.00	0.00	2.33	6.00	4.00	12.33
04/26/18	0.00	0.00	2.30	6.00	4.00	12.30
04/27/18	0.00	0.00	2.31	6.00	4.00	12.31
04/28/18	0.00	0.00	2.35	6.00	4.00	12.35
04/29/18	0.00	0.00	2.39	6.00	4.00	12.39
04/30/18	0.00	0.00	2.40	6.00	4.00	12.40

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.
2. GWRS plant offline for routine maintenance activities

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
04/01/18	5.03	4.86	5.09	4.81	5.04	5.10	4.98	5.02	4.77	4.73	4.92	5.06	4.70	4.84	4.60	4.69
04/02/18	4.95	4.82	5.16	4.80	5.01	5.00	4.95	5.04	4.74	4.71	4.91	5.02	4.87	4.87	4.59	4.68
04/03/18	5.02	4.84	5.08	4.78	4.99	5.00	4.94	4.99	4.76	4.69	4.90	5.04	4.87	4.81	4.58	4.68
04/04/18	5.01	5.10	5.03	4.80	5.02	4.98	4.98	4.97	4.93	4.72	4.88	5.01	4.83	4.82	4.54	4.64
04/05/18	4.99	5.01	5.01	4.73	4.98	4.96	4.93	4.97	4.87	4.64	5.06	4.97	4.82	4.82	4.52	4.64
04/06/18	4.98	5.01	5.01	4.83	5.02	4.93	4.97	4.99	4.85	4.68	5.05	5.00	4.80	4.79	4.62	4.64
04/07/18	4.95	4.94	5.09	4.73	5.00	4.95	4.93	4.96	4.85	4.68	4.99	4.99	4.82	4.79	4.68	4.61
04/08/18	4.99	4.99	5.04	4.78	4.98	4.95	4.96	5.00	4.88	4.68	4.98	5.02	4.84	4.78	4.66	4.63
04/09/18	5.04	5.04	5.07	4.78	5.03	5.00	4.99	5.00	4.89	4.69	4.98	5.04	4.85	4.77	4.65	4.65
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)
04/12/18	5.02	5.01	4.99	4.79	5.03	5.02	4.89	5.01	4.88	4.66	4.98	5.01	4.82	4.80	4.66	4.63
04/13/18	4.97	4.97	5.05	4.78	5.01	4.97	4.91	5.01	4.84	4.65	4.98	5.01	4.78	4.75	4.63	4.62
04/14/18	4.92	4.95	5.01	4.80	5.03	4.93	4.95	4.97	4.85	4.64	4.99	5.00	4.77	4.78	4.62	4.64
04/15/18	4.97	4.95	5.01	4.75	5.01	4.95	4.90	4.93	4.88	4.68	4.98	5.00	4.78	4.79	4.64	4.61
04/16/18	4.98	5.00	4.96	4.77	4.98	4.94	4.96	4.91	4.84	4.74	4.99	5.02	4.78	4.74	4.62	4.61
04/17/18	4.96	4.92	4.96	4.65	4.95	4.91	4.91	4.92	4.81	4.75	4.94	4.92	4.79	4.95	4.60	4.61
04/18/18	4.94	4.92	4.96	4.75	4.86	4.90	4.87	4.89	4.80	4.74	4.96	4.92	4.80	4.91	4.61	4.70
04/19/18	4.97	4.93	4.94	4.65	4.92	4.93	4.94	4.88	4.78	4.76	4.98	5.10	4.79	4.91	4.60	4.73
04/20/18	4.93	4.94	5.00	4.73	4.91	4.94	4.87	4.93	4.69	4.77	4.99	5.13	4.76	4.88	4.60	4.71
04/21/18	4.97	4.92	4.96	4.70	4.90	4.91	4.93	4.97	4.73	4.78	4.97	5.10	4.76	4.86	4.61	4.72
04/22/18	4.95	4.91	4.95	4.95	4.89	4.94	5.00	4.94	4.68	4.70	4.94	5.10	4.72	4.87	4.59	4.71
04/23/18	5.10	4.89	4.99	4.93	4.92	4.95	5.00	4.98	4.64	4.73	4.93	5.08	4.73	4.86	4.58	4.70
04/24/18	5.13	4.86	4.88	4.88	4.96	4.89	4.97	4.94	4.59	4.76	4.93	5.09	4.75	4.80	4.57	4.68
04/25/18	5.08	4.85	4.90	4.84	5.01	4.89	5.05	4.93	4.63	4.73	4.93	5.09	4.75	4.84	4.57	4.66
04/26/18	5.06	4.85	4.89	4.84	4.97	4.94	5.04	5.04	4.60	4.67	4.95	5.03	4.71	4.87	4.53	4.67
04/27/18	5.00	4.83	4.89	4.84	5.00	4.88	5.02	5.05	4.56	4.67	4.90	5.03	4.69	4.89	4.54	4.70
04/28/18	5.03	4.87	4.79	4.88	4.97	4.90	5.01	5.06	4.51	4.72	4.91	5.01	4.67	4.83	4.54	4.70
04/29/18	5.02	4.86	4.75	4.80	4.97	5.13	4.95	5.02	4.48	4.72	4.83	4.98	4.69	4.84	4.51	4.70
04/30/18	5.03	4.83	5.07	4.74	4.96	5.05	4.98	5.02	4.49	4.68	4.82	5.01	4.68	4.85	4.52	4.69

Notes: Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

2. GWRS plant offline for routine maintenance activities

3. GWRS plant only online for part of the day due to routine maintenance and process controller upgrades, resulting in some or all cell PDT value not being available for the day.

Turbidity and other operational data used to determine MF process running normally with no membrane integrity issues.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
04/01/18	4.72	4.87	4.87	4.75	4.77	4.66	4.71	4.83	4.94	4.93	4.74	4.85	5.00	4.92	4.93	4.99
04/02/18	4.70	4.85	4.87	4.77	4.76	4.67	4.71	4.84	4.97	4.92	4.75	4.85	4.98	4.84	4.89	5.18
04/03/18	4.70	4.78	4.84	4.72	4.74	4.64	4.70	4.82	4.98	4.86	4.75	4.84	4.97	4.82	4.86	4.99
04/04/18	4.70	4.71	4.81	4.66	4.72	4.63	4.66	4.74	4.96	4.87	4.77	4.82	4.91	4.82	4.86	4.96
04/05/18	4.66	4.70	4.80	4.66	4.71	4.58	4.66	4.72	4.98	4.88	4.75	4.89	4.88	4.81	4.87	4.97
04/06/18	4.66	4.73	4.77	4.63	4.69	4.59	4.64	4.72	5.04	4.88	4.72	4.96	4.90	4.79	4.88	4.98
04/07/18	4.65	4.70	4.77	4.64	4.67	4.60	4.62	4.74	5.05	4.88	4.74	4.93	4.92	4.84	4.84	4.97
04/08/18	4.64	4.72	4.80	4.66	4.68	4.57	4.64	4.76	5.01	4.87	4.80	4.93	5.00	4.80	4.81	4.92
04/09/18	4.64	4.75	4.80	4.65	4.69	4.57	4.68	4.75	5.01	4.89	4.80	4.96	5.09	4.78	4.83	4.98
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)
04/12/18	4.67	4.76	4.80	4.66	4.72	4.60	4.63	4.74	5.14	4.88	4.85	4.92	5.15	4.87	4.85	5.04
04/13/18	4.65	4.71	4.77	4.64	4.65	4.60	4.61	4.75	5.06	4.79	4.82	4.91	5.12	4.85	4.85	5.01
04/14/18	4.65	4.70	4.73	4.66	4.64	4.58	4.62	4.74	5.05	4.86	4.82	4.97	5.08	4.80	4.90	4.99
04/15/18	4.65	4.70	4.74	4.66	4.63	4.58	4.65	4.72	5.02	4.86	4.83	4.97	5.07	4.83	4.91	5.00
04/16/18	4.64	4.71	4.77	4.62	4.65	4.55	4.63	4.72	5.03	4.75	4.80	4.89	5.05	4.83	4.85	4.94
04/17/18	4.63	4.67	4.75	4.62	4.63	4.53	4.59	4.71	5.04	4.76	4.79	4.89	5.03	4.82	4.80	4.94
04/18/18	4.62	4.63	4.73	4.62	4.60	4.51	4.53	4.65	4.99	4.78	4.79	4.93	4.99	4.79	4.85	4.95
04/19/18	4.61	4.67	4.70	4.59	4.61	4.48	4.55	4.64	4.98	4.77	4.75	4.90	5.06	4.77	4.85	4.99
04/20/18	4.61	4.68	4.68	4.56	4.61	4.50	4.57	4.66	5.00	4.73	4.79	4.89	5.09	4.75	4.81	4.95
04/21/18	4.62	4.69	4.69	4.57	4.59	4.53	4.56	4.68	5.00	4.71	4.79	4.89	5.08	4.77	4.79	4.93
04/22/18	4.73	4.67	4.71	4.58	4.75	4.67	4.55	4.67	4.95	4.74	4.79	4.90	5.08	4.77	4.76	4.91
04/23/18	4.77	4.64	4.72	4.58	4.87	4.76	4.65	4.62	4.95	4.72	4.77	4.91	5.08	4.75	4.74	4.90
04/24/18	4.73	4.61	4.88	4.54	4.77	4.71	4.70	4.75	4.98	4.66	4.75	4.88	5.04	4.75	4.79	4.89
04/25/18	4.74	4.58	4.93	4.51	4.74	4.66	4.67	4.89	4.98	4.68	4.75	4.82	5.02	4.75	4.77	4.87
04/26/18	4.75	4.55	4.88	4.50	4.77	4.64	4.68	4.85	4.96	4.77	4.76	4.78	5.03	4.75	4.77	4.87
04/27/18	4.74	4.58	4.87	4.48	4.78	4.65	4.70	4.82	4.98	4.81	4.74	4.80	4.99	4.73	4.75	4.85
04/28/18	4.73	4.67	4.85	4.67	4.77	4.64	4.71	4.82	4.96	4.73	4.71	4.83	4.95	4.80	4.79	4.81
04/29/18	4.69	4.86	4.82	4.78	4.73	4.62	4.68	4.76	4.91	4.75	4.72	4.85	4.98	4.90	4.87	4.90
04/30/18	4.68	4.84	4.84	4.75	4.70	4.62	4.66	4.71	5.01	4.81	4.72	4.80	5.02	4.86	4.87	5.03

Notes: Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

2. GWRS plant offline for routine maintenance activities

3. GWRS plant only online for part of the day due to routine maintenance and process controller upgrades, resulting in some or all cell PDT value not being available for the day.

Turbidity and other operational data used to determine MF process running normally with no membrane integrity issues.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	MicroFiltration Process online monitoring results Log Removal Value E01 LRV	E02 LRV	E03 LRV	E04 LRV
04/01/18	4.86	4.89	4.53	4.54
04/02/18	4.84	4.93	4.58	4.60
04/03/18	4.84	4.91	4.57	4.60
04/04/18	4.84	4.92	4.52	4.52
04/05/18	4.79	4.91	4.42	4.46
04/06/18	5.02	4.84	4.42	4.51
04/07/18	4.93	4.84	4.43	4.85
04/08/18	4.90	4.86	4.42	4.72
04/09/18	N/A (3)	N/A (3)	N/A (3)	N/A (3)
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	N/A (3)	N/A (3)	N/A (3)	N/A (3)
04/12/18	4.94	4.89	4.47	4.71
04/13/18	4.89	4.83	4.42	4.64
04/14/18	4.94	4.86	4.44	4.69
04/15/18	4.92	4.92	4.44	4.63
04/16/18	4.89	4.82	4.31	4.66
04/17/18	4.86	4.81	4.38	4.70
04/18/18	4.80	4.92	4.39	4.67
04/19/18	4.80	5.09	4.39	4.62
04/20/18	4.84	4.95	4.35	4.66
04/21/18	4.85	4.98	4.45	4.64
04/22/18	4.89	4.96	4.62	4.65
04/23/18	4.86	5.03	4.55	4.58
04/24/18	4.87	5.00	4.63	4.55
04/25/18	4.83	4.96	4.59	4.65
04/26/18	4.83	4.93	4.58	4.60
04/27/18	4.81	4.97	4.56	4.53
04/28/18	4.82	4.91	4.54	4.60
04/29/18	4.84	4.90	4.52	4.49
04/30/18	4.83	4.92	4.52	4.43

Notes: Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

2. GWRS plant offline for routine maintenance activities

3. GWRS plant only online for part of the day due to routine maintenance and process controller upgrades, resulting in some or all cell PDT value not being available for the day.

Turbidity and other operational data used to determine MF process running normally with no membrane integrity issues.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Effluent Turbidity - NTU

Date	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
04/01/18	0.11	0.11	0.12	0.12	0.10	0.10	0.08	0.09	0.08	0.09	0.10	0.10	0.06	0.07	0.08	0.09	0.05	0.06	0.09
04/02/18	0.11	0.11	0.12	0.12	0.10	0.10	0.08	0.09	0.08	0.09	0.10	0.11	0.07	0.08	0.08	0.09	0.05	0.09	0.09
04/03/18	0.10	0.11	0.12	0.12	0.09	0.10	0.08	0.08	0.07	0.09	0.08	0.11	0.08	0.09	0.08	0.08	0.05	0.07	0.08
04/04/18	0.08	0.10	0.09	0.12	0.09	0.09	0.09	0.10	0.07	0.07	0.07	0.08	0.07	0.08	0.08	0.13	0.05	0.07	0.08
04/05/18	0.07	0.08	0.06	0.07	0.09	0.09	0.10	0.10	0.07	0.07	0.07	0.08	0.07	0.08	0.06	0.07	0.05	0.06	0.07
04/06/18	0.08	0.08	0.06	0.07	0.09	0.09	0.10	0.10	0.07	0.08	0.08	0.08	0.07	0.08	0.07	0.07	0.05	0.06	0.07
04/07/18	0.08	0.08	0.07	0.07	0.09	0.09	0.10	0.10	0.08	0.09	0.09	0.10	0.07	0.07	0.07	0.08	0.05	0.06	0.08
04/08/18	0.08	0.09	0.07	0.08	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.11	0.06	0.07	0.08	0.08	0.05	0.07	0.08
04/09/18	0.11	0.16	0.10	0.14	0.11	0.13	0.11	0.13	0.11	0.11	0.12	0.13	0.08	0.10	0.10	0.13	0.06	0.09	0.09
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	0.13	0.20 (3)	0.18	0.32 (3)	0.17	0.31 (3)	0.13	0.19	0.14	0.21	0.16	0.21	0.07	0.09	0.12	0.18	0.06	0.09	0.09
04/12/18	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.12	0.13	0.07	0.07	0.09	0.09	0.05	0.05	0.08
04/13/18	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.12	0.13	0.07	0.08	0.08	0.09	0.05	0.05	0.09
04/14/18	0.08	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.13	0.14	0.07	0.08	0.09	0.09	0.05	0.06	0.09
04/15/18	0.08	0.09	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.14	0.15	0.08	0.09	0.09	0.10	0.05	0.07	0.09
04/16/18	0.09	0.09	0.10	0.11	0.10	0.10	0.10	0.11	0.11	0.12	0.14	0.15	0.10	0.10	0.09	0.10	0.06	0.06	0.10
04/17/18	0.08	0.09	0.10	0.10	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.15	0.09	0.10	0.09	0.09	0.05	0.07	0.09
04/18/18	0.07	0.09	0.08	0.10	0.09	0.10	0.09	0.10	0.10	0.10	0.08	0.08	0.09	0.11	0.09	0.09	0.05	0.06	0.08
04/19/18	0.08	0.08	0.07	0.08	0.09	0.09	0.09	0.09	0.10	0.10	0.08	0.08	0.07	0.10	0.09	0.09	0.05	0.06	0.08
04/20/18	0.08	0.09	0.08	0.09	0.09	0.10	0.09	0.09	0.10	0.11	0.08	0.09	0.06	0.07	0.09	0.09	0.05	0.06	0.08
04/21/18	0.09	0.10	0.10	0.11	0.10	0.10	0.10	0.10	0.11	0.12	0.10	0.10	0.07	0.08	0.10	0.10	0.06	0.14	0.09
04/22/18	0.10	0.11	0.10	0.11	0.10	0.10	0.10	0.10	0.12	0.12	0.11	0.12	0.07	0.08	0.10	0.10	0.06	0.07	0.09
04/23/18	0.11	0.12	0.11	0.11	0.10	0.11	0.10	0.10	0.12	0.13	0.12	0.13	0.07	0.08	0.10	0.10	0.06	0.07	0.10
04/24/18	0.09	0.10	0.10	0.10	0.10	0.10	0.09	0.10	0.12	0.12	0.13	0.16	0.07	0.08	0.10	0.10	0.05	0.06	0.09
04/25/18	0.08	0.09	0.10	0.11	0.09	0.10	0.09	0.10	0.12	0.12	0.13	0.14	0.07	0.08	0.09	0.10	0.05	0.06	0.09
04/26/18	0.09	0.10	0.09	0.11	0.10	0.10	0.09	0.10	0.12	0.12	0.13	0.15	0.07	0.08	0.10	0.10	0.06	0.06	0.09
04/27/18	0.09	0.09	0.08	0.09	0.09	0.10	0.09	0.09	0.12	0.12	0.14	0.14	0.08	0.09	0.10	0.11	0.05	0.07	0.09
04/28/18	0.09	0.09	0.09	0.10	0.10	0.10	0.09	0.09	0.12	0.13	0.14	0.15	0.08	0.10	0.10	0.11	0.06	0.08	0.10
04/29/18	0.11	0.12	0.11	0.11	0.11	0.11	0.09	0.10	0.12	0.13	0.15	0.15	0.09	0.10	0.11	0.12	0.07	0.08	0.11
04/30/18	0.10	0.11	0.10	0.11	0.10	0.11	0.09	0.10	0.12	0.12	0.15	0.15	0.09	0.10	0.11	0.12	0.06	0.07	0.10

Notes: Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

2. GWRS plant offline for routine maintenance activities

3. Maximum turbidity values a result of initial startup of GWRS plant. Maximum turbidity values below 0.5 ntu shutdown requirement level.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Reverse Osmosis Process online monitoring results																	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)						Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	ROP		ROF			ROP			ROF			ROP						
	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
04/01/18	0.035	0.036	7.723	7.206	8.301	0.030	0.026	0.034	1,649	1,598	1,697	29	27	32	99.61	2.41	98.22	1.75
04/02/18	0.034	0.037	7.923	7.282	8.997	0.029	0.025	0.036	1,564	1,490	1,679	28	25	32	99.63	2.43	98.20	1.74
04/03/18	0.037	0.038	8.477	7.889	9.241	0.037	0.034	0.041	1,747	1,622	1,935	31	28	38	99.56	2.36	98.20	1.74
04/04/18	0.038	0.038	9.057	8.653	9.476	0.049	0.037	0.060	1,816	1,747	1,887	32	29	36	99.46	2.27	98.22	1.75
04/05/18	0.038	0.038	8.682	8.228	9.350	0.043	0.038	0.050	1,810	1,736	1,911	32	29	37	99.51	2.31	98.22	1.75
04/06/18	0.036	0.037	8.543	8.061	9.265	0.046	0.041	0.052	1,817	1,743	1,888	32	30	36	99.46	2.27	98.23	1.75
04/07/18	0.036	0.037	8.847	8.139	9.282	0.046	0.041	0.051	1,784	1,729	1,864	32	29	37	99.48	2.29	98.22	1.75
04/08/18	0.036	0.036	8.460	7.873	9.212	0.036	0.028	0.042	1,676	1,620	1,724	30	27	37	99.57	2.37	98.18	1.74
04/09/18	0.037	0.037	8.791	8.768	8.809	0.031	0.030	0.033	1,563	1,536	1,598	28	26	29	99.64	2.45	98.23	1.75
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	0.035	0.036	8.454	8.007	8.798	0.046	0.038	0.062	1,794	1,626	1,846	39	36	53	99.46	2.27	97.83	1.66
04/12/18	0.021	0.034	8.529	8.055	9.132	0.043	0.041	0.052	1,808	1,752	1,869	34	31	36	99.49	2.29	98.13	1.73
04/13/18	0.034	0.034	8.463	7.885	9.200	0.040	0.033	0.048	1,846	1,784	1,912	34	30	37	99.52	2.32	98.18	1.74
04/14/18	0.033	0.075	8.547	8.062	9.106	0.045	0.038	0.074	1,818	1,738	1,900	33	30	38	99.48	2.28	98.19	1.74
04/15/18	0.033	0.033	8.153	7.605	8.838	0.039	0.030	0.045	1,661	1,603	1,711	30	28	33	99.52	2.32	98.17	1.74
04/16/18	0.031	0.032	8.373	7.828	9.063	0.035	0.031	0.038	1,587	1,505	1,706	28	26	32	99.59	2.38	98.21	1.75
04/17/18	0.030	0.031	8.513	8.059	9.357	0.039	0.034	0.045	1,762	1,660	1,891	31	28	36	99.54	2.34	98.21	1.75
04/18/18	0.033	0.035	8.281	7.811	8.990	0.039	0.036	0.044	1,824	1,756	1,899	33	30	37	99.52	2.32	98.20	1.74
04/19/18	0.033	0.034	8.382	7.902	9.090	0.041	0.036	0.052	1,845	1,754	1,940	34	30	63	99.51	2.31	98.15	1.73
04/20/18	0.032	0.033	8.320	7.776	9.061	0.038	0.035	0.044	1,859	1,805	1,891	33	30	37	99.55	2.34	98.20	1.74
04/21/18	0.031	0.033	8.369	7.733	8.906	0.040	0.036	0.046	1,810	1,732	1,869	33	31	36	99.53	2.32	98.20	1.74
04/22/18	0.032	0.033	8.315	7.404	14.482	0.038	0.033	0.044	1,655	1,606	1,701	30	27	34	99.54	2.34	98.18	1.74
04/23/18	0.032	0.033	8.374	7.741	9.429	0.036	0.032	0.041	1,607	1,533	1,737	30	26	33	99.57	2.37	98.15	1.73
04/24/18	0.031	0.033	8.679	8.117	9.657	0.040	0.034	0.046	1,788	1,676	1,932	33	29	38	99.54	2.34	98.15	1.73
04/25/18	0.027	0.030	8.489	7.905	9.363	0.040	0.034	0.050	1,845	1,774	1,915	34	31	38	99.53	2.33	98.13	1.73
04/26/18	0.032	0.033	8.433	7.908	9.198	0.042	0.037	0.049	1,875	1,807	1,962	35	31	40	99.50	2.30	98.12	1.73
04/27/18	0.029	0.034	8.505	7.942	9.272	0.042	0.037	0.050	1,885	1,792	1,982	37	33	42	99.51	2.31	98.04	1.71
04/28/18	0.030	0.032	8.609	8.035	9.337	0.038	0.033	0.045	1,870	1,798	1,950	37	35	41	99.56	2.35	98.00	1.70
04/29/18	0.028	0.029	8.249	7.666	9.178	0.034	0.032	0.037	1,695	1,621	1,772	34	31	37	99.59	2.39	97.97	1.69
04/30/18	0.029	0.031	8.421	7.725	9.272	0.033	0.029	0.041	1,642	1,559	1,786	34	30	39	99.60	2.40	97.93	1.68

Notes:

2. GWRS plant offline for routine maintenance activities

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	UltraViolet / AOP Process online monitoring results					
	UVT %	FLOW	POWER	EED	Peroxide Dose	Log
Date	avg	MG	kW	kWh/kgal	mg/l	Removal
04/01/18	98.55	96.810	24,370.2	0.25	3.0	6
04/02/18	98.22	97.158	24,747.4	0.25	3.0	6
04/03/18	98.04	97.383	24,886.8	0.26	3.0	6
04/04/18	98.29	99.292	25,304.5	0.25	3.0	6
04/05/18	98.38	98.801	25,140.4	0.25	3.0	6
04/06/18	98.33	99.102	25,229.9	0.25	3.0	6
04/07/18	98.31	99.327	25,281.1	0.25	3.0	6
04/08/18	98.15	97.480	24,884.1	0.26	3.0	6
04/09/18	98.42	85.458	22,041.3	0.26	3.0	6
04/10/18	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
04/11/18	98.45	10.898	3,080.0	0.28	3.0	6
04/12/18	97.89	55.763	14,715.1	0.26	3.0	6
04/13/18	97.75	99.434	25,628.4	0.26	3.0	6
04/14/18	98.04	96.529	24,956.5	0.26	3.0	6
04/15/18	98.08	88.897	23,052.0	0.26	3.0	6
04/16/18	97.67	98.434	24,965.9	0.25	3.0	6
04/17/18	97.57	99.445	24,921.6	0.25	3.0	6
04/18/18	97.53	98.959	25,117.1	0.25	3.0	6
04/19/18	97.64	97.472	24,709.2	0.25	3.0	6
04/20/18	97.29	91.197	23,104.0	0.25	3.0	6
04/21/18	97.33	98.174	25,177.9	0.26	3.0	6
04/22/18	97.40	93.833	24,264.9	0.26	3.0	6
04/23/18	96.81	97.264	25,029.1	0.26	3.0	6
04/24/18	96.77	97.939	25,101.6	0.26	3.0	6
04/25/18	96.86	99.241	25,446.1	0.26	3.0	6
04/26/18	96.72	99.195	25,241.7	0.25	3.0	6
04/27/18	96.61	98.164	24,847.6	0.25	3.0	6
04/28/18	96.68	95.848	24,073.5	0.25	3.0	6
04/29/18	96.50	95.045	24,005.7	0.25	3.0	6
04/30/18	96.42	95.713	24,385.3	0.25	3.0	6

Notes: Based on August 28, 2009 letter from California Department of Public Health (now DDW).

2. GWRS plant offline for routine maintenance activities

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
05/01/18	12.78	12.78	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/02/18	12.76	12.76	12.34	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/03/18	12.73	12.73	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/04/18	12.72	12.72	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/05/18	12.82	12.82	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/06/18	12.85	12.85	12.39	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/07/18	12.77	12.77	12.38	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/08/18	12.76	12.76	12.34	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/09/18	12.68	12.68	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/10/18	12.78	12.78	12.30	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/11/18	12.83	12.83	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/12/18	12.84	12.84	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/13/18	12.87	12.87	12.39	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/14/18	12.84	12.84	12.37	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/15/18	12.74	12.74	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/16/18	12.73	12.73	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/17/18	12.85	12.85	12.30	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/18/18	12.81	12.81	12.30	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/19/18	12.84	12.84	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/20/18	12.88	12.88	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/21/18	12.87	12.87	12.33	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/22/18	12.76	12.76	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/23/18	12.76	12.76	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/24/18	12.76	12.76	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/25/18	12.73	12.73	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/26/18	12.74	12.74	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/27/18	12.76	12.76	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/28/18	12.78	12.78	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/29/18	12.76	12.76	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/30/18	12.72	12.72	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/31/18	12.68	12.68	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

Date	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
05/01/18	0.00	4.43	2.35	6.00	0.00	12.78
05/02/18	0.00	4.43	2.34	6.00	0.00	12.76
05/03/18	0.00	4.41	2.32	6.00	0.00	12.73
05/04/18	0.00	4.41	2.31	6.00	0.00	12.72
05/05/18	0.00	4.47	2.36	6.00	0.00	12.82
05/06/18	0.00	4.46	2.39	6.00	0.00	12.85
05/07/18	0.00	4.39	2.38	6.00	0.00	12.77
05/08/18	0.00	4.42	2.34	6.00	0.00	12.76
05/09/18	0.00	4.39	2.29	6.00	0.00	12.68
05/10/18	0.00	4.48	2.30	6.00	0.00	12.78
05/11/18	0.00	4.48	2.35	6.00	0.00	12.83
05/12/18	0.00	4.48	2.36	6.00	0.00	12.84
05/13/18	0.00	4.49	2.39	6.00	0.00	12.87
05/14/18	0.00	4.47	2.37	6.00	0.00	12.84
05/15/18	0.00	4.45	2.29	6.00	0.00	12.74
05/16/18	0.00	4.45	2.28	6.00	0.00	12.73
05/17/18	0.00	4.54	2.30	6.00	0.00	12.85
05/18/18	0.00	4.51	2.30	6.00	0.00	12.81
05/19/18	0.00	4.53	2.31	6.00	0.00	12.84
05/20/18	0.00	4.56	2.32	6.00	0.00	12.88
05/21/18	0.00	4.54	2.33	6.00	0.00	12.87
05/22/18	0.00	4.47	2.28	6.00	0.00	12.76
05/23/18	0.00	4.52	2.24	6.00	0.00	12.76
05/24/18	0.00	4.51	2.24	6.00	0.00	12.76
05/25/18	0.00	4.50	2.22	6.00	0.00	12.73
05/26/18	0.00	4.49	2.25	6.00	0.00	12.74
05/27/18	0.00	4.48	2.28	6.00	0.00	12.76
05/28/18	0.00	4.49	2.29	6.00	0.00	12.78
05/29/18	0.00	4.47	2.28	6.00	0.00	12.76
05/30/18	0.00	4.50	2.22	6.00	0.00	12.72
05/31/18	0.00	4.48	2.19	6.00	0.00	12.68

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Documented Virus Reduction Achieved					
	OCSD	MF+Cl_2	RO	UV/AOP	Underground travel time (1)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
05/01/18	0.00	0.00	2.35	6.00	4.00	12.35
05/02/18	0.00	0.00	2.34	6.00	4.00	12.34
05/03/18	0.00	0.00	2.32	6.00	4.00	12.32
05/04/18	0.00	0.00	2.31	6.00	4.00	12.31
05/05/18	0.00	0.00	2.36	6.00	4.00	12.36
05/06/18	0.00	0.00	2.39	6.00	4.00	12.39
05/07/18	0.00	0.00	2.38	6.00	4.00	12.38
05/08/18	0.00	0.00	2.34	6.00	4.00	12.34
05/09/18	0.00	0.00	2.29	6.00	4.00	12.29
05/10/18	0.00	0.00	2.30	6.00	4.00	12.30
05/11/18	0.00	0.00	2.35	6.00	4.00	12.35
05/12/18	0.00	0.00	2.36	6.00	4.00	12.36
05/13/18	0.00	0.00	2.39	6.00	4.00	12.39
05/14/18	0.00	0.00	2.37	6.00	4.00	12.37
05/15/18	0.00	0.00	2.29	6.00	4.00	12.29
05/16/18	0.00	0.00	2.28	6.00	4.00	12.28
05/17/18	0.00	0.00	2.30	6.00	4.00	12.30
05/18/18	0.00	0.00	2.30	6.00	4.00	12.30
05/19/18	0.00	0.00	2.31	6.00	4.00	12.31
05/20/18	0.00	0.00	2.32	6.00	4.00	12.32
05/21/18	0.00	0.00	2.33	6.00	4.00	12.33
05/22/18	0.00	0.00	2.28	6.00	4.00	12.28
05/23/18	0.00	0.00	2.24	6.00	4.00	12.24
05/24/18	0.00	0.00	2.24	6.00	4.00	12.24
05/25/18	0.00	0.00	2.22	6.00	4.00	12.22
05/26/18	0.00	0.00	2.25	6.00	4.00	12.25
05/27/18	0.00	0.00	2.28	6.00	4.00	12.28
05/28/18	0.00	0.00	2.29	6.00	4.00	12.29
05/29/18	0.00	0.00	2.28	6.00	4.00	12.28
05/30/18	0.00	0.00	2.22	6.00	4.00	12.22
05/31/18	0.00	0.00	2.19	6.00	4.00	12.19

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Log Removal Value

Date	A01 LRV	A02 LRV	A03 LRV	A04 LRV	A05 LRV	A06 LRV	A07 LRV	A08 LRV	B01 LRV	B02 LRV	B03 LRV	B04 LRV	B05 LRV	B06 LRV	B07 LRV	B08 LRV
05/01/18	5.03	4.81	5.11	4.79	5.00	5.00	5.00	4.99	4.45	4.70	4.78	4.99	4.82	4.77	4.51	4.69
05/02/18	5.04	5.15	5.09	4.82	5.00	4.98	4.99	4.98	4.64	4.68	4.79	5.01	4.85	4.71	4.51	4.66
05/03/18	5.01	5.07	5.04	4.80	5.00	4.96	4.97	4.95	4.83	4.61	4.77	5.01	4.83	4.75	4.65	4.64
05/04/18	5.00	4.96	5.02	4.81	5.00	5.04	4.91	4.95	4.87	4.60	4.89	4.98	4.83	4.74	4.68	4.62
05/05/18	5.00	5.03	5.00	4.77	4.98	4.98	4.88	4.93	4.87	4.62	4.91	4.97	4.85	4.73	4.64	4.60
05/06/18	4.95	5.03	5.03	4.80	4.99	4.98	4.89	4.92	4.86	4.56	4.94	4.96	4.81	4.72	4.64	4.61
05/07/18	4.93	4.94	4.98	4.79	4.93	4.96	4.90	4.91	4.83	4.56	4.93	4.99	4.80	4.75	4.65	4.61
05/08/18	4.96	4.98	4.96	4.74	4.92	4.97	4.88	4.90	4.83	4.52	4.92	4.94	4.78	4.77	4.64	4.62
05/09/18	4.94	4.99	4.89	4.74	4.88	4.94	4.86	4.95	4.86	4.50	4.94	4.94	4.80	4.75	4.63	4.59
05/10/18	4.94	4.97	4.99	4.68	4.96	4.97	4.87	4.91	4.81	4.50	4.93	4.92	4.75	4.73	4.64	4.57
05/11/18	4.93	4.96	4.94	4.69	4.96	4.96	4.83	4.85	4.80	4.67	4.87	4.93	4.73	4.67	4.61	4.54
05/12/18	4.93	4.92	4.98	4.72	4.93	4.99	4.84	4.90	4.79	4.77	4.87	4.91	4.76	4.67	4.60	4.56
05/13/18	4.95	4.91	5.01	4.75	4.92	4.98	4.88	4.90	4.79	4.69	4.86	4.86	4.76	4.85	4.60	4.69
05/14/18	4.91	4.90	4.85	4.67	4.84	4.95	4.84	4.88	4.78	4.71	4.83	4.87	4.77	4.92	4.61	4.75
05/15/18	4.88	4.92	4.83	4.68	4.90	4.93	4.77	4.90	4.77	4.73	4.87	5.05	4.75	4.91	4.61	4.72
05/16/18	4.96	4.96	4.92	4.64	4.88	4.96	4.86	4.88	4.75	4.71	4.87	5.09	4.75	4.89	4.60	4.68
05/17/18	4.96	4.90	4.92	4.69	4.87	4.95	4.88	4.90	4.78	4.68	4.85	5.08	4.74	4.83	4.59	4.70
05/18/18	4.91	4.93	4.87	4.92	4.87	4.93	4.96	4.91	4.74	4.68	4.83	5.06	4.73	4.84	4.59	4.70
05/19/18	5.18	4.91	4.86	4.94	4.88	4.92	4.94	4.88	4.74	4.70	4.82	5.10	4.73	4.83	4.58	4.71
05/20/18	5.10	4.91	4.84	4.91	5.08	4.91	4.94	4.88	4.71	4.65	4.82	5.07	4.74	4.84	4.59	4.71
05/21/18	5.13	4.92	4.89	4.92	5.05	4.94	4.91	4.87	4.72	4.68	4.79	5.11	4.72	4.89	4.58	4.70
05/22/18	5.11	4.88	4.89	4.86	5.02	4.96	4.91	5.04	4.74	4.69	4.80	5.06	4.71	4.86	4.59	4.70
05/23/18	5.10	4.87	4.87	4.84	5.05	4.94	4.98	5.05	4.74	4.69	4.79	5.06	4.72	4.85	4.59	4.68
05/24/18	5.09	4.86	4.87	4.84	5.02	5.06	4.90	4.96	4.71	4.70	4.75	5.06	4.68	4.81	4.56	4.69
05/25/18	5.09	4.84	4.94	4.88	4.99	5.07	4.92	5.04	4.72	4.65	4.76	5.06	4.68	4.87	4.54	4.66
05/26/18	5.07	4.89	4.95	4.85	5.03	5.06	4.99	4.99	4.69	4.65	4.76	5.08	4.71	4.88	4.53	4.66
05/27/18	5.09	4.82	4.97	4.85	5.02	5.03	4.92	5.02	4.68	4.63	4.72	5.06	4.83	4.82	4.54	4.69
05/28/18	5.01	5.04	5.17	4.86	5.03	5.03	4.91	5.00	4.93	4.66	4.70	5.09	4.87	4.82	4.54	4.68
05/29/18	5.06	5.02	5.19	4.87	5.02	5.01	4.92	4.98	4.89	4.66	4.72	5.05	4.87	4.81	4.66	4.66
05/30/18	5.04	5.00	5.17	4.89	5.00	5.04	4.90	5.02	4.83	4.65	4.85	5.01	4.87	4.79	4.68	4.65
05/31/18	5.07	5.07	5.12	4.88	5.04	5.01	4.90	5.01	4.81	4.61	4.87	4.98	4.84	4.81	4.67	4.65

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
05/01/18	4.65	4.80	4.83	4.73	4.68	4.60	4.68	4.73	5.07	4.80	4.69	4.79	4.96	4.78	4.84	5.03
05/02/18	4.70	4.77	4.80	4.69	4.68	4.57	4.65	4.70	5.00	4.77	4.68	4.78	4.93	4.77	4.86	5.00
05/03/18	4.78	4.77	4.77	4.70	4.72	4.57	4.64	4.72	5.01	4.73	4.69	4.84	4.95	4.79	4.82	4.95
05/04/18	4.80	4.74	4.77	4.72	4.74	4.57	4.69	4.75	5.00	4.72	4.72	4.94	4.93	4.81	4.82	4.93
05/05/18	4.81	4.71	4.79	4.70	4.70	4.59	4.72	4.73	5.01	4.76	4.69	4.91	4.94	4.84	4.83	4.97
05/06/18	4.81	4.74	4.77	4.71	4.70	4.61	4.72	4.74	5.06	4.76	4.73	4.92	5.02	4.83	4.83	4.97
05/07/18	4.77	4.71	4.73	4.66	4.68	4.60	4.66	4.71	5.05	4.71	4.81	4.95	5.10	4.80	4.79	4.94
05/08/18	4.73	4.68	4.70	4.64	4.66	4.56	4.60	4.67	5.03	4.82	4.81	4.95	5.09	4.81	4.80	4.95
05/09/18	4.75	4.71	4.74	4.67	4.64	4.53	4.62	4.68	5.02	4.96	4.81	4.92	5.05	4.79	4.84	4.94
05/10/18	4.76	4.70	4.75	4.64	4.67	4.52	4.65	4.68	5.00	4.96	4.83	4.94	5.07	4.76	4.83	4.91
05/11/18	4.73	4.64	4.73	4.63	4.68	4.48	4.63	4.67	4.99	4.95	4.81	4.91	5.09	4.77	4.82	4.87
05/12/18	4.70	4.63	4.73	4.62	4.62	4.48	4.59	4.65	5.00	4.98	4.79	4.86	5.04	4.78	4.81	4.87
05/13/18	4.70	4.65	4.71	4.61	4.61	4.49	4.57	4.66	5.00	4.99	4.83	4.89	5.02	4.79	4.80	4.88
05/14/18	4.67	4.67	4.70	4.60	4.63	4.47	4.58	4.68	4.99	4.95	4.85	4.90	5.04	4.78	4.79	4.90
05/15/18	4.64	4.65	4.64	4.60	4.61	4.45	4.57	4.65	4.97	4.94	4.84	4.91	5.03	4.77	4.78	4.90
05/16/18	4.62	4.63	4.63	4.56	4.61	4.45	4.58	4.62	4.97	4.94	4.84	4.91	5.03	4.76	4.74	4.90
05/17/18	4.62	4.62	4.65	4.54	4.62	4.64	4.56	4.62	4.98	4.90	4.83	4.88	5.05	4.74	4.73	4.84
05/18/18	4.83	4.58	4.65	4.53	4.85	4.73	4.66	4.62	4.97	4.87	4.83	4.87	5.05	4.73	4.75	4.85
05/19/18	4.96	4.57	4.65	4.53	4.99	4.69	4.82	4.80	4.96	4.88	4.83	4.86	5.04	4.74	4.75	4.86
05/20/18	4.98	4.58	4.83	4.56	4.92	4.72	4.83	4.92	4.97	4.91	4.80	4.91	5.05	4.73	4.73	4.85
05/21/18	4.95	4.58	4.91	4.57	4.90	4.74	4.80	4.87	4.96	5.02	4.79	4.91	5.05	4.71	4.75	4.88
05/22/18	4.91	4.55	4.91	4.55	4.90	4.73	4.80	4.88	4.93	5.13	4.79	4.88	5.05	4.70	4.75	4.88
05/23/18	4.88	4.55	4.87	4.53	4.86	4.66	4.80	4.85	4.90	5.09	4.81	4.87	5.06	4.73	4.81	4.88
05/24/18	4.86	4.71	4.86	4.66	4.84	4.61	4.79	4.83	4.83	5.08	4.82	4.85	5.00	4.77	4.93	4.94
05/25/18	4.87	4.82	4.87	4.76	4.84	4.61	4.78	4.85	4.85	5.07	4.78	4.82	5.01	4.82	4.91	5.06
05/26/18	4.90	4.78	4.85	4.77	4.82	4.62	4.77	4.82	4.93	5.07	4.75	4.82	5.04	4.80	4.89	5.00
05/27/18	4.90	4.78	4.83	4.78	4.83	4.67	4.78	4.81	4.96	5.05	4.76	4.85	5.03	4.82	4.91	4.97
05/28/18	4.90	4.80	4.84	4.78	4.83	4.70	4.80	4.83	5.02	5.02	4.77	4.87	4.98	4.78	4.92	4.96
05/29/18	4.89	4.74	4.84	4.75	4.82	4.68	4.77	4.82	5.07	5.03	4.78	4.89	4.99	4.80	4.92	4.97
05/30/18	4.85	4.70	4.80	4.73	4.82	4.66	4.73	4.82	5.02	5.04	4.75	4.96	4.98	4.80	4.90	4.98
05/31/18	4.82	4.70	4.81	4.70	4.79	4.62	4.73	4.83	5.01	5.03	4.73	4.93	4.93	4.81	4.88	4.94

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

	MicroFiltration Process online monitoring results Log Removal Value															
Date	**E01** LRV	**E02** LRV	**E03** LRV	**E04** LRV												
05/01/18	4.78	4.90	4.43	4.48												
05/02/18	4.75	4.88	4.44	4.43												
05/03/18	4.75	4.83	4.41	4.42												
05/04/18	4.85	4.82	4.44	4.41												
05/05/18	4.95	4.87	4.47	4.50												
05/06/18	4.95	4.89	4.46	4.76												
05/07/18	4.94	4.87	4.39	4.74												
05/08/18	4.90	4.81	4.42	4.70												
05/09/18	4.87	4.80	4.39	4.71												
05/10/18	4.87	4.78	4.48	4.67												
05/11/18	4.84	4.77	4.70	4.67												
05/12/18	4.86	4.75	4.58	4.68												
05/13/18	4.84	4.72	4.63	4.70												
05/14/18	4.86	4.78	4.62	4.63												
05/15/18	4.83	5.01	4.51	4.60												
05/16/18	4.81	4.93	4.57	4.61												
05/17/18	4.85	4.97	4.59	4.62												
05/18/18	4.85	4.93	4.51	4.61												
05/19/18	4.80	4.96	4.56	4.62												
05/20/18	4.87	4.96	4.57	4.67												
05/21/18	4.88	4.96	4.54	4.66												
05/22/18	4.88	4.94	4.47	4.63												
05/23/18	4.87	4.95	4.52	4.66												
05/24/18	4.82	4.98	4.51	4.64												
05/25/18	4.79	4.92	4.50	4.63												
05/26/18	4.80	4.93	4.49	4.64												
05/27/18	4.81	4.94	4.48	4.60												
05/28/18	4.83	4.93	4.49	4.58												
05/29/18	4.86	4.91	4.47	4.55												
05/30/18	4.89	4.94	4.50	4.59												
05/31/18	4.96	4.91	4.48	4.86												

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Effluent Turbidity - NTU

Date	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
05/01/18	0.08	0.10	0.10	0.10	0.09	0.10	0.09	0.10	0.08	0.12	0.10	0.15	0.09	0.10	0.10	0.11	0.06	0.07	0.09
05/02/18	0.08	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.06	0.06	0.06	0.07	0.08	0.11	0.09	0.11	0.05	0.06	0.08
05/03/18	0.07	0.08	0.09	0.10	0.08	0.09	0.10	0.10	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.04	0.05	0.07
05/04/18	0.09	0.09	0.10	0.10	0.09	0.09	0.10	0.10	0.06	0.06	0.07	0.08	0.07	0.08	0.08	0.08	0.05	0.05	0.08
05/05/18	0.09	0.10	0.11	0.11	0.09	0.09	0.10	0.11	0.06	0.06	0.08	0.14	0.07	0.07	0.08	0.09	0.05	0.07	0.08
05/06/18	0.11	0.11	0.11	0.12	0.10	0.10	0.11	0.11	0.06	0.07	0.08	0.09	0.07	0.08	0.09	0.09	0.05	0.08	0.09
05/07/18	0.10	0.11	0.11	0.12	0.10	0.10	0.11	0.11	0.06	0.07	0.09	0.09	0.07	0.08	0.09	0.09	0.05	0.06	0.09
05/08/18	0.10	0.10	0.11	0.12	0.10	0.10	0.10	0.11	0.06	0.10	0.08	0.12	0.07	0.07	0.09	0.09	0.05	0.06	0.08
05/09/18	0.09	0.10	0.11	0.11	0.09	0.10	0.10	0.11	0.06	0.07	0.08	0.08	0.07	0.07	0.09	0.09	0.05	0.06	0.08
05/10/18	0.09	0.09	0.11	0.11	0.09	0.10	0.10	0.10	0.06	0.06	0.08	0.08	0.07	0.08	0.09	0.09	0.05	0.07	0.08
05/11/18	0.10	0.10	0.11	0.11	0.10	0.10	0.10	0.10	0.07	0.07	0.08	0.09	0.07	0.07	0.08	0.09	0.05	0.05	0.08
05/12/18	0.09	0.10	0.11	0.11	0.10	0.10	0.10	0.10	0.07	0.07	0.09	0.09	0.06	0.07	0.08	0.09	0.05	0.05	0.08
05/13/18	0.09	0.10	0.11	0.12	0.10	0.11	0.11	0.11	0.08	0.08	0.10	0.10	0.07	0.08	0.09	0.10	0.05	0.06	0.09
05/14/18	0.09	0.11	0.12	0.12	0.10	0.11	0.11	0.11	0.08	0.09	0.10	0.11	0.08	0.09	0.10	0.10	0.05	0.06	0.09
05/15/18	0.09	0.11	0.11	0.12	0.10	0.11	0.10	0.11	0.09	0.10	0.10	0.12	0.07	0.08	0.10	0.10	0.05	0.06	0.09
05/16/18	0.08	0.10	0.10	0.12	0.09	0.10	0.10	0.10	0.08	0.10	0.08	0.08	0.07	0.07	0.10	0.12	0.05	0.05	0.08
05/17/18	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.07	0.07	0.09	0.10	0.07	0.08	0.09	0.11	0.05	0.07	0.08
05/18/18	0.09	0.09	0.08	0.09	0.09	0.09	0.10	0.10	0.07	0.08	0.09	0.10	0.07	0.08	0.09	0.09	0.05	0.06	0.08
05/19/18	0.09	0.11	0.09	0.09	0.09	0.10	0.10	0.11	0.08	0.08	0.11	0.11	0.07	0.08	0.09	0.10	0.05	0.05	0.09
05/20/18	0.09	0.10	0.09	0.10	0.09	0.10	0.10	0.10	0.08	0.09	0.12	0.12	0.07	0.08	0.10	0.10	0.05	0.05	0.09
05/21/18	0.09	0.10	0.10	0.15	0.09	0.10	0.10	0.10	0.08	0.09	0.12	0.13	0.07	0.08	0.10	0.10	0.05	0.08	0.09
05/22/18	0.09	0.10	0.10	0.11	0.09	0.09	0.10	0.11	0.08	0.09	0.13	0.13	0.07	0.08	0.10	0.10	0.05	0.05	0.09
05/23/18	0.08	0.09	0.09	0.10	0.09	0.09	0.08	0.09	0.08	0.08	0.13	0.14	0.08	0.09	0.10	0.10	0.04	0.05	0.08
05/24/18	0.09	0.12	0.09	0.10	0.10	0.11	0.06	0.07	0.09	0.10	0.14	0.15	0.08	0.08	0.10	0.11	0.05	0.05	0.09
05/25/18	0.08	0.08	0.09	0.10	0.09	0.09	0.05	0.06	0.09	0.13	0.14	0.15	0.08	0.09	0.10	0.11	0.05	0.05	0.09
05/26/18	0.09	0.09	0.10	0.10	0.09	0.10	0.05	0.07	0.10	0.11	0.15	0.15	0.09	0.09	0.11	0.11	0.05	0.05	0.09
05/27/18	0.09	0.10	0.10	0.10	0.09	0.10	0.05	0.06	0.10	0.10	0.15	0.15	0.09	0.10	0.11	0.11	0.05	0.05	0.09
05/28/18	0.10	0.14	0.11	0.13	0.10	0.11	0.05	0.06	0.10	0.11	0.15	0.16	0.09	0.11	0.11	0.11	0.05	0.06	0.10
05/29/18	0.09	0.10	0.10	0.11	0.10	0.10	0.05	0.06	0.09	0.11	0.15	0.16	0.09	0.11	0.11	0.11	0.05	0.05	0.09
05/30/18	0.07	0.09	0.09	0.11	0.09	0.10	0.08	0.09	0.10	0.10	0.15	0.16	0.09	0.10	0.10	0.11	0.04	0.05	0.09
05/31/18	0.07	0.08	0.08	0.09	0.08	0.09	0.09	0.09	0.10	0.10	0.13	0.15	0.10	0.11	0.10	0.10	0.04	0.06	0.09

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Reverse Osmosis Process online monitoring results																	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)						Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	ROP		ROF			ROP			ROF			ROP						
Date	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
05/01/18	0.031	0.032	8.741	8.167	9.513	0.039	0.034	0.045	1,820	1,701	1,922	37	32	41	99.55	2.35	97.98	1.69
05/02/18	0.031	0.031	8.789	8.329	9.420	0.041	0.035	0.046	1,883	1,808	1,970	38	33	43	99.54	2.34	97.99	1.70
05/03/18	0.032	0.032	8.520	8.026	9.291	0.041	0.035	0.056	1,894	1,817	1,975	39	35	42	99.52	2.32	97.94	1.69
05/04/18	0.032	0.033	8.242	7.724	9.113	0.040	0.036	0.049	1,881	1,812	1,961	39	35	43	99.52	2.31	97.93	1.68
05/05/18	0.031	0.031	8.225	7.751	8.867	0.036	0.031	0.040	1,836	1,782	1,914	38	35	43	99.56	2.36	97.91	1.68
05/06/18	0.030	0.031	8.058	7.279	12.561	0.033	0.031	0.036	1,686	1,610	1,762	37	33	41	99.59	2.39	97.83	1.66
05/07/18	0.027	0.028	7.994	7.390	8.944	0.033	0.028	0.041	1,633	1,546	1,791	36	32	41	99.58	2.38	97.81	1.66
05/08/18	0.025	0.029	8.465	7.719	9.179	0.039	0.031	0.045	1,806	1,699	1,926	39	35	45	99.54	2.34	97.82	1.66
05/09/18	0.029	0.030	8.432	7.458	9.117	0.043	0.038	0.053	1,855	1,779	1,944	43	39	47	99.49	2.29	97.71	1.64
05/10/18	0.028	0.030	8.285	7.830	8.908	0.041	0.036	0.047	1,900	1,825	1,962	44	40	49	99.50	2.30	97.69	1.64
05/11/18	0.024	0.027	8.232	7.689	8.906	0.037	0.030	0.047	1,903	1,813	1,982	46	38	54	99.55	2.35	97.60	1.62
05/12/18	0.015	0.024	8.326	7.753	8.989	0.036	0.033	0.043	1,895	1,826	1,965	48	43	52	99.56	2.36	97.47	1.60
05/13/18	0.026	0.030	8.290	7.618	12.864	0.034	0.027	0.039	1,712	1,637	1,794	44	41	47	99.59	2.39	97.44	1.59
05/14/18	0.029	0.030	8.050	7.371	8.990	0.035	0.031	0.044	1,655	1,572	1,792	44	39	49	99.57	2.37	97.35	1.58
05/15/18	0.025	0.027	8.332	7.855	9.194	0.043	0.037	0.051	1,820	1,723	1,912	47	43	52	99.49	2.29	97.41	1.59
05/16/18	0.025	0.027	8.302	7.828	8.761	0.044	0.038	0.050	1,859	1,800	1,910	49	46	54	99.47	2.28	97.37	1.58
05/17/18	0.027	0.028	8.297	7.829	8.932	0.041	0.038	0.046	1,883	1,807	1,981	50	45	58	99.50	2.30	97.34	1.57
05/18/18	0.025	0.028	8.371	7.799	9.775	0.042	0.038	0.046	1,886	1,838	1,945	47	41	54	99.50	2.30	97.51	1.60
05/19/18	0.028	0.030	8.321	7.853	8.909	0.041	0.037	0.050	1,821	1,756	1,868	42	39	46	99.51	2.31	97.68	1.63
05/20/18	0.027	0.028	7.936	7.380	8.592	0.038	0.031	0.046	1,683	1,628	1,732	40	36	43	99.52	2.32	97.64	1.63
05/21/18	0.027	0.027	7.855	7.374	8.541	0.037	0.033	0.041	1,630	1,549	1,773	38	35	43	99.53	2.33	97.66	1.63
05/22/18	0.027	0.027	8.017	7.509	8.713	0.042	0.036	0.046	1,783	1,692	1,900	42	38	47	99.48	2.28	97.66	1.63
05/23/18	0.026	0.026	8.067	7.670	8.559	0.047	0.042	0.055	1,850	1,790	1,920	44	40	50	99.42	2.24	97.61	1.62
05/24/18	0.026	0.026	8.042	7.574	8.570	0.046	0.041	0.053	1,849	1,792	1,909	44	40	48	99.43	2.24	97.62	1.62
05/25/18	0.026	0.027	7.991	7.458	8.628	0.048	0.041	0.056	1,870	1,795	1,971	44	40	50	99.40	2.22	97.63	1.62
05/26/18	0.027	0.027	8.040	7.634	8.444	0.045	0.039	0.051	1,858	1,811	1,921	44	41	48	99.44	2.25	97.63	1.62
05/27/18	0.028	0.028	7.702	7.339	8.422	0.041	0.036	0.045	1,762	1,694	1,825	42	38	48	99.47	2.28	97.60	1.62
05/28/18	0.029	0.029	7.475	7.038	8.219	0.039	0.035	0.043	1,643	1,571	1,705	41	37	46	99.48	2.29	97.49	1.60
05/29/18	0.028	0.029	7.710	7.139	8.534	0.040	0.036	0.045	1,616	1,532	1,744	38	32	43	99.48	2.28	97.67	1.63
05/30/18	0.027	0.028	7.972	7.537	8.639	0.048	0.044	0.053	1,779	1,686	1,876	41	37	47	99.40	2.22	97.69	1.64
05/31/18	0.028	0.028	8.181	7.852	8.784	0.053	0.046	0.064	1,855	1,795	1,936	43	39	48	99.36	2.19	97.70	1.64

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	UltraViolet / AOP Process online monitoring results					
	UVT %	FLOW	POWER	EED	Peroxide Dose	Log
Date	avg	MG	kW	kWh/kgal	mg/l	Removal
05/01/18	96.39	93.589	23,680.3	0.25	3.0	6
05/02/18	96.65	97.357	24,692.2	0.25	3.0	6
05/03/18	96.54	98.167	24,966.1	0.25	3.0	6
05/04/18	96.77	97.207	24,712.5	0.25	3.0	6
05/05/18	96.86	97.866	25,038.6	0.26	3.0	6
05/06/18	96.85	94.392	24,065.4	0.25	3.0	6
05/07/18	96.61	95.225	24,196.5	0.25	3.0	6
05/08/18	96.66	94.236	23,959.6	0.25	3.0	6
05/09/18	96.61	92.853	23,506.1	0.25	3.0	6
05/10/18	96.70	95.070	23,863.6	0.25	3.0	6
05/11/18	96.63	97.555	24,470.4	0.25	3.0	6
05/12/18	96.79	97.668	24,399.9	0.25	3.0	6
05/13/18	96.86	93.693	23,944.6	0.26	3.0	6
05/14/18	96.64	96.326	24,754.9	0.26	3.0	6
05/15/18	96.61	97.786	24,931.1	0.25	3.0	6
05/16/18	96.76	96.934	24,435.3	0.25	3.0	6
05/17/18	96.46	96.754	24,356.6	0.25	3.0	6
05/18/18	96.51	99.446	25,449.9	0.26	3.0	6
05/19/18	96.73	99.659	25,443.3	0.26	3.0	6
05/20/18	97.18	96.438	24,788.0	0.26	3.0	6
05/21/18	97.17	94.473	24,257.2	0.26	3.0	6
05/22/18	97.30	97.010	24,766.8	0.26	3.0	6
05/23/18	97.45	96.822	24,657.0	0.25	3.0	6
05/24/18	97.48	95.798	24,853.5	0.26	3.0	6
05/25/18	97.58	101.037	25,607.0	0.25	3.0	6
05/26/18	97.69	100.267	25,677.6	0.26	3.0	6
05/27/18	97.74	95.862	24,575.7	0.26	3.0	6
05/28/18	97.82	92.786	23,717.8	0.26	3.0	6
05/29/18	97.65	91.823	24,063.6	0.26	3.0	6
05/30/18	97.13	97.355	25,292.8	0.26	3.0	6
05/31/18	96.67	99.621	25,702.3	0.26	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)
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Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
06/01/18	12.68	12.68	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/02/18	12.67	12.67	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/03/18	12.70	12.70	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/04/18	12.76	12.76	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/05/18	12.76	12.76	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/06/18	12.81	12.81	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/07/18	12.79	12.79	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/08/18	12.76	12.76	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/09/18	12.76	12.76	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/10/18	12.79	12.79	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/11/18	12.81	12.81	12.23	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/12/18	12.81	12.81	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/13/18	12.71	12.71	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/14/18	12.73	12.73	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/15/18	12.79	12.79	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/16/18	12.80	12.80	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/17/18	12.85	12.85	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/18/18	12.86	12.86	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/19/18	12.77	12.77	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/20/18	12.73	12.73	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/21/18	12.74	12.74	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/22/18	12.74	12.74	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/23/18	12.76	12.76	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/24/18	12.80	12.80	12.23	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/25/18	12.79	12.79	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/26/18	12.70	12.70	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/27/18	12.68	12.68	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/28/18	12.68	12.68	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/29/18	12.66	12.66	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/30/18	12.66	12.66	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
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system no. 3090001 , Project no. 745

	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
06/01/18	0.00	4.46	2.22	6.00	0.00	12.68
06/02/18	0.00	4.51	2.17	6.00	0.00	12.67
06/03/18	0.00	4.48	2.22	6.00	0.00	12.70
06/04/18	0.00	4.52	2.24	6.00	0.00	12.76
06/05/18	0.00	4.56	2.20	6.00	0.00	12.76
06/06/18	0.00	4.60	2.22	6.00	0.00	12.81
06/07/18	0.00	4.59	2.20	6.00	0.00	12.79
06/08/18	0.00	4.57	2.19	6.00	0.00	12.76
06/09/18	0.00	4.56	2.20	6.00	0.00	12.76
06/10/18	0.00	4.57	2.22	6.00	0.00	12.79
06/11/18	0.00	4.58	2.23	6.00	0.00	12.81
06/12/18	0.00	4.62	2.19	6.00	0.00	12.81
06/13/18	0.00	4.60	2.11	6.00	0.00	12.71
06/14/18	0.00	4.59	2.14	6.00	0.00	12.73
06/15/18	0.00	4.58	2.22	6.00	0.00	12.79
06/16/18	0.00	4.56	2.24	6.00	0.00	12.80
06/17/18	0.00	4.57	2.28	6.00	0.00	12.85
06/18/18	0.00	4.58	2.29	6.00	0.00	12.86
06/19/18	0.00	4.57	2.21	6.00	0.00	12.77
06/20/18	0.00	4.55	2.18	6.00	0.00	12.73
06/21/18	0.00	4.55	2.19	6.00	0.00	12.74
06/22/18	0.00	4.54	2.21	6.00	0.00	12.74
06/23/18	0.00	4.52	2.24	6.00	0.00	12.76
06/24/18	0.00	4.56	2.23	6.00	0.00	12.80
06/25/18	0.00	4.54	2.24	6.00	0.00	12.79
06/26/18	0.00	4.51	2.19	6.00	0.00	12.70
06/27/18	0.00	4.52	2.17	6.00	0.00	12.68
06/28/18	0.00	4.49	2.18	6.00	0.00	12.68
06/29/18	0.00	4.48	2.19	6.00	0.00	12.66
06/30/18	0.00	4.45	2.21	6.00	0.00	12.66

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Documented Virus Reduction Achieved					
Date	OCSD *LRV*	$MF+Cl_2$ *LRV*	RO *LRV*	UV/AOP *LRV*	Underground travel time (1) *LRV*	Total *LRV*
06/01/18	0.00	0.00	2.22	6.00	4.00	12.22
06/02/18	0.00	0.00	2.17	6.00	4.00	12.17
06/03/18	0.00	0.00	2.22	6.00	4.00	12.22
06/04/18	0.00	0.00	2.24	6.00	4.00	12.24
06/05/18	0.00	0.00	2.20	6.00	4.00	12.20
06/06/18	0.00	0.00	2.22	6.00	4.00	12.22
06/07/18	0.00	0.00	2.20	6.00	4.00	12.20
06/08/18	0.00	0.00	2.19	6.00	4.00	12.19
06/09/18	0.00	0.00	2.20	6.00	4.00	12.20
06/10/18	0.00	0.00	2.22	6.00	4.00	12.22
06/11/18	0.00	0.00	2.23	6.00	4.00	12.23
06/12/18	0.00	0.00	2.19	6.00	4.00	12.19
06/13/18	0.00	0.00	2.11	6.00	4.00	12.11
06/14/18	0.00	0.00	2.14	6.00	4.00	12.14
06/15/18	0.00	0.00	2.22	6.00	4.00	12.22
06/16/18	0.00	0.00	2.24	6.00	4.00	12.24
06/17/18	0.00	0.00	2.28	6.00	4.00	12.28
06/18/18	0.00	0.00	2.29	6.00	4.00	12.29
06/19/18	0.00	0.00	2.21	6.00	4.00	12.21
06/20/18	0.00	0.00	2.18	6.00	4.00	12.18
06/21/18	0.00	0.00	2.19	6.00	4.00	12.19
06/22/18	0.00	0.00	2.21	6.00	4.00	12.21
06/23/18	0.00	0.00	2.24	6.00	4.00	12.24
06/24/18	0.00	0.00	2.23	6.00	4.00	12.23
06/25/18	0.00	0.00	2.24	6.00	4.00	12.24
06/26/18	0.00	0.00	2.19	6.00	4.00	12.19
06/27/18	0.00	0.00	2.17	6.00	4.00	12.17
06/28/18	0.00	0.00	2.18	6.00	4.00	12.18
06/29/18	0.00	0.00	2.19	6.00	4.00	12.19
06/30/18	0.00	0.00	2.21	6.00	4.00	12.21

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
06/01/18	5.00	5.07	5.13	4.85	5.02	4.99	4.88	5.01	4.81	4.55	4.86	4.98	4.82	4.79	4.68	4.63
06/02/18	5.06	5.02	5.13	4.82	4.96	5.01	4.87	4.99	4.83	4.59	4.83	5.00	4.83	4.77	4.66	4.63
06/03/18	5.09	5.06	5.17	4.86	4.97	5.00	4.87	4.97	4.82	4.64	4.80	5.01	4.82	4.78	4.64	4.62
06/04/18	5.08	5.01	5.18	4.78	5.01	5.04	4.89	4.94	4.85	4.61	4.80	5.04	4.85	4.79	4.65	4.64
06/05/18	4.97	5.03	5.15	4.77	5.01	5.02	4.89	4.96	4.79	4.76	4.81	4.96	4.83	4.80	4.63	4.63
06/06/18	5.00	4.99	5.13	4.80	5.00	4.97	4.90	4.96	4.78	4.75	4.82	4.98	4.81	4.79	4.63	4.60
06/07/18	4.99	4.95	5.09	4.83	5.07	4.96	4.85	4.93	4.79	4.69	4.79	4.98	4.78	4.72	4.62	4.61
06/08/18	4.99	4.96	5.04	4.78	5.04	4.91	4.89	4.99	4.78	4.66	4.82	4.97	4.79	4.84	4.62	4.72
06/09/18	4.98	5.03	5.11	4.80	5.05	4.99	4.91	4.99	4.82	4.64	4.78	5.14	4.79	4.88	4.62	4.76
06/10/18	4.99	4.99	5.12	4.83	5.00	4.96	4.94	4.94	4.81	4.71	4.77	5.13	4.80	4.89	4.62	4.73
06/11/18	4.97	4.91	5.07	4.75	5.00	4.95	4.88	4.94	4.79	4.73	4.79	5.09	4.78	4.94	4.63	4.74
06/12/18	4.96	4.96	5.06	4.77	5.00	4.96	4.87	4.90	4.79	4.68	4.76	5.07	4.75	4.90	4.63	4.71
06/13/18	4.96	4.95	5.05	4.96	4.95	4.97	5.09	4.96	4.74	4.62	4.77	5.06	4.76	4.81	4.60	4.67
06/14/18	4.92	4.94	4.99	4.90	4.98	4.92	4.99	4.91	4.71	4.68	4.78	5.06	4.77	4.82	4.59	4.66
06/15/18	5.05	4.98	5.04	4.92	5.04	4.95	5.00	4.93	4.72	4.67	4.75	5.04	4.78	4.84	4.58	4.67
06/16/18	5.11	4.92	5.00	4.93	5.05	4.96	5.03	4.94	4.73	4.64	4.74	5.04	4.77	4.86	4.56	4.68
06/17/18	5.09	4.92	5.00	4.88	5.06	4.96	4.99	4.94	4.76	4.66	4.75	5.03	4.75	4.91	4.57	4.68
06/18/18	5.05	4.94	4.99	4.91	5.05	4.95	4.97	5.03	4.75	4.68	4.72	5.03	4.76	4.87	4.58	4.71
06/19/18	5.08	4.98	4.99	4.90	5.03	5.11	4.99	4.97	4.75	4.62	4.72	5.04	4.73	4.86	4.57	4.68
06/20/18	5.10	4.99	5.02	4.86	5.01	5.07	4.98	5.00	4.75	4.67	4.72	5.04	4.71	4.87	4.55	4.66
06/21/18	5.05	4.90	5.00	4.86	5.01	5.02	4.95	4.99	4.71	4.71	4.71	5.04	4.72	4.86	4.55	4.67
06/22/18	5.05	4.92	4.97	4.90	5.02	5.01	4.97	4.99	4.70	4.68	4.70	5.05	4.83	4.79	4.54	4.64
06/23/18	5.07	5.10	5.21	4.89	5.01	4.99	4.95	5.01	4.85	4.70	4.73	5.02	4.85	4.78	4.52	4.63
06/24/18	5.10	5.06	5.18	4.88	5.01	5.01	5.03	4.99	4.88	4.68	4.69	4.99	4.82	4.82	4.65	4.64
06/25/18	5.08	5.04	5.16	4.83	5.03	5.02	4.98	4.97	4.81	4.66	4.70	5.00	4.87	4.78	4.67	4.65
06/26/18	5.02	5.03	5.14	4.84	5.00	5.02	4.95	4.94	4.81	4.66	4.77	5.00	4.89	4.77	4.65	4.63
06/27/18	5.05	5.03	5.14	4.80	5.02	5.02	4.92	4.94	4.78	4.64	4.76	4.97	4.83	4.76	4.63	4.59
06/28/18	5.05	5.00	5.10	4.84	4.97	4.99	4.94	4.93	4.81	4.62	4.80	4.93	4.83	4.77	4.62	4.60
06/29/18	5.01	5.02	5.13	4.85	5.01	5.00	4.96	4.95	4.82	4.61	4.81	4.97	4.86	4.81	4.63	4.62
06/30/18	5.01	5.02	5.09	4.86	4.98	5.00	4.96	4.98	4.82	4.64	4.76	4.94	4.85	4.78	4.61	4.61

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
06/01/18	4.81	4.70	4.81	4.70	4.82	4.58	4.73	4.83	5.01	4.99	4.78	4.92	4.99	4.82	4.88	4.96
06/02/18	4.79	4.65	4.81	4.69	4.81	4.60	4.72	4.79	4.98	4.96	4.86	4.98	5.12	4.81	4.86	4.99
06/03/18	4.85	4.67	4.81	4.69	4.79	4.65	4.72	4.80	4.96	5.00	4.86	4.95	5.13	4.78	4.87	4.98
06/04/18	4.85	4.69	4.81	4.68	4.81	4.65	4.71	4.82	5.00	5.01	4.86	4.94	5.11	4.81	4.87	4.96
06/05/18	4.80	4.67	4.79	4.68	4.81	4.62	4.71	4.79	4.95	5.02	4.85	4.90	5.08	4.78	4.82	4.97
06/06/18	4.81	4.65	4.79	4.70	4.81	4.60	4.69	4.80	4.97	5.04	4.83	4.91	5.07	4.78	4.84	4.97
06/07/18	4.82	4.64	4.80	4.67	4.80	4.59	4.68	4.78	5.02	4.98	4.82	4.91	5.07	4.79	4.85	4.98
06/08/18	4.79	4.63	4.75	4.64	4.78	4.57	4.70	4.76	5.03	4.94	4.83	4.91	5.08	4.78	4.82	4.96
06/09/18	4.79	4.67	4.75	4.65	4.76	4.56	4.69	4.78	4.99	4.97	4.83	4.90	5.06	4.79	4.84	4.96
06/10/18	4.80	4.67	4.76	4.67	4.78	4.57	4.70	4.80	4.94	4.98	4.84	4.88	5.09	4.77	4.87	4.96
06/11/18	4.81	4.65	4.76	4.66	4.78	4.58	4.69	4.78	4.99	4.98	4.83	4.89	5.11	4.75	4.87	4.95
06/12/18	4.75	4.64	4.73	4.62	4.74	4.65	4.78	4.75	5.05	4.97	4.84	4.92	5.07	4.77	4.86	4.92
06/13/18	4.91	4.61	4.69	4.60	4.85	4.68	4.87	4.72	4.99	4.93	4.83	4.89	5.05	4.74	4.83	4.88
06/14/18	4.98	4.60	4.88	4.61	4.97	4.67	4.80	4.83	4.95	4.90	4.83	4.87	5.06	4.72	4.80	4.86
06/15/18	4.96	4.61	4.97	4.59	4.95	4.68	4.79	5.01	4.96	4.92	4.80	4.89	5.07	4.73	4.80	4.92
06/16/18	4.98	4.63	4.90	4.57	4.96	4.68	4.80	4.93	4.97	5.01	4.79	4.89	5.03	4.72	4.81	4.91
06/17/18	4.98	4.64	4.89	4.62	4.90	4.69	4.81	4.89	4.96	5.09	4.80	4.86	4.99	4.73	4.77	4.91
06/18/18	4.98	4.66	4.91	4.64	4.88	4.71	4.81	4.87	4.91	5.08	4.81	4.87	5.00	4.76	4.81	4.91
06/19/18	4.94	4.81	4.87	4.75	4.90	4.70	4.77	4.88	4.90	5.06	4.81	4.86	4.98	4.80	4.91	4.92
06/20/18	4.93	4.84	4.81	4.81	4.92	4.68	4.75	4.87	4.92	5.03	4.83	4.85	4.98	4.87	4.90	4.94
06/21/18	4.92	4.74	4.82	4.78	4.92	4.68	4.77	4.84	4.96	5.03	4.82	4.82	5.04	4.82	4.89	5.02
06/22/18	4.89	4.72	4.83	4.77	4.88	4.68	4.76	4.84	5.05	5.03	4.80	4.81	5.03	4.83	4.88	5.02
06/23/18	4.91	4.73	4.86	4.77	4.86	4.67	4.75	4.86	5.07	5.04	4.77	4.78	4.98	4.81	4.85	5.01
06/24/18	4.90	4.70	4.85	4.75	4.85	4.65	4.76	4.84	5.04	5.02	4.76	4.83	4.98	4.82	4.82	4.98
06/25/18	4.90	4.72	4.86	4.73	4.87	4.64	4.75	4.82	5.05	5.01	4.73	4.95	5.00	4.79	4.83	5.01
06/26/18	4.88	4.69	4.83	4.72	4.89	4.66	4.73	4.84	5.03	5.00	4.74	4.94	4.99	4.78	4.83	5.02
06/27/18	4.85	4.67	4.79	4.69	4.84	4.63	4.70	4.82	5.02	5.00	4.83	4.91	5.02	4.86	4.85	4.96
06/28/18	4.86	4.66	4.79	4.68	4.82	4.60	4.69	4.80	5.01	5.01	4.90	4.89	5.17	4.87	4.88	4.94
06/29/18	4.82	4.67	4.77	4.67	4.80	4.62	4.70	4.81	5.01	4.99	4.85	4.89	5.15	4.78	4.89	4.96
06/30/18	4.81	4.68	4.78	4.69	4.78	4.62	4.71	4.80	5.00	5.00	4.81	4.89	5.16	4.80	4.87	4.96

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

MicroFiltration Process online monitoring results

Log Removal Value

Date	E01 LRV	E02 LRV	E03 LRV	E04 LRV
06/01/18	4.93	4.90	4.46	4.74
06/02/18	4.96	4.89	4.51	4.74
06/03/18	4.89	4.88	4.48	4.73
06/04/18	4.87	4.88	4.52	4.71
06/05/18	4.88	4.86	4.56	4.74
06/06/18	4.90	4.84	4.72	4.74
06/07/18	4.91	4.87	4.67	4.74
06/08/18	4.88	4.84	4.68	4.77
06/09/18	4.90	4.91	4.71	4.76
06/10/18	4.89	5.08	4.68	4.73
06/11/18	4.86	5.05	4.66	4.78
06/12/18	4.85	5.03	4.67	4.76
06/13/18	4.88	4.99	4.65	4.75
06/14/18	4.89	5.01	4.63	4.64
06/15/18	4.90	5.01	4.62	4.67
06/16/18	4.82	4.96	4.60	4.73
06/17/18	4.82	4.96	4.62	4.79
06/18/18	4.81	4.92	4.58	4.77
06/19/18	4.83	4.97	4.58	4.81
06/20/18	4.84	4.99	4.60	4.90
06/21/18	4.83	4.97	4.61	4.92
06/22/18	4.78	4.98	4.62	4.79
06/23/18	4.84	4.97	4.59	4.67
06/24/18	4.93	4.92	4.56	4.65
06/25/18	4.91	4.94	4.54	4.60
06/26/18	4.89	4.97	4.51	4.62
06/27/18	4.89	4.99	4.52	4.87
06/28/18	4.95	4.97	4.49	4.83
06/29/18	4.91	4.93	4.48	4.83
06/30/18	4.87	4.96	4.45	4.80

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
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MicroFiltration Process online monitoring results

Effluent Turbidity - NTU

Date	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
06/01/18	0.08	0.09	0.09	0.09	0.08	0.09	0.09	0.10	0.08	0.10	0.12	0.15	0.09	0.12	0.10	0.11	0.05	0.05	0.09
06/02/18	0.09	0.10	0.10	0.10	0.09	0.09	0.10	0.10	0.08	0.09	0.12	0.13	0.08	0.08	0.11	0.12	0.05	0.06	0.09
06/03/18	0.10	0.11	0.10	0.10	0.09	0.10	0.10	0.10	0.09	0.09	0.13	0.14	0.08	0.08	0.12	0.12	0.05	0.06	0.09
06/04/18	0.10	0.11	0.10	0.11	0.09	0.10	0.10	0.10	0.09	0.10	0.13	0.14	0.08	0.09	0.12	0.12	0.05	0.06	0.10
06/05/18	0.10	0.11	0.10	0.11	0.09	0.10	0.10	0.10	0.08	0.09	0.14	0.14	0.09	0.09	0.12	0.12	0.05	0.06	0.10
06/06/18	0.09	0.10	0.10	0.10	0.09	0.10	0.09	0.09	0.08	0.09	0.14	0.14	0.09	0.09	0.11	0.12	0.05	0.05	0.09
06/07/18	0.09	0.10	0.09	0.11	0.09	0.10	0.09	0.10	0.08	0.10	0.15	0.15	0.09	0.10	0.12	0.12	0.05	0.05	0.09
06/08/18	0.08	0.09	0.09	0.10	0.08	0.09	0.09	0.09	0.08	0.10	0.15	0.15	0.09	0.11	0.12	0.12	0.05	0.05	0.09
06/09/18	0.09	0.10	0.10	0.10	0.09	0.09	0.09	0.10	0.09	0.10	0.15	0.16	0.11	0.12	0.12	0.13	0.05	0.07	0.10
06/10/18	0.10	0.11	0.11	0.12	0.09	0.10	0.10	0.10	0.09	0.11	0.16	0.16	0.12	0.13	0.12	0.13	0.06	0.09	0.11
06/11/18	0.11	0.14	0.11	0.13	0.10	0.13	0.10	0.12	0.09	0.10	0.16	0.17	0.13	0.14	0.13	0.15	0.06	0.08	0.11
06/12/18	0.10	0.11	0.10	0.11	0.09	0.09	0.09	0.10	0.09	0.10	0.16	0.16	0.13	0.13	0.12	0.13	0.06	0.07	0.10
06/13/18	0.09	0.10	0.10	0.11	0.09	0.09	0.09	0.10	0.09	0.10	0.16	0.16	0.13	0.14	0.12	0.12	0.06	0.09	0.10
06/14/18	0.09	0.10	0.09	0.10	0.09	0.09	0.09	0.10	0.09	0.10	0.16	0.17	0.14	0.14	0.12	0.12	0.07	0.10	0.10
06/15/18	0.10	0.11	0.10	0.10	0.09	0.09	0.10	0.10	0.07	0.10	0.10	0.17	0.10	0.14	0.11	0.13	0.06	0.11	0.09
06/16/18	0.10	0.11	0.11	0.12	0.09	0.09	0.10	0.10	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.05	0.06	0.08
06/17/18	0.10	0.10	0.11	0.12	0.09	0.09	0.10	0.10	0.06	0.07	0.07	0.07	0.09	0.09	0.09	0.09	0.05	0.06	0.08
06/18/18	0.11	0.12	0.11	0.12	0.10	0.11	0.10	0.11	0.06	0.07	0.07	0.07	0.09	0.09	0.10	0.11	0.06	0.06	0.09
06/19/18	0.10	0.11	0.11	0.12	0.09	0.10	0.09	0.10	0.06	0.10	0.07	0.12	0.08	0.09	0.09	0.10	0.06	0.07	0.08
06/20/18	0.10	0.10	0.11	0.11	0.09	0.09	0.10	0.10	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.07	0.08	0.08
06/21/18	0.10	0.10	0.11	0.11	0.09	0.09	0.10	0.10	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.12	0.05	0.07	0.08
06/22/18	0.10	0.10	0.11	0.12	0.09	0.10	0.09	0.10	0.06	0.06	0.08	0.09	0.08	0.08	0.09	0.09	0.05	0.05	0.08
06/23/18	0.11	0.12	0.11	0.12	0.10	0.10	0.10	0.10	0.07	0.07	0.09	0.10	0.08	0.09	0.09	0.10	0.06	0.07	0.09
06/24/18	0.11	0.11	0.12	0.13	0.10	0.12	0.10	0.11	0.07	0.09	0.10	0.11	0.09	0.11	0.10	0.10	0.06	0.10	0.10
06/25/18	0.11	0.12	0.12	0.13	0.10	0.10	0.11	0.13	0.08	0.09	0.11	0.12	0.10	0.10	0.11	0.11	0.07	0.07	0.10
06/26/18	0.11	0.12	0.12	0.13	0.10	0.11	0.10	0.11	0.08	0.10	0.09	0.12	0.09	0.10	0.10	0.11	0.07	0.09	0.10
06/27/18	0.09	0.10	0.10	0.14	0.08	0.10	0.09	0.10	0.07	0.08	0.06	0.07	0.09	0.10	0.10	0.12	0.06	0.07	0.08
06/28/18	0.09	0.11	0.09	0.10	0.07	0.07	0.09	0.10	0.07	0.08	0.06	0.07	0.09	0.10	0.09	0.10	0.05	0.07	0.08
06/29/18	0.09	0.10	0.09	0.09	0.07	0.07	0.09	0.09	0.08	0.08	0.07	0.08	0.09	0.10	0.09	0.10	0.05	0.06	0.08
06/30/18	0.09	0.10	0.09	0.10	0.07	0.09	0.09	0.10	0.08	0.09	0.08	0.09	0.09	0.10	0.10	0.10	0.06	0.08	0.08

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Reverse Osmosis Process online monitoring results														Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)									
	ROP		ROF			ROP			ROF			ROP						
	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
06/01/18	0.023	0.028	8.021	7.604	8.563	0.048	0.043	0.054	1,862	1,808	1,904	43	39	47	99.40	2.22	97.69	1.64
06/02/18	0.023	0.025	7.484	7.700	8.778	0.051	0.044	0.080	1,849	1,819	1,887	43	40	60	99.32	2.17	97.67	1.63
06/03/18	0.018	0.031	7.657	7.198	8.401	0.046	0.036	0.068	1,723	1,666	1,832	40	37	52	99.40	2.22	97.65	1.63
06/04/18	0.033	0.040	7.655	7.180	8.417	0.044	0.041	0.050	1,615	1,527	1,743	37	33	41	99.42	2.24	97.69	1.64
06/05/18	0.033	0.037	7.974	7.550	8.765	0.050	0.043	0.060	1,772	1,674	1,876	40	36	46	99.37	2.20	97.73	1.64
06/06/18	0.033	0.034	7.904	7.199	15.075	0.048	0.045	0.050	1,844	1,768	1,925	43	36	48	99.39	2.22	97.69	1.64
06/07/18	0.029	0.032	7.600	7.099	8.128	0.048	0.043	0.054	1,828	1,753	1,901	41	37	45	99.37	2.20	97.76	1.65
06/08/18	0.024	0.025	7.754	7.285	8.318	0.050	0.045	0.057	1,848	1,766	1,919	42	38	47	99.35	2.19	97.74	1.65
06/09/18	0.015	0.021	7.656	7.231	8.187	0.048	0.042	0.052	1,820	1,768	1,879	43	39	47	99.37	2.20	97.66	1.63
06/10/18	0.014	0.024	7.328	6.853	8.186	0.044	0.037	0.051	1,679	1,618	1,771	39	36	42	99.39	2.22	97.69	1.64
06/11/18	0.019	0.026	7.334	6.678	8.442	0.044	0.038	0.048	1,598	1,508	1,754	37	32	43	99.40	2.23	97.67	1.63
06/12/18	0.026	0.029	7.744	7.263	8.459	0.050	0.045	0.055	1,787	1,692	1,874	42	37	49	99.35	2.19	97.67	1.63
06/13/18	0.021	0.025	8.348	7.987	9.006	0.064	0.052	0.084	1,851	1,785	1,938	44	40	49	99.23	2.11	97.65	1.63
06/14/18	0.025	0.029	7.847	7.205	8.332	0.057	0.048	0.066	1,865	1,783	1,947	46	40	53	99.28	2.14	97.56	1.61
06/15/18	0.017	0.024	7.609	7.099	8.162	0.046	0.043	0.050	1,869	1,799	1,934	45	38	49	99.40	2.22	97.60	1.62
06/16/18	0.026	0.031	7.589	7.070	8.093	0.044	0.038	0.047	1,829	1,761	1,893	43	40	47	99.43	2.24	97.65	1.63
06/17/18	0.027	0.028	7.524	7.002	9.620	0.040	0.035	0.045	1,718	1,662	1,773	41	37	46	99.47	2.28	97.61	1.62
06/18/18	0.028	0.029	7.738	6.852	12.969	0.040	0.037	0.046	1,653	1,539	1,832	41	35	47	99.48	2.29	97.53	1.61
06/19/18	0.014	0.019	7.761	7.238	8.574	0.048	0.043	0.056	1,824	1,719	1,938	43	38	49	99.38	2.21	97.64	1.63
06/20/18	0.018	0.027	7.506	6.974	8.165	0.049	0.045	0.053	1,860	1,783	1,947	45	38	51	99.34	2.18	97.60	1.62
06/21/18	0.021	0.027	7.611	7.114	8.037	0.049	0.045	0.055	1,858	1,776	1,929	45	40	50	99.35	2.19	97.58	1.62
06/22/18	0.021	0.025	7.621	6.975	8.243	0.047	0.043	0.051	1,844	1,769	1,935	44	39	49	99.38	2.21	97.63	1.63
06/23/18	0.016	0.026	7.758	7.350	8.307	0.045	0.039	0.050	1,816	1,732	1,880	42	39	46	99.42	2.24	97.70	1.64
06/24/18	0.027	0.029	7.312	6.675	8.085	0.043	0.037	0.050	1,645	1,586	1,703	39	36	42	99.41	2.23	97.66	1.63
06/25/18	0.031	0.032	7.474	6.908	8.448	0.043	0.038	0.050	1,606	1,541	1,713	38	34	43	99.43	2.24	97.64	1.63
06/26/18	0.030	0.031	7.789	7.247	8.636	0.051	0.037	0.057	1,759	1,652	1,889	41	36	48	99.35	2.19	97.65	1.63
06/27/18	0.030	0.030	8.221	7.576	9.223	0.056	0.047	0.069	1,843	1,784	1,901	44	40	47	99.32	2.17	97.64	1.63
06/28/18	0.031	0.031	7.620	7.135	8.227	0.050	0.045	0.056	1,846	1,779	1,921	43	40	48	99.35	2.18	97.65	1.63
06/29/18	0.029	0.031	7.364	6.788	7.942	0.048	0.044	0.053	1,830	1,777	1,880	43	39	49	99.35	2.19	97.63	1.63
06/30/18	0.033	0.034	7.286	6.751	7.848	0.045	0.038	0.049	1,749	1,689	1,823	41	39	46	99.38	2.21	97.64	1.63

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	UltraViolet / AOP Process online monitoring results					
Date	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
06/01/18	96.56	98.386	25,444.5	0.26	3.0	6
06/02/18	96.74	97.788	25,176.6	0.26	3.0	6
06/03/18	97.07	71.685	18,573.4	0.26	3.0	6
06/04/18	96.86	96.805	24,665.4	0.25	3.0	6
06/05/18	96.92	96.578	24,382.8	0.25	3.0	6
06/06/18	96.93	99.681	25,026.1	0.25	3.0	6
06/07/18	96.65	99.792	25,117.5	0.25	3.0	6
06/08/18	96.29	99.525	25,154.1	0.25	3.0	6
06/09/18	96.63	99.735	25,005.9	0.25	3.0	6
06/10/18	96.86	95.693	23,775.1	0.25	3.0	6
06/11/18	96.87	95.376	23,705.6	0.25	3.0	6
06/12/18	96.99	96.597	24,481.8	0.25	3.0	6
06/13/18	96.89	99.403	25,184.8	0.25	3.0	6
06/14/18	96.52	98.552	24,550.6	0.25	3.0	6
06/15/18	96.55	96.732	24,528.4	0.25	3.0	6
06/16/18	96.76	100.108	25,119.1	0.25	3.0	6
06/17/18	96.95	98.116	24,597.5	0.25	3.0	6
06/18/18	96.91	95.316	24,300.3	0.25	3.0	6
06/19/18	96.77	95.496	24,496.3	0.26	3.0	6
06/20/18	96.78	99.212	25,172.3	0.25	3.0	6
06/21/18	96.88	95.611	24,082.3	0.25	3.0	6
06/22/18	96.81	99.497	24,846.3	0.25	3.0	6
06/23/18	96.70	98.986	24,732.0	0.25	3.0	6
06/24/18	96.87	97.657	24,544.2	0.25	3.0	6
06/25/18	96.77	95.409	24,087.8	0.25	3.0	6
06/26/18	96.91	95.272	24,067.0	0.25	3.0	6
06/27/18	97.06	100.177	24,928.3	0.25	3.0	6
06/28/18	97.28	98.221	24,410.0	0.25	3.0	6
06/29/18	97.30	98.392	24,438.1	0.25	3.0	6
06/30/18	97.29	98.425	24,385.5	0.25	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus$_{(1)}$	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
07/01/18	12.73	12.73	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/02/18	12.80	12.80	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/03/18	12.77	12.77	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/04/18	12.79	12.79	12.23	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/05/18	12.83	12.83	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/06/18	12.76	12.76	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/07/18	12.77	12.77	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/08/18	12.78	12.78	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/09/18	12.80	12.80	12.23	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/10/18	12.74	12.74	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/11/18	12.73	12.73	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/12/18	12.72	12.72	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/13/18	12.74	12.74	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/14/18	12.75	12.75	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/15/18	12.77	12.77	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/16/18	12.76	12.76	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/17/18	12.75	12.75	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/18/18	12.76	12.76	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/19/18	12.72	12.72	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/20/18	12.68	12.68	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/21/18	12.69	12.69	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/22/18	12.74	12.74	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/23/18	12.70	12.70	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/24/18	12.66	12.66	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/25/18	12.62	12.62	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/26/18	12.55	12.55	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/27/18	12.59	12.59	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/28/18	12.70	12.70	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/29/18	12.73	12.73	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/30/18	12.75	12.75	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/31/18	12.70	12.70	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
07/01/18	0.00	4.52	2.22	6.00	0.00	12.73
07/02/18	0.00	4.59	2.21	6.00	0.00	12.80
07/03/18	0.00	4.56	2.21	6.00	0.00	12.77
07/04/18	0.00	4.56	2.23	6.00	0.00	12.79
07/05/18	0.00	4.58	2.25	6.00	0.00	12.83
07/06/18	0.00	4.57	2.19	6.00	0.00	12.76
07/07/18	0.00	4.59	2.18	6.00	0.00	12.77
07/08/18	0.00	4.56	2.22	6.00	0.00	12.78
07/09/18	0.00	4.57	2.23	6.00	0.00	12.80
07/10/18	0.00	4.56	2.18	6.00	0.00	12.74
07/11/18	0.00	4.54	2.19	6.00	0.00	12.73
07/12/18	0.00	4.53	2.19	6.00	0.00	12.72
07/13/18	0.00	4.55	2.19	6.00	0.00	12.74
07/14/18	0.00	4.58	2.17	6.00	0.00	12.75
07/15/18	0.00	4.58	2.19	6.00	0.00	12.77
07/16/18	0.00	4.56	2.20	6.00	0.00	12.76
07/17/18	0.00	4.56	2.19	6.00	0.00	12.75
07/18/18	0.00	4.57	2.20	6.00	0.00	12.76
07/19/18	0.00	4.56	2.16	6.00	0.00	12.72
07/20/18	0.00	4.51	2.18	6.00	0.00	12.68
07/21/18	0.00	4.52	2.17	6.00	0.00	12.69
07/22/18	0.00	4.54	2.20	6.00	0.00	12.74
07/23/18	0.00	4.48	2.22	6.00	0.00	12.70
07/24/18	0.00	4.47	2.18	6.00	0.00	12.66
07/25/18	0.00	4.49	2.13	6.00	0.00	12.62
07/26/18	0.00	4.44	2.11	6.00	0.00	12.55
07/27/18	0.00	4.48	2.12	6.00	0.00	12.59
07/28/18	0.00	4.56	2.14	6.00	0.00	12.70
07/29/18	0.00	4.57	2.16	6.00	0.00	12.73
07/30/18	0.00	4.56	2.19	6.00	0.00	12.75
07/31/18	0.00	4.57	2.13	6.00	0.00	12.70

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Documented Virus Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
Date	LRV	LRV	LRV	LRV	LRV	LRV
07/01/18	0.00	0.00	2.22	6.00	4.00	12.22
07/02/18	0.00	0.00	2.21	6.00	4.00	12.21
07/03/18	0.00	0.00	2.21	6.00	4.00	12.21
07/04/18	0.00	0.00	2.23	6.00	4.00	12.23
07/05/18	0.00	0.00	2.25	6.00	4.00	12.25
07/06/18	0.00	0.00	2.19	6.00	4.00	12.19
07/07/18	0.00	0.00	2.18	6.00	4.00	12.18
07/08/18	0.00	0.00	2.22	6.00	4.00	12.22
07/09/18	0.00	0.00	2.23	6.00	4.00	12.23
07/10/18	0.00	0.00	2.18	6.00	4.00	12.18
07/11/18	0.00	0.00	2.19	6.00	4.00	12.19
07/12/18	0.00	0.00	2.19	6.00	4.00	12.19
07/13/18	0.00	0.00	2.19	6.00	4.00	12.19
07/14/18	0.00	0.00	2.17	6.00	4.00	12.17
07/15/18	0.00	0.00	2.19	6.00	4.00	12.19
07/16/18	0.00	0.00	2.20	6.00	4.00	12.20
07/17/18	0.00	0.00	2.19	6.00	4.00	12.19
07/18/18	0.00	0.00	2.20	6.00	4.00	12.20
07/19/18	0.00	0.00	2.16	6.00	4.00	12.16
07/20/18	0.00	0.00	2.18	6.00	4.00	12.18
07/21/18	0.00	0.00	2.17	6.00	4.00	12.17
07/22/18	0.00	0.00	2.20	6.00	4.00	12.20
07/23/18	0.00	0.00	2.22	6.00	4.00	12.22
07/24/18	0.00	0.00	2.18	6.00	4.00	12.18
07/25/18	0.00	0.00	2.13	6.00	4.00	12.13
07/26/18	0.00	0.00	2.11	6.00	4.00	12.11
07/27/18	0.00	0.00	2.12	6.00	4.00	12.12
07/28/18	0.00	0.00	2.14	6.00	4.00	12.14
07/29/18	0.00	0.00	2.16	6.00	4.00	12.16
07/30/18	0.00	0.00	2.19	6.00	4.00	12.19
07/31/18	0.00	0.00	2.13	6.00	4.00	12.13

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	A01	**A02**	**A03**	**A04**	**A05**	**A06**	**A07**	**A08**	**B01**	**B02**	**B03**	**B04**	**B05**	**B06**	**B07**	**B08**
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
07/01/18	4.96	4.98	5.07	4.83	4.96	4.96	4.93	4.95	4.81	4.78	4.76	4.93	4.86	4.78	4.61	4.61
07/02/18	4.99	4.99	5.09	4.88	5.00	4.98	4.97	4.94	4.80	4.81	4.79	4.95	4.83	4.77	4.62	4.63
07/03/18	5.01	4.96	5.09	4.84	4.99	4.99	4.93	4.90	4.77	4.80	4.79	4.94	4.79	4.73	4.61	4.61
07/04/18	5.01	5.01	5.05	4.85	4.96	4.97	4.93	4.95	4.72	4.76	4.80	4.92	4.78	4.85	4.57	4.71
07/05/18	5.02	4.96	5.12	4.80	4.95	4.98	4.93	4.96	4.79	4.79	4.77	5.05	4.81	4.89	4.60	4.75
07/06/18	4.96	4.96	5.09	4.80	4.96	4.96	4.92	4.96	4.83	4.78	4.78	5.11	4.85	4.88	4.61	4.72
07/07/18	4.93	5.02	5.05	4.83	4.94	4.97	4.96	4.90	4.79	4.78	4.94	5.05	4.81	4.84	4.59	4.68
07/08/18	4.99	4.99	5.10	4.81	4.96	4.93	4.91	4.88	4.73	4.76	5.01	5.01	4.77	4.82	4.56	4.67
07/09/18	4.95	4.99	5.10	4.91	4.97	4.97	5.13	4.91	4.73	4.75	5.00	5.03	4.79	4.83	4.57	4.68
07/10/18	4.94	4.97	5.06	4.90	5.10	4.97	5.08	4.83	4.76	4.72	5.00	4.97	4.79	4.84	4.56	4.69
07/11/18	5.10	4.93	5.10	4.93	5.04	4.98	5.03	4.87	4.74	4.71	4.98	4.97	4.78	4.85	4.54	4.68
07/12/18	5.13	4.90	5.08	4.91	5.10	4.93	5.03	4.91	4.71	4.71	4.94	4.97	4.77	4.78	4.53	4.66
07/13/18	5.10	4.91	5.00	4.90	5.06	4.93	5.01	4.93	4.69	4.72	4.95	4.98	4.75	4.76	4.58	4.64
07/14/18	5.07	4.88	5.00	4.92	4.99	4.90	5.00	5.02	4.71	4.70	4.96	5.00	4.73	4.79	4.63	4.65
07/15/18	5.07	4.90	4.96	4.92	5.03	5.03	5.03	5.06	4.80	4.78	4.95	5.02	4.77	4.84	4.65	4.67
07/16/18	5.07	4.91	4.96	4.91	5.02	5.02	5.02	5.00	4.68	4.72	4.95	4.99	4.73	4.82	4.62	4.66
07/17/18	5.08	4.91	4.95	4.93	5.04	5.04	4.98	5.01	4.66	4.66	4.94	5.00	4.71	4.78	4.59	4.63
07/18/18	5.02	4.92	4.92	4.93	5.01	5.01	4.97	4.92	4.69	4.67	4.93	4.97	4.68	4.78	4.58	4.61
07/19/18	5.02	5.08	5.32	4.91	4.98	5.04	5.01	4.95	4.62	4.68	4.87	4.96	4.79	4.78	4.57	4.59
07/20/18	5.05	5.00	5.18	4.90	5.01	4.96	5.00	4.98	4.83	4.67	4.86	4.97	4.84	4.78	4.57	4.62
07/21/18	5.07	5.06	5.17	4.86	4.99	5.03	4.96	4.96	4.84	4.64	4.87	4.96	4.87	4.77	4.66	4.60
07/22/18	5.05	5.07	5.10	4.90	5.01	4.98	5.03	4.93	4.84	4.62	5.04	4.95	4.90	4.78	4.70	4.62
07/23/18	5.03	5.03	5.08	4.85	5.02	4.95	5.02	4.93	4.83	4.59	5.02	4.97	4.84	4.77	4.69	4.61
07/24/18	5.04	5.01	5.14	4.84	4.97	4.92	4.98	4.94	4.83	4.63	5.02	4.95	4.81	4.78	4.67	4.57
07/25/18	4.98	5.01	5.10	4.79	5.02	4.93	5.00	4.97	4.84	4.60	5.00	4.93	4.82	4.77	4.63	4.57
07/26/18	5.03	5.03	5.10	4.78	5.00	4.95	4.96	4.97	4.81	4.78	5.00	4.94	4.83	4.75	4.60	4.56
07/27/18	4.98	5.02	5.14	4.78	4.97	4.93	4.96	4.96	4.80	4.79	5.02	4.93	4.83	4.73	4.62	4.57
07/28/18	4.97	5.04	5.13	4.76	4.97	4.94	5.02	4.94	4.81	4.75	5.02	4.92	4.83	4.72	4.59	4.56
07/29/18	4.98	4.98	5.11	4.78	4.98	4.93	5.01	4.95	4.79	4.76	5.00	4.90	4.82	4.71	4.61	4.57
07/30/18	5.00	4.92	5.07	4.76	4.98	4.94	4.98	4.97	4.77	4.78	4.99	4.90	4.79	4.72	4.58	4.56
07/31/18	4.99	4.97	5.07	4.76	4.94	4.92	4.94	4.95	4.77	4.74	4.98	5.04	4.78	4.84	4.57	4.63

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Log Removal Value

Date	C01 LRV	C02 LRV	C03 LRV	C04 LRV	C05 LRV	C06 LRV	C07 LRV	C08 LRV	D01 LRV	D02 LRV	D03 LRV	D04 LRV	D05 LRV	D06 LRV	D07 LRV	D08 LRV
07/01/18	4.82	4.68	4.82	4.73	4.81	4.61	4.72	4.80	4.99	4.97	4.83	4.90	5.15	4.80	4.87	4.95
07/02/18	4.83	4.67	4.82	4.71	4.82	4.59	4.71	4.80	5.03	4.94	4.83	4.93	5.09	4.78	4.89	4.97
07/03/18	4.82	4.64	4.78	4.67	4.82	4.56	4.70	4.81	5.02	4.93	4.82	4.89	5.08	4.78	4.86	4.94
07/04/18	4.81	4.63	4.77	4.68	4.77	4.56	4.69	4.81	4.99	4.95	4.85	4.85	5.13	4.80	4.87	4.94
07/05/18	4.82	4.62	4.78	4.69	4.75	4.58	4.67	4.76	5.00	4.97	4.83	4.88	5.08	4.78	4.87	4.94
07/06/18	4.84	4.65	4.77	4.68	4.78	4.57	4.64	4.74	5.01	4.99	4.80	4.89	5.11	4.76	4.88	4.95
07/07/18	4.80	4.63	4.74	4.63	4.80	4.69	4.62	4.75	5.00	4.96	4.83	4.90	5.12	4.75	4.88	4.95
07/08/18	4.76	4.70	4.73	4.61	4.79	4.77	4.71	4.74	5.00	4.95	4.83	4.90	5.09	4.73	4.90	4.91
07/09/18	4.77	4.75	4.74	4.64	4.79	4.70	4.81	4.73	4.99	4.95	4.84	4.86	5.07	4.73	4.88	4.90
07/10/18	4.92	4.70	4.88	4.64	4.93	4.68	4.80	4.73	5.00	4.92	4.83	4.86	5.06	4.73	4.86	4.91
07/11/18	4.99	4.68	4.91	4.62	5.00	4.70	4.79	4.82	4.99	4.92	4.82	4.90	5.06	4.70	4.86	4.89
07/12/18	4.94	4.63	4.85	4.58	4.97	4.68	4.77	4.91	4.94	5.01	4.80	4.88	5.07	4.71	4.84	4.88
07/13/18	4.90	4.62	4.85	4.55	4.95	4.67	4.74	4.87	4.91	5.07	4.77	4.84	5.04	4.69	4.83	4.91
07/14/18	4.98	4.64	4.88	4.58	4.94	4.71	4.76	4.89	4.97	5.07	4.80	4.82	5.07	4.67	4.86	4.89
07/15/18	4.98	4.60	4.88	4.72	4.94	4.68	4.79	4.92	4.98	5.06	4.80	4.81	5.07	4.70	5.00	4.89
07/16/18	4.89	4.77	4.84	4.76	4.93	4.68	4.76	4.89	4.95	5.07	4.79	4.82	5.01	4.74	4.94	4.91
07/17/18	4.89	4.79	4.83	4.76	4.92	4.74	4.73	4.89	4.99	5.06	4.78	4.80	4.99	4.82	4.91	5.01
07/18/18	4.91	4.75	4.83	4.76	4.91	4.70	4.73	4.88	5.06	5.02	4.79	4.79	5.01	4.79	4.91	4.99
07/19/18	4.87	4.72	4.80	4.72	4.89	4.67	4.73	4.83	5.04	4.99	4.80	4.80	4.99	4.77	4.89	4.97
07/20/18	4.86	4.69	4.81	4.70	4.87	4.67	4.71	4.84	5.03	5.00	4.75	4.84	4.95	4.73	4.88	5.00
07/21/18	4.82	4.70	4.81	4.70	4.90	4.65	4.71	4.83	5.02	5.03	4.75	4.98	4.96	4.73	4.94	4.98
07/22/18	4.82	4.71	4.80	4.70	4.93	4.66	4.73	4.80	5.04	5.02	4.75	4.94	5.00	4.75	4.91	4.96
07/23/18	4.84	4.71	4.81	4.69	4.89	4.66	4.73	4.81	5.08	5.01	4.74	4.92	4.99	4.76	4.89	5.01
07/24/18	4.82	4.78	4.82	4.68	4.87	4.64	4.70	4.81	5.06	5.02	4.77	4.88	5.05	4.78	4.86	5.02
07/25/18	4.79	4.80	4.80	4.66	4.84	4.62	4.68	4.79	5.03	4.99	4.84	4.87	5.13	4.80	4.86	4.99
07/26/18	4.78	4.79	4.78	4.66	4.83	4.62	4.69	4.79	5.00	4.97	4.85	4.89	5.14	4.78	4.91	4.94
07/27/18	4.80	4.76	4.76	4.67	4.85	4.62	4.68	4.80	4.99	4.97	4.85	4.90	5.13	4.75	4.92	4.92
07/28/18	4.78	4.75	4.76	4.69	4.84	4.61	4.67	4.78	5.01	4.95	4.84	4.87	5.12	4.73	4.92	4.92
07/29/18	4.79	4.77	4.76	4.69	4.86	4.62	4.68	4.79	5.06	4.95	4.82	4.90	5.12	4.72	4.89	4.93
07/30/18	4.78	4.76	4.77	4.68	4.86	4.60	4.68	4.80	5.06	4.95	4.84	4.87	5.12	4.74	4.91	4.96
07/31/18	4.76	4.74	4.77	4.68	4.83	4.58	4.65	4.78	5.03	4.93	4.82	4.83	5.10	4.72	4.89	4.96

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	MicroFiltration Process online monitoring results Log Removal Value															
	E01 LRV	E02 LRV	E03 LRV	E04 LRV												
07/01/18	4.92	4.93	4.52	4.77												
07/02/18	4.92	4.94	4.69	4.78												
07/03/18	4.93	4.94	4.68	4.70												
07/04/18	4.88	4.93	4.65	4.71												
07/05/18	4.84	4.93	4.64	4.74												
07/06/18	4.90	5.06	4.65	4.78												
07/07/18	4.87	5.02	4.62	4.74												
07/08/18	4.87	5.07	4.63	4.78												
07/09/18	4.86	5.08	4.66	4.76												
07/10/18	4.88	5.03	4.60	4.77												
07/11/18	4.84	5.08	4.57	4.71												
07/12/18	4.86	5.04	4.60	4.71												
07/13/18	4.88	5.07	4.59	4.72												
07/14/18	4.83	5.03	4.61	4.75												
07/15/18	4.81	5.05	4.58	4.72												
07/16/18	4.79	5.05	4.56	4.67												
07/17/18	4.81	4.97	4.56	4.65												
07/18/18	4.81	4.98	4.57	4.63												
07/19/18	4.81	5.00	4.56	4.66												
07/20/18	4.94	4.99	4.51	4.64												
07/21/18	4.91	4.99	4.52	4.57												
07/22/18	4.92	4.97	4.54	4.57												
07/23/18	4.89	4.96	4.48	4.63												
07/24/18	4.90	4.94	4.47	4.82												
07/25/18	4.91	4.93	4.49	4.79												
07/26/18	4.87	4.93	4.44	4.77												
07/27/18	4.86	4.99	4.48	4.77												
07/28/18	4.85	4.93	4.63	4.78												
07/29/18	4.85	4.91	4.61	4.80												
07/30/18	4.89	4.87	4.63	4.77												
07/31/18	4.90	4.90	4.62	4.73												

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Effluent Turbidity - NTU

	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
Date	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
07/01/18	0.09	0.10	0.10	0.10	0.07	0.08	0.09	0.10	0.08	0.09	0.09	0.10	0.09	0.10	0.10	0.10	0.06	0.07	0.09
07/02/18	0.09	0.10	0.10	0.11	0.07	0.07	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.10	0.11	0.07	0.09	0.09
07/03/18	0.09	0.09	0.09	0.10	0.06	0.07	0.09	0.10	0.09	0.10	0.09	0.10	0.08	0.09	0.10	0.10	0.06	0.07	0.08
07/04/18	0.09	0.09	0.10	0.11	0.07	0.07	0.09	0.10	0.10	0.14	0.09	0.10	0.08	0.09	0.11	0.11	0.06	0.08	0.09
07/05/18	0.11	0.15	0.12	0.13	0.08	0.10	0.10	0.12	0.11	0.13	0.10	0.12	0.09	0.10	0.12	0.13	0.06	0.07	0.10
07/06/18	0.10	0.16	0.14	0.48 *	0.08	0.15	0.10	0.12	0.12	0.16	0.10	0.12	0.09	0.14	0.12	0.15	0.07	0.09	0.10
07/07/18	0.09	0.10	0.11	0.11	0.07	0.08	0.09	0.09	0.11	0.12	0.10	0.11	0.08	0.09	0.12	0.13	0.06	0.07	0.09
07/08/18	0.09	0.10	0.11	0.11	0.07	0.07	0.09	0.10	0.12	0.12	0.10	0.12	0.08	0.09	0.12	0.12	0.06	0.07	0.09
07/09/18	0.10	0.10	0.12	0.13	0.07	0.08	0.09	0.10	0.12	0.13	0.11	0.13	0.09	0.10	0.12	0.14	0.07	0.08	0.10
07/10/18	0.10	0.11	0.12	0.13	0.07	0.07	0.09	0.10	0.12	0.14	0.11	0.12	0.08	0.10	0.12	0.13	0.06	0.07	0.10
07/11/18	0.09	0.10	0.13	0.13	0.07	0.07	0.09	0.09	0.11	0.14	0.09	0.12	0.08	0.09	0.12	0.13	0.06	0.08	0.09
07/12/18	0.09	0.10	0.10	0.13	0.07	0.07	0.09	0.10	0.08	0.09	0.06	0.07	0.08	0.09	0.11	0.12	0.05	0.06	0.08
07/13/18	0.08	0.09	0.08	0.08	0.07	0.07	0.09	0.09	0.09	0.10	0.05	0.06	0.08	0.09	0.11	0.12	0.06	0.07	0.08
07/14/18	0.09	0.10	0.09	0.10	0.08	0.08	0.10	0.16	0.10	0.11	0.06	0.07	0.09	0.10	0.12	0.14	0.06	0.07	0.09
07/15/18	0.09	0.09	0.09	0.10	0.08	0.08	0.09	0.10	0.10	0.11	0.08	0.09	0.09	0.10	0.12	0.14	0.07	0.07	0.09
07/16/18	0.09	0.10	0.09	0.10	0.08	0.08	0.09	0.10	0.11	0.12	0.09	0.10	0.10	0.11	0.12	0.13	0.07	0.07	0.09
07/17/18	0.09	0.10	0.08	0.09	0.07	0.08	0.09	0.10	0.11	0.12	0.10	0.12	0.10	0.10	0.12	0.12	0.06	0.07	0.09
07/18/18	0.09	0.10	0.09	0.09	0.08	0.08	0.09	0.10	0.12	0.13	0.10	0.11	0.11	0.11	0.12	0.18	0.07	0.07	0.10
07/19/18	0.09	0.10	0.09	0.09	0.08	0.08	0.09	0.10	0.12	0.14	0.11	0.11	0.11	0.13	0.11	0.12	0.07	0.07	0.10
07/20/18	0.10	0.11	0.09	0.10	0.08	0.08	0.09	0.10	0.12	0.13	0.11	0.12	0.12	0.13	0.11	0.12	0.07	0.07	0.10
07/21/18	0.10	0.11	0.10	0.10	0.08	0.09	0.10	0.10	0.13	0.14	0.12	0.12	0.13	0.17	0.11	0.12	0.07	0.08	0.11
07/22/18	0.10	0.11	0.10	0.11	0.08	0.09	0.10	0.10	0.13	0.15	0.13	0.13	0.14	0.15	0.12	0.12	0.08	0.08	0.11
07/23/18	0.11	0.12	0.10	0.12	0.09	0.10	0.10	0.11	0.14	0.19	0.13	0.14	0.14	0.15	0.12	0.13	0.08	0.08	0.11
07/24/18	0.10	0.11	0.10	0.11	0.08	0.09	0.10	0.10	0.09	0.15	0.09	0.14	0.15	0.15	0.12	0.12	0.08	0.08	0.10
07/25/18	0.09	0.10	0.10	0.11	0.07	0.09	0.09	0.10	0.07	0.07	0.06	0.06	0.14	0.16	0.12	0.12	0.08	0.08	0.09
07/26/18	0.08	0.09	0.07	0.09	0.07	0.08	0.08	0.08	0.07	0.07	0.06	0.06	0.11	0.15	0.10	0.14	0.06	0.08	0.08
07/27/18	0.08	0.09	0.06	0.07	0.08	0.08	0.08	0.08	0.07	0.08	0.06	0.06	0.09	0.10	0.09	0.09	0.05	0.05	0.07
07/28/18	0.09	0.09	0.06	0.07	0.08	0.08	0.08	0.09	0.08	0.08	0.06	0.06	0.09	0.09	0.09	0.10	0.05	0.05	0.08
07/29/18	0.09	0.10	0.08	0.09	0.08	0.09	0.09	0.09	0.08	0.10	0.07	0.07	0.09	0.10	0.10	0.10	0.05	0.06	0.08
07/30/18	0.09	0.10	0.08	0.10	0.08	0.09	0.09	0.09	0.09	0.09	0.07	0.07	0.09	0.10	0.09	0.10	0.05	0.05	0.08
07/31/18	0.09	0.10	0.10	0.11	0.08	0.09	0.09	0.09	0.08	0.10	0.07	0.12	0.09	0.10	0.09	0.10	0.05	0.05	0.08

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

* Reading due to plant outage caused by an unexpected power interruption.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Reverse Osmosis Process online monitoring results																	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)						Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	ROP		ROF			ROP			ROF			ROP						
Date	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
07/01/18	0.033	0.033	6.933	6.341	7.691	0.042	0.038	0.047	1,615	1,559	1,662	38	35	42	99.39	2.22	97.62	1.62
07/02/18	0.032	0.033	7.287	6.747	8.234	0.045	0.041	0.048	1,629	1,523	1,870	40	34	48	99.39	2.21	97.57	1.61
07/03/18	0.032	0.033	7.623	7.124	8.325	0.047	0.044	0.051	1,808	1,723	1,881	43	39	48	99.38	2.21	97.61	1.62
07/04/18	0.033	0.033	7.644	7.084	8.122	0.045	0.038	0.054	1,804	1,737	1,875	44	40	49	99.40	2.23	97.57	1.61
07/05/18	0.034	0.035	7.194	6.599	7.974	0.040	0.037	0.045	1,638	1,547	1,713	42	37	48	99.44	2.25	97.45	1.59
07/06/18	0.039	0.043	7.833	7.270	8.907	0.051	0.045	0.073	1,751	1,656	1,836	46	38	58	99.35	2.19	97.40	1.58
07/07/18	0.049	0.052	7.731	5.673	14.371*	0.051	0.046	0.058	1,759	1,678	1,826	42	38	48	99.34	2.18	97.59	1.62
07/08/18	0.045	0.048	7.516	6.973	8.243	0.045	0.037	0.051	1,704	1,662	1,794	41	37	47	99.40	2.22	97.61	1.62
07/09/18	0.038	0.040	7.506	6.862	9.894	0.044	0.038	0.051	1,616	1,531	1,691	40	35	46	99.42	2.23	97.53	1.61
07/10/18	0.038	0.038	7.969	7.338	11.861	0.052	0.046	0.061	1,734	1,639	1,862	43	38	48	99.34	2.18	97.53	1.61
07/11/18	0.038	0.038	7.839	7.348	8.390	0.051	0.045	0.060	1,802	1,721	1,891	44	40	49	99.36	2.19	97.56	1.61
07/12/18	0.035	0.036	7.731	7.241	8.295	0.050	0.046	0.053	1,848	1,788	1,906	44	40	49	99.36	2.19	97.61	1.62
07/13/18	0.041	0.044	7.789	7.187	8.320	0.051	0.045	0.055	1,829	1,765	1,905	43	40	47	99.35	2.19	97.65	1.63
07/14/18	0.046	0.055	7.808	7.122	8.299	0.053	0.044	0.080	1,802	1,744	1,864	46	39	68	99.32	2.17	97.47	1.60
07/15/18	0.062	0.071	7.439	6.827	8.109	0.048	0.041	0.064	1,675	1,600	1,743	41	37	58	99.35	2.19	97.52	1.61
07/16/18	0.071	0.073	7.441	6.939	8.273	0.047	0.041	0.054	1,595	1,484	1,746	38	33	44	99.37	2.20	97.64	1.63
07/17/18	0.060	0.066	7.797	7.310	8.400	0.051	0.046	0.056	1,760	1,675	1,857	41	37	46	99.35	2.19	97.67	1.63
07/18/18	0.053	0.056	7.996	7.527	8.448	0.051	0.046	0.055	1,824	1,773	1,895	43	39	48	99.37	2.20	97.65	1.63
07/19/18	0.049	0.051	7.860	7.333	8.394	0.054	0.049	0.060	1,824	1,751	1,892	45	40	51	99.32	2.16	97.55	1.61
07/20/18	0.044	0.048	7.894	7.457	8.375	0.052	0.047	0.056	1,818	1,746	1,902	45	40	50	99.34	2.18	97.52	1.61
07/21/18	0.042	0.043	8.011	7.328	10.857	0.054	0.047	0.059	1,794	1,751	1,848	44	41	49	99.33	2.17	97.54	1.61
07/22/18	0.044	0.045	7.555	6.932	8.182	0.048	0.040	0.052	1,622	1,565	1,721	40	37	43	99.37	2.20	97.52	1.61
07/23/18	0.045	0.046	7.632	7.096	8.234	0.046	0.042	0.051	1,552	1,459	1,692	38	33	44	99.40	2.22	97.53	1.61
07/24/18	0.047	0.049	7.905	7.464	8.446	0.052	0.047	0.059	1,722	1,618	1,861	42	37	48	99.34	2.18	97.59	1.62
07/25/18	0.048	0.048	8.047	7.584	8.673	0.059	0.050	0.068	1,780	1,717	1,832	43	40	47	99.26	2.13	97.57	1.61
07/26/18	0.049	0.049	7.717	7.212	8.167	0.060	0.054	0.067	1,804	1,748	1,891	45	40	51	99.22	2.11	97.51	1.60
07/27/18	0.046	0.048	7.637	7.060	8.122	0.058	0.054	0.064	1,809	1,751	1,877	46	42	50	99.24	2.12	97.47	1.60
07/28/18	0.044	0.045	7.776	7.311	8.318	0.057	0.046	0.066	1,756	1,697	1,804	44	41	48	99.27	2.14	97.51	1.60
07/29/18	0.044	0.045	7.543	7.010	8.203	0.052	0.043	0.058	1,588	1,524	1,669	39	36	42	99.31	2.16	97.53	1.61
07/30/18	0.045	0.045	7.441	6.942	8.069	0.048	0.045	0.051	1,556	1,488	1,704	39	34	45	99.36	2.19	97.52	1.61
07/31/18	0.061	0.094	7.515	6.902	8.183	0.056	0.050	0.064	1,688	1,625	1,751	41	37	47	99.25	2.13	97.56	1.61

Notes:

* Higher than normal maximum value due to an analyzer issue.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
07/01/18	97.56	95.602	23,792.1	0.25	3.0	6
07/02/18	97.80	95.569	24,084.1	0.25	3.0	6
07/03/18	97.82	96.821	24,421.2	0.25	3.0	6
07/04/18	97.49	96.535	23,952.3	0.25	3.0	6
07/05/18	97.49	94.230	23,722.0	0.25	3.0	6
07/06/18	97.80	90.628	22,855.1	0.25	3.0	6
07/07/18	97.58	84.159	21,494.1	0.26	3.0	6
07/08/18	97.64	98.366	24,720.8	0.25	3.0	6
07/09/18	97.48	97.685	24,457.8	0.25	3.0	6
07/10/18	97.66	93.263	23,368.7	0.25	3.0	6
07/11/18	97.72	96.020	23,838.4	0.25	3.0	6
07/12/18	97.68	97.513	24,052.8	0.25	3.0	6
07/13/18	97.77	98.902	24,595.4	0.25	3.0	6
07/14/18	97.92	95.990	23,868.0	0.25	3.0	6
07/15/18	97.85	74.401	18,903.0	0.25	3.0	6
07/16/18	97.56	86.452	21,884.6	0.25	3.0	6
07/17/18	97.60	99.530	24,940.9	0.25	3.0	6
07/18/18	97.60	100.133	25,041.7	0.25	3.0	6
07/19/18	97.54	98.928	24,483.3	0.25	3.0	6
07/20/18	97.50	98.116	24,293.9	0.25	3.0	6
07/21/18	97.25	99.407	24,598.3	0.25	3.0	6
07/22/18	97.18	99.666	24,519.6	0.25	3.0	6
07/23/18	97.14	98.033	24,254.6	0.25	3.0	6
07/24/18	97.06	97.603	24,307.7	0.25	3.0	6
07/25/18	97.21	99.992	24,726.5	0.25	3.0	6
07/26/18	97.06	98.603	24,042.9	0.24	3.0	6
07/27/18	96.92	99.666	24,375.3	0.24	3.0	6
07/28/18	97.08	99.705	24,383.6	0.24	3.0	6
07/29/18	97.27	99.877	23,651.0	0.24	3.0	6
07/30/18	97.25	96.499	23,674.0	0.25	3.0	6
07/31/18	97.22	96.469	23,621.2	0.24	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	*LRV*	*LRV*	*Y/N*	*Y/N*	*Y/N*	>0.2	>0.5	>0.2	>0.5	>0.5
08/01/18	12.64	12.64	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/02/18	12.70	12.70	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/03/18	12.72	12.72	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/04/18	12.68	12.68	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/05/18	12.70	12.70	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/06/18	12.65	12.65	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/07/18	12.59	12.59	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/08/18	12.57	12.57	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/09/18	12.57	12.57	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/10/18	12.55	12.55	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/11/18	12.47	12.47	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/12/18	12.51	12.51	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/13/18	12.52	12.52	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/14/18	12.46	12.46	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/15/18	12.48	12.48	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/16/18	12.45	12.45	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/17/18	12.49	12.49	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/18/18	12.52	12.52	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/19/18	12.51	12.51	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/20/18	12.54	12.54	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/21/18	12.46	12.46	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/22/18	12.42	12.42	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/23/18	12.44	12.44	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/24/18	12.45	12.45	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/25/18	12.43	12.43	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/26/18	12.50	12.50	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/27/18	12.51	12.51	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/28/18	12.45	12.45	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/29/18	12.45	12.45	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/30/18	12.44	12.44	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/31/18	12.44	12.44	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
08/01/18	0.00	4.55	2.09	6.00	0.00	12.64
08/02/18	0.00	4.57	2.13	6.00	0.00	12.70
08/03/18	0.00	4.58	2.14	6.00	0.00	12.72
08/04/18	0.00	4.53	2.15	6.00	0.00	12.68
08/05/18	0.00	4.53	2.17	6.00	0.00	12.70
08/06/18	0.00	4.47	2.18	6.00	0.00	12.65
08/07/18	0.00	4.45	2.14	6.00	0.00	12.59
08/08/18	0.00	4.46	2.10	6.00	0.00	12.57
08/09/18	0.00	4.39	2.18	6.00	0.00	12.57
08/10/18	0.00	4.38	2.17	6.00	0.00	12.55
08/11/18	0.00	4.33	2.14	6.00	0.00	12.47
08/12/18	0.00	4.31	2.20	6.00	0.00	12.51
08/13/18	0.00	4.32	2.20	6.00	0.00	12.52
08/14/18	0.00	4.32	2.14	6.00	0.00	12.46
08/15/18	0.00	4.29	2.19	6.00	0.00	12.48
08/16/18	0.00	4.25	2.19	6.00	0.00	12.45
08/17/18	0.00	4.31	2.18	6.00	0.00	12.49
08/18/18	0.00	4.35	2.17	6.00	0.00	12.52
08/19/18	0.00	4.34	2.18	6.00	0.00	12.51
08/20/18	0.00	4.35	2.19	6.00	0.00	12.54
08/21/18	0.00	4.31	2.15	6.00	0.00	12.46
08/22/18	0.00	4.30	2.12	6.00	0.00	12.42
08/23/18	0.00	4.30	2.13	6.00	0.00	12.44
08/24/18	0.00	4.30	2.15	6.00	0.00	12.45
08/25/18	0.00	4.29	2.14	6.00	0.00	12.43
08/26/18	0.00	4.32	2.18	6.00	0.00	12.50
08/27/18	0.00	4.31	2.20	6.00	0.00	12.51
08/28/18	0.00	4.32	2.13	6.00	0.00	12.45
08/29/18	0.00	4.33	2.12	6.00	0.00	12.45
08/30/18	0.00	4.34	2.10	6.00	0.00	12.44
08/31/18	0.00	4.34	2.10	6.00	0.00	12.44

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Documented Virus Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
08/01/18	0.00	0.00	2.09	6.00	4.00	12.09
08/02/18	0.00	0.00	2.13	6.00	4.00	12.13
08/03/18	0.00	0.00	2.14	6.00	4.00	12.14
08/04/18	0.00	0.00	2.15	6.00	4.00	12.15
08/05/18	0.00	0.00	2.17	6.00	4.00	12.17
08/06/18	0.00	0.00	2.18	6.00	4.00	12.18
08/07/18	0.00	0.00	2.14	6.00	4.00	12.14
08/08/18	0.00	0.00	2.10	6.00	4.00	12.10
08/09/18	0.00	0.00	2.18	6.00	4.00	12.18
08/10/18	0.00	0.00	2.17	6.00	4.00	12.17
08/11/18	0.00	0.00	2.14	6.00	4.00	12.14
08/12/18	0.00	0.00	2.20	6.00	4.00	12.20
08/13/18	0.00	0.00	2.20	6.00	4.00	12.20
08/14/18	0.00	0.00	2.14	6.00	4.00	12.14
08/15/18	0.00	0.00	2.19	6.00	4.00	12.19
08/16/18	0.00	0.00	2.19	6.00	4.00	12.19
08/17/18	0.00	0.00	2.18	6.00	4.00	12.18
08/18/18	0.00	0.00	2.17	6.00	4.00	12.17
08/19/18	0.00	0.00	2.18	6.00	4.00	12.18
08/20/18	0.00	0.00	2.19	6.00	4.00	12.19
08/21/18	0.00	0.00	2.15	6.00	4.00	12.15
08/22/18	0.00	0.00	2.12	6.00	4.00	12.12
08/23/18	0.00	0.00	2.13	6.00	4.00	12.13
08/24/18	0.00	0.00	2.15	6.00	4.00	12.15
08/25/18	0.00	0.00	2.14	6.00	4.00	12.14
08/26/18	0.00	0.00	2.18	6.00	4.00	12.18
08/27/18	0.00	0.00	2.20	6.00	4.00	12.20
08/28/18	0.00	0.00	2.13	6.00	4.00	12.13
08/29/18	0.00	0.00	2.12	6.00	4.00	12.12
08/30/18	0.00	0.00	2.10	6.00	4.00	12.10
08/31/18	0.00	0.00	2.10	6.00	4.00	12.10

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
08/01/18	5.04	5.02	5.19	4.77	4.96	4.93	4.95	4.93	4.85	4.82	5.01	5.11	4.83	4.91	4.55	4.71
08/02/18	4.96	4.96	5.11	4.70	4.92	4.89	4.75	4.87	4.80	4.76	4.98	5.09	4.82	4.88	4.57	4.71
08/03/18	4.92	5.01	5.08	4.70	4.94	4.86	4.87	4.89	4.72	4.72	4.97	5.03	4.81	4.85	4.58	4.68
08/04/18	4.95	5.00	5.08	4.85	4.95	4.90	4.99	4.93	4.75	4.72	5.00	5.02	4.79	4.87	4.53	4.67
08/05/18	4.91	4.93	4.98	4.86	4.90	4.91	5.09	4.90	4.75	4.73	5.00	5.03	4.76	4.85	4.53	4.66
08/06/18	5.06	4.95	5.03	4.85	5.04	4.86	5.05	4.89	4.73	4.72	4.98	5.02	4.75	4.89	4.47	4.67
08/07/18	5.04	4.95	5.04	4.85	5.06	4.85	5.04	4.89	4.72	4.72	4.98	5.03	4.75	4.92	4.45	4.67
08/08/18	5.03	4.99	5.10	4.90	5.07	4.90	5.02	4.85	4.77	4.70	4.95	5.04	4.78	4.87	4.46	4.65
08/09/18	4.95	4.89	5.01	4.84	5.07	4.82	4.95	4.88	4.67	4.69	4.96	4.99	4.75	4.79	4.39	4.62
08/10/18	5.03	4.87	4.97	4.84	5.00	4.89	4.94	4.96	4.66	4.66	4.92	4.96	4.71	4.78	4.38	4.62
08/11/18	5.03	4.89	4.94	4.83	4.98	4.96	4.89	4.97	4.64	4.64	4.88	4.96	4.69	4.76	4.33	4.61
08/12/18	5.00	4.88	4.93	4.79	4.98	4.94	4.91	4.96	4.62	4.67	4.91	4.98	4.68	4.83	4.31	4.62
08/13/18	5.00	4.86	4.96	4.80	4.92	4.92	5.00	4.89	4.65	4.65	4.91	4.96	4.67	4.79	4.32	4.63
08/14/18	4.99	5.07	4.94	4.78	5.00	4.88	4.95	4.93	4.62	4.66	4.88	4.97	4.82	4.74	4.32	4.62
08/15/18	4.92	5.08	5.12	4.81	4.96	4.92	4.96	4.90	4.79	4.63	4.88	4.95	4.84	4.70	4.29	4.57
08/16/18	4.97	5.07	5.15	4.79	4.94	4.94	4.96	4.94	4.79	4.61	4.87	4.93	4.84	4.74	4.25	4.55
08/17/18	4.95	5.05	5.09	4.84	4.93	4.96	4.97	4.91	4.78	4.60	4.88	4.90	4.84	4.73	4.31	4.56
08/18/18	4.97	5.03	5.13	4.81	4.93	4.93	4.93	4.91	4.76	4.61	5.00	4.92	4.83	4.73	4.35	4.56
08/19/18	4.90	5.02	5.12	4.82	4.95	4.91	4.92	4.86	4.79	4.60	5.03	4.93	4.84	4.81	4.34	4.57
08/20/18	4.95	5.02	5.11	4.81	4.96	4.92	4.92	4.92	4.75	4.58	5.03	4.93	4.84	4.78	4.35	4.58
08/21/18	4.97	5.04	5.10	4.75	4.98	4.91	4.96	4.91	4.76	4.76	5.02	4.93	4.79	4.77	4.31	4.56
08/22/18	4.90	5.00	5.11	4.75	4.93	4.90	4.92	4.92	4.75	4.84	5.03	4.93	4.81	4.81	4.30	4.56
08/23/18	4.96	5.08	5.19	4.80	5.01	4.94	4.94	4.93	4.78	4.85	5.01	4.92	4.84	4.84	4.30	4.56
08/24/18	5.01	5.10	5.20	4.83	5.01	4.95	4.95	4.91	4.80	4.84	5.01	4.96	4.86	4.87	4.30	4.59
08/25/18	4.96	5.10	5.16	4.83	4.96	4.94	4.98	4.91	4.80	4.84	5.05	4.95	4.86	4.83	4.29	4.58
08/26/18	4.99	5.07	5.12	4.82	5.03	4.96	5.03	4.89	4.80	4.84	5.02	4.93	4.83	4.82	4.32	4.56
08/27/18	4.98	5.07	5.12	4.82	5.00	4.91	4.97	4.93	4.77	4.80	5.02	4.92	4.83	4.85	4.31	4.55
08/28/18	4.99	5.08	5.13	4.80	4.99	4.95	4.93	4.92	4.79	4.81	5.00	4.96	4.81	4.85	4.32	4.57
08/29/18	4.95	5.09	5.15	4.82	4.97	4.95	4.96	4.91	4.80	4.81	5.01	4.97	4.83	4.82	4.33	4.57
08/30/18	4.95	5.06	5.15	4.78	4.99	4.94	4.95	4.89	4.77	4.80	5.01	4.97	4.80	4.82	4.34	4.59
08/31/18	4.91	5.08	5.16	4.83	5.01	4.95	4.97	4.92	4.78	4.81	4.99	4.98	4.83	4.83	4.34	4.60

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
08/01/18	4.79	4.77	4.74	4.67	4.83	4.59	4.65	4.75	5.03	4.93	4.83	4.87	5.10	4.73	4.88	4.97
08/02/18	4.77	4.77	4.72	4.64	4.83	4.59	4.65	4.75	5.03	4.93	4.83	4.85	5.09	4.75	4.86	4.97
08/03/18	4.74	4.75	4.73	4.64	4.80	4.58	4.72	4.75	5.03	4.92	4.80	4.83	5.09	4.76	4.86	4.90
08/04/18	4.73	4.76	4.76	4.64	4.76	4.66	4.79	4.75	5.04	4.91	4.81	4.85	5.08	4.75	4.87	4.91
08/05/18	4.97	4.77	4.75	4.62	4.77	4.73	4.80	4.73	5.00	4.88	4.81	4.81	5.07	4.73	4.85	4.93
08/06/18	5.04	4.74	4.83	4.63	4.93	4.74	4.79	4.81	4.92	4.88	4.81	4.79	5.04	4.70	4.83	4.92
08/07/18	5.00	4.73	4.89	4.64	5.05	4.75	4.77	4.98	4.89	4.86	4.80	4.81	5.02	4.71	4.79	4.93
08/08/18	5.01	4.77	4.92	4.65	4.95	4.71	4.79	4.89	4.94	5.09	4.82	4.81	5.07	4.70	4.81	4.89
08/09/18	4.96	4.72	4.89	4.62	4.96	4.67	4.77	4.89	4.94	5.01	4.79	4.83	5.05	4.67	4.79	4.87
08/10/18	4.86	4.67	4.82	4.68	4.95	4.67	4.73	4.87	4.92	4.95	4.77	4.82	5.05	4.66	4.82	4.88
08/11/18	4.88	4.67	4.83	4.75	4.94	4.71	4.74	4.84	4.90	4.98	4.75	4.81	5.05	4.65	4.91	4.88
08/12/18	4.86	4.79	4.83	4.74	4.92	4.71	4.76	4.85	4.89	4.98	4.72	4.81	5.04	4.68	4.89	4.88
08/13/18	4.84	4.86	4.85	4.73	4.89	4.69	4.76	4.86	4.97	4.96	4.75	4.80	5.00	4.76	4.90	5.00
08/14/18	4.82	4.83	4.85	4.71	4.86	4.66	4.73	4.87	5.06	4.95	4.73	4.77	4.96	4.73	4.90	5.01
08/15/18	4.81	4.84	4.81	4.69	4.88	4.66	4.71	4.86	5.01	4.95	4.71	4.74	4.97	4.74	4.86	4.99
08/16/18	4.81	4.82	4.79	4.68	4.88	4.67	4.71	4.83	5.03	4.96	4.72	4.84	4.98	4.76	4.88	5.00
08/17/18	4.80	4.79	4.78	4.70	4.87	4.67	4.70	4.81	5.03	4.96	4.71	4.93	4.93	4.69	4.89	4.98
08/18/18	4.82	4.81	4.80	4.71	4.87	4.69	4.70	4.82	5.03	4.96	4.72	4.93	4.87	4.68	4.86	4.91
08/19/18	4.85	4.81	4.83	4.71	4.86	4.69	4.70	4.82	5.03	4.96	4.73	4.94	4.90	4.72	4.85	4.94
08/20/18	4.79	4.80	4.78	4.71	4.84	4.67	4.68	4.80	4.99	4.96	4.77	4.95	4.98	4.72	4.84	4.95
08/21/18	4.76	4.78	4.78	4.68	4.84	4.66	4.67	4.78	4.98	4.94	4.86	4.95	5.08	4.70	4.85	4.94
08/22/18	4.78	4.81	4.78	4.67	4.84	4.64	4.68	4.77	5.01	4.93	4.89	4.91	5.09	4.70	4.83	4.94
08/23/18	4.88	4.87	4.80	4.72	4.88	4.65	4.70	4.80	5.05	4.98	4.88	4.91	5.10	4.73	4.82	4.95
08/24/18	4.93	4.88	4.85	4.75	4.96	4.72	4.72	4.88	5.08	4.99	4.86	4.98	5.16	4.75	4.88	4.97
08/25/18	4.91	4.88	4.85	4.72	4.96	4.72	4.73	4.88	5.09	4.99	4.86	4.97	5.19	4.75	4.87	4.97
08/26/18	4.85	4.85	4.81	4.70	4.95	4.69	4.74	4.88	5.06	4.93	4.85	4.96	5.16	4.73	4.86	4.98
08/27/18	4.86	4.84	4.79	4.72	4.92	4.69	4.72	4.86	5.05	4.94	4.84	4.97	5.12	4.70	4.83	4.94
08/28/18	4.85	4.85	4.83	4.72	4.92	4.72	4.72	4.83	5.05	4.95	4.84	4.97	5.11	4.73	4.84	4.97
08/29/18	4.86	4.85	4.84	4.70	4.95	4.71	4.73	4.84	5.04	4.94	4.85	4.98	5.12	4.74	4.87	4.99
08/30/18	4.81	4.86	4.83	4.73	4.90	4.72	4.74	4.82	5.05	4.97	4.86	4.98	5.13	4.75	4.89	4.98
08/31/18	4.77	4.87	4.83	4.74	4.85	4.72	4.77	4.77	5.08	4.98	4.86	4.98	5.10	4.75	4.88	4.97

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Log Removal Value

Date	E01 LRV	E02 LRV	E03 LRV	E04 * LRV											
08/01/18	4.84	4.96	4.63	4.71											
08/02/18	4.91	5.17	4.64	4.77											
08/03/18	4.86	5.06	4.64	4.86											
08/04/18	4.83	5.05	4.62	4.86											
08/05/18	4.85	5.02	4.64	4.86											
08/06/18	4.87	5.06	4.67	4.88											
08/07/18	4.87	5.01	4.65	4.92											
08/08/18	4.83	5.01	4.65	5.04											
08/09/18	4.84	4.98	4.63	5.04											
08/10/18	4.84	5.01	4.63	5.04											
08/11/18	4.80	5.02	4.62	5.04											
08/12/18	4.74	5.00	4.58	5.04											
08/13/18	4.77	4.96	4.60	5.04											
08/14/18	4.75	4.93	4.55	4.91											
08/15/18	4.77	4.95	4.55	4.64											
08/16/18	4.84	4.95	4.55	4.63											
08/17/18	4.86	4.89	4.53	4.68											
08/18/18	4.83	4.85	4.52	4.71											
08/19/18	4.94	4.85	4.52	4.72											
08/20/18	4.84	4.86	4.51	4.74											
08/21/18	4.89	4.86	4.52	4.75											
08/22/18	4.92	4.84	4.59	4.76											
08/23/18	4.87	4.84	4.78	4.78											
08/24/18	4.90	4.86	4.70	4.72											
08/25/18	4.85	4.91	4.68	4.68											
08/26/18	4.87	4.88	4.66	4.68											
08/27/18	4.90	4.84	4.67	4.65											
08/28/18	4.88	4.90	4.69	4.71											
08/29/18	4.88	4.86	4.69	4.70											
08/30/18	4.85	4.85	4.69	4.67											
08/31/18	4.83	4.88	4.71	4.98											

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* New Scinor PVDF membranes installed in MF Cell E04 on 8/15/18

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	MicroFiltration Process online monitoring results Effluent Turbidity - NTU																		
	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04 *		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
08/01/18	0.09	0.11	0.10	0.13	0.08	0.09	0.09	0.10	0.08	0.09	0.06	0.07	0.09	0.11	0.10	0.11	0.05	0.06	0.08
08/02/18	0.08	0.10	0.10	0.11	0.08	0.08	0.09	0.09	0.09	0.10	0.06	0.07	0.09	0.10	0.10	0.10	0.05	0.05	0.08
08/03/18	0.08	0.08	0.09	0.10	0.08	0.08	0.09	0.09	0.09	0.10	0.07	0.08	0.09	0.14	0.10	0.12	0.05	0.05	0.08
08/04/18	0.08	0.09	0.08	0.10	0.08	0.09	0.09	0.10	0.10	0.11	0.08	0.09	0.09	0.09	0.10	0.10	0.05	0.06	0.08
08/05/18	0.09	0.10	0.10	0.11	0.09	0.09	0.09	0.10	0.11	0.11	0.09	0.10	0.10	0.11	0.10	0.10	0.05	0.06	0.09
08/06/18	0.09	0.10	0.11	0.11	0.09	0.09	0.10	0.10	0.11	0.12	0.10	0.11	0.10	0.11	0.10	0.10	0.05	0.06	0.10
08/07/18	0.10	0.11	0.11	0.11	0.09	0.10	0.10	0.10	0.10	0.13	0.09	0.12	0.11	0.12	0.10	0.11	0.05	0.06	0.09
08/08/18	0.09	0.11	0.10	0.12	0.09	0.10	0.10	0.11	0.08	0.11	0.09	0.10	0.11	0.12	0.10	0.12	0.06	0.06	0.09
08/09/18	0.08	0.09	0.07	0.09	0.09	0.09	0.10	0.10	0.09	0.09	0.10	0.10	0.09	0.11	0.09	0.10	0.05	0.06	0.08
08/10/18	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.09	0.11	0.11	0.11	0.09	0.11	0.10	0.10	0.05	0.06	0.09
08/11/18	0.07	0.09	0.09	0.10	0.09	0.10	0.09	0.10	0.10	0.11	0.12	0.12	0.09	0.10	0.10	0.10	0.05	0.06	0.09
08/12/18	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.10	0.11	0.13	0.13	0.09	0.11	0.10	0.11	0.06	0.06	0.09
08/13/18	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.13	0.14	0.10	0.11	0.10	0.11	0.06	0.06	0.10
08/14/18	0.08	0.10	0.09	0.10	0.09	0.10	0.10	0.10	0.10	0.12	0.11	0.14	0.10	0.11	0.10	0.12	0.06	0.07	0.09
08/15/18	0.09	0.09	0.08	0.08	0.09	0.10	0.09	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.06	0.06	0.09
08/16/18	0.08	0.09	0.08	0.08	0.09	0.10	0.09	0.10	0.09	0.10	0.10	0.10	0.09	0.11	0.09	0.12	0.05	0.06	0.09
08/17/18	0.09	0.09	0.08	0.08	0.09	0.10	0.09	0.10	0.10	0.10	0.11	0.11	0.09	0.10	0.09	0.10	0.05	0.06	0.09
08/18/18	0.09	0.09	0.07	0.08	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.12	0.10	0.11	0.10	0.10	0.06	0.07	0.09
08/19/18	0.10	0.10	0.07	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.12	0.12	0.11	0.13	0.10	0.10	0.06	0.06	0.10
08/20/18	0.10	0.11	0.08	0.10	0.10	0.10	0.10	0.10	0.11	0.12	0.12	0.13	0.12	0.13	0.10	0.10	0.06	0.11	0.10
08/21/18	0.10	0.11	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.12	0.10	0.13	0.12	0.14	0.10	0.10	0.06	0.06	0.10
08/22/18	0.08	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.10	0.10	0.09	0.09	0.12	0.13	0.10	0.10	0.06	0.07	0.09
08/23/18	0.08	0.09	0.08	0.09	0.09	0.10	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.13	0.10	0.12	0.05	0.06	0.08
08/24/18	0.09	0.09	0.07	0.08	0.09	0.10	0.09	0.10	0.10	0.11	0.09	0.10	0.08	0.09	0.09	0.10	0.05	0.06	0.08
08/25/18	0.09	0.09	0.07	0.08	0.09	0.10	0.09	0.09	0.11	0.11	0.09	0.11	0.08	0.09	0.10	0.10	0.06	0.06	0.08
08/26/18	0.09	0.09	0.07	0.08	0.09	0.10	0.09	0.10	0.11	0.13	0.10	0.12	0.09	0.11	0.10	0.10	0.06	0.06	0.08
08/27/18	0.09	0.10	0.07	0.07	0.10	0.10	0.09	0.09	0.11	0.12	0.10	0.12	0.09	0.10	0.10	0.10	0.06	0.06	0.08
08/28/18	0.09	0.09	0.06	0.07	0.10	0.10	0.09	0.09	0.11	0.12	0.11	0.12	0.10	0.10	0.10	0.10	0.06	0.10	0.09
08/29/18	0.08	0.09	0.06	0.08	0.09	0.10	0.09	0.09	0.11	0.14	0.11	0.12	0.10	0.11	0.10	0.10	0.06	0.08	0.08
08/30/18	0.09	0.09	0.05	0.06	0.10	0.10	0.09	0.09	0.12	0.12	0.11	0.13	0.10	0.11	0.09	0.10	0.06	0.07	0.08
08/31/18	0.09	0.09	0.05	0.07	0.10	0.10	0.09	0.09	0.12	0.12	0.10	0.11	0.11	0.11	0.09	0.10	0.06	0.06	0.08

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

* New Scinor PVDF membranes installed in MF Cell E04 on 8/15/18

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	Reverse Osmosis Process online monitoring results																	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)						Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	ROP		ROF			ROP			ROF			ROP						
Date	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
08/01/18	0.044	0.044	7.745	6.944	12.263	0.063	0.055	0.093	1,808	1,684	1,955	48	41	66	99.18	2.09	97.34	1.57
08/02/18	0.044	0.044	7.538	7.025	8.030	0.056	0.051	0.060	1,842	1,747	1,921	46	41	51	99.25	2.13	97.52	1.61
08/03/18	0.045	0.047	7.474	5.956	8.038	0.055	0.052	0.057	1,831	1,750	1,916	45	41	51	99.27	2.14	97.52	1.61
08/04/18	0.044	0.045	7.523	6.658	8.081	0.053	0.049	0.057	1,780	1,703	1,900	44	41	49	99.29	2.15	97.53	1.61
08/05/18	0.044	0.044	7.481	6.825	7.993	0.050	0.045	0.055	1,644	1,592	1,688	41	37	46	99.33	2.17	97.52	1.61
08/06/18	0.043	0.044	7.505	5.681	8.253	0.050	0.046	0.056	1,603	1,502	1,715	40	35	46	99.34	2.18	97.49	1.60
08/07/18	0.040	0.041	7.827	7.098	8.429	0.057	0.051	0.061	1,694	1,614	1,806	43	38	50	99.28	2.14	97.47	1.60
08/08/18	0.040	0.040	8.615	7.612	9.792	0.068	0.050	0.099	1,778	1,728	1,816	42	36	47	99.21	2.10	97.61	1.62
08/09/18	0.040	0.040	7.747	7.560	8.429	0.052	0.046	0.055	1,817	1,739	1,927	44	40	51	99.33	2.18	97.56	1.61
08/10/18	0.031	0.040	7.687	7.344	8.476	0.052	0.049	0.061	1,835	1,789	1,886	46	42	51	99.32	2.17	97.50	1.60
08/11/18	0.033	0.033	7.746	5.505	8.800	0.057	0.050	0.126	1,810	1,783	1,851	46	43	50	99.27	2.14	97.49	1.60
08/12/18	0.034	0.036	7.926	6.190	8.831	0.049	0.046	0.054	1,718	1,668	1,773	43	40	49	99.38	2.20	97.48	1.60
08/13/18	0.037	0.037	7.944	5.788	8.620	0.050	0.045	0.058	1,641	1,541	1,776	42	37	48	99.37	2.20	97.43	1.59
08/14/18	0.035	0.036	7.824	5.631	8.681	0.057	0.050	0.097	1,725	1,649	1,813	44	40	48	99.28	2.14	97.47	1.60
08/15/18	0.035	0.036	7.853	5.305	8.573	0.050	0.047	0.053	1,812	1,743	1,895	45	41	50	99.36	2.19	97.52	1.61
08/16/18	0.035	0.036	7.904	7.283	9.699	0.051	0.049	0.053	1,839	1,755	1,926	45	40	52	99.36	2.19	97.53	1.61
08/17/18	0.035	0.036	7.692	7.109	8.370	0.051	0.049	0.056	1,812	1,716	1,891	46	40	51	99.33	2.18	97.49	1.60
08/18/18	0.033	0.034	7.492	5.271	8.089	0.051	0.046	0.055	1,747	1,683	1,836	43	40	47	99.32	2.17	97.52	1.61
08/19/18	0.035	0.035	7.528	6.799	8.107	0.050	0.045	0.057	1,638	1,581	1,692	40	37	45	99.33	2.18	97.55	1.61
08/20/18	0.030	0.032	7.647	5.510	8.523	0.049	0.045	0.056	1,583	1,474	1,696	38	32	45	99.36	2.19	97.58	1.62
08/21/18	0.027	0.028	7.912	7.306	8.372	0.056	0.050	0.063	1,685	1,610	1,783	42	37	48	99.29	2.15	97.51	1.60
08/22/18	0.034	0.035	7.671	7.323	8.244	0.058	0.050	0.071	1,801	1,733	1,904	44	40	50	99.24	2.12	97.56	1.61
08/23/18	0.033	0.034	7.516	7.100	7.960	0.055	0.051	0.060	1,865	1,799	1,931	39	35	47	99.26	2.13	97.89	1.68
08/24/18	0.036	0.053	7.474	6.970	7.853	0.053	0.049	0.058	1,867	1,806	1,928	39	34	44	99.30	2.15	97.93	1.68
08/25/18	0.056	0.059	7.558	7.064	7.966	0.055	0.048	0.062	1,816	1,760	1,907	38	36	42	99.27	2.14	97.89	1.67
08/26/18	0.056	0.057	7.788	6.981	13.567	0.051	0.043	0.057	1,657	1,604	1,745	35	32	39	99.35	2.18	97.89	1.68
08/27/18	0.054	0.056	7.536	7.036	7.936	0.048	0.043	0.051	1,591	1,500	1,693	34	31	38	99.37	2.20	97.87	1.67
08/28/18	0.052	0.058	7.620	6.998	8.238	0.056	0.052	0.060	1,680	1,600	1,784	35	32	40	99.26	2.13	97.91	1.68
08/29/18	0.052	0.061	7.775	7.392	8.181	0.059	0.055	0.063	1,810	1,733	1,916	38	34	43	99.25	2.12	97.90	1.68
08/30/18	0.053	0.054	7.611	7.195	7.949	0.060	0.056	0.064	1,826	1,752	1,903	38	35	42	99.21	2.10	97.90	1.68
08/31/18	0.049	0.055	7.555	7.062	7.964	0.060	0.056	0.064	1,823	1,757	1,879	40	34	44	99.20	2.10	97.83	1.66

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
08/01/18	97.74	89.758	22,045.5	0.25	3.0	6
08/02/18	97.40	72.205	18,097.8	0.25	3.0	6
08/03/18	97.27	97.588	23,597.4	0.24	3.0	6
08/04/18	97.38	94.591	22,610.7	0.24	3.0	6
08/05/18	97.60	94.405	22,652.8	0.24	3.0	6
08/06/18	97.61	92.362	22,604.1	0.24	3.0	6
08/07/18	97.40	95.612	23,314.3	0.24	3.0	6
08/08/18	98.00	89.382	22,042.2	0.25	3.0	6
08/09/18	97.34	61.203	16,188.1	0.26	3.0	6
08/10/18	97.15	98.896	24,053.0	0.24	3.0	6
08/11/18	97.15	95.371	23,218.2	0.24	3.0	6
08/12/18	96.88	95.532	23,171.1	0.24	3.0	6
08/13/18	96.50	94.913	22,791.7	0.24	3.0	6
08/14/18	96.77	94.358	22,616.3	0.24	3.0	6
08/15/18	97.31	96.725	23,374.6	0.24	3.0	6
08/16/18	97.32	98.514	23,897.6	0.24	3.0	6
08/17/18	97.53	98.644	23,817.8	0.24	3.0	6
08/18/18	97.65	97.691	23,528.1	0.24	3.0	6
08/19/18	97.92	93.795	22,749.7	0.24	3.0	6
08/20/18	97.72	94.023	22,653.4	0.24	3.0	6
08/21/18	97.50	95.950	23,118.1	0.24	3.0	6
08/22/18	98.42	94.144	22,788.3	0.24	3.0	6
08/23/18	98.84	40.326	11,827.2	0.29	3.0	6
08/24/18	98.89	29.657	9,524.4	0.32	3.0	6
08/25/18	98.93	29.544	9,530.8	0.32	3.0	6
08/26/18	98.69	29.649	9,616.0	0.32	3.0	6
08/27/18	98.68	29.642	9,604.2	0.32	3.0	6
08/28/18	98.49	29.651	9,596.9	0.32	3.0	6
08/29/18	98.27	29.643	9,605.0	0.32	3.0	6
08/30/18	98.28	28.464	9,276.6	0.33	3.0	6
08/31/18	98.28	29.727	9,704.9	0.33	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
09/01/18	12.43	12.43	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/02/18	12.48	12.48	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/03/18	12.50	12.50	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/04/18	12.46	12.46	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/05/18	12.46	12.46	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/06/18	12.74	12.74	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/07/18	12.75	12.75	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/08/18	12.72	12.72	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/09/18	12.78	12.78	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/10/18	12.81	12.81	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/11/18	12.77	12.77	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/12/18	12.74	12.74	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/13/18	12.73	12.73	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/14/18	12.69	12.69	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/15/18	12.69	12.69	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/16/18	12.73	12.73	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/17/18 *	*	*	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/18/18 **	0.00	0.00	12.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
09/19/18 **	0.00	0.00	12.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
09/20/18 **	0.00	0.00	12.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
09/21/18 **	0.00	0.00	12.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
09/22/18 **	0.00	0.00	12.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
09/23/18 **	0.00	0.00	12.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
09/24/18 **	0.00	0.00	12.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
09/25/18	13.56	13.56	12.62	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/26/18	12.83	12.83	12.29	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/27/18	12.55	12.55	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/28/18	12.65	12.65	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/29/18	12.73	12.73	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/30/18	12.76	12.76	12.39	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

* Plant online from 12am to 3am with only 5 MF Cells in service, no PDT performed on those 5 Cells.

** Plant Offline for maintenance activities.

Date	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
09/01/18	0.00	4.35	2.09	6.00	0.00	12.43
09/02/18	0.00	4.37	2.11	6.00	0.00	12.48
09/03/18	0.00	4.34	2.15	6.00	0.00	12.50
09/04/18	0.00	4.34	2.13	6.00	0.00	12.46
09/05/18	0.00	4.41	2.05	6.00	0.00	12.46
09/06/18	0.00	4.61	2.13	6.00	0.00	12.74
09/07/18	0.00	4.62	2.13	6.00	0.00	12.75
09/08/18	0.00	4.62	2.10	6.00	0.00	12.72
09/09/18	0.00	4.63	2.14	6.00	0.00	12.78
09/10/18	0.00	4.66	2.15	6.00	0.00	12.81
09/11/18	0.00	4.64	2.13	6.00	0.00	12.77
09/12/18	0.00	4.64	2.10	6.00	0.00	12.74
09/13/18	0.00	4.64	2.08	6.00	0.00	12.73
09/14/18	0.00	4.63	2.06	6.00	0.00	12.69
09/15/18	0.00	4.64	2.05	6.00	0.00	12.69
09/16/18	0.00	4.65	2.08	6.00	0.00	12.73
09/17/18 *	*	*	*	*	*	*
09/18/18 **	0.00	0.00	0.00	0.00	0.00	0.00
09/19/18 **	0.00	0.00	0.00	0.00	0.00	0.00
09/20/18 **	0.00	0.00	0.00	0.00	0.00	0.00
09/21/18 **	0.00	0.00	0.00	0.00	0.00	0.00
09/22/18 **	0.00	0.00	0.00	0.00	0.00	0.00
09/23/18 **	0.00	0.00	0.00	0.00	0.00	0.00
09/24/18 **	0.00	0.00	0.00	0.00	0.00	0.00
09/25/18	4.94	4.94	2.62	6.00	0.00	13.56
09/26/18	4.54	4.54	2.29	6.00	0.00	12.83
09/27/18	0.00	4.41	2.15	6.00	0.00	12.55
09/28/18	0.00	4.40	2.25	6.00	0.00	12.65
09/29/18	0.00	4.41	2.32	6.00	0.00	12.73
09/30/18	0.00	4.37	2.39	6.00	0.00	12.76

Notes:

* Plant online from 12am to 3am with only 5 MF Cells in service, no PDT performed on those 5 Cells.

** Plant Offline for maintenance activities.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Documented Virus Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
Date	LRV	LRV	LRV	LRV	LRV	LRV
09/01/18	0.00	0.00	2.09	6.00	4.00	12.09
09/02/18	0.00	0.00	2.11	6.00	4.00	12.11
09/03/18	0.00	0.00	2.15	6.00	4.00	12.15
09/04/18	0.00	0.00	2.13	6.00	4.00	12.13
09/05/18	0.00	0.00	2.05	6.00	4.00	12.05
09/06/18	0.00	0.00	2.13	6.00	4.00	12.13
09/07/18	0.00	0.00	2.13	6.00	4.00	12.13
09/08/18	0.00	0.00	2.10	6.00	4.00	12.10
09/09/18	0.00	0.00	2.14	6.00	4.00	12.14
09/10/18	0.00	0.00	2.15	6.00	4.00	12.15
09/11/18	0.00	0.00	2.13	6.00	4.00	12.13
09/12/18	0.00	0.00	2.10	6.00	4.00	12.10
09/13/18	0.00	0.00	2.08	6.00	4.00	12.08
09/14/18	0.00	0.00	2.06	6.00	4.00	12.06
09/15/18	0.00	0.00	2.05	6.00	4.00	12.05
09/16/18	0.00	0.00	2.08	6.00	4.00	12.08
09/17/18	0.00	0.00	2.16	6.00	4.00	12.16
09/18/18 *	N/A	N/A	N/A	N/A	N/A	N/A
09/19/18 *	N/A	N/A	N/A	N/A	N/A	N/A
09/20/18 *	N/A	N/A	N/A	N/A	N/A	N/A
09/21/18 *	N/A	N/A	N/A	N/A	N/A	N/A
09/22/18 *	N/A	N/A	N/A	N/A	N/A	N/A
09/23/18 *	N/A	N/A	N/A	N/A	N/A	N/A
09/24/18 *	N/A	N/A	N/A	N/A	N/A	N/A
09/25/18	0.00	0.00	2.62	6.00	4.00	12.62
09/26/18	0.00	0.00	2.29	6.00	4.00	12.29
09/27/18	0.00	0.00	2.15	6.00	4.00	12.15
09/28/18	0.00	0.00	2.25	6.00	4.00	12.25
09/29/18	0.00	0.00	2.32	6.00	4.00	12.32
09/30/18	0.00	0.00	2.39	6.00	4.00	12.39

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

* Plant Offline for maintenance activities.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results															
	Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
09/01/18	4.91	5.02	5.16	4.80	4.99	4.93	4.93	4.92	4.79	4.79	5.02	4.96	4.82	4.83	4.35	4.58
09/02/18	4.96	5.05	5.20	4.80	5.01	4.94	4.91	4.97	4.80	4.83	5.03	4.96	4.83	4.83	4.37	4.58
09/03/18	4.94	5.05	5.13	4.85	4.98	4.92	4.96	4.91	4.78	4.81	5.03	4.95	4.79	4.86	4.34	4.59
09/04/18	4.92	5.05	5.16	4.86	4.93	4.92	4.95	4.94	4.78	4.78	5.03	4.98	4.83	4.83	4.34	4.60
09/05/18	4.95	5.01	5.17	4.83	4.98	4.94	4.93	4.91	4.78	4.78	5.04	5.00	4.83	4.82	4.41	4.60
09/06/18	4.98	5.06	5.12	4.83	4.99	4.92	4.94	4.84	4.79	4.81	5.01	5.08	4.78	4.94	4.66	4.61
09/07/18	5.01	5.09	5.15	4.80	5.03	4.98	4.98	4.86	4.82	4.83	4.99	5.09	4.80	4.97	4.70	4.70
09/08/18	4.98	5.09	5.14	4.96	5.02	4.94	4.92	4.89	4.78	4.78	5.01	5.09	4.82	4.93	4.68	4.76
09/09/18	4.95	5.01	5.11	4.97	4.99	4.93	4.94	4.93	4.78	4.80	5.01	5.08	4.79	4.95	4.67	4.70
09/10/18	4.99	5.02	5.18	4.95	4.96	4.93	4.93	4.91	4.78	4.79	5.00	5.10	4.78	4.95	4.67	4.68
09/11/18	5.00	5.02	5.23	4.93	4.98	4.94	4.92	4.91	4.77	4.80	4.99	5.06	4.79	4.99	4.67	4.71
09/12/18	5.00	5.02	5.23	4.93	4.98	5.09	4.95	4.87	4.80	4.79	5.01	5.03	4.77	4.97	4.66	4.68
09/13/18	5.00	5.02	5.23	4.93	4.98	5.14	4.96	4.86	4.78	4.80	4.99	5.04	4.77	4.91	4.65	4.66
09/14/18	5.00	5.02	5.23	4.93	4.98	5.14	4.96	4.86	4.75	4.79	5.01	5.02	4.73	4.88	4.64	4.65
09/15/18	5.00	5.02	5.23	4.93	4.98	5.14	4.96	4.86	4.74	4.78	5.02	5.03	4.73	4.86	4.64	4.65
09/16/18	5.00	5.02	5.23	4.93	4.98	5.14	4.96	4.86	4.74	4.78	5.02	5.04	4.82	4.87	4.65	4.67
09/17/18 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/18/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/19/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/20/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/21/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/22/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/23/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/24/18 **	2.25	2.42	2.25	2.11	2.66	2.16	2.35	2.41	2.62	2.28	2.13	2.17	2.53	2.16	2.20	2.41
09/25/18	4.87	5.22	5.35	5.04	5.33	5.14	5.08	4.82	5.18	4.86	5.11	5.20	5.01	5.17	4.74	4.78
09/26/18	5.03	5.13	5.22	4.93	5.23	4.98	4.99	4.74	4.90	4.66	4.94	4.94	4.80	4.91	4.54	4.61
09/27/18	4.99	5.06	5.12	4.86	5.22	4.91	4.96	4.73	4.72	4.52	4.77	4.76	4.73	4.69	4.41	4.47
09/28/18	4.96	5.10	5.09	4.87	5.21	4.93	4.97	4.74	4.68	4.48	4.71	4.68	4.60	4.66	4.40	4.41
09/29/18	4.99	5.05	5.13	4.84	5.15	4.92	4.98	4.74	4.59	4.49	4.71	4.69	4.58	4.64	4.41	4.45
09/30/18	4.97	5.04	5.07	4.89	5.15	4.95	4.97	4.77	4.61	4.46	4.68	4.67	4.56	4.59	4.37	4.41

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* Plant online from 12am to 3am with only 5 MF Cells in service, no PDT performed on those 5 Cells.

** Plant Offline for maintenance activities.

MicroFiltration Process online monitoring results

Log Removal Value

Date	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
09/01/18	4.77	4.86	4.85	4.74	4.83	4.69	4.76	4.77	5.08	4.97	4.86	4.99	5.09	4.75	4.88	4.95
09/02/18	4.76	4.84	4.83	4.74	4.82	4.66	4.74	4.79	5.08	4.95	4.87	4.98	5.12	4.75	4.86	4.94
09/03/18	4.77	4.85	4.83	4.75	4.84	4.68	4.74	4.81	5.07	4.95	4.88	4.95	5.13	4.74	4.83	4.94
09/04/18	4.78	4.83	4.81	4.74	4.83	4.68	4.74	4.78	5.04	4.98	4.87	4.96	5.09	4.73	4.83	4.98
09/05/18	4.80	4.83	4.82	4.72	4.80	4.68	4.74	4.75	5.04	4.99	4.87	4.96	5.08	4.72	4.82	4.96
09/06/18	4.81	4.85	4.84	4.71	4.79	4.68	4.74	4.76	5.07	4.96	4.88	4.94	5.06	4.75	4.82	4.99
09/07/18	4.81	4.86	4.84	4.73	4.79	4.68	4.74	4.79	5.03	4.92	4.87	4.95	5.04	4.75	4.80	4.96
09/08/18	4.81	4.89	4.86	4.76	4.79	4.70	4.75	4.82	5.06	4.94	4.84	4.99	5.11	4.78	4.87	4.97
09/09/18	4.78	4.86	4.84	4.73	4.81	4.70	4.74	4.81	5.05	4.95	4.85	4.96	5.13	4.75	4.85	4.98
09/10/18	4.86	4.83	4.84	4.71	4.81	4.71	4.75	4.80	5.01	4.98	4.87	4.94	5.09	4.72	4.83	4.95
09/11/18	4.92	4.83	4.85	4.80	4.84	4.71	4.77	4.83	5.01	5.09	4.87	4.94	5.09	4.71	4.85	4.97
09/12/18	4.92	4.83	4.85	4.87	4.87	4.71	4.84	4.83	5.01	5.09	4.87	4.94	5.15	4.78	4.89	5.00
09/13/18	4.92	4.83	4.85	4.87	4.87	4.71	4.90	4.82	5.01	5.09	4.87	4.94	5.15	4.78	5.02	4.98
09/14/18	4.92	4.83	4.85	4.87	4.87	4.71	4.90	4.82	5.01	5.09	4.87	4.94	5.15	4.78	5.02	4.98
09/15/18	4.92	4.83	4.85	4.87	4.87	4.71	4.90	4.82	5.01	5.09	4.87	4.94	5.15	4.78	5.02	4.98
09/16/18	4.92	4.83	4.85	4.87	4.87	4.71	4.90	4.82	5.01	5.09	4.87	4.94	5.15	4.78	5.02	4.98
09/17/18 *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/18/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/19/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/20/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/21/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/22/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/23/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/24/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/25/18 ***	0.00	0.00	0.00	0.00	5.05	4.94	5.04	5.00	5.28	5.20	5.00	5.10	0.00	0.00	5.30	5.16
09/26/18	4.91	4.96	5.01	4.87	4.99	4.84	4.89	4.94	5.18	5.30	4.97	5.14	5.30	4.95	5.27	5.13
09/27/18	4.88	4.88	4.98	4.82	4.94	4.79	4.81	4.87	5.11	5.14	4.80	4.95	5.18	4.78	5.03	5.00
09/28/18	4.84	4.86	4.97	4.80	4.91	4.77	4.80	4.84	5.12	5.14	4.83	4.93	5.16	4.76	5.02	4.99
09/29/18	4.85	4.88	4.96	4.79	4.92	4.76	4.80	4.84	5.08	5.10	4.82	4.92	5.16	4.74	5.02	4.95
09/30/18	4.85	4.88	4.98	4.78	4.91	4.76	4.80	4.85	5.07	5.05	4.82	4.92	5.15	4.73	4.99	4.94

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* Plant online from 12am to 3am with only 5 MF Cells in service, no PDT performed on those 5 Cells.

** Plant Offline for maintenance activities.

*** Cells with Zero values did not operate on this date.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Log Removal Value

Date	E01 LRV	E02 LRV	E03 LRV	E04 LRV
09/01/18	4.85	4.87	4.68	5.36
09/02/18	4.86	4.85	4.68	5.28
09/03/18	4.87	4.84	4.67	5.34
09/04/18	4.88	4.83	4.65	5.24
09/05/18	4.83	4.81	4.61	5.03
09/06/18	4.82	4.85	4.64	5.07
09/07/18	4.85	4.84	4.62	5.13
09/08/18	4.89	4.86	4.62	4.98
09/09/18	4.88	4.84	4.63	5.06
09/10/18	4.93	4.81	4.66	5.14
09/11/18	4.91	4.83	4.64	5.01
09/12/18	4.90	4.80	4.64	4.99
09/13/18	4.91	4.80	4.64	5.06
09/14/18	4.94	4.80	4.63	5.43
09/15/18	4.99	4.86	4.66	5.43
09/16/18	4.91	4.93	4.66	5.43
09/17/18 *	0.00	0.00	0.00	0.00
09/18/18 **	0.00	0.00	0.00	0.00
09/19/18 **	0.00	0.00	0.00	0.00
09/20/18 **	0.00	0.00	0.00	0.00
09/21/18 **	0.00	0.00	0.00	0.00
09/22/18 **	0.00	0.00	0.00	0.00
09/23/18 **	0.00	0.00	0.00	0.00
09/24/18 **	0.00	0.00	0.00	0.00
09/25/18 ***	0.00	0.00	0.00	0.00
09/26/18	5.00	5.05	4.90	5.60
09/27/18	4.89	5.02	4.74	5.30
09/28/18	4.88	5.00	4.72	5.43
09/29/18	4.88	4.90	4.68	5.34
09/30/18	4.87	4.88	4.70	5.57

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* Plant online from 12am to 3am with only 5 MF Cells in service, no PDT performed on those 5 Cells.

** Plant Offline for maintenance activities.

*** Cells with Zero values did not operate on this date.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Effluent Turbidity - NTU

Date	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
09/01/18	0.09	0.10	0.06	0.06	0.10	0.11	0.09	0.09	0.12	0.12	0.11	0.12	0.11	0.12	0.10	0.10	0.06	0.06	0.09
09/02/18	0.09	0.10	0.05	0.07	0.10	0.11	0.08	0.09	0.12	0.12	0.11	0.12	0.11	0.12	0.10	0.10	0.06	0.07	0.08
09/03/18	0.09	0.10	0.05	0.06	0.10	0.11	0.08	0.09	0.12	0.13	0.11	0.11	0.12	0.12	0.10	0.10	0.06	0.06	0.08
09/04/18	0.10	0.10	0.06	0.08	0.10	0.11	0.09	0.09	0.08	0.13	0.08	0.12	0.12	0.12	0.10	0.10	0.06	0.07	0.08
09/05/18	0.08	0.10	0.09	0.09	0.09	0.11	0.09	0.09	0.06	0.06	0.06	0.07	0.10	0.14	0.10	0.11	0.06	0.07	0.07
09/06/18	0.07	0.09	0.09	0.09	0.10	0.10	0.09	0.10	0.06	0.06	0.07	0.07	0.09	0.12	0.09	0.10	0.05	0.05	0.07
09/07/18	0.07	0.08	0.10	0.10	0.10	0.10	0.09	0.10	0.06	0.06	0.07	0.07	0.08	0.10	0.09	0.10	0.05	0.06	0.07
09/08/18	0.09	0.11	0.09	0.10	0.10	0.11	0.09	0.09	0.06	0.06	0.07	0.07	0.09	0.11	0.09	0.09	0.05	0.06	0.07
09/09/18	0.09	0.10	0.09	0.11	0.10	0.11	0.09	0.09	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.05	0.06	0.08
09/10/18	0.08	0.09	0.11	0.12	0.10	0.12	0.09	0.10	0.06	0.08	0.07	0.08	0.09	0.10	0.10	0.10	0.05	0.06	0.08
09/11/18	0.09	0.10	0.11	0.12	0.10	0.11	0.09	0.09	0.07	0.10	0.08	0.12	0.09	0.10	0.10	0.12	0.05	0.06	0.08
09/12/18	0.08	0.09	0.11	0.12	0.10	0.15	0.08	0.09	0.07	0.08	0.07	0.08	0.09	0.10	0.09	0.11	0.05	0.06	0.08
09/13/18	0.08	0.09	0.10	0.11	0.10	0.10	0.08	0.09	0.07	0.08	0.08	0.09	0.08	0.09	0.08	0.09	0.06	0.06	0.08
09/14/18	0.08	0.09	0.10	0.11	0.10	0.11	0.08	0.09	0.07	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.05	0.07	0.08
09/15/18	0.09	0.09	0.11	0.11	0.10	0.11	0.08	0.09	0.08	0.09	0.09	0.10	0.08	0.08	0.08	0.09	0.06	0.07	0.08
09/16/18	0.09	0.09	0.10	0.11	0.11	0.11	0.09	0.10	0.09	0.10	0.11	0.11	0.08	0.09	0.09	0.09	0.06	0.07	0.07
09/17/18 *	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.08
09/18/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/19/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/20/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/21/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/22/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/23/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/24/18 **	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/25/18	0.12	0.17	0.09	0.10	0.11	0.14	0.11	0.12	0.00	0.00	0.21	0.79	0.18	0.26	0.21	0.22	0.00	0.00	0.15
09/26/18	0.10	0.37	0.07	0.13	0.13	0.52	0.11	0.15	0.15	0.24	0.18	0.28	0.13	0.26	0.15	0.29	0.16	0.35	0.12
09/27/18	0.09	0.11	0.06	0.13	0.11	0.34	0.11	0.15	0.14	0.17	0.16	0.31	0.09	0.18	0.13	0.22	0.09	0.19	0.10
09/28/18	0.12	0.31	0.06	0.07	0.12	0.17	0.16	0.32	0.16	0.20	0.19	0.36	0.08	0.11	0.12	0.14	0.09	0.11	0.10
09/29/18	0.09	0.10	0.05	0.06	0.16	0.35	0.11	0.15	0.18	0.30	0.19	0.28	0.08	0.09	0.12	0.13	0.10	0.11	0.11
09/30/18	0.10	0.14	0.06	0.07	0.12	0.30	0.10	0.11	0.18	0.41	0.18	0.20	0.08	0.11	0.13	0.15	0.11	0.15	0.11

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

Reverse Osmosis Process online monitoring results

Date	Turbidity (ntu) ROP avg	Turbidity (ntu) ROP max	TOC (ppm) ROF avg	TOC ROF min	TOC ROF max	TOC ROP avg	TOC ROP min	TOC ROP max	EC ROF avg	EC ROF min	EC ROF max	EC ROP avg	EC ROP min	EC ROP max	Calculated TOC removal based on Daily Avg %	Calculated TOC removal Log	Calculated EC removal based on Daily Avg %	Calculated EC removal Log
09/01/18	0.062	0.066	7.646	7.250	8.137	0.063	0.056	0.069	1,794	1,745	1,847	40	38	44	99.18	2.09	97.74	1.65
09/02/18	0.068	0.069	7.432	6.957	7.916	0.058	0.046	0.066	1,674	1,612	1,766	38	35	41	99.22	2.11	97.75	1.65
09/03/18	0.067	0.069	7.457	6.680	14.180	0.052	0.047	0.057	1,569	1,520	1,604	36	33	40	99.30	2.15	97.71	1.64
09/04/18	0.062	0.065	7.179	6.136	7.758	0.054	0.050	0.058	1,531	1,448	1,630	34	31	39	99.25	2.13	97.77	1.65
09/05/18	0.055	0.059	7.927	7.563	8.748	0.070	0.054	0.091	1,744	1,630	1,911	39	34	46	99.12	2.05	97.77	1.65
09/06/18	0.052	0.056	7.780	7.061	10.772	0.057	0.051	0.063	1,810	1,734	1,896	40	34	44	99.26	2.13	97.79	1.66
09/07/18	0.052	0.061	7.520	7.064	8.040	0.056	0.051	0.060	1,808	1,736	1,887	40	37	44	99.25	2.13	97.79	1.66
09/08/18	0.056	0.057	7.473	6.936	8.020	0.060	0.051	0.064	1,769	1,714	1,868	39	37	42	99.20	2.10	97.78	1.65
09/09/18	0.062	0.066	7.305	6.782	7.787	0.053	0.046	0.060	1,655	1,614	1,712	37	35	42	99.28	2.14	97.77	1.65
09/10/18	0.058	0.063	7.375	6.885	7.894	0.052	0.046	0.055	1,581	1,513	1,662	35	32	39	99.29	2.15	97.78	1.65
09/11/18	0.055	0.056	7.556	7.029	8.182	0.056	0.050	0.062	1,667	1,598	1,747	37	33	40	99.26	2.13	97.81	1.66
09/12/18	0.055	0.061	7.610	7.170	8.838	0.060	0.051	0.071	1,757	1,696	1,852	38	34	42	99.21	2.10	97.84	1.67
09/13/18	0.058	0.060	7.745	7.267	8.378	0.064	0.060	0.069	1,799	1,726	1,881	40	36	44	99.18	2.08	97.80	1.66
09/14/18	0.052	0.060	7.562	7.176	7.957	0.067	0.060	0.074	1,825	1,757	1,906	40	37	44	99.12	2.06	97.79	1.66
09/15/18	0.049	0.061	7.658	7.109	8.043	0.068	0.059	0.075	1,787	1,720	1,889	40	36	43	99.11	2.05	97.77	1.65
09/16/18	0.058	0.061	7.625	7.225	8.115	0.063	0.053	0.072	1,679	1,647	1,739	38	35	42	99.17	2.08	97.75	1.65
09/17/18	0.051	0.052	7.931	7.827	7.983	0.054	0.053	0.055	1,643	1,620	1,668	39	38	40	99.32	2.16	97.64	1.63
09/18/18 *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0	0.00	0.00	0.00	0.00
09/19/18 *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0	0.00	0.00	0.00	0.00
09/20/18 *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0	0.00	0.00	0.00	0.00
09/21/18 *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0	0.00	0.00	0.00	0.00
09/22/18 *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0	0.00	0.00	0.00	0.00
09/23/18 *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0	0.00	0.00	0.00	0.00
09/24/18 *	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0	0.00	0.00	0.00	0.00
09/25/18	0.072	0.077	8.184	7.865	8.330	0.020	0.000	0.054	1,703	1,576	1,779	38	35	41	99.76	2.62	97.74	1.65
09/26/18	0.064	0.068	7.984	7.564	8.307	0.041	0.000	0.068	1,783	1,722	1,868	38	35	43	99.48	2.29	97.85	1.67
09/27/18	0.066	0.071	7.973	7.529	8.542	0.057	0.043	0.067	1,801	1,738	1,862	39	36	50	99.28	2.15	97.81	1.66
09/28/18	0.065	0.066	7.862	7.415	8.186	0.045	0.038	0.050	1,766	1,733	1,864	38	36	42	99.43	2.25	97.86	1.67
09/29/18	0.064	0.064	7.879	7.363	8.398	0.038	0.031	0.041	1,673	1,643	1,731	35	33	38	99.52	2.32	97.90	1.68
09/30/18	0.065	0.065	7.839	7.317	8.364	0.032	0.022	0.037	1,565	1,538	1,626	33	30	37	99.59	2.39	97.91	1.68

Notes:

* Plant Offline for maintenance activities.

Date	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
09/01/18	98.23	29.663	9,697.3	0.33	3.0	6
09/02/18	98.15	29.674	9,691.5	0.33	3.0	6
09/03/18	98.09	29.675	9,661.4	0.33	3.0	6
09/04/18	97.92	29.668	9,607.0	0.32	3.0	6
09/05/18	97.70	29.658	9,570.5	0.32	3.0	6
09/06/18	97.77	29.656	9,569.1	0.32	3.0	6
09/07/18	97.81	29.645	9,565.6	0.32	3.0	6
09/08/18	97.96	29.656	9,565.3	0.32	3.0	6
09/09/18	98.04	29.664	9,555.9	0.32	3.0	6
09/10/18	97.82	29.069	9,317.2	0.32	3.0	6
09/11/18	97.85	29.773	9,571.4	0.32	3.0	6
09/12/18	97.98	29.793	9,370.5	0.31	3.0	6
09/13/18	97.84	29.685	9,441.1	0.32	3.0	6
09/14/18	98.35	29.390	9,304.2	0.32	3.0	6
09/15/18	98.35	23.485	8,170.2	0.35	3.0	6
09/16/18	98.17	18.301	7,034.2	0.38	3.0	6
09/17/18	97.19	12.437	4,887.0	0.39	3.0	6
09/18/18*	0.00	0.000	0.0	0.00	0.0	0
09/19/18*	0.00	0.000	0.0	0.00	0.0	0
09/20/18*	0.00	0.000	0.0	0.00	0.0	0
09/21/18*	0.00	0.000	0.0	0.00	0.0	0
09/22/18*	0.00	0.000	0.0	0.00	0.0	0
09/23/18*	0.00	0.000	0.0	0.00	0.0	0
09/24/18*	0.00	0.000	0.0	0.00	0.0	0
09/25/18	98.94	8.970	5,775.5	0.64	3.0	6
09/26/18	99.23	20.469	7,070.1	0.35	3.0	6
09/27/18	99.32	29.158	9,833.6	0.34	3.0	6
09/28/18	99.31	27.698	9,510.6	0.34	3.0	6
09/29/18	99.33	29.824	10,072.3	0.34	3.0	6
09/30/18	98.51	29.826	10,047.3	0.34	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

* Plant Offline for maintenance activities.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
							MFE		ROP		
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	NTU		NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
10/01/18	12.75	12.75	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/02/18	12.55	12.55	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/03/18	12.65	12.65	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/04/18	12.66	12.66	12.31	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/05/18	12.88	12.88	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/06/18	12.97	12.97	12.37	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/07/18	13.01	13.01	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/08/18	13.06	13.06	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/09/18	12.60	12.60	12.00	Y	Y	Y	0.0	0.0	0.4 *	0.1*	0.0
10/10/18	12.95	12.95	12.37	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/11/18	12.92	12.92	12.38	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/12/18	12.95	12.95	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/13/18	13.05	13.05	12.49	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/14/18	13.15	13.15	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/15/18	13.13	13.13	12.55	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/16/18	13.03	13.03	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/17/18	13.01	13.01	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/18/18	13.00	13.00	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/19/18	12.99	12.99	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/20/18	13.00	13.00	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/21/18	13.05	13.05	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/22/18	13.11	13.11	12.54	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/23/18	12.90	12.90	12.34	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/24/18	12.67	12.67	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/25/18	12.93	12.93	12.38	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/26/18	12.89	12.89	12.38	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/27/18	12.97	12.97	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/28/18	13.04	13.04	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/29/18	13.06	13.06	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/30/18	12.97	12.97	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/31/18	12.90	12.90	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

* High value due to turbidity analyzer losing communication with SCADA system for a portion of the day.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
10/01/18	0.00	4.39	2.36	6.00	0.00	12.75
10/02/18	0.00	4.31	2.25	6.00	0.00	12.55
10/03/18	0.00	4.37	2.28	6.00	0.00	12.65
10/04/18	0.00	4.35	2.31	6.00	0.00	12.66
10/05/18	0.00	4.53	2.35	6.00	0.00	12.88
10/06/18	0.00	4.60	2.37	6.00	0.00	12.97
10/07/18	0.00	4.59	2.43	6.00	0.00	13.01
10/08/18	0.00	4.59	2.46	6.00	0.00	13.06
10/09/18	0.00	4.60	2.00 *	6.00	0.00	12.60
10/10/18	0.00	4.58	2.37	6.00	0.00	12.95
10/11/18	0.00	4.54	2.38	6.00	0.00	12.92
10/12/18	0.00	4.53	2.41	6.00	0.00	12.95
10/13/18	0.00	4.55	2.49	6.00	0.00	13.05
10/14/18	0.00	4.58	2.57	6.00	0.00	13.15
10/15/18	0.00	4.58	2.55	6.00	0.00	13.13
10/16/18	0.00	4.55	2.48	6.00	0.00	13.03
10/17/18	0.00	4.55	2.47	6.00	0.00	13.01
10/18/18	0.00	4.56	2.45	6.00	0.00	13.00
10/19/18	0.00	4.55	2.44	6.00	0.00	12.99
10/20/18	0.00	4.55	2.46	6.00	0.00	13.00
10/21/18	0.00	4.54	2.51	6.00	0.00	13.05
10/22/18	0.00	4.58	2.54	6.00	0.00	13.11
10/23/18	0.00	4.56	2.34	6.00	0.00	12.90
10/24/18	0.00	4.54	2.14 *	6.00	0.00	12.67
10/25/18	0.00	4.56	2.38	6.00	0.00	12.93
10/26/18	0.00	4.51	2.38	6.00	0.00	12.89
10/27/18	0.00	4.53	2.44	6.00	0.00	12.97
10/28/18	0.00	4.53	2.51	6.00	0.00	13.04
10/29/18	0.00	4.49	2.57	6.00	0.00	13.06
10/30/18	0.00	4.52	2.45	6.00	0.00	12.97
10/31/18	0.00	4.47	2.43	6.00	0.00	12.90

Notes:

* Lower than normal LRV recorded due to temporarily elevated TOC, suspected to be Acetone.
Currently working with OCSD to determine source.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Documented Virus Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
10/01/18	0.00	0.00	2.36	6.00	4.00	12.36
10/02/18	0.00	0.00	2.25	6.00	4.00	12.25
10/03/18	0.00	0.00	2.28	6.00	4.00	12.28
10/04/18	0.00	0.00	2.31	6.00	4.00	12.31
10/05/18	0.00	0.00	2.35	6.00	4.00	12.35
10/06/18	0.00	0.00	2.37	6.00	4.00	12.37
10/07/18	0.00	0.00	2.43	6.00	4.00	12.43
10/08/18	0.00	0.00	2.46	6.00	4.00	12.46
10/09/18	0.00	0.00	2.00 *	6.00	4.00	12.00
10/10/18	0.00	0.00	2.37	6.00	4.00	12.37
10/11/18	0.00	0.00	2.38	6.00	4.00	12.38
10/12/18	0.00	0.00	2.41	6.00	4.00	12.41
10/13/18	0.00	0.00	2.49	6.00	4.00	12.49
10/14/18	0.00	0.00	2.57	6.00	4.00	12.57
10/15/18	0.00	0.00	2.55	6.00	4.00	12.55
10/16/18	0.00	0.00	2.48	6.00	4.00	12.48
10/17/18	0.00	0.00	2.47	6.00	4.00	12.47
10/18/18	0.00	0.00	2.45	6.00	4.00	12.45
10/19/18	0.00	0.00	2.44	6.00	4.00	12.44
10/20/18	0.00	0.00	2.46	6.00	4.00	12.46
10/21/18	0.00	0.00	2.51	6.00	4.00	12.51
10/22/18	0.00	0.00	2.54	6.00	4.00	12.54
10/23/18	0.00	0.00	2.34	6.00	4.00	12.34
10/24/18	0.00	0.00	2.14 *	6.00	4.00	12.14
10/25/18	0.00	0.00	2.38	6.00	4.00	12.38
10/26/18	0.00	0.00	2.38	6.00	4.00	12.38
10/27/18	0.00	0.00	2.44	6.00	4.00	12.44
10/28/18	0.00	0.00	2.51	6.00	4.00	12.51
10/29/18	0.00	0.00	2.57	6.00	4.00	12.57
10/30/18	0.00	0.00	2.45	6.00	4.00	12.45
10/31/18	0.00	0.00	2.43	6.00	4.00	12.43

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

* Lower than normal LRV recorded due to temporarily elevated TOC, suspected to be Acetone. Currently working with OCSD to determine source.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
10/01/18	5.03	5.03	5.06	4.88	5.22	4.90	4.99	4.77	4.60	4.47	4.71	4.69	4.57	4.62	4.39	4.41
10/02/18	4.99	5.04	5.08	4.87	5.22	4.90	4.91	4.75	4.47	4.31	4.73	4.69	4.58	4.58	4.39	4.47
10/03/18	4.97	5.00	5.14	4.89	5.17	4.89	4.95	4.78	4.51	4.37	4.72	4.73	4.55	4.61	4.41	4.47
10/04/18	4.97	5.03	5.09	4.87	5.11	4.89	4.91	4.80	4.50	4.35	4.81	4.71	4.57	4.57	4.41	4.45
10/05/18	4.95	4.99	5.10	4.88	5.16	4.89	4.90	4.74	4.81	4.67	4.98	4.91	4.74	4.79	4.53	4.57
10/06/18	4.92	4.99	5.06	4.87	5.13	4.91	4.92	4.79	4.90	4.75	5.02	5.00	4.81	4.88	4.63	4.60
10/07/18	4.95	4.96	4.99	4.89	5.16	4.91	4.92	4.77	4.87	4.71	4.96	4.96	4.78	4.85	4.63	4.59
10/08/18	4.96	5.00	5.03	4.84	5.14	4.85	4.94	4.76	4.89	4.71	4.95	4.95	4.79	4.86	4.64	4.59
10/09/18	4.94	4.96	5.06	4.86	5.13	4.88	4.89	4.74	4.89	4.67	4.98	4.99	4.75	4.84	4.61	4.60
10/10/18	4.95	4.98	5.02	4.83	5.12	4.91	4.89	4.80	4.89	4.67	4.97	4.96	4.73	4.81	4.61	4.58
10/11/18	4.94	5.01	5.02	4.87	5.11	4.88	4.87	4.80	4.88	4.69	4.98	4.91	4.77	4.79	4.62	4.54
10/12/18	4.95	5.01	4.98	4.84	5.13	4.82	4.90	4.72	5.02	4.68	4.97	4.90	4.75	4.78	4.61	4.53
10/13/18	5.12	5.08	5.03	4.90	5.03	4.83	4.94	4.69	4.85	4.67	4.95	4.89	4.75	4.77	4.60	4.55
10/14/18	5.02	5.02	5.11	4.89	5.07	4.85	4.91	4.71	4.78	4.68	4.97	4.92	4.76	4.77	4.59	4.58
10/15/18	4.99	5.03	5.12	4.88	5.05	4.87	4.92	4.63	4.74	4.77	4.97	4.94	4.76	4.76	4.58	4.58
10/16/18	4.96	5.06	5.01	4.86	4.99	4.94	5.00	4.65	4.72	4.75	4.98	4.93	4.71	4.76	4.58	4.55
10/17/18	4.96	4.92	5.01	4.86	4.98	4.92	4.93	4.91	4.71	4.74	5.01	4.88	4.71	4.73	4.58	4.55
10/18/18	4.98	4.97	5.01	4.84	4.95	4.93	4.89	4.94	4.72	4.68	5.00	4.87	4.69	4.73	4.65	4.56
10/19/18	4.94	4.99	5.03	4.84	4.99	4.89	4.89	4.90	4.70	4.70	4.98	4.87	4.70	4.73	4.64	4.55
10/20/18	4.98	4.95	5.01	4.85	4.96	4.92	4.93	4.85	4.69	4.69	4.98	4.87	4.72	4.74	4.61	4.55
10/21/18	4.97	4.95	5.04	4.83	4.98	4.91	4.91	4.90	4.71	4.68	4.98	4.88	4.69	4.82	4.61	4.54
10/22/18	4.88	4.91	4.99	4.82	4.99	4.89	4.92	4.93	4.68	4.67	4.97	4.87	4.68	4.81	4.61	4.58
10/23/18	4.88	4.95	4.94	4.78	4.98	4.89	4.87	4.86	4.68	4.66	4.96	4.85	4.68	4.78	4.60	4.58
10/24/18	4.94	4.96	4.93	4.78	5.01	4.85	4.82	4.84	4.68	4.62	4.94	4.94	4.68	4.76	4.59	4.54
10/25/18	4.92	4.86	4.97	4.76	5.05	4.85	4.80	4.88	4.65	4.62	4.94	4.95	4.82	4.77	4.59	4.58
10/26/18	4.83	4.86	4.98	4.78	4.95	4.87	4.82	4.90	4.68	4.63	4.92	4.95	4.78	4.78	4.60	4.57
10/27/18	4.87	4.93	4.97	4.78	4.96	4.82	4.83	4.88	4.68	4.62	4.94	4.94	4.76	4.78	4.61	4.58
10/28/18	4.87	4.94	4.89	4.77	4.99	4.80	4.81	4.87	4.64	4.62	4.94	4.93	4.78	4.75	4.60	4.65
10/29/18	4.83	4.94	4.94	4.75	4.90	4.80	4.82	4.85	4.63	4.61	4.91	4.93	4.76	4.74	4.58	4.66
10/30/18	4.87	4.83	4.96	4.74	4.86	4.84	4.84	4.85	4.64	4.60	4.93	4.90	4.74	4.75	4.57	4.65
10/31/18	4.87	4.86	4.93	4.70	4.87	4.84	4.79	4.81	4.62	4.59	4.87	4.87	4.72	4.72	4.55	4.62

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
10/01/18	4.85	4.87	5.00	4.81	4.90	4.77	4.81	4.88	5.08	5.09	4.83	4.92	5.14	4.75	4.97	4.94
10/02/18	4.91	4.93	4.96	4.81	4.92	4.81	4.83	4.89	5.07	5.09	4.81	4.91	5.13	4.74	4.99	5.01
10/03/18	4.88	4.90	4.98	4.81	4.93	4.79	4.86	4.88	5.07	5.04	4.78	4.89	5.09	4.72	4.98	5.01
10/04/18	4.83	4.86	4.91	4.79	4.90	4.73	4.82	4.84	5.07	5.06	4.77	4.88	5.05	4.70	4.89	4.94
10/05/18	4.80	4.84	4.88	4.75	4.85	4.70	4.77	4.80	5.05	5.05	4.80	4.88	5.06	4.71	4.90	4.94
10/06/18	4.79	4.84	4.83	4.75	4.84	4.70	4.77	4.81	5.04	5.03	4.79	4.88	5.10	4.70	4.92	4.93
10/07/18	4.77	4.84	4.83	4.75	4.85	4.69	4.74	4.82	5.01	5.00	4.79	4.92	5.09	4.68	4.92	4.85
10/08/18	4.79	4.84	4.84	4.74	4.85	4.69	4.71	4.80	5.02	5.00	4.78	4.94	5.10	4.68	4.89	4.86
10/09/18	4.80	4.82	4.83	4.74	4.84	4.70	4.72	4.79	5.03	5.01	4.77	4.93	5.09	4.66	4.90	4.90
10/10/18	4.77	4.80	4.82	4.69	4.82	4.69	4.71	4.76	5.02	4.98	4.75	4.88	5.06	4.66	4.89	4.89
10/11/18	4.78	4.78	4.84	4.67	4.80	4.66	4.70	4.75	5.01	4.97	4.72	4.85	5.06	4.68	4.86	4.85
10/12/18	4.77	4.76	4.85	4.68	4.78	4.67	4.71	4.75	5.03	5.01	4.74	4.87	5.09	4.70	4.86	4.87
10/13/18	4.75	4.79	4.83	4.67	4.77	4.69	4.72	4.73	5.02	4.99	4.75	4.83	5.08	4.69	4.86	4.86
10/14/18	4.75	4.82	4.83	4.69	4.78	4.69	4.73	4.75	5.05	4.96	4.73	4.86	5.04	4.69	4.87	4.86
10/15/18	4.75	4.82	4.82	4.69	4.80	4.69	4.73	4.75	5.06	4.99	4.72	4.90	5.05	4.69	4.88	4.87
10/16/18	4.75	4.78	4.82	4.67	4.77	4.68	4.74	4.72	4.99	4.97	4.72	4.88	5.02	4.66	4.83	4.88
10/17/18	4.70	4.74	4.76	4.63	4.74	4.63	4.79	4.72	4.95	4.92	4.72	4.84	5.00	4.63	4.78	4.82
10/18/18	4.69	4.75	4.75	4.62	4.76	4.59	4.83	4.72	4.97	5.02	4.72	4.80	5.02	4.59	4.80	4.84
10/19/18	4.71	4.72	4.80	4.63	4.75	4.67	4.75	4.71	4.96	5.04	4.71	4.80	5.03	4.59	4.81	4.90
10/20/18	4.81	4.70	4.80	4.76	4.74	4.73	4.75	4.70	4.96	4.95	4.71	4.81	5.02	4.66	4.80	4.95
10/21/18	4.86	4.74	4.89	4.84	4.76	4.74	4.78	4.70	4.98	4.93	4.71	4.83	4.99	4.71	4.78	4.94
10/22/18	4.81	4.86	4.92	4.77	4.74	4.71	4.75	4.72	4.92	4.90	4.70	4.82	4.96	4.67	4.78	4.96
10/23/18	4.79	4.85	4.84	4.72	4.71	4.69	4.69	4.79	4.85	4.88	4.67	4.78	4.97	4.67	4.79	4.95
10/24/18	4.80	4.80	4.84	4.71	4.78	4.68	4.67	4.87	4.87	4.89	4.67	4.74	5.04	4.68	4.75	4.93
10/25/18	4.75	4.80	4.85	4.70	4.84	4.67	4.68	4.86	4.89	4.90	4.66	4.79	5.08	4.65	4.77	4.92
10/26/18	4.73	4.79	4.83	4.67	4.82	4.64	4.69	4.85	4.90	4.90	4.71	4.91	5.09	4.64	4.77	4.91
10/27/18	4.73	4.77	4.83	4.64	4.80	4.63	4.67	4.82	4.91	4.89	4.80	4.90	5.09	4.66	4.85	4.93
10/28/18	4.72	4.77	4.84	4.65	4.80	4.65	4.69	4.80	4.90	4.88	4.77	4.90	5.07	4.66	5.01	4.92
10/29/18	4.72	4.78	4.82	4.67	4.78	4.64	4.69	4.77	4.89	4.89	4.74	4.90	5.02	4.65	4.87	4.92
10/30/18	4.69	4.78	4.79	4.65	4.76	4.60	4.65	4.76	4.86	4.89	4.75	4.87	5.02	4.61	4.84	4.92
10/31/18	4.69	4.75	4.77	4.63	4.74	4.58	4.62	4.76	4.81	4.84	4.76	4.83	5.01	4.63	4.85	4.91

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
Date	E01 LRV	E02 LRV	E03 LRV	E04 LRV												
10/01/18	4.84	4.94	4.69	5.39												
10/02/18	4.87	4.91	4.67	5.23												
10/03/18	4.85	4.88	4.63	5.25												
10/04/18	4.80	4.86	4.60	5.23												
10/05/18	4.83	4.90	4.58	5.42												
10/06/18	4.85	4.91	4.61	5.43												
10/07/18	4.82	4.86	4.64	5.38												
10/08/18	4.86	4.85	4.62	5.17												
10/09/18	4.91	4.87	4.63	5.30												
10/10/18	4.80	4.90	4.64	5.23												
10/11/18	4.75	4.92	4.59	5.19												
10/12/18	4.78	4.86	4.65	5.25												
10/13/18	4.78	4.88	4.61	5.25												
10/14/18	4.75	4.88	4.65	5.32												
10/15/18	4.77	4.90	4.69	5.26												
10/16/18	4.81	4.88	4.65	5.16												
10/17/18	4.79	4.83	4.60	5.22												
10/18/18	4.71	4.87	4.61	5.28												
10/19/18	4.73	4.84	4.60	5.10												
10/20/18	4.76	4.83	4.58	5.06												
10/21/18	4.76	4.86	4.58	5.16												
10/22/18	4.77	4.84	4.60	5.44												
10/23/18	4.87	4.80	4.56	5.44												
10/24/18	4.85	4.80	4.56	5.27												
10/25/18	4.82	4.77	4.56	5.28												
10/26/18	4.83	4.82	4.51	5.36												
10/27/18	4.86	4.78	4.53	5.20												
10/28/18	4.86	4.79	4.53	5.24												
10/29/18	4.83	4.76	4.49	5.14												
10/30/18	4.77	4.77	4.52	5.13												
10/31/18	4.75	4.72	4.47	5.12												

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Effluent Turbidity - NTU																		
	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
Date	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
10/01/18	0.10	0.11	0.06	0.07	0.11	0.13	0.12	0.17	0.17	0.22	0.18	0.20	0.09	0.11	0.13	0.13	0.11	0.11	0.11
10/02/18	0.10	0.11	0.06	0.07	0.11	0.12	0.10	0.12	0.15	0.19	0.18	0.20	0.10	0.11	0.13	0.22	0.11	0.15	0.11
10/03/18	0.10	0.11	0.06	0.06	0.10	0.12	0.09	0.10	0.11	0.19	0.15	0.20	0.10	0.11	0.12	0.13	0.10	0.10	0.10
10/04/18	0.09	0.11	0.09	0.11	0.11	0.20	0.11	0.51*	0.09	0.11	0.12	0.14	0.09	0.11	0.12	0.12	0.08	0.10	0.10
10/05/18	0.08	0.11	0.09	0.11	0.10	0.11	0.09	0.09	0.10	0.11	0.13	0.14	0.10	0.10	0.12	0.12	0.07	0.08	0.10
10/06/18	0.09	0.10	0.10	0.13	0.10	0.11	0.09	0.09	0.10	0.12	0.14	0.17	0.10	0.11	0.12	0.13	0.07	0.08	0.10
10/07/18	0.10	0.10	0.09	0.12	0.10	0.11	0.09	0.09	0.11	0.13	0.14	0.16	0.11	0.12	0.12	0.13	0.07	0.08	0.10
10/08/18	0.09	0.10	0.09	0.10	0.10	0.11	0.09	0.10	0.11	0.13	0.15	0.17	0.11	0.12	0.12	0.13	0.08	0.08	0.11
10/09/18	0.09	0.10	0.09	0.09	0.10	0.11	0.09	0.09	0.11	0.15	0.15	0.17	0.12	0.13	0.12	0.12	0.07	0.08	0.10
10/10/18	0.08	0.15	0.08	0.10	0.10	0.10	0.08	0.09	0.12	0.17	0.15	0.18	0.12	0.13	0.12	0.12	0.08	0.09	0.10
10/11/18	0.09	0.10	0.08	0.09	0.10	0.10	0.08	0.09	0.12	0.15	0.16	0.18	0.12	0.13	0.12	0.12	0.08	0.08	0.10
10/12/18	0.08	0.11	0.09	0.11	0.10	0.13	0.09	0.10	0.12	0.15	0.16	0.23	0.13	0.17	0.12	0.13	0.08	0.08	0.11
10/13/18	0.08	0.09	0.08	0.10	0.09	0.10	0.09	0.09	0.12	0.16	0.16	0.19	0.13	0.16	0.12	0.13	0.08	0.09	0.11
10/14/18	0.09	0.09	0.09	0.10	0.10	0.15	0.08	0.09	0.12	0.17	0.15	0.18	0.12	0.14	0.13	0.13	0.08	0.09	0.11
10/15/18	0.09	0.10	0.09	0.10	0.09	0.10	0.08	0.09	0.12	0.19	0.16	0.21	0.11	0.15	0.13	0.13	0.08	0.09	0.11
10/16/18	0.09	0.09	0.09	0.10	0.09	0.09	0.08	0.08	0.12	0.15	0.16	0.19	0.12	0.15	0.12	0.13	0.08	0.09	0.10
10/17/18	0.07	0.12	0.09	0.11	0.09	0.13	0.08	0.10	0.08	0.13	0.11	0.21	0.09	0.15	0.11	0.12	0.07	0.08	0.09
10/18/18	0.07	0.09	0.08	0.12	0.09	0.10	0.09	0.09	0.06	0.11	0.07	0.10	0.06	0.08	0.10	0.10	0.05	0.06	0.08
10/19/18	0.08	0.09	0.09	0.13	0.09	0.10	0.08	0.09	0.07	0.11	0.08	0.13	0.06	0.08	0.10	0.11	0.05	0.06	0.08
10/20/18	0.09	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.08	0.13	0.08	0.13	0.07	0.09	0.11	0.11	0.06	0.07	0.08
10/21/18	0.10	0.11	0.09	0.10	0.10	0.10	0.09	0.10	0.08	0.16	0.09	0.14	0.07	0.08	0.10	0.11	0.06	0.06	0.09
10/22/18	0.10	0.19	0.08	0.09	0.10	0.10	0.09	0.10	0.09	0.13	0.10	0.13	0.07	0.07	0.10	0.13	0.06	0.07	0.09
10/23/18	0.09	0.10	0.08	0.09	0.10	0.13	0.09	0.12	0.08	0.13	0.10	0.14	0.08	0.24	0.10	0.10	0.06	0.06	0.08
10/24/18	0.09	0.11	0.08	0.09	0.09	0.11	0.09	0.09	0.08	0.10	0.10	0.14	0.07	0.08	0.10	0.10	0.06	0.06	0.08
10/25/18	0.10	0.16	0.13	0.16	0.10	0.13	0.08	0.10	0.08	0.10	0.11	0.15	0.07	0.10	0.10	0.10	0.05	0.06	0.09
10/26/18	0.10	0.11	0.13	0.15	0.09	0.10	0.09	0.09	0.09	0.12	0.12	0.14	0.08	0.10	0.10	0.10	0.06	0.06	0.10
10/27/18	0.10	0.12	0.12	0.13	0.09	0.10	0.09	0.09	0.10	0.12	0.13	0.14	0.08	0.10	0.10	0.10	0.06	0.07	0.10
10/28/18	0.10	0.11	0.12	0.13	0.10	0.10	0.09	0.10	0.10	0.11	0.14	0.17	0.08	0.09	0.10	0.11	0.06	0.07	0.10
10/29/18	0.10	0.11	0.11	0.12	0.10	0.11	0.09	0.10	0.11	0.14	0.14	0.17	0.10	0.11	0.11	0.11	0.07	0.08	0.10
10/30/18	0.10	0.11	0.10	0.12	0.09	0.10	0.08	0.09	0.09	0.13	0.12	0.15	0.10	0.12	0.10	0.11	0.06	0.07	0.09
10/31/18	0.09	0.11	0.10	0.13	0.10	0.13	0.08	0.10	0.08	0.09	0.10	0.11	0.08	0.10	0.09	0.10	0.06	0.06	0.09

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

* High value due to analyzer issue addressed the same day.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Reverse Osmosis Process online monitoring results														Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)									
	ROP		ROF			ROP			ROF			ROP						
	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
10/01/18	0.062	0.063	7.818	7.318	8.378	0.035	0.024	0.044	1,555	1,482	1,686	33	30	38	99.56	2.36	97.88	1.67
10/02/18	0.060	0.064	8.273	7.626	11.966	0.047	0.040	0.058	1,695	1,634	1,797	38	33	43	99.43	2.25	97.79	1.66
10/03/18	0.057	0.065	8.239	7.751	8.863	0.044	0.037	0.052	1,764	1,684	1,862	41	35	47	99.47	2.28	97.70	1.64
10/04/18	0.062	0.067	8.506	8.020	9.053	0.042	0.035	0.047	1,833	1,778	1,912	41	37	46	99.51	2.31	97.77	1.65
10/05/18	0.060	0.064	8.121	7.513	8.885	0.037	0.033	0.040	1,780	1,687	1,868	38	34	43	99.55	2.35	97.85	1.67
10/06/18	0.059	0.065	7.922	7.290	8.524	0.034	0.026	0.042	1,719	1,665	1,794	37	33	40	99.57	2.37	97.87	1.67
10/07/18	0.066	0.068	7.742	6.992	8.474	0.029	0.023	0.034	1,595	1,539	1,645	33	30	37	99.62	2.43	97.93	1.68
10/08/18	0.071	0.072	7.978	7.254	8.702	0.028	0.023	0.042	1,595	1,502	1,733	33	29	39	99.65	2.46	97.91	1.68
10/09/18	0.250**	0.564**	8.508	7.794	9.122	0.086*	0.037	0.228*	1,765	1,640	1,929	36	31	43	98.99	2.00 *	97.94	1.69
10/10/18	0.075	0.087	8.414	8.133	9.038	0.036	0.032	0.041	1,826	1,780	1,895	38	34	41	99.58	2.37	97.94	1.69
10/11/18	0.074	0.077	7.907	5.839	8.713	0.033	0.031	0.038	1,815	1,744	1,898	37	33	42	99.58	2.38	97.95	1.69
10/12/18	0.054	0.064	8.002	7.571	8.799	0.031	0.026	0.041	1,825	1,769	1,878	38	33	59	99.61	2.41	97.91	1.68
10/13/18	0.051	0.052	8.345	7.685	9.115	0.027	0.020	0.041	1,747	1,658	1,868	37	33	44	99.68	2.49	97.91	1.68
10/14/18	0.053	0.053	7.979	7.389	8.971	0.022	0.019	0.025	1,588	1,516	1,634	33	30	38	99.73	2.57	97.91	1.68
10/15/18	0.058	0.061	7.675	6.035	8.479	0.022	0.019	0.026	1,591	1,500	1,734	32	28	37	99.72	2.55	97.96	1.69
10/16/18	0.063	0.072	7.973	7.478	8.609	0.026	0.015	0.038	1,754	1,648	1,890	36	31	42	99.67	2.48	97.95	1.69
10/17/18	0.074	0.077	7.779	5.953	8.567	0.027	0.019	0.035	1,821	1,758	1,881	38	33	43	99.66	2.47	97.92	1.68
10/18/18	0.077	0.077	7.817	7.416	8.608	0.028	0.023	0.033	1,814	1,742	1,882	38	34	43	99.64	2.45	97.88	1.67
10/19/18	0.071	0.076	7.127	5.653	8.198	0.026	0.020	0.036	1,803	1,726	1,873	37	34	42	99.63	2.44	97.95	1.69
10/20/18	0.055	0.056	7.092	5.373	8.104	0.025	0.020	0.031	1,738	1,677	1,832	36	32	39	99.65	2.46	97.95	1.69
10/21/18	0.058	0.065	7.156	5.722	7.977	0.022	0.019	0.027	1,642	1,584	1,697	34	30	38	99.69	2.51	97.92	1.68
10/22/18	0.069	0.077	7.447	6.772	8.307	0.022	0.018	0.033	1,618	1,522	1,792	33	29	39	99.71	2.54	97.96	1.69
10/23/18	0.077	0.078	7.709	7.198	8.480	0.035	0.027	0.058	1,744	1,663	1,838	35	31	41	99.55	2.34	97.97	1.69
10/24/18	0.078	0.078	8.065	6.029	9.541	0.059*	0.025	0.210*	1,799	1,725	1,870	38	33	42	99.27	2.14*	97.88	1.67
10/25/18	0.077	0.077	7.739	5.812	8.509	0.032	0.024	0.051	1,768	1,713	1,840	36	32	40	99.58	2.38	97.96	1.69
10/26/18	0.076	0.077	7.779	5.733	8.583	0.032	0.028	0.036	1,747	1,674	1,805	36	32	40	99.59	2.38	97.92	1.68
10/27/18	0.075	0.076	7.728	6.085	8.450	0.028	0.024	0.032	1,699	1,653	1,761	36	33	40	99.64	2.44	97.89	1.68
10/28/18	0.067	0.071	7.590	7.086	8.375	0.024	0.017	0.029	1,611	1,555	1,658	33	31	38	99.69	2.51	97.93	1.68
10/29/18	0.064	0.072	7.629	7.124	8.637	0.021	0.017	0.026	1,558	1,462	1,703	32	29	37	99.73	2.57	97.92	1.68
10/30/18	0.071	0.074	7.791	7.100	8.818	0.027	0.024	0.032	1,694	1,601	1,806	34	29	39	99.65	2.45	97.99	1.70
10/31/18	0.076	0.076	7.889	7.442	8.359	0.029	0.026	0.037	1,774	1,705	1,832	36	32	40	99.63	2.43	97.98	1.70

Notes:

* Lower than normal LRV recorded due to temporarily elevated TOC, suspected to be Acetone. Currently working with OCSD to determine source.

** High value due to turbidity analyzer losing communication with SCADA system for a portion of the day.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
10/01/18	98.06	29.823	10,050.6	0.34	3.0	6
10/02/18	98.06	28.500	9,718.2	0.34	3.0	6
10/03/18	97.66	28.766	9,651.4	0.34	3.0	6
10/04/18	97.30	50.903	14,834.3	0.29	3.0	6
10/05/18	97.72	85.043	22,262.2	0.26	3.0	6
10/06/18	97.70	89.688	23,241.6	0.26	3.0	6
10/07/18	97.45	89.697	23,327.5	0.26	3.0	6
10/08/18	97.71	89.702	23,743.4	0.26	3.0	6
10/09/18	97.56	89.684	23,635.5	0.26	3.0	6
10/10/18	97.67	88.952	23,152.0	0.26	3.0	6
10/11/18	97.60	90.629	23,196.5	0.26	3.0	6
10/12/18	97.49	94.500	23,198.5	0.25	3.0	6
10/13/18	97.59	86.643	21,483.5	0.25	3.0	6
10/14/18	97.58	90.289	23,120.3	0.26	3.0	6
10/15/18	97.03	89.533	23,034.8	0.26	3.0	6
10/16/18	96.81	92.049	23,132.4	0.25	3.0	6
10/17/18	97.25	95.138	23,736.1	0.25	3.0	6
10/18/18	97.37	99.239	24,863.6	0.25	3.0	6
10/19/18	97.29	95.440	23,435.2	0.25	3.0	6
10/20/18	97.44	94.762	23,243.4	0.25	3.0	6
10/21/18	97.30	96.732	24,238.1	0.25	3.0	6
10/22/18	97.61	95.435	24,266.6	0.25	3.0	6
10/23/18	97.41	98.218	24,753.6	0.25	3.0	6
10/24/18	97.34	96.768	24,571.8	0.25	3.0	6
10/25/18	97.37	96.489	24,489.4	0.25	3.0	6
10/26/18	97.22	97.338	24,233.6	0.25	3.0	6
10/27/18	97.23	95.879	23,969.7	0.25	3.0	6
10/28/18	97.37	96.392	24,256.0	0.25	3.0	6
10/29/18	97.38	95.456	24,235.1	0.25	3.0	6
10/30/18	97.18	97.136	24,919.5	0.26	3.0	6
10/31/18	97.37	99.450	25,412.6	0.26	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
	Giardia	Cryptosporidium	Virus(1)	Giardia (10)	Cryptosporidium (10)	Virus (12)	MFE NTU		ROP NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
11/01/18	12.86	12.86	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/02/18	12.85	12.85	12.39	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/03/18	12.90	12.90	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/04/18	12.87	12.87	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/05/18	13.05	13.05	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/06/18	12.94	12.94	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/07/18	12.97	12.97	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/08/18	12.93	12.93	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/09/18	12.97	12.97	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/10/18	12.86	12.86	12.50	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/11/18	13.06	13.06	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/12/18	13.08	13.08	12.58	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/13/18	13.02	13.02	12.50	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/14/18	12.98	12.98	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/15/18	13.00	13.00	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/16/18	12.96	12.96	12.42	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/17/18	12.99	12.99	12.49	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/18/18	12.99	12.99	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/19/18	13.04	13.04	12.52	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/20/18	13.01	13.01	12.49	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/21/18	12.96	12.96	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/22/18	12.94	12.94	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/23/18	13.02	13.02	12.55	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/24/18	13.11	13.11	12.61	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/25/18	13.07	13.07	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/26/18	13.03	13.03	12.53	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/27/18	12.94	12.94	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/28/18	12.78	12.78	12.37	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/29/18	12.89	12.89	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/30/18	12.87	12.87	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

Date	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (ToT)	Total
	LRV	LRV	LRV	LRV	LRV	LRV
11/01/18	0.00	4.43	2.43	6.00	0.00	12.86
11/02/18	0.00	4.47	2.39	6.00	0.00	12.85
11/03/18	0.00	4.46	2.44	6.00	0.00	12.90
11/04/18	0.00	4.40	2.48	6.00	0.00	12.87
11/05/18	0.00	4.49	2.56	6.00	0.00	13.05
11/06/18	0.00	4.54	2.41	6.00	0.00	12.94
11/07/18	0.00	4.54	2.43	6.00	0.00	12.97
11/08/18	0.00	4.52	2.41	6.00	0.00	12.93
11/09/18	0.00	4.51	2.46	6.00	0.00	12.97
11/10/18	0.00	4.36	2.50	6.00	0.00	12.86
11/11/18	0.00	4.50	2.56	6.00	0.00	13.06
11/12/18	0.00	4.50	2.58	6.00	0.00	13.08
11/13/18	0.00	4.53	2.50	6.00	0.00	13.02
11/14/18	0.00	4.51	2.46	6.00	0.00	12.98
11/15/18	0.00	4.56	2.44	6.00	0.00	13.00
11/16/18	0.00	4.54	2.42	6.00	0.00	12.96
11/17/18	0.00	4.50	2.49	6.00	0.00	12.99
11/18/18	0.00	4.52	2.48	6.00	0.00	12.99
11/19/18	0.00	4.52	2.52	6.00	0.00	13.04
11/20/18	0.00	4.52	2.49	6.00	0.00	13.01
11/21/18	0.00	4.50	2.46	6.00	0.00	12.96
11/22/18	0.00	4.46	2.48	6.00	0.00	12.94
11/23/18	0.00	4.47	2.55	6.00	0.00	13.02
11/24/18	0.00	4.50	2.61	6.00	0.00	13.11
11/25/18	0.00	4.49	2.57	6.00	0.00	13.07
11/26/18	0.00	4.51	2.53	6.00	0.00	13.03
11/27/18	0.00	4.48	2.46	6.00	0.00	12.94
11/28/18	0.00	4.41	2.37	6.00	0.00	12.78
11/29/18	0.00	4.42	2.47	6.00	0.00	12.89
11/30/18	0.00	4.39	2.47	6.00	0.00	12.87

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

Date	Documented Virus Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
11/01/18	0.00	0.00	2.43	6.00	4.00	12.43
11/02/18	0.00	0.00	2.39	6.00	4.00	12.39
11/03/18	0.00	0.00	2.44	6.00	4.00	12.44
11/04/18	0.00	0.00	2.48	6.00	4.00	12.48
11/05/18	0.00	0.00	2.56	6.00	4.00	12.56
11/06/18	0.00	0.00	2.41	6.00	4.00	12.41
11/07/18	0.00	0.00	2.43	6.00	4.00	12.43
11/08/18	0.00	0.00	2.41	6.00	4.00	12.41
11/09/18	0.00	0.00	2.46	6.00	4.00	12.46
11/10/18	0.00	0.00	2.50	6.00	4.00	12.50
11/11/18	0.00	0.00	2.56	6.00	4.00	12.56
11/12/18	0.00	0.00	2.58	6.00	4.00	12.58
11/13/18	0.00	0.00	2.50	6.00	4.00	12.50
11/14/18	0.00	0.00	2.46	6.00	4.00	12.46
11/15/18	0.00	0.00	2.44	6.00	4.00	12.44
11/16/18	0.00	0.00	2.42	6.00	4.00	12.42
11/17/18	0.00	0.00	2.49	6.00	4.00	12.49
11/18/18	0.00	0.00	2.48	6.00	4.00	12.48
11/19/18	0.00	0.00	2.52	6.00	4.00	12.52
11/20/18	0.00	0.00	2.49	6.00	4.00	12.49
11/21/18	0.00	0.00	2.46	6.00	4.00	12.46
11/22/18	0.00	0.00	2.48	6.00	4.00	12.48
11/23/18	0.00	0.00	2.55	6.00	4.00	12.55
11/24/18	0.00	0.00	2.61	6.00	4.00	12.61
11/25/18	0.00	0.00	2.57	6.00	4.00	12.57
11/26/18	0.00	0.00	2.53	6.00	4.00	12.53
11/27/18	0.00	0.00	2.46	6.00	4.00	12.46
11/28/18	0.00	0.00	2.37	6.00	4.00	12.37
11/29/18	0.00	0.00	2.47	6.00	4.00	12.47
11/30/18	0.00	0.00	2.47	6.00	4.00	12.47

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results — Log Removal Value															
	A01	**A02**	**A03**	**A04**	**A05**	**A06**	**A07**	**A08**	**B01**	**B02**	**B03**	**B04**	**B05**	**B06**	**B07**	**B08**
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
11/01/18	4.84	4.88	4.89	4.69	4.90	4.83	4.79	4.77	4.63	4.60	4.85	4.90	4.71	4.72	4.55	4.60
11/02/18	4.88	4.85	4.91	4.68	4.91	4.80	4.79	4.80	4.61	4.57	4.88	4.89	4.70	4.70	4.55	4.61
11/03/18	4.92	4.85	4.96	4.66	4.90	4.78	4.78	4.84	4.62	4.58	4.90	4.92	4.72	4.73	4.56	4.64
11/04/18	4.90	4.81	4.87	4.72	4.89	4.78	4.77	4.84	4.62	4.58	4.90	4.93	4.73	4.74	4.56	4.66
11/05/18	4.84	4.84	4.86	4.82	4.88	4.82	4.79	4.86	4.57	4.56	4.86	4.86	4.73	4.71	4.53	4.60
11/06/18	4.83	5.03	4.87	4.82	4.89	4.80	4.76	4.81	4.56	4.58	4.89	4.86	4.71	4.71	4.54	4.60
11/07/18	4.88	4.98	4.85	4.87	4.84	4.79	4.76	4.79	4.73	4.57	4.86	4.84	4.71	4.72	4.54	4.60
11/08/18	4.82	4.97	4.87	4.78	4.88	4.82	4.69	4.75	4.73	4.54	4.84	4.80	4.70	4.70	4.52	4.58
11/09/18	5.06	5.04	5.09	4.78	5.04	4.77	4.70	4.82	4.73	4.70	4.83	4.81	4.71	4.67	4.51	4.56
11/10/18	4.99	5.02	5.03	4.82	4.94	4.94	4.70	4.78	4.72	4.72	4.36	4.83	4.68	4.67	4.48	4.56
11/11/18	4.91	4.99	5.05	4.79	5.01	4.95	4.87	4.77	4.72	4.68	4.67	4.81	4.68	4.68	4.50	4.57
11/12/18	4.95	5.03	5.05	4.79	4.98	4.92	4.85	4.90	4.71	4.69	4.98	4.79	4.69	4.69	4.50	4.58
11/13/18	4.92	4.95	5.02	4.75	5.00	4.91	4.82	4.91	4.68	4.66	4.99	4.81	4.65	4.67	4.58	4.53
11/14/18	4.93	5.00	5.05	4.82	5.01	4.94	4.91	4.88	4.72	4.67	4.96	4.87	4.66	4.63	4.65	4.56
11/15/18	5.03	5.00	5.05	4.82	5.01	4.94	4.92	4.87	4.73	4.66	4.92	4.90	4.64	4.62	4.64	4.58
11/16/18	4.98	4.95	5.01	4.73	5.00	4.91	4.92	4.86	4.74	4.69	4.92	4.89	4.63	4.79	4.62	4.58
11/17/18	4.92	5.00	4.98	4.79	4.94	4.90	4.84	4.84	4.69	4.68	4.94	4.89	4.62	4.85	4.62	4.55
11/18/18	4.92	5.00	5.03	4.77	4.95	4.89	4.88	4.90	4.69	4.67	4.95	5.02	4.65	4.82	4.60	4.56
11/19/18	4.95	4.92	5.01	4.73	4.97	4.87	4.91	4.83	4.70	4.66	4.93	5.07	4.65	4.83	4.59	4.59
11/20/18	4.94	4.93	5.02	4.70	4.99	4.86	4.95	4.81	4.70	4.62	4.91	5.03	4.62	4.83	4.60	4.55
11/21/18	4.94	4.98	5.02	4.72	4.95	4.90	4.93	4.86	4.68	4.64	4.90	5.03	4.75	4.77	4.60	4.56
11/22/18	4.87	4.92	4.97	4.66	4.97	4.90	4.87	4.79	4.68	4.61	4.89	5.01	4.77	4.73	4.58	4.56
11/23/18	4.89	4.94	4.96	4.75	5.00	4.90	4.86	4.80	4.68	4.64	4.91	5.06	4.81	4.76	4.59	4.66
11/24/18	4.93	4.90	4.97	4.68	4.93	4.90	4.87	4.83	4.66	4.64	4.93	5.06	4.79	4.76	4.56	4.70
11/25/18	4.90	4.92	4.99	4.72	4.93	4.84	4.85	4.87	4.64	4.63	4.92	5.02	4.75	4.78	4.57	4.67
11/26/18	4.92	4.95	4.97	4.73	4.89	4.86	4.86	4.84	4.64	4.60	4.88	5.02	4.74	4.76	4.56	4.62
11/27/18	4.87	4.95	4.88	4.65	4.90	4.82	4.84	4.80	4.62	4.60	4.89	4.99	4.74	4.74	4.54	4.60
11/28/18	4.86	4.89	4.90	4.68	4.90	4.86	4.81	4.78	4.61	4.56	4.88	4.97	4.74	4.70	4.53	4.60
11/29/18	4.88	4.89	4.87	4.69	4.88	4.86	4.85	4.81	4.61	4.54	4.85	4.96	4.72	4.71	4.53	4.60
11/30/18	4.86	4.92	4.87	4.92	4.92	4.82	4.85	4.81	4.61	4.57	4.87	4.94	4.71	4.69	4.53	4.59

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Log Removal Value

Date	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
11/01/18	4.71	4.73	4.79	4.63	4.75	4.59	4.64	4.75	4.78	4.82	4.72	4.84	5.01	4.61	4.86	4.87
11/02/18	4.69	4.73	4.78	4.62	4.77	4.62	4.64	4.76	4.81	4.83	4.72	4.85	5.05	4.63	4.84	4.85
11/03/18	4.67	4.75	4.79	4.63	4.75	4.66	4.62	4.75	4.81	4.85	4.73	4.83	5.02	4.61	4.81	4.88
11/04/18	4.66	4.76	4.81	4.64	4.73	4.67	4.63	4.74	4.81	4.88	4.74	4.83	5.01	4.61	4.87	4.90
11/05/18	4.66	4.73	4.76	4.61	4.75	4.59	4.60	4.72	4.80	4.80	4.70	4.82	5.00	4.61	4.79	4.83
11/06/18	4.64	4.72	4.75	4.59	4.76	4.59	4.62	4.72	4.80	4.81	4.71	4.80	4.94	4.60	4.82	4.82
11/07/18	4.65	4.71	4.75	4.57	4.75	4.60	4.61	4.72	4.79	4.79	4.72	4.81	4.97	4.65	4.82	4.83
11/08/18	4.65	4.70	4.75	4.59	4.73	4.61	4.59	4.70	4.86	4.80	4.71	4.81	5.00	4.68	4.78	4.85
11/09/18	4.64	4.69	4.73	4.58	4.71	4.60	4.56	4.72	4.97	4.82	4.70	4.81	5.01	4.66	4.75	4.83
11/10/18	4.63	4.66	4.70	4.55	4.69	4.59	4.57	4.70	4.94	4.82	4.69	4.81	5.00	4.66	4.77	4.80
11/11/18	4.62	4.67	4.71	4.57	4.69	4.59	4.59	4.65	4.94	4.81	4.68	4.80	4.96	4.66	4.76	4.80
11/12/18	4.64	4.67	4.71	4.57	4.70	4.60	4.67	4.65	4.91	4.81	4.67	4.80	4.92	4.66	4.77	4.79
11/13/18	4.60	4.65	4.68	4.54	4.69	4.68	4.73	4.66	4.89	4.83	4.67	4.80	4.94	4.63	4.75	4.77
11/14/18	4.71	4.63	4.67	4.51	4.66	4.77	4.73	4.64	4.89	4.88	4.68	4.77	4.95	4.63	4.73	4.82
11/15/18	4.85	4.64	4.69	4.65	4.63	4.75	4.70	4.64	4.86	4.90	4.67	4.74	4.94	4.67	4.77	4.97
11/16/18	4.81	4.66	4.69	4.73	4.63	4.73	4.71	4.62	4.88	4.88	4.67	4.73	4.92	4.73	4.79	4.96
11/17/18	4.82	4.79	4.80	4.74	4.64	4.71	4.75	4.59	4.89	4.88	4.69	4.78	4.92	4.75	4.76	4.95
11/18/18	4.84	4.87	4.89	4.77	4.62	4.73	4.74	4.69	4.86	4.88	4.68	4.76	4.95	4.73	4.73	4.94
11/19/18	4.82	4.87	4.88	4.74	4.77	4.72	4.72	4.75	4.85	4.88	4.63	4.71	4.95	4.73	4.73	4.92
11/20/18	4.78	4.79	4.86	4.68	4.86	4.66	4.70	4.71	4.83	4.87	4.64	4.74	4.98	4.71	4.74	4.94
11/21/18	4.77	4.77	4.88	4.67	4.80	4.64	4.68	4.71	4.79	4.86	4.70	4.80	5.10	4.70	4.70	4.92
11/22/18	4.74	4.77	4.85	4.70	4.80	4.63	4.67	4.67	4.80	4.89	4.79	4.83	5.07	4.69	4.76	4.92
11/23/18	4.74	4.78	4.83	4.70	4.81	4.68	4.69	4.65	4.81	4.89	4.76	4.85	5.06	4.72	4.97	4.91
11/24/18	4.75	4.79	4.84	4.71	4.82	4.72	4.71	4.69	4.81	4.87	4.78	4.82	5.05	4.75	4.88	4.91
11/25/18	4.74	4.77	4.84	4.69	4.81	4.70	4.72	4.70	4.80	4.86	4.79	4.83	5.06	4.76	4.88	4.92
11/26/18	4.71	4.75	4.81	4.64	4.78	4.68	4.70	4.68	4.79	4.86	4.76	4.82	5.11	4.73	4.84	4.91
11/27/18	4.71	4.71	4.78	4.62	4.78	4.65	4.66	4.63	4.78	4.83	4.72	4.83	5.04	4.67	4.79	4.88
11/28/18	4.70	4.71	4.76	4.60	4.76	4.64	4.64	4.61	4.74	4.81	4.70	4.80	4.97	4.68	4.74	4.83
11/29/18	4.67	4.71	4.75	4.60	4.74	4.63	4.63	4.62	4.71	4.80	4.68	4.80	4.98	4.70	4.78	4.86
11/30/18	4.67	4.69	4.74	4.61	4.76	4.62	4.61	4.63	4.72	4.78	4.69	4.82	5.00	4.67	4.77	4.89

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value			
	E01	**E02**	**E03**	**E04**
Date	LRV	LRV	LRV	LRV
11/01/18	4.77	4.75	4.43	5.06
11/02/18	4.78	4.74	4.47	5.17
11/03/18	4.77	4.75	4.46	4.94
11/04/18	4.74	4.79	4.40	4.86
11/05/18	4.75	4.75	4.49	4.97
11/06/18	4.70	4.91	4.66	5.13
11/07/18	4.71	4.93	4.61	5.07
11/08/18	4.71	4.92	4.58	4.92
11/09/18	4.76	4.87	4.57	5.13
11/10/18	4.87	4.89	4.60	5.67
11/11/18	4.85	4.89	4.58	5.48
11/12/18	4.87	4.87	4.57	5.30
11/13/18	4.80	4.81	4.57	5.26
11/14/18	4.79	4.81	4.53	5.23
11/15/18	4.79	4.84	4.56	5.30
11/16/18	4.81	4.83	4.54	5.19
11/17/18	4.77	4.82	4.50	5.06
11/18/18	4.74	4.82	4.52	5.04
11/19/18	4.76	4.81	4.52	5.00
11/20/18	4.74	4.81	4.52	5.03
11/21/18	4.74	4.80	4.50	5.01
11/22/18	4.70	4.78	4.46	5.16
11/23/18	4.70	4.80	4.47	5.05
11/24/18	4.72	4.80	4.50	4.92
11/25/18	4.70	4.77	4.49	4.98
11/26/18	4.73	4.78	4.51	5.10
11/27/18	4.72	4.80	4.48	5.04
11/28/18	4.76	4.80	4.41	5.62
11/29/18	4.82	4.79	4.42	5.19
11/30/18	4.79	4.80	4.39	5.31

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

MicroFiltration Process online monitoring results

Effluent Turbidity - NTU

Date	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
11/01/18	0.08	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.08	0.10	0.11	0.26	0.07	0.09	0.09	0.09	0.06	0.06	0.08
11/02/18	0.07	0.12	0.09	0.10	0.10	0.10	0.09	0.09	0.08	0.11	0.11	0.12	0.07	0.10	0.09	0.09	0.06	0.07	0.09
11/03/18	0.08	0.09	0.09	0.10	0.10	0.10	0.09	0.09	0.09	0.12	0.12	0.15	0.08	0.09	0.09	0.09	0.06	0.08	0.09
11/04/18	0.08	0.09	0.10	0.11	0.10	0.11	0.08	0.10	0.09	0.15	0.13	0.14	0.08	0.10	0.09	0.09	0.06	0.07	0.09
11/05/18	0.08	0.10	0.10	0.11	0.10	0.10	0.09	0.09	0.08	0.11	0.14	0.15	0.09	0.11	0.09	0.09	0.07	0.07	0.09
11/06/18	0.08	0.09	0.10	0.10	0.09	0.10	0.08	0.09	0.08	0.12	0.14	0.16	0.09	0.10	0.09	0.09	0.06	0.09	0.09
11/07/18	0.07	0.09	0.08	0.11	0.09	0.10	0.10	0.12	0.08	0.09	0.14	0.15	0.09	0.10	0.09	0.12	0.06	0.07	0.09
11/08/18	0.07	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.10	0.13	0.14	0.15	0.09	0.10	0.09	0.10	0.06	0.06	0.09
11/09/18	0.07	0.09	0.09	0.10	0.09	0.09	0.09	0.09	0.08	0.11	0.15	0.31	0.09	0.10	0.10	0.10	0.06	0.07	0.09
11/10/18	0.08	0.09	0.08	0.10	0.09	0.09	0.09	0.09	0.08	0.11	0.15	0.16	0.10	0.10	0.10	0.10	0.06	0.07	0.09
11/11/18	0.08	0.09	0.09	0.10	0.09	0.10	0.08	0.09	0.08	0.10	0.16	0.27	0.09	0.10	0.10	0.15	0.06	0.07	0.09
11/12/18	0.08	0.09	0.08	0.09	0.09	0.10	0.09	0.09	0.08	0.15	0.16	0.17	0.09	0.10	0.10	0.10	0.06	0.07	0.09
11/13/18	0.08	0.09	0.08	0.09	0.09	0.09	0.09	0.09	0.07	0.13	0.14	0.34 *	0.09	0.10	0.10	0.12	0.06	0.07	0.09
11/14/18	0.09	0.09	0.07	0.09	0.09	0.09	0.09	0.09	0.06	0.10	0.10	0.11	0.07	0.10	0.09	0.10	0.06	0.06	0.08
11/15/18	0.08	0.10	0.08	0.09	0.09	0.10	0.09	0.10	0.07	0.10	0.10	0.13	0.07	0.08	0.09	0.09	0.06	0.06	0.08
11/16/18	0.06	0.08	0.08	0.10	0.10	0.10	0.10	0.10	0.07	0.13	0.11	0.12	0.08	0.11	0.09	0.12	0.06	0.07	0.08
11/17/18	0.07	0.08	0.08	0.09	0.10	0.10	0.09	0.10	0.08	0.12	0.11	0.15	0.09	0.14	0.09	0.09	0.06	0.07	0.09
11/18/18	0.07	0.08	0.09	0.10	0.10	0.10	0.09	0.09	0.09	0.12	0.12	0.16	0.09	0.10	0.09	0.10	0.06	0.07	0.09
11/19/18	0.08	0.08	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.11	0.12	0.13	0.09	0.10	0.09	0.10	0.06	0.08	0.09
11/20/18	0.08	0.09	0.09	0.09	0.09	0.10	0.09	0.12	0.09	0.10	0.12	0.13	0.10	0.15	0.09	0.10	0.06	0.07	0.09
11/21/18	0.08	0.08	0.09	0.09	0.10	0.10	0.09	0.09	0.09	0.11	0.13	0.16	0.09	0.11	0.09	0.09	0.06	0.07	0.09
11/22/18	0.08	0.08	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.11	0.14	0.18	0.10	0.11	0.09	0.13	0.07	0.07	0.09
11/23/18	0.08	0.09	0.09	0.09	0.10	0.11	0.10	0.10	0.10	0.11	0.14	0.14	0.09	0.11	0.09	0.11	0.06	0.07	0.09
11/24/18	0.09	0.10	0.08	0.09	0.10	0.10	0.09	0.10	0.10	0.13	0.14	0.19	0.10	0.12	0.09	0.09	0.06	0.07	0.09
11/25/18	0.09	0.09	0.08	0.09	0.10	0.10	0.09	0.09	0.10	0.11	0.14	0.16	0.10	0.11	0.09	0.09	0.06	0.07	0.10
11/26/18	0.09	0.10	0.10	0.13	0.10	0.10	0.09	0.09	0.10	0.11	0.15	0.15	0.10	0.11	0.09	0.09	0.06	0.07	0.10
11/27/18	0.08	0.09	0.10	0.11	0.09	0.10	0.09	0.09	0.08	0.13	0.11	0.15	0.09	0.10	0.09	0.09	0.06	0.09	0.09
11/28/18	0.07	0.09	0.10	0.16	0.09	0.09	0.09	0.09	0.05	0.08	0.07	0.12	0.07	0.10	0.09	0.10	0.06	0.08	0.07
11/29/18	0.07	0.08	0.10	0.13	0.09	0.09	0.09	0.09	0.05	0.06	0.07	0.08	0.05	0.06	0.09	0.10	0.05	0.05	0.07
11/30/18	0.08	0.10	0.10	0.11	0.09	0.09	0.08	0.09	0.05	0.06	0.07	0.09	0.05	0.05	0.09	0.09	0.04	0.05	0.07

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

* Value occurred during PM activity on turbidity analyzer.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Reverse Osmosis Process online monitoring results																	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)						Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	ROP		ROF			ROP			ROF			ROP						
	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
11/01/18	0.075	0.075	7.514	7.055	8.160	0.028	0.024	0.032	1,808	1,764	1,869	37	34	41	99.63	2.43	97.94	1.69
11/02/18	0.073	0.074	7.157	5.626	7.951	0.029	0.026	0.035	1,806	1,768	1,866	35	32	39	99.59	2.39	98.05	1.71
11/03/18	0.074	0.075	7.194	5.641	7.905	0.026	0.019	0.031	1,767	1,693	1,829	34	32	38	99.64	2.44	98.05	1.71
11/04/18	0.075	0.076	7.749	6.918	12.768	0.026	0.018	0.039	1,649	1,602	1,703	32	29	36	99.67	2.48	98.06	1.71
11/05/18	0.076	0.077	7.239	6.745	7.849	0.020	0.015	0.024	1,569	1,473	1,685	30	26	34	99.73	2.56	98.12	1.73
11/06/18	0.072	0.074	7.361	6.892	8.060	0.029	0.025	0.036	1,718	1,622	1,849	32	28	38	99.61	2.41	98.12	1.73
11/07/18	0.064	0.069	7.376	6.990	8.060	0.028	0.022	0.034	1,751	1,690	1,814	34	31	36	99.63	2.43	98.09	1.72
11/08/18	0.061	0.068	7.461	7.050	7.961	0.029	0.024	0.038	1,766	1,706	1,831	34	32	37	99.61	2.41	98.09	1.72
11/09/18	0.059	0.069	7.097	6.652	7.707	0.025	0.020	0.032	1,730	1,680	1,800	32	29	34	99.65	2.46	98.17	1.74
11/10/18	0.072	0.077	7.237	6.719	7.981	0.023	0.015	0.029	1,715	1,666	1,757	32	29	35	99.68	2.50	98.16	1.73
11/11/18	0.076	0.077	7.252	6.888	7.976	0.020	0.014	0.025	1,625	1,583	1,670	30	28	33	99.72	2.56	98.17	1.74
11/12/18	0.076	0.076	7.229	6.688	8.316	0.019	0.015	0.023	1,555	1,460	1,681	29	25	33	99.74	2.58	98.15	1.73
11/13/18	0.075	0.075	7.492	7.141	8.419	0.024	0.015	0.029	1,688	1,604	1,784	30	27	35	99.68	2.50	98.21	1.75
11/14/18	0.074	0.075	7.412	6.995	8.097	0.026	0.018	0.034	1,738	1,664	1,807	31	28	35	99.66	2.46	98.19	1.74
11/15/18	0.075	0.075	7.462	6.992	8.270	0.027	0.019	0.030	1,725	1,670	1,770	31	29	34	99.64	2.44	98.19	1.74
11/16/18	0.072	0.075	7.421	6.814	8.136	0.028	0.023	0.030	1,738	1,672	1,808	32	29	36	99.62	2.42	98.15	1.73
11/17/18	0.073	0.073	7.644	7.002	8.311	0.025	0.016	0.030	1,686	1,623	1,760	31	29	33	99.67	2.49	98.16	1.73
11/18/18	0.073	0.073	7.278	6.751	8.011	0.024	0.020	0.028	1,589	1,546	1,649	30	27	34	99.67	2.48	98.13	1.73
11/19/18	0.071	0.072	7.463	6.850	8.366	0.023	0.020	0.027	1,573	1,505	1,674	29	26	32	99.70	2.52	98.17	1.74
11/20/18	0.072	0.072	7.790	7.207	8.615	0.025	0.020	0.029	1,704	1,613	1,821	31	27	35	99.68	2.49	98.21	1.75
11/21/18	0.071	0.072	7.846	7.279	8.450	0.027	0.022	0.031	1,770	1,719	1,827	32	29	37	99.66	2.46	98.19	1.74
11/22/18	0.069	0.070	8.081	7.505	8.817	0.027	0.019	0.033	1,687	1,580	1,770	30	28	33	99.67	2.48	98.22	1.75
11/23/18	0.067	0.068	7.333	6.861	8.155	0.021	0.015	0.026	1,553	1,502	1,594	29	26	34	99.72	2.55	98.11	1.72
11/24/18	0.062	0.063	7.444	6.732	8.183	0.018	0.014	0.022	1,594	1,534	1,676	31	28	35	99.75	2.61	98.07	1.72
11/25/18	0.065	0.066	7.499	6.847	8.236	0.020	0.015	0.027	1,587	1,554	1,626	29	27	32	99.73	2.57	98.17	1.74
11/26/18	0.066	0.067	7.656	6.905	8.603	0.023	0.018	0.025	1,560	1,465	1,704	28	25	32	99.70	2.53	98.20	1.74
11/27/18	0.068	0.068	7.838	7.090	8.832	0.027	0.021	0.032	1,703	1,624	1,821	30	27	35	99.65	2.46	98.23	1.75
11/28/18	0.067	0.068	8.258	7.992	8.686	0.035	0.024	0.052	1,766	1,721	1,820	31	29	34	99.57	2.37	98.22	1.75
11/29/18	0.067	0.067	7.771	7.239	8.428	0.026	0.021	0.032	1,713	1,663	1,772	30	28	32	99.66	2.47	98.27	1.76
11/30/18	0.067	0.068	7.658	7.141	8.310	0.026	0.021	0.031	1,708	1,641	1,819	29	26	34	99.66	2.47	98.28	1.76

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
11/01/18	97.10	96.519	24,643.6	0.26	3.0	6
11/02/18	97.26	96.963	25,211.3	0.26	3.0	6
11/03/18	97.17	97.897	25,672.6	0.26	3.0	6
11/04/18	97.19	94.124	24,927.7	0.26	3.0	6
11/05/18	97.39	99.731	26,411.5	0.26	3.0	6
11/06/18	97.25	97.361	25,853.6	0.27	3.0	6
11/07/18	97.30	99.809	26,357.2	0.26	3.0	6
11/08/18	97.25	96.579	24,937.0	0.26	3.0	6
11/09/18	97.20	95.492	24,350.9	0.26	3.0	6
11/10/18	97.44	95.262	24,277.4	0.25	3.0	6
11/11/18	97.40	94.988	24,758.9	0.26	3.0	6
11/12/18	97.31	94.924	25,132.3	0.26	3.0	6
11/13/18	97.30	94.133	25,041.7	0.27	3.0	6
11/14/18	97.31	97.863	25,501.0	0.26	3.0	6
11/15/18	97.31	93.695	23,972.9	0.26	3.0	6
11/16/18	97.14	95.670	24,423.8	0.26	3.0	6
11/17/18	97.12	90.982	23,437.8	0.26	3.0	6
11/18/18	97.32	93.377	24,292.7	0.26	3.0	6
11/19/18	97.19	91.017	23,835.8	0.26	3.0	6
11/20/18	97.24	93.366	23,852.3	0.26	3.0	6
11/21/18	97.14	94.698	24,224.6	0.26	3.0	6
11/22/18	97.37	91.945	23,765.3	0.26	3.0	6
11/23/18	96.96	95.346	24,855.5	0.26	3.0	6
11/24/18	96.94	85.662	22,918.5	0.27	3.0	6
11/25/18	97.42	90.205	23,687.4	0.26	3.0	6
11/26/18	97.23	93.195	24,023.4	0.26	3.0	6
11/27/18	97.34	97.711	25,374.6	0.26	3.0	6
11/28/18	96.96	98.844	25,432.4	0.26	3.0	6
11/29/18	96.81	94.986	24,556.9	0.26	3.0	6
11/30/18	96.91	99.297	26,257.6	0.26	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

Date	Total Documented Pathogenic Microorganism Reduction Achieved			Minimum Required Log Reduction Achieved			Compliance % Exceedance Time				
	Giardia	Cryptosporidium	$Virus_{(1)}$	Giardia (10)	Cryptosporidium (10)	Virus (12)	MFE NTU		ROP NTU		TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
12/01/18	12.90	12.90	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/02/18	13.10	13.10	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/03/18	13.07	13.07	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/04/18	12.96	12.96	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/05/18	12.94	12.94	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/06/18	12.86	12.86	12.52	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/07/18	13.02	13.02	12.55	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/08/18	13.00	13.00	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/09/18	13.05	13.05	12.61	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/10/18	13.02	13.02	12.62	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/11/18	12.84	12.84	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/12/18	12.80	12.80	12.40	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/13/18	12.88	12.88	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/14/18	13.01	13.01	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/15/18	12.98	12.98	12.53	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/16/18	13.09	13.09	12.64	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/17/18	12.95	12.95	12.52	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/18/18	12.94	12.94	12.53	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/19/18	12.91	12.91	12.49	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/20/18	12.91	12.91	12.50	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/21/18	12.91	12.91	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/22/18	12.92	12.92	12.54	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/23/18	12.91	12.91	12.58	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/24/18	12.99	12.99	12.65	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/25/18	12.97	12.97	12.65	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/26/18	13.12	13.12	12.75	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/27/18	13.06	13.06	12.61	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/28/18	13.06	13.06	12.61	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/29/18	13.04	13.04	12.61	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/30/18	13.09	13.09	12.67	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/31/18	13.07	13.07	12.65	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	Documented Giardia and Cryptosporidium Reduction Achieved					
	OCSD	MF+Cl_2	RO	UV/AOP	Underground travel time (ToT)	Total
	LRV	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
12/01/18	0.00	4.42	2.48	6.00	0.00	12.90
12/02/18	0.00	4.53	2.57	6.00	0.00	13.10
12/03/18	0.00	4.50	2.57	6.00	0.00	13.07
12/04/18	0.00	4.48	2.47	6.00	0.00	12.96
12/05/18	0.00	4.48	2.46	6.00	0.00	12.94
12/06/18	0.00	4.34	2.52	6.00	0.00	12.86
12/07/18	0.00	4.47	2.55	6.00	0.00	13.02
12/08/18	0.00	4.43	2.57	6.00	0.00	13.00
12/09/18	0.00	4.45	2.61	6.00	0.00	13.05
12/10/18	0.00	4.40	2.62	6.00	0.00	13.02
12/11/18	0.00	4.37	2.47	6.00	0.00	12.84
12/12/18	0.00	4.40	2.40	6.00	0.00	12.80
12/13/18	0.00	4.41	2.48	6.00	0.00	12.88
12/14/18	0.00	4.45	2.57	6.00	0.00	13.01
12/15/18	0.00	4.45	2.53	6.00	0.00	12.98
12/16/18	0.00	4.45	2.64	6.00	0.00	13.09
12/17/18	0.00	4.44	2.52	6.00	0.00	12.95
12/18/18	0.00	4.41	2.53	6.00	0.00	12.94
12/19/18	0.00	4.42	2.49	6.00	0.00	12.91
12/20/18	0.00	4.41	2.50	6.00	0.00	12.91
12/21/18	0.00	4.40	2.51	6.00	0.00	12.91
12/22/18	0.00	4.38	2.54	6.00	0.00	12.92
12/23/18	0.00	4.33	2.58	6.00	0.00	12.91
12/24/18	0.00	4.34	2.65	6.00	0.00	12.99
12/25/18	0.00	4.33	2.65	6.00	0.00	12.97
12/26/18	0.00	4.37	2.75	6.00	0.00	13.12
12/27/18	0.00	4.45	2.61	6.00	0.00	13.06
12/28/18	0.00	4.45	2.61	6.00	0.00	13.06
12/29/18	0.00	4.43	2.61	6.00	0.00	13.04
12/30/18	0.00	4.43	2.67	6.00	0.00	13.09
12/31/18	0.00	4.42	2.65	6.00	0.00	13.07

Notes:

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Documented Virus Reduction Achieved					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
12/01/18	0.00	0.00	2.48	6.00	4.00	12.48
12/02/18	0.00	0.00	2.57	6.00	4.00	12.57
12/03/18	0.00	0.00	2.57	6.00	4.00	12.57
12/04/18	0.00	0.00	2.47	6.00	4.00	12.47
12/05/18	0.00	0.00	2.46	6.00	4.00	12.46
12/06/18	0.00	0.00	2.52	6.00	4.00	12.52
12/07/18	0.00	0.00	2.55	6.00	4.00	12.55
12/08/18	0.00	0.00	2.57	6.00	4.00	12.57
12/09/18	0.00	0.00	2.61	6.00	4.00	12.61
12/10/18	0.00	0.00	2.62	6.00	4.00	12.62
12/11/18	0.00	0.00	2.47	6.00	4.00	12.47
12/12/18	0.00	0.00	2.40	6.00	4.00	12.40
12/13/18	0.00	0.00	2.48	6.00	4.00	12.48
12/14/18	0.00	0.00	2.57	6.00	4.00	12.57
12/15/18	0.00	0.00	2.53	6.00	4.00	12.53
12/16/18	0.00	0.00	2.64	6.00	4.00	12.64
12/17/18	0.00	0.00	2.52	6.00	4.00	12.52
12/18/18	0.00	0.00	2.53	6.00	4.00	12.53
12/19/18	0.00	0.00	2.49	6.00	4.00	12.49
12/20/18	0.00	0.00	2.50	6.00	4.00	12.50
12/21/18	0.00	0.00	2.51	6.00	4.00	12.51
12/22/18	0.00	0.00	2.54	6.00	4.00	12.54
12/23/18	0.00	0.00	2.58	6.00	4.00	12.58
12/24/18	0.00	0.00	2.65	6.00	4.00	12.65
12/25/18	0.00	0.00	2.65	6.00	4.00	12.65
12/26/18	0.00	0.00	2.75	6.00	4.00	12.75
12/27/18	0.00	0.00	2.61	6.00	4.00	12.61
12/28/18	0.00	0.00	2.61	6.00	4.00	12.61
12/29/18	0.00	0.00	2.61	6.00	4.00	12.61
12/30/18	0.00	0.00	2.67	6.00	4.00	12.67
12/31/18	0.00	0.00	2.65	6.00	4.00	12.65

Notes:

1. One additional log-virus credit taken for 1 month travel time between the primary and secondary project boundary where no drinking water wells operate.

Orange County Water District - Ground Water Replenishment System (GWRS)

State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report

system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
12/01/18	4.84	4.91	4.92	4.87	4.84	4.82	4.88	4.79	4.60	4.52	4.87	4.94	4.70	4.68	4.52	4.58
12/02/18	4.83	5.05	4.85	4.87	4.87	4.82	4.88	4.80	4.60	4.53	4.88	4.98	4.73	4.67	4.53	4.58
12/03/18	4.86	4.97	4.91	4.85	4.89	4.81	4.86	4.83	4.72	4.52	4.85	4.93	4.67	4.67	4.50	4.57
12/04/18	4.82	4.99	5.13	4.77	4.98	4.82	4.85	4.78	4.71	4.54	4.84	4.96	4.64	4.63	4.48	4.54
12/05/18	4.99	5.02	5.02	4.80	4.98	4.81	4.85	4.77	4.63	4.66	4.80	4.94	4.64	4.59	4.48	4.52
12/06/18	4.92	5.01	5.07	4.73	4.95	4.83	4.82	4.76	4.67	4.63	4.81	4.95	4.65	4.61	4.46	4.34
12/07/18	4.90	4.91	5.05	4.81	4.91	4.91	4.95	4.75	4.68	4.62	4.83	4.94	4.65	4.57	4.49	4.57
12/08/18	4.88	4.95	4.94	4.75	4.97	4.85	4.91	4.83	4.63	4.64	4.92	4.91	4.63	4.54	4.64	4.60
12/09/18	4.94	4.96	4.91	4.75	4.97	4.83	4.95	4.83	4.66	4.64	4.90	4.93	4.62	4.54	4.63	4.61
12/10/18	4.92	5.00	4.95	4.75	4.98	4.84	4.94	4.82	4.64	4.64	4.89	4.91	4.62	4.55	4.59	4.61
12/11/18	4.91	4.88	4.97	4.74	4.94	4.84	4.88	4.88	4.62	4.60	4.92	4.86	4.59	4.55	4.56	4.62
12/12/18	4.92	4.88	4.97	4.74	4.92	4.83	4.86	4.83	4.63	4.57	4.92	4.87	4.59	4.69	4.53	4.61
12/13/18	4.87	4.90	5.00	4.79	4.91	4.82	4.81	4.82	4.61	4.56	4.88	5.02	4.59	4.70	4.55	4.56
12/14/18	4.91	4.89	4.90	4.79	4.93	4.84	4.85	4.82	4.59	4.56	4.87	5.06	4.57	4.66	4.55	4.56
12/15/18	4.93	4.92	4.94	4.71	4.96	4.87	4.86	4.79	4.61	4.61	4.88	5.04	4.59	4.67	4.55	4.57
12/16/18	4.86	4.96	4.93	4.76	4.92	4.83	4.81	4.81	4.60	4.56	4.87	5.00	4.76	4.66	4.53	4.58
12/17/18	4.90	4.89	4.91	4.79	4.92	4.83	4.82	4.85	4.58	4.53	4.87	4.98	4.78	4.65	4.52	4.57
12/18/18	4.88	4.97	4.88	4.72	4.90	4.81	4.80	4.81	4.59	4.55	4.84	5.02	4.71	4.67	4.51	4.55
12/19/18	4.88	4.92	4.96	4.71	4.86	4.81	4.80	4.85	4.56	4.56	4.76	5.00	4.70	4.66	4.50	4.52
12/20/18	4.86	4.94	4.91	4.77	4.91	4.81	4.77	4.83	4.56	4.55	4.77	4.99	4.73	4.64	4.52	4.63
12/21/18	4.91	4.85	4.92	4.73	4.92	4.84	4.80	4.81	4.56	4.51	4.79	4.99	4.67	4.62	4.50	4.70
12/22/18	4.81	4.89	4.89	4.75	4.92	4.80	4.88	4.81	4.53	4.54	4.75	4.97	4.70	4.62	4.48	4.67
12/23/18	4.87	4.81	4.83	4.65	4.90	4.80	4.87	4.78	4.53	4.55	4.73	4.96	4.74	4.62	4.47	4.67
12/24/18	4.80	4.86	4.81	4.69	4.85	4.73	4.83	4.78	4.54	4.49	4.74	4.93	4.71	4.65	4.49	4.68
12/25/18	4.80	4.82	4.85	4.67	4.87	4.79	4.81	4.75	4.49	4.50	4.72	4.93	4.71	4.61	4.49	4.66
12/26/18	4.84	4.80	4.81	4.90	4.88	4.81	4.84	4.76	4.54	4.50	4.70	4.96	4.69	4.58	4.47	4.67
12/27/18	4.81	4.99	4.83	4.77	4.84	4.75	4.83	4.80	4.46	4.46	4.70	4.94	4.67	4.59	4.45	4.66
12/28/18	4.79	4.95	4.77	4.81	4.83	4.76	4.84	4.73	4.70	4.45	4.70	4.91	4.69	4.57	4.45	4.60
12/29/18	4.79	4.97	4.73	4.81	4.93	4.73	4.75	4.75	4.67	4.43	4.64	4.88	4.66	4.55	4.44	4.61
12/30/18	4.78	4.93	4.74	4.81	4.98	4.74	4.83	4.70	4.68	4.66	4.64	4.90	4.65	4.53	4.43	4.61
12/31/18	4.73	4.97	4.97	4.75	4.89	4.88	4.82	4.71	4.65	4.70	4.64	4.89	4.65	4.53	4.42	4.59

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	MicroFiltration Process online monitoring results Log Removal Value															
	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
Date	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
12/01/18	4.67	4.72	4.75	4.62	4.74	4.62	4.59	4.61	4.73	4.83	4.70	4.79	4.98	4.68	4.79	4.86
12/02/18	4.70	4.73	4.78	4.64	4.72	4.60	4.62	4.56	4.72	4.83	4.70	4.75	4.92	4.69	4.74	4.86
12/03/18	4.67	4.69	4.74	4.59	4.73	4.60	4.61	4.55	4.74	4.79	4.69	4.75	4.91	4.67	4.78	4.83
12/04/18	4.63	4.69	4.69	4.58	4.72	4.57	4.58	4.60	4.81	4.75	4.71	4.75	4.93	4.62	4.77	4.79
12/05/18	4.63	4.70	4.67	4.58	4.68	4.55	4.58	4.54	4.90	4.72	4.70	4.77	4.93	4.58	4.74	4.82
12/06/18	4.65	4.69	4.65	4.55	4.71	4.56	4.53	4.51	4.85	4.72	4.69	4.77	4.90	4.60	4.73	4.80
12/07/18	4.62	4.67	4.64	4.54	4.70	4.56	4.62	4.47	4.85	4.74	4.70	4.74	4.89	4.65	4.74	4.79
12/08/18	4.58	4.64	4.66	4.54	4.65	4.53	4.71	4.43	4.86	4.74	4.66	4.75	4.91	4.63	4.72	4.78
12/09/18	4.60	4.63	4.65	4.54	4.66	4.63	4.71	4.45	4.85	4.78	4.66	4.75	4.93	4.63	4.71	4.76
12/10/18	4.75	4.59	4.66	4.52	4.66	4.69	4.68	4.40	4.83	4.85	4.67	4.71	4.92	4.62	4.73	4.81
12/11/18	4.81	4.54	4.65	4.64	4.63	4.69	4.65	4.37	4.83	4.83	4.63	4.68	4.85	4.59	4.70	4.89
12/12/18	4.75	4.54	4.63	4.69	4.60	4.66	4.65	4.40	4.84	4.80	4.60	4.67	4.83	4.65	4.68	4.88
12/13/18	4.73	4.68	4.61	4.66	4.56	4.63	4.66	4.41	4.83	4.81	4.59	4.66	4.84	4.69	4.66	4.84
12/14/18	4.73	4.78	4.60	4.66	4.58	4.61	4.63	4.53	4.86	4.81	4.60	4.65	4.84	4.62	4.70	4.87
12/15/18	4.75	4.77	4.71	4.68	4.76	4.64	4.63	4.71	4.81	4.83	4.59	4.69	4.88	4.64	4.68	4.85
12/16/18	4.74	4.73	4.78	4.68	4.92	4.69	4.66	4.61	4.81	4.83	4.61	4.77	4.97	4.66	4.65	4.85
12/17/18	4.70	4.74	4.79	4.64	4.87	4.65	4.65	4.72	4.84	4.78	4.59	4.80	5.14	4.59	4.67	4.81
12/18/18	4.67	4.71	4.77	4.60	4.83	4.59	4.60	4.85	4.83	4.81	4.65	4.79	4.98	4.57	4.74	4.83
12/19/18	4.65	4.69	4.75	4.60	4.81	4.58	4.57	4.82	4.80	4.82	4.75	4.78	4.98	4.60	4.90	4.82
12/20/18	4.64	4.70	4.77	4.59	4.79	4.56	4.56	4.77	4.82	4.78	4.74	4.81	5.01	4.56	4.82	4.87
12/21/18	4.66	4.70	4.75	4.61	4.77	4.57	4.57	4.76	4.82	4.80	4.72	4.79	5.02	4.58	4.80	4.85
12/22/18	4.68	4.68	4.74	4.60	4.76	4.59	4.59	4.74	4.80	4.81	4.71	4.77	5.03	4.62	4.76	4.83
12/23/18	4.67	4.68	4.74	4.59	4.75	4.59	4.60	4.74	4.82	4.77	4.72	4.77	5.00	4.59	4.78	4.84
12/24/18	4.67	4.69	4.76	4.59	4.69	4.59	4.60	4.71	4.81	4.77	4.70	4.75	4.96	4.60	4.80	4.85
12/25/18	4.64	4.67	4.75	4.61	4.69	4.58	4.60	4.71	4.80	4.75	4.67	4.76	4.99	4.59	4.78	4.84
12/26/18	4.62	4.70	4.76	4.62	4.69	4.59	4.57	4.72	4.78	4.75	4.68	4.77	4.98	4.64	4.72	4.81
12/27/18	4.61	4.68	4.75	4.57	4.66	4.57	4.49	4.71	4.75	4.76	4.72	4.73	4.96	4.61	4.71	4.81
12/28/18	4.60	4.64	4.70	4.52	4.67	4.54	4.48	4.71	4.76	4.74	4.70	4.70	4.92	4.59	4.73	4.78
12/29/18	4.57	4.66	4.70	4.51	4.67	4.51	4.49	4.71	4.72	4.72	4.65	4.68	4.87	4.56	4.66	4.77
12/30/18	4.54	4.64	4.69	4.52	4.65	4.47	4.50	4.72	4.81	4.72	4.66	4.68	4.92	4.54	4.72	4.75
12/31/18	4.53	4.59	4.65	4.50	4.63	4.46	4.49	4.67	4.96	4.69	4.67	4.68	4.92	4.50	4.71	4.74

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	MicroFiltration Process online monitoring results Log Removal Value															
	E01 LRV	E02 LRV	E03 LRV	E04 LRV												
12/01/18	4.84	4.82	4.42	5.22												
12/02/18	4.78	4.94	4.55	5.22												
12/03/18	4.73	4.96	4.52	5.32												
12/04/18	4.78	4.91	4.52	5.35												
12/05/18	4.78	4.89	4.55	5.20												
12/06/18	4.71	4.93	4.55	4.99												
12/07/18	4.72	4.88	4.48	5.15												
12/08/18	4.72	4.85	4.50	5.15												
12/09/18	4.71	4.88	4.55	5.22												
12/10/18	4.75	4.86	4.55	5.25												
12/11/18	4.76	4.81	4.50	5.04												
12/12/18	4.72	4.88	4.49	5.18												
12/13/18	4.66	4.90	4.49	5.20												
12/14/18	4.69	4.83	4.45	5.24												
12/15/18	4.67	4.82	4.45	5.07												
12/16/18	4.66	4.79	4.45	5.21												
12/17/18	4.64	4.84	4.44	5.16												
12/18/18	4.63	4.79	4.41	5.09												
12/19/18	4.59	4.81	4.42	5.15												
12/20/18	4.56	4.79	4.41	4.94												
12/21/18	4.60	4.76	4.40	5.05												
12/22/18	4.57	4.73	4.38	5.24												
12/23/18	4.60	4.74	4.33	5.09												
12/24/18	4.77	4.78	4.34	5.05												
12/25/18	4.79	4.76	4.33	5.03												
12/26/18	4.74	4.77	4.37	5.18												
12/27/18	4.74	4.96	4.56	4.97												
12/28/18	4.72	4.87	4.50	5.49												
12/29/18	4.70	4.89	4.52	5.22												
12/30/18	4.66	4.84	4.46	5.17												
12/31/18	4.57	4.86	4.45	5.37												

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

Date	MicroFiltration Process online monitoring results Effluent Turbidity - NTU																		
	A01-A04		A05-A08		B01-B04		B05-B08		C01-C04		C05-C08		D01-D04		D05-D08		E01-E04		MFE
	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg	max	avg
12/01/18	0.08	0.09	0.09	0.10	0.09	0.09	0.08	0.09	0.06	0.07	0.07	0.08	0.05	0.06	0.09	0.10	0.05	0.05	0.07
12/02/18	0.08	0.09	0.10	0.11	0.24 *	3.66	0.09	0.09	0.06	0.09	0.08	0.09	0.05	0.05	0.09	0.10	0.05	0.06	0.08
12/03/18	0.08	0.09	0.10	0.11	0.09	0.10	0.09	0.09	0.06	0.09	0.09	0.10	0.05	0.06	0.10	0.10	0.05	0.05	0.08
12/04/18	0.08	0.09	0.13	0.14	0.09	0.10	0.09	0.09	0.07	0.08	0.08	0.14	0.05	0.06	0.09	0.10	0.05	0.05	0.08
12/05/18	0.08	0.09	0.13	0.15	0.09	0.09	0.09	0.09	0.07	0.10	0.07	0.09	0.05	0.07	0.09	0.14	0.05	0.05	0.08
12/06/18	0.07	0.09	0.15	0.17	0.09	0.09	0.09	0.09	0.07	0.10	0.08	0.10	0.06	0.07	0.09	0.10	0.04	0.06	0.08
12/07/18	0.08	0.08	0.16	0.17	0.09	0.10	0.09	0.09	0.07	0.10	0.09	0.10	0.06	0.07	0.08	0.09	0.04	0.05	0.09
12/08/18	0.08	0.09	0.16	0.17	0.09	0.10	0.09	0.09	0.08	0.10	0.10	0.12	0.06	0.07	0.09	0.09	0.04	0.05	0.09
12/09/18	0.09	0.09	0.16	0.17	0.09	0.10	0.09	0.09	0.08	0.09	0.11	0.12	0.06	0.08	0.09	0.09	0.05	0.06	0.09
12/10/18	0.09	0.10	0.14	0.17	0.10	0.13	0.09	0.10	0.09	0.12	0.12	0.13	0.06	0.07	0.09	0.09	0.05	0.06	0.09
12/11/18	0.08	0.09	0.13	0.14	0.09	0.09	0.09	0.09	0.07	0.09	0.11	0.14	0.07	0.08	0.09	0.09	0.05	0.05	0.08
12/12/18	0.06	0.09	0.11	0.13	0.10	0.10	0.08	0.09	0.06	0.07	0.08	0.09	0.06	0.09	0.09	0.10	0.05	0.06	0.08
12/13/18	0.07	0.08	0.11	0.15	0.10	0.12	0.08	0.09	0.06	0.07	0.09	0.10	0.06	0.07	0.09	0.11	0.05	0.07	0.08
12/14/18	0.08	0.09	0.12	0.15	0.11	0.12	0.08	0.09	0.06	0.10	0.10	0.11	0.06	0.08	0.10	0.11	0.06	0.07	0.09
12/15/18	0.08	0.09	0.13	0.14	0.10	0.10	0.07	0.08	0.07	0.08	0.11	0.12	0.06	0.08	0.10	0.10	0.06	0.06	0.09
12/16/18	0.08	0.09	0.17	0.18	0.10	0.10	0.07	0.08	0.07	0.08	0.12	0.16	0.08	0.08	0.10	0.10	0.06	0.06	0.09
12/17/18	0.08	0.09	0.17	0.18	0.10	0.10	0.07	0.08	0.08	0.09	0.13	0.13	0.09	0.10	0.10	0.10	0.06	0.07	0.10
12/18/18	0.08	0.09	0.12	0.18	0.09	0.10	0.07	0.07	0.07	0.08	0.10	0.14	0.08	0.09	0.10	0.10	0.05	0.06	0.08
12/19/18	0.08	0.09	0.11	0.16	0.09	0.10	0.07	0.07	0.06	0.07	0.08	0.08	0.08	0.08	0.10	0.10	0.04	0.05	0.08
12/20/18	0.07	0.12	0.11	0.17	0.09	0.10	0.08	0.08	0.05	0.06	0.08	0.08	0.08	0.12	0.10	0.10	0.04	0.05	0.08
12/21/18	0.07	0.10	0.11	0.15	0.09	0.10	0.07	0.08	0.06	0.07	0.08	0.09	0.08	0.08	0.09	0.10	0.04	0.05	0.08
12/22/18	0.08	0.09	0.11	0.12	0.09	0.10	0.07	0.08	0.07	0.08	0.10	0.10	0.08	0.09	0.10	0.11	0.05	0.05	0.08
12/23/18	0.09	0.10	0.13	0.17	0.10	0.10	0.08	0.08	0.07	0.08	0.11	0.11	0.08	0.09	0.10	0.10	0.05	0.05	0.09
12/24/18	0.09	0.10	0.09	0.12	0.09	0.10	0.07	0.08	0.08	0.10	0.11	0.12	0.08	0.09	0.10	0.10	0.04	0.05	0.08
12/25/18	0.09	0.10	0.09	0.11	0.09	0.10	0.07	0.07	0.08	0.12	0.12	0.14	0.09	0.10	0.10	0.11	0.04	0.05	0.09
12/26/18	0.08	0.09	0.09	0.10	0.09	0.10	0.07	0.09	0.09	0.10	0.12	0.13	0.08	0.09	0.10	0.10	0.05	0.06	0.09
12/27/18	0.08	0.09	0.09	0.10	0.10	0.10	0.09	0.10	0.09	0.11	0.14	0.14	0.08	0.09	0.10	0.10	0.05	0.06	0.09
12/28/18	0.07	0.08	0.10	0.10	0.10	0.10	0.09	0.10	0.10	0.10	0.14	0.14	0.08	0.09	0.09	0.10	0.05	0.05	0.09
12/29/18	0.07	0.08	0.10	0.11	0.10	0.10	0.09	0.10	0.10	0.14	0.14	0.16	0.09	0.10	0.10	0.10	0.05	0.05	0.09
12/30/18	0.08	0.09	0.10	0.11	0.10	0.10	0.09	0.10	0.10	0.11	0.14	0.15	0.10	0.13	0.10	0.10	0.05	0.06	0.10
12/31/18	0.08	0.09	0.10	0.11	0.10	0.10	0.10	0.10	0.11	0.15	0.15	0.22	0.11	0.12	0.10	0.10	0.05	0.06	0.10

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

* (“High value due to valve issue on MF Cell B01 while cell was not in service.”)

Orange County Water District - Ground Water Replenishment System (GWRS)
State Water Resources Control Board - Div. of Drinking Water - Title 22 Groundwater Recharge Report
system no. 3090001 , Project no. 745

	Reverse Osmosis Process online monitoring results																	
	Turbidity (ntu)		Total Organic Carbon (TOC - ppm)						Electro Conductivity (EC)						Calculated TOC removal based on Daily Avg		Calculated EC removal based on Daily Avg	
	ROP		ROF			ROP			ROF			ROP						
Date	avg	max	avg	min	max	avg	min	max	avg	min	max	avg	min	max	%	Log	%	Log
12/01/18	0.064	0.066	7.567	6.965	8.345	0.025	0.018	0.032	1,712	1,671	1,762	31	29	34	99.67	2.48	98.18	1.74
12/02/18	0.062	0.064	7.378	6.974	8.176	0.020	0.011	0.025	1,635	1,575	1,702	30	27	33	99.73	2.57	98.17	1.74
12/03/18	0.065	0.066	7.234	6.771	8.071	0.019	0.015	0.027	1,559	1,476	1,679	28	25	31	99.73	2.57	98.20	1.75
12/04/18	0.065	0.065	7.545	7.120	8.155	0.025	0.021	0.033	1,739	1,632	1,844	31	28	34	99.66	2.47	98.22	1.75
12/05/18	0.066	0.066	7.649	7.219	8.289	0.027	0.021	0.034	1,793	1,714	1,867	32	29	35	99.65	2.46	98.22	1.75
12/06/18	0.065	0.065	7.646	7.194	8.295	0.023	0.014	0.030	1,756	1,522	1,851	30	24	34	99.70	2.52	98.27	1.76
12/07/18	0.063	0.065	7.193	6.565	8.268	0.020	0.016	0.026	1,641	1,508	1,783	27	23	31	99.72	2.55	98.38	1.79
12/08/18	0.057	0.060	7.625	7.076	8.434	0.020	0.010	0.026	1,729	1,691	1,777	29	27	32	99.73	2.57	98.31	1.77
12/09/18	0.062	0.064	7.382	6.856	8.207	0.018	0.013	0.022	1,659	1,597	1,722	29	26	32	99.75	2.61	98.28	1.76
12/10/18	0.062	0.064	7.463	6.791	8.284	0.018	0.014	0.026	1,611	1,513	1,744	28	25	31	99.76	2.62	98.29	1.77
12/11/18	0.063	0.064	7.631	7.059	8.557	0.026	0.019	0.033	1,745	1,667	1,831	30	27	34	99.66	2.47	98.29	1.77
12/12/18	0.063	0.064	7.691	7.215	8.351	0.030	0.023	0.037	1,798	1,735	1,874	30	28	34	99.60	2.40	98.31	1.77
12/13/18	0.064	0.064	7.479	6.899	8.165	0.025	0.016	0.036	1,829	1,774	1,878	31	28	33	99.67	2.48	98.32	1.77
12/14/18	0.066	0.069	7.425	6.902	8.184	0.020	0.014	0.024	1,744	1,657	1,867	30	28	32	99.73	2.57	98.29	1.77
12/15/18	0.065	0.067	7.494	6.920	8.223	0.022	0.011	0.031	1,672	1,635	1,736	29	28	32	99.70	2.53	98.24	1.75
12/16/18	0.068	0.069	7.453	6.878	8.212	0.017	0.013	0.022	1,586	1,539	1,632	28	26	32	99.77	2.64	98.26	1.76
12/17/18	0.068	0.069	7.463	6.730	8.406	0.023	0.013	0.134	1,535	1,452	1,636	26	24	30	99.69	2.52	98.28	1.76
12/18/18	0.068	0.068	7.659	7.078	8.598	0.023	0.018	0.027	1,622	1,555	1,717	28	26	32	99.70	2.53	98.26	1.76
12/19/18	0.068	0.069	7.699	7.044	8.284	0.025	0.018	0.030	1,695	1,625	1,749	29	26	32	99.67	2.49	98.28	1.76
12/20/18	0.068	0.068	7.505	6.869	8.273	0.024	0.020	0.031	1,700	1,629	1,773	29	27	32	99.68	2.50	98.28	1.76
12/21/18	0.069	0.069	7.638	7.018	8.361	0.023	0.020	0.028	1,773	1,700	1,865	31	28	34	99.69	2.51	98.27	1.76
12/22/18	0.068	0.068	7.710	7.077	8.369	0.022	0.016	0.031	1,769	1,728	1,822	31	29	34	99.71	2.54	98.24	1.75
12/23/18	0.068	0.069	7.484	6.925	8.333	0.020	0.017	0.024	1,679	1,624	1,738	29	27	32	99.74	2.58	98.25	1.76
12/24/18	0.068	0.068	7.464	7.009	8.188	0.017	0.011	0.020	1,604	1,551	1,652	28	26	30	99.77	2.65	98.24	1.76
12/25/18	0.067	0.067	6.892	6.372	7.832	0.016	0.013	0.020	1,557	1,500	1,615	28	25	32	99.78	2.65	98.20	1.75
12/26/18	0.067	0.067	6.998	6.244	8.377	0.012	0.007	0.015	1,560	1,497	1,647	29	26	31	99.82	2.75	98.16	1.73
12/27/18	0.067	0.067	7.722	6.969	8.517	0.019	0.014	0.023	1,691	1,589	1,808	30	27	34	99.75	2.61	98.23	1.75
12/28/18	0.067	0.068	7.604	7.037	8.366	0.019	0.016	0.023	1,779	1,692	1,872	30	27	33	99.75	2.61	98.34	1.78
12/29/18	0.068	0.068	7.605	6.866	8.411	0.018	0.010	0.024	1,771	1,731	1,817	29	27	31	99.76	2.61	98.38	1.79
12/30/18	0.065	0.067	7.753	7.037	8.544	0.017	0.010	0.023	1,683	1,624	1,734	28	26	31	99.78	2.67	98.34	1.78
12/31/18	0.068	0.068	7.789	7.014	8.623	0.017	0.014	0.024	1,601	1,523	1,671	26	24	29	99.78	2.65	98.34	1.78

Notes:

Date	UltraViolet / AOP Process online monitoring results UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
12/01/18	96.88	99.391	26,302.4	0.26	3.0	6
12/02/18	97.11	96.389	25,633.1	0.27	3.0	6
12/03/18	96.76	94.029	24,896.4	0.26	3.0	6
12/04/18	96.96	97.992	25,398.9	0.26	3.0	6
12/05/18	96.80	97.857	25,348.0	0.26	3.0	6
12/06/18	96.81	96.556	25,249.9	0.26	3.0	6
12/07/18	97.17	97.784	25,610.9	0.26	3.0	6
12/08/18	97.06	98.050	25,499.4	0.26	3.0	6
12/09/18	97.26	98.645	25,324.8	0.26	3.0	6
12/10/18	96.84	96.472	24,677.4	0.26	3.0	6
12/11/18	96.91	100.007	25,881.9	0.26	3.0	6
12/12/18	97.21	97.919	25,354.6	0.26	3.0	6
12/13/18	97.28	98.553	25,655.5	0.26	3.0	6
12/14/18	97.20	98.953	25,757.4	0.26	3.0	6
12/15/18	97.11	98.831	25,705.6	0.26	3.0	6
12/16/18	97.44	95.300	25,073.2	0.26	3.0	6
12/17/18	97.35	95.722	25,438.3	0.27	3.0	6
12/18/18	97.49	97.292	25,343.7	0.26	3.0	6
12/19/18	97.39	98.969	25,823.6	0.26	3.0	6
12/20/18	97.44	99.025	25,954.3	0.26	3.0	6
12/21/18	97.28	99.241	26,058.7	0.26	3.0	6
12/22/18	97.25	97.839	25,428.3	0.26	3.0	6
12/23/18	97.23	97.375	25,196.5	0.26	3.0	6
12/24/18	97.26	95.350	24,744.5	0.26	3.0	6
12/25/18	96.98	94.977	25,184.8	0.27	3.0	6
12/26/18	97.16	90.644	23,930.7	0.26	3.0	6
12/27/18	97.10	90.940	24,397.8	0.27	3.0	6
12/28/18	97.05	96.905	25,559.0	0.26	3.0	6
12/29/18	97.29	97.888	25,961.5	0.27	3.0	6
12/30/18	97.25	96.292	25,717.2	0.27	3.0	6
12/31/18	97.00	94.709	25,276.6	0.27	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

minimum EED = 0.23 kwh/kgal

Appendix G

Groundwater Quality Data
at the Talbert Barrier

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

GWRS 2018 Quarterly Sampling Dates
OCWD Water Quality Department
TALBERT BARRIER - GROUNDWATER

Monitoring Well	Qtr 1	Qtr 2	Qtr 3	Qtr 4
OCWD-M10/1-4	01/22/2018	04/23/2018	07/23/2018	10/22/2018
OCWD-M11/1-4	02/07/2018	04/25/2018	07/25/2018	10/24/2018
OCWD-M19/3	02/08/2018	04/11/2018	07/11/2018	10/10/2018
OCWD-M45/1-5	01/10/2018	04/10/2018	07/10/2018	10/09/2018
OCWD-M46/2-5	01/23/2018	05/07/2018	08/07/2018	10/08/2018
OCWD-M46A/1	01/23/2018	05/07/2018	08/07/2018	10/08/2018
OCWD-M47/1-5	01/24/2018	04/24/2018	07/24/2018	10/23/2018

Notes for Appendix G Tables:

► Water quality data are summarized for monitoring wells M10, M11, M19, M45, M46, M46A and M47 in the following tables. OCWD-M19/3 is a non-compliance monitoring well.

► Listed dates (above) are the quarterly compliance monitoring dates; other samples may have been collected during the year. Detections of organic chemicals are reported for all samples collected in 2018 and are not limited to the quarterly compliance samples.

► Results listed in the table for each quarter are the range of the minimum and maximum values detected at the well location, which may consist of one to five well casings. Figures and report text list the well ID (e.g. OCWD-M10), casing number (e.g., M10/1, M10/2, M10/3 and M10/4), as appropriate.

► Appendices B & C contain a list of all methods and reportable detection limits (RDL).

► Detailed data reports are available upon request.

► The more stringent value in the range of secondary MCLs is used in the tables (e.g., <MCL) for TDS, electrical conductivity (EC), chloride and sulfate.

► MCL: Maximum Contaminant Level

► N/A: Not applicable

► ND: Not detected at reportable detection limit (RDL)

► NL: SWRCB Division of Drinking Water (DDW) Notification Level

► NR: Not Required

► nr: Not reported

► NS: Not sampled

► SMCL: Secondary Maximum Contaminant Level

► TR: Trace

GWRS 2018 Quarterly Sampling Dates
OCWD Water Quality Department
TALBERT BARRIER - GROUNDWATER

Notes for Appendix G Tables (continued):

► A comprehensive suite of tests covering inorganics, metals, volatile organics (VOCs), synthetic organic compounds (SOCs), radiological and microbial parameters were analyzed at 35 permit-specified groundwater monitoring wells since the commencement of the GWRS treatment facility. In June 2010, OCWD proposed a revised groundwater monitoring frequency from quarterly to annually for selected analytes that have reported no detections. The proposed reduced frequency of testing was (1) based on real-time data for analytes reported as non-detect at the reporting detection limit, (2) supported by two Independent Advisory Panels having oversight for the GWRS project and the Santa Ana River (SARMON) long-term monitoring program, and (3) a condition of the GWRS permit to routinely review data and based on results, to modify the groundwater monitoring program every two years or sooner with approval by the RWQCB and SWRCB DDW (formerly CDPH - July 2014 CDPH moved to the SWRCB with a new name, Division of Drinking Water).

The revised monitoring frequency was approved by the RWQCB (3/14/2011) and SWRCB DDW (9/20/2010) and consists of reduction in asbestos, dioxin, selected SOCs, and radionuclides monitoring from quarterly to annually (see Table 1) for monitoring well locations. Julio Lara/RWQCB advised that monitoring for these analytes are not permit required but OCWD voluntarily performed the monitoring. OCWD elected to conduct comprehensive testing at the start-up of GWRS; however, with years of a robust database for these non-compliance targets (asbestos, dioxin, EPA 625), OCWD concurred with the RWQCB and ceased testing for these analytes in January 2014. Samples may have been collected for other analytes (cyanide, some radionuclides, etc.) but consensus is to cease testing and use resources more effectively in the future. Comprehensive testing was performed during the first quarter 2011 and served as the "annual comprehensive testing" and "initial anchor date." Future "annual comprehensive testing" rotated sequentially through the quarters (e.g., 2Q2012, 3Q2013, 4Q2014, etc.).

Table 1

Talbert Barrier and Forebay Area GWRS Groundwater Monitoring Well
Approved Revised Monitoring Program[1]
Inorganic, Organic, and Radiological Analytes

Q - Year	Comprehensive[2]	Reduced[3,4,5]	Q - Year	Comprehensive[2]	Reduced[3,4,5]
Q1 - 2015	x		Q1 - 2018	x	
Q2 - 2015		x	Q2 - 2018		x
Q3 - 2015		x	Q3 - 2018		x
Q4 - 2015		x	Q4 - 2018		x
Q1 - 2016		x	Q1 - 2019		x
Q2 - 2016	x		Q2 - 2019	x	
Q3 - 2016		x	Q3 - 2019		x
Q4 - 2016		x	Q4 - 2019		x
Q1 - 2017		x	Q1 - 2020		x
Q2 - 2017		x	Q2 - 2020		x
Q3 - 2017	x		Q3 - 2020	x	
Q4 - 2017		x	Q4 - 2020		x

[1]Approved RWQCB (03/14/2011) and CDPH (09/20/10)

[2]Comprehensive: OCWD voluntarily screens for inorganic and organic analytes and radionuclides beyond the permit specific analytes

[3]Reduced: Annual asbestos, cyanide, selected SOC's, EPA 625, and radionuclides

[4]GWRS IAP Meeting 08/27/13: Panel Concurs to cease monitoring for asbestos and dioxin based on years of non-detections

[5]GWRS IAP Meeting 08/29/17: Panel concurs to reduce select inorganic and organic monitoring. In addition, Panel concurs to cease select inorganic and organic voluntary monitoring.

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	OCWD-M10 Qtr 1	OCWD-M10 Qtr 2	OCWD-M10 Qtr 3	OCWD-M10 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	2.1 - 8.7	2.3 - 7.7	1.5 - 9.1	1.3 - 8.5
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 2.9	ND - 2.2	ND - 3.7	ND - 3
Barium (Ba), ug/L	OCWD	1000	6.4 - 63.8	7 - 71.4	6.7 - 102	6.3 - 46.3
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	0.35 - 0.66	0.32 - 0.65	0.29 - 0.73	0.32 - 0.81
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.27	ND	ND	ND
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND - 1.1	ND - 1.8	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 2.05	ND - 1.45	ND - 1.26	ND - 1.42
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.01	NR	NR	ND - 0.013
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND - 1.8	ND
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	ND - 0.7	ND - 0.25	ND	ND - 0.2
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	NR
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND - 5	ND - 3
Electrical Conductivity (EC), um/cm	OCWD	900	153 - 620	153 - 706	147 - 889	147 - 470
Iron (Fe), ug/L	OCWD	300	ND - 14.4	ND - 13.4	ND - 10.3	ND - 59.4
Manganese (Mn), ug/L	OCWD	50	1.6 - 49.1	2.2 - 42.6	1.9 - 37.1	1.8 - 35.4
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	1.6 - 48.5	2.2 - 42.5	1.7 - 35.6	1.8 - 33.3
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND - 16	ND - 8	ND - 4	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	92 - 390	95 - 424	88 - 578	78 - 274
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.1	ND	ND - 0.1	ND - 0.2
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND - 5.2	ND	1.1 - 2.1	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND - 1.5	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.18 - 0.26	0.17 - 0.26	0.16 - 0.25	0.19 - 0.25
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	ND - 4.6	ND - 4.1	ND - 4.1	ND - 4.8
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	OCWD-M10 Qtr 1	OCWD-M10 Qtr 2	OCWD-M10 Qtr 3	OCWD-M10 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < MCL
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND	ND
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND

* Reduced 525.2 list of analytes (525-R)

OCWD-M10/1
Organic Detections by Method

Year 2018, Quarter 2

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
4/23/2018 10:20	1,4-Dioxane (14DIOX)	1.4	ug/L	1

Year 2018, Quarter 3

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/23/2018 12:10	1,4-Dioxane (14DIOX)	1.6	ug/L	1

Year 2018, Quarter 4

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/22/2018 11:30	1,4-Dioxane (14DIOX)	1.2	ug/L	1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/22/2018 11:30	Carbamazepine (CBMAZP)	1.5	ng/L	1
10/22/2018 11:30	Sulfamethoxazole (SULTHZ)	1.5	ng/L	1

OCWD-M10/2
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/22/2018	10:15	Chloroform (CHCl3)	0.7	ug/L	0.5
1/22/2018	10:15	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/23/2018	9:45	Chloroform (CHCl3)	TR	ug/L	0.5
4/23/2018	9:45	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2018, Quarter 4

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/22/2018	10:45	Chloroform (CHCl3)	0.2	ug/L	0.1
10/22/2018	10:45	Total Trihalomethanes (TTHMs)	0.2	ug/L	0.1

OCWD-M10/3
Organic Detections by Method

Year 2018, Quarter 1

METHOD: ***14DIOX***

Sample Date & Time		*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
1/22/2018	9:45	1,4-Dioxane (14DIOX)	4.7	ug/L	1

Year 2018, Quarter 2

METHOD: ***14DIOX***

Sample Date & Time		*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
4/23/2018	11:00	1,4-Dioxane (14DIOX)	5.4	ug/L	1

Year 2018, Quarter 3

METHOD: ***14DIOX***

Sample Date & Time		*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
7/23/2018	11:20	1,4-Dioxane (14DIOX)	5.9	ug/L	1

Year 2018, Quarter 4

METHOD: ***14DIOX***

Sample Date & Time		*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
10/22/2018	10:05	1,4-Dioxane (14DIOX)	6.5	ug/L	1

OCWD-M10/4
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/22/2018	9:15	Carbamazepine (CBMAZP)	1.6	ng/L	1
10/22/2018	9:15	Gemfibrozil (GMFIBZ)	1.6	ng/L	1
10/22/2018	9:15	N,N-diethyl-m-toluamide (DEET)	2.9	ng/L	1

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	OCWD-M11 Qtr 1	OCWD-M11 Qtr 2	OCWD-M11 Qtr 3	OCWD-M11 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	1.9 - 4.3	1.7 - 4.7	1.8 - 6.5	1.9 - 6.3
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 3	ND - 2.3	ND - 3.1	ND - 2.8
Barium (Ba), ug/L	OCWD	1000	12.8 - 113	12.6 - 112	11.9 - 115	9.9 - 70.8
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND - 1.3	ND - 1.4	ND
Fluoride (F), mg/L	OCWD	2	0.23 - 1.06	0.23 - 1.03	0.35 - 1.01	0.38 - 0.78
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.85	ND - 0.85	ND - 0.75	ND - 0.98
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND - 1.3	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	1.14 - 2.54	1.04 - 2.38	1.04 - 2.27	1.19 - 2.3
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND	NR	NR	ND - 0.002
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 2.8	ND - 2.2	ND - 2.8	ND - 2.8
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	0.25 - 0.8	0.25 - 1.3	0.25 - 1.3	0.25 - 1
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	140 - 783	143 - 812	143 - 800	147 - 593
Iron (Fe), ug/L	OCWD	300	ND	ND	ND	ND
Manganese (Mn), ug/L	OCWD	50	ND	ND - 1.1	ND - 1	ND
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND	ND	ND	ND
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	96 - **526**	98 - 484	102 - 488	104 - 338
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.5	ND - 0.1	ND - 0.1	ND - 0.1
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	ND	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.17 - 0.27	0.16 - 0.26	0.14 - 0.24	0.2 - 0.25
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	2 - 4.5	2 - 4.1	2.2 - 4.1	2.4 - 3.9
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
EPTC (EPTC), ug/L	OCWD	N/A	ND	ND	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	ND	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	OCWD-M11 Qtr 1	OCWD-M11 Qtr 2	OCWD-M11 Qtr 3	OCWD-M11 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND < NL	ND < NL	ND	ND
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	ND*	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND

* Reduced 525.2 list of analytes (525-R)

OCWD-M11/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	10:05	Chloroform (CHCl3)	0.8	ug/L	0.5
2/7/2018	10:05	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/25/2018	9:40	Chloroform (CHCl3)	0.7	ug/L	0.5
4/25/2018	9:40	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/25/2018	9:50	Chloroform (CHCl3)	1.1	ug/L	0.5
7/25/2018	9:50	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	9:40	Chloroform (CHCl3)	0.8	ug/L	0.5
10/24/2018	9:40	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	9:40	Bromodichloromethane (CHBrCl)	0.2	ug/L	0.1
10/24/2018	9:40	Chloroform (CHCl3)	0.7	ug/L	0.1
10/24/2018	9:40	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.1

OCWD-M11/2
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	10:45	Chloroform (CHCl3)	TR	ug/L	0.5
2/7/2018	10:45	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/25/2018	10:25	Chloroform (CHCl3)	TR	ug/L	0.5
4/25/2018	10:25	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/25/2018	9:55	Chloroform (CHCl3)	TR	ug/L	0.5
7/25/2018	9:55	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	10:25	Chloroform (CHCl3)	TR	ug/L	0.5
10/24/2018	10:25	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	10:25	Chloroform (CHCl3)	0.4	ug/L	0.1
10/24/2018	10:25	Total Trihalomethanes (TTHMs)	0.4	ug/L	0.1

OCWD-M11/3
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	11:10	Chloroform (CHCl3)	0.7	ug/L	0.5
2/7/2018	11:10	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/25/2018	10:30	Chloroform (CHCl3)	0.6	ug/L	0.5
4/25/2018	10:30	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/25/2018	10:55	Chloroform (CHCl3)	TR	ug/L	0.5
7/25/2018	10:55	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	10:45	Chloroform (CHCl3)	TR	ug/L	0.5
10/24/2018	10:45	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	10:45	Chloroform (CHCl3)	0.3	ug/L	0.1
10/24/2018	10:45	Total Trihalomethanes (TTHMs)	0.3	ug/L	0.1

OCWD-M11/3
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/24/2018 10:45	Sulfamethoxazole (SULTHZ)	1.7	ng/L	1

OCWD-M11/4
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	10:25	1,4-Dioxane (14DIOX)	1.9	ug/L	1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	10:25	Chloroform (CHCl3)	0.8	ug/L	0.5
2/7/2018	10:25	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

Year 2018, Quarter 2

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/25/2018	9:45	1,4-Dioxane (14DIOX)	1.3	ug/L	1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/25/2018	9:45	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
4/25/2018	9:45	Chloroform (CHCl3)	1.3	ug/L	0.5
4/25/2018	9:45	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/25/2018	10:50	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
7/25/2018	10:50	Chloroform (CHCl3)	1.3	ug/L	0.5
7/25/2018	10:50	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

OCWD-M11/4
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	10:00	Chloroform (CHCl3)	0.8	ug/L	0.5
10/24/2018	10:00	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	10:00	Bromodichloromethane (CHBrCl)	0.2	ug/L	0.1
10/24/2018	10:00	Chloroform (CHCl3)	0.8	ug/L	0.1
10/24/2018	10:00	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/24/2018	10:00	Sulfamethoxazole (SULTHZ)	1.2	ng/L	1

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	Permit Limit	OCWD-M19/3 Qtr 1	OCWD-M19/3 Qtr 2	OCWD-M19/3 Qtr 3	OCWD-M19/3 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	7.8	6.4	7.7	5.4
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	1.3	ND	ND	1.1
Barium (Ba), ug/L	OCWD	1000	10.8	11.7	13.9	17
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	0.13	0.11	ND	ND
Hexavalent Chromium (CrVI), ug/L	OCWD	10	0.25	0.22	ND	0.26
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	1.17	1.09	1.64	1.43
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.004	NR	NR	ND
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND	ND
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	1.8	1.2	2	1.9 - 2.6
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	ND	ND	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	98	99	114	130
Iron (Fe), ug/L	OCWD	300	ND	5.2	7.4	6.3
Manganese (Mn), ug/L	OCWD	50	3.5	2.6	3.2	3.2
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND	ND	ND	ND
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	64	60	76	79
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.2	0.1	0.2	0.2
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	ND	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.26	0.23	0.25	0.27
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	3.4	3.2	2.9	3.4
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	NR	NR	ND
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	OCWD-M19/3 Qtr 1	OCWD-M19/3 Qtr 2	OCWD-M19/3 Qtr 3	OCWD-M19/3 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND	ND	ND	ND
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND

OCWD-M19/3
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/8/2018	10:10	Chloroform (CHCl3)	1.8	ug/L	0.5
2/8/2018	10:10	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/11/2018	9:55	Chloroform (CHCl3)	1.2	ug/L	0.5
4/11/2018	9:55	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/11/2018	10:10	Chloroform (CHCl3)	2.0	ug/L	0.5
7/11/2018	10:10	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
7/11/2018	10:10	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/10/2018	11:05	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
10/10/2018	11:05	Chloroform (CHCl3)	2.6	ug/L	0.5
10/10/2018	11:05	Total Trihalomethanes (TTHMs)	2.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/10/2018	11:05	Bromodichloromethane (CHBrCl)	0.4	ug/L	0.1
10/10/2018	11:05	Chloroform (CHCl3)	1.5	ug/L	0.1
10/10/2018	11:05	Total Trihalomethanes (TTHMs)	1.9	ug/L	0.1

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	OCWD-M45 Qtr 1	OCWD-M45 Qtr 2	OCWD-M45 Qtr 3	OCWD-M45 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	ND - 11.2	ND - 10.1	ND - 9.7	1.3 - 9.9
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 2.8	ND - 1.5	ND - 2.6	ND - 2.9
Barium (Ba), ug/L	OCWD	1000	6.1 - 57	6.3 - 52.9	6.4 - 59.9	7.1 - 50.6
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	0.29 - 0.93	0.28 - 0.89	0.3 - 0.89	0.29 - 0.87
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND	ND	ND	ND
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND - 1.4	ND - 1.4	ND - 1.1	ND - 1.7
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 2.18	ND - 2.19	ND - 2.05	ND - 1.98
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.062	NR	NR	ND - 0.085
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 2.8	ND - 1.8	ND - 2	ND - 2.9
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	ND	ND	ND - 0.6	ND - 0.6
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND - 140	ND - 140	ND - 150	ND - 150
Electrical Conductivity (EC), um/cm	OCWD	900	215 - **1,090**	216 - **1,080**	207 - **1,100**	189 - **1,100**
Iron (Fe), ug/L	OCWD	300	ND - 51.4	ND - 52.8	ND - 43.5	ND - 46.2
Manganese (Mn), ug/L	OCWD	50	6.2 - 16.7	5.8 - 13.4	2.8 - 11.8	1.4 - 10.6
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	6.3 - 15.4	5.9 - 14	2.6 - 11.4	1.5 - 10.4
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND - 8	ND - 4	ND - 2
Total Dissolved Solids (TDS), mg/L	OCWD	500	130 - **732**	126 - **720**	132 - **710**	108 - **708**
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.2	ND - 0.2	ND - 0.2	ND - 0.2
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND - 1.1	1.3 - 4.2	ND - 2.3
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.11 - 0.33	ND - 0.31	0.1 - 0.31	0.11 - 0.31
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	ND - 4	ND - 3.9	ND - 3.2	ND - 3.9
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	OCWD-M45 Qtr 1	OCWD-M45 Qtr 2	OCWD-M45 Qtr 3	OCWD-M45 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < MCL
524.2	Volatile Organic Compounds (VOCs)	OCWD / TestAmer	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND

* Reduced 525.2 list of analytes (525-R)

OCWD-M45/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/10/2018	8:55	Tetrachloroethene (PCE)	TR	ug/L	0.5
1/10/2018	8:55	Trichloroethene (TCE)	TR	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/10/2018	9:30	Tetrachloroethene (PCE)	TR	ug/L	0.5
4/10/2018	9:30	Trichloroethene (TCE)	TR	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/10/2018	9:20	Tetrachloroethene (PCE)	TR	ug/L	0.5
7/10/2018	9:20	Trichloroethene (TCE)	0.5	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2018	9:55	Tetrachloroethene (PCE)	TR	ug/L	0.5
10/9/2018	9:55	Trichloroethene (TCE)	TR	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2018	9:55	Tetrachloroethene (PCE)	0.3	ug/L	0.1
10/9/2018	9:55	Trichloroethene (TCE)	0.4	ug/L	0.1

OCWD-M45/2
Organic Detections by Method

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/10/2018 10:35	Chloroform (CHCl3)	0.6	ug/L	0.5
7/10/2018 10:35	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2018 11:10	Chloroform (CHCl3)	0.6	ug/L	0.5
10/9/2018 11:10	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2018 11:10	Chloroform (CHCl3)	0.5	ug/L	0.1
10/9/2018 11:10	Total Trihalomethanes (TTHMs)	0.5	ug/L	0.1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2018 11:10	Sulfamethoxazole (SULTHZ)	1.0	ng/L	1

OCWD-M45/3
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/10/2018	9:45	1,4-Dioxane (14DIOX)	6.7	ug/L	1

Year 2018, Quarter 2

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/10/2018	10:45	1,4-Dioxane (14DIOX)	4.9	ug/L	1

Year 2018, Quarter 3

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/10/2018	10:05	1,4-Dioxane (14DIOX)	3.7	ug/L	1

Year 2018, Quarter 4

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/9/2018	11:35	1,4-Dioxane (14DIOX)	5.1	ug/L	1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/9/2018	11:35	Gemfibrozil (GMFIBZ)	7.3	ng/L	1
10/9/2018	11:35	Ibuprofen (IBPRFN)	3.1	ng/L	1
10/9/2018	11:35	N,N-diethyl-m-toluamide (DEET)	1.1	ng/L	1
10/9/2018	11:35	Primidone (PRIMDN)	1.9	ng/L	1

OCWD-M45/4
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/10/2018 10:35	1,4-Dioxane (14DIOX)	2.4	ug/L	1

Year 2018, Quarter 2

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
4/10/2018 12:05	1,4-Dioxane (14DIOX)	1.8	ug/L	1

Year 2018, Quarter 3

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/10/2018 10:55	1,4-Dioxane (14DIOX)	1.6	ug/L	1

Year 2018, Quarter 4

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2018 10:50	1,4-Dioxane (14DIOX)	1.2	ug/L	1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2018 10:50	Carbamazepine (CBMAZP)	1.2	ng/L	1
10/9/2018 10:50	Gemfibrozil (GMFIBZ)	1.1	ng/L	1

OCWD-M45/5
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
10/9/2018 10:30	Caffeine (CAFFEI)	8.4	ng/L	3

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	OCWD-M46 & 46A Qtr 1	OCWD-M46 & 46A Qtr 2	OCWD-M46 & 46A Qtr 3	OCWD-M46 & 46A Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	8.9 - 20	5.2 - 17.5	6.1 - 21.7	6.2 - 16.6
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 4.8	ND - 3.6	ND - 5	ND - 4.8
Barium (Ba), ug/L	OCWD	1000	3.8 - 19.4	3.7 - 19.8	4.2 - 17	3.4 - 20.8
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	1 - 2.1	ND
Fluoride (F), mg/L	OCWD	2	0.11 - 0.73	ND - 0.75	ND - 0.75	ND - 0.73
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.24	ND - 0.24	ND - 0.2	ND - 0.29
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	ND - 1	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 1.39	ND - 1.45	ND - 1.61	ND - 1.5
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.004	NR	NR	ND
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 1.9	ND - 1.6	ND - 2.3	ND - 2.1
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	ND - 1.8	ND - 2.2	ND - 1.7	ND - 1.8
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND - 40	ND - 40	ND - 45	ND - 45
Electrical Conductivity (EC), um/cm	OCWD	900	128 - 364	133 - 363	130 - 360	126 - 348
Iron (Fe), ug/L	OCWD	300	ND - 19.5	ND - 17.9	ND - 18.7	ND - 16.6
Manganese (Mn), ug/L	OCWD	50	ND - 5.2	ND - 4.8	ND - 5.4	ND - 4.4
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 5.1	ND - 4.8	ND - 4.8	ND - 5.2
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND - 64	ND - 16	ND - 2	ND - 2
Total Dissolved Solids (TDS), mg/L	OCWD	500	74 - 208	92 - 228	71 - 196	76 - 216
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.1 - 0.3	0.1 - 0.2	ND - 0.2	0.1 - 0.2
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	ND - 2.4	ND - 1.7
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.11 - 0.26	0.1 - 0.24	0.11 - 0.26	0.12 - 0.25
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	1.2 - 10.6	ND - 10.5	ND - 10.5	ND - 10.4
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	OCWD-M46 & 46A Qtr 1	OCWD-M46 & 46A Qtr 2	OCWD-M46 & 46A Qtr 3	OCWD-M46 & 46A Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND	ND	ND < NL	ND < MCL
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < NL

* Reduced 525.2 list of analytes (525-R)

OCWD-M46A/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2018	12:00	Chloroform (CHCl3)	1.8	ug/L	0.5
1/23/2018	12:00	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2018	12:00	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/7/2018	9:40	Chloroform (CHCl3)	2.2	ug/L	0.5
5/7/2018	9:40	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/7/2018	9:40	n-Nitrosodimethylamine (NDMA)	3.1	ng/L	2

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/7/2018	9:05	Chloroform (CHCl3)	1.7	ug/L	0.5
8/7/2018	9:05	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/7/2018	9:05	n-Nitrosodimethylamine (NDMA)	2.5	ng/L	2

OCWD-M46A/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/8/2018	9:15	Chloroform (CHCl3)	1.6	ug/L	0.5
10/8/2018	9:15	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/8/2018	9:15	Chloroform (CHCl3)	1.2	ug/L	0.1
10/8/2018	9:15	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/8/2018	9:15	n-Nitrosodimethylamine (NDMA)	2.8	ng/L	2

OCWD-M46/2
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2018	10:10	Chloroform (CHCl3)	1.7	ug/L	0.5
1/23/2018	10:10	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/7/2018	10:50	Chloroform (CHCl3)	1.7	ug/L	0.5
5/7/2018	10:50	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/7/2018	10:40	Chloroform (CHCl3)	1.5	ug/L	0.5
8/7/2018	10:40	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/8/2018	10:00	Chloroform (CHCl3)	1.8	ug/L	0.5
10/8/2018	10:00	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/8/2018	10:00	Chloroform (CHCl3)	1.3	ug/L	0.1
10/8/2018	10:00	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.1

OCWD-M46/3
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/8/2018	10:35	Chloroform (CHCl3)	0.1	ug/L	0.1
10/8/2018	10:35	Total Trihalomethanes (TTHMs)	0.1	ug/L	0.1

OCWD-M46/5
Organic Detections by Method

Year 2018, Quarter 3

METHOD: 14DIOX

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
8/7/2018	9:55	1,4-Dioxane (14DIOX)	1.1	ug/L	1

Year 2018, Quarter 4

METHOD: 14DIOX

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/8/2018	9:50	1,4-Dioxane (14DIOX)	1.0	ug/L	1

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	OCWD-M47 Qtr 1	OCWD-M47 Qtr 2	OCWD-M47 Qtr 3	OCWD-M47 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	3.5 - 49.4	2.9 - 17.1	3.6 - 17.9	3.1 - 16.7
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 4.2	ND - 3.5	ND - 5.9	ND - 10.2
Barium (Ba), ug/L	OCWD	1000	3.8 - 30.9	3.4 - 31.3	4.3 - 35.8	4.2 - 33.4
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND - 1.1	ND
Fluoride (F), mg/L	OCWD	2	0.28 - 0.9	0.28 - 0.89	0.29 - 0.89	0.28 - 0.87
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.28	ND - 0.25	ND - 0.25	ND - 0.27
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 1.66	ND - 1.61	ND - 1.5	ND - 1.51
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.005	NR	NR	ND - 0.005
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND	ND
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	ND - 1.6	ND - 1.7	ND - 1.8	ND - 1.5
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	ND	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND - **80**	ND - **90**	ND - **90**	ND - **80**
Electrical Conductivity (EC), um/cm	OCWD	900	198 - 358	197 - 358	195 - 363	198 - 357
Iron (Fe), ug/L	OCWD	300	8 - 61.8	8.5 - 70.1	6.6 - 59.5	7.4 - 36.7
Manganese (Mn), ug/L	OCWD	50	1.2 - 22.7	ND - 23.2	ND - 19.3	ND - 22.2
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 22.5	ND - 22.4	ND - 19.3	ND - 21.7
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND - 8	ND - 4	ND - 4
Total Dissolved Solids (TDS), mg/L	OCWD	500	124 - 224	120 - 228	132 - 232	92 - 204
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.6	ND - 0.2	ND - 0.4	ND - 0.4
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	ND - 1.7	ND - 2
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	ND - 0.25	ND - 0.25	ND - 0.23	ND - 0.24
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	ND - 3.8	ND - 3.9	ND - 3.8	ND - 3.9
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	OCWD-M47 Qtr 1	OCWD-M47 Qtr 2	OCWD-M47 Qtr 3	OCWD-M47 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND	ND	ND	ND
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND

* Reduced 525.2 list of analytes (525-R)

OCWD-M47/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: ***CEC***

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/23/2018	9:20	Carbamazepine (CBMAZP)	1.5	ng/L	1

OCWD-M47/2
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/24/2018	9:45	Chloroform (CHCl3)	1.6	ug/L	0.5
1/24/2018	9:45	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/24/2018	10:25	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
4/24/2018	10:25	Chloroform (CHCl3)	1.7	ug/L	0.5
4/24/2018	10:25	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/24/2018	11:10	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
7/24/2018	11:10	Chloroform (CHCl3)	1.8	ug/L	0.5
7/24/2018	11:10	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/23/2018	11:25	Chloroform (CHCl3)	1.5	ug/L	0.5
10/23/2018	11:25	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/23/2018	11:25	Bromodichloromethane (CHBrCl)	0.2	ug/L	0.1
10/23/2018	11:25	Chloroform (CHCl3)	1.1	ug/L	0.1
10/23/2018	11:25	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.1

OCWD-M47/2
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/23/2018 11:25	Sulfamethoxazole (SULTHZ)	1.6	ng/L	1

Appendix H

Talbert Barrier Monitoring Well Groundwater Quality Data

1,4-Dioxane, NDMA and Selected Constituents

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

TABLE H-1
MONITORING WELL OCWD-M10
1,4-dioxane and NDMA Concentrations, 2014- 2018

M10/1 *Talbert, Alpha-I,II Aquifers* *Perforations: 80-160 ft bgs*			**M10/2** *Alpha III Aquifer* *Perforations: 175-195 ft bgs*			**M10/3** *Beta Aquifer* *Perforations: 215-240 ft bgs*			**M10/4** *Lambda, Omicron Aquifer* *Perforations: 280-305 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
4/2/2014	3.5	na	4/2/2014	1.2	na	4/21/2014	8.3	<2	4/21/2014	1	<2
4/21/2014	4.1	<2	4/21/2014	1.5	<2	7/28/2014	6.8	<2	7/28/2014	<1	<2
7/28/2014	3	<2	7/28/2014	1.4	<2	8/5/2014	5.8	na	10/20/2014	<1	<2
10/20/2014	3.1	<2	10/20/2014	3.1	<2	10/20/2014	8.2	<2	1/26/2015	1.4	<2
1/26/2015	3.5	<2	1/26/2015	4.9	<2	1/26/2015	7.7	<2	4/20/2015	1.6	<2
4/20/2015	3.9	<2	4/20/2015	5	<2	4/20/2015	<1	<2	6/1/2015	1.8	na
6/1/2015	2.9	na	6/1/2015	4.4	na	6/1/2015	7.4	na	7/27/2015	1.4	<2
7/27/2015	3	<2	7/27/2015	3.2	<2	7/27/2015	7.6	<2	10/19/2015	<1	<2
10/19/2015	2.5	<2	10/19/2015	1.4	<2	10/19/2015	7.2	<2	12/29/2015	<1	na
1/25/2016	1.9	<2	1/25/2016	<1	<2	1/25/2016	5.7	<2	1/25/2016	<1	<2
4/18/2016	2.3	<2	4/18/2016	1.3	<2	4/18/2016	8	<2	4/18/2016	<1	<2
7/25/2016	1.5	<2	7/25/2016	<1	<2	7/25/2016	10	<2	7/25/2016	<1	<2
10/17/2016	1.5	na	10/17/2016	<1	na	10/17/2016	7.6	na	10/17/2016	<1	na
1/23/2017	1.8	<2	1/23/2017	<1	<2	1/23/2017	6.6	<2	1/23/2017	<1	<2
4/17/2017	1.4	<2	4/17/2017	<1	<2	4/17/2017	5.7	<2	4/17/2017	<1	<2
7/24/2017	1	<2	7/24/2017	<1	<2	7/24/2017	6.5	<2	7/24/2017	<1	<2
10/16/2017	1.7	<2	10/16/2017	<1	<2	10/16/2017	8.1	<2	10/16/2017	<1	<2
12/12/2017	0.1	na	12/12/2017	<1	na	12/12/2017	4.8	na	12/12/2017	<1	na
1/22/2018	0.1	<2	1/22/2018	<1	<2	1/22/2018	4.7	<2	1/22/2018	<1	<2
4/23/2018	1.4	<2	4/23/2018	<1	<2	4/23/2018	5.4	<2	4/23/2018	<1	<2
7/23/2018	1.6	<2	7/23/2018	<1	<2	7/23/2018	5.9	<2	7/23/2018	<1	<2
10/22/2018	1.2	<2	10/22/2018	<1	<2	10/22/2018	6.5	<2	10/22/2018	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE H-2
MONITORING WELL OCWD-M11
1,4-dioxane and NDMA Concentrations, 2014-2018

M11/1 *Talbert Aquifer Perforations 70-105 ft bgs*			**M11/2** *Talbert, Alpha-III Aquifers Perforations 125-150 ft bgs*			**M11/3** *Beta-I, Beta-II, Beta-III Aquifers Perforations 170-225 ft bgs*			**M11/4** *Lambda, Omicron Aquifers Perforations 260-290 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
1/29/2014	1.6	<2	1/29/2014	0.1	<2	1/29/2014	<1	<2	1/29/2014	<1	<2
4/23/2014	1.9	<2	4/23/2014	1.6	<2	4/23/2014	<1	<2	4/23/2014	<1	<2
7/29/2014	1.5	<2	7/29/2014	1	<2	7/29/2014	<1	<2	7/29/2014	<1	<2
10/22/2014	1.1	<2	10/22/2014	<1	<2	10/22/2014	<1	<2	10/22/2014	<1	<2
1/28/2015	<1	<2	1/28/2015	<1	<2	1/28/2015	<1	<2	1/28/2015	0.1	<2
4/22/2015	na	<2	4/22/2015	na	<2	4/22/2015	na	<2	4/22/2015	2.2	<2
6/24/2015	<1	na	6/24/2015	<1	na	6/24/2015	<1	na	6/24/2015	2.9	na
7/28/2015	<1	<2	7/28/2015	<1	<2	7/28/2015	<1	<2	7/28/2015	2.9	<2
10/21/2015	<1	<2	10/21/2015	<1	<2	10/21/2015	<1	<2	10/21/2015	2.8	<2
1/27/2016	<1	<2	1/27/2016	<1	<2	1/27/2016	<1	<2	1/27/2016	3.1	<2
4/20/2016	<1	<2	4/20/2016	<1	<2	4/20/2016	<1	<2	4/20/2016	3.6	<2
7/26/2016	<1	<2	7/26/2016	<1	<2	7/26/2016	<1	<2	7/26/2016	3.1	<2
10/19/2016	<1	na	10/19/2016	<1	na	10/19/2016	<1	na	10/19/2016	2.5	na
1/25/2017	<1	<2	1/25/2017	<1	<2	1/25/2017	<1	<2	1/25/2017	2.5	<2
4/19/2017	<1	<2	4/19/2017	<1	<2	4/19/2017	<1	<2	4/19/2017	2.6	<2
7/26/2017	<1	<2	7/26/2017	<1	<2	7/26/2017	<1	<2	7/26/2017	1.5	<2
10/18/2017	<1	<2	10/18/2017	<1	<2	10/18/2017	<1	<2	10/18/2017	1.6	<2
2/7/2018	<1	<2	2/7/2018	<1	<2	2/7/2018	<1	<2	2/7/2018	1.9	<2
4/25/2018	<1	<2	4/25/2018	<1	<2	4/25/2018	<1	<2	4/25/2018	1.3	<2
7/25/2018	<1	<2	7/25/2018	<1	<2	7/25/2018	<1	<2	7/25/2018	<1	<2
10/24/2018	<1	<2	10/24/2018	<1	<2	10/24/2018	<1	<2	10/24/2018	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE H-3
MONITORING WELL OCWD-M19
1,4-dioxane and NDMA Concentrations, 2014 - 2018

M19/1 *Talbert Aquifer* *Perforations: 60-110 ft bgs*			**M19/2** *Alpha Aquifer* *Perforations: 130-195 ft bgs*			**M19/3** *Beta Aquifer* *Perforations: 215-265 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
04/08/14	<1	<2	04/08/14	<1	<2	01/14/14	<1	<2
10/07/14	<1	<2	10/07/14	<1	<2	04/08/14	1.9	<2
04/08/15	<1	<2	04/08/15	<1	<2	08/11/14	<1	<2
10/07/15	<1	na	10/07/15	<1	na	10/07/14	<1	<2
04/06/16	<1	na	04/06/16	<1	na	01/13/15	1.5	<2
10/05/16	<1	na	10/05/16	<1	na	04/08/15	<1	<2
02/23/17	<1	na	02/23/17	<1	na	07/29/15	<1	<2
10/04/17	<1	na	10/04/17	<1	na	10/07/15	<1	<2
04/11/18	<1	na	04/11/18	<1	na	01/12/16	<1	<2
10/10/18	<1	na	10/10/18	<1	na	04/06/16	<1	<2
						07/12/16	<1	2.7
						10/05/16	<1	<2
						02/23/17	<1	<2
						04/05/17	<1	<2
						07/12/17	<1	<2
						10/04/17	<1	<2
						02/08/18	<1	<2
						04/11/18	<1	<2
						07/11/18	<1	<2
						10/10/18	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE H-4
MONITORING WELL OCWD-M45
1,4-dioxane and NDMA Concentrations, 2014 - 2018

M45/1 *Alpha-III, Beta-I,II Perforations 195-205 ft bgs*			**M45/2** *Beta-III Aquifer Perforations 250-260 ft bgs*			**M45/3** *Omicron Aquifer Perforations 335-345 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/13/14	<1	<2	01/13/14	<1	<2	01/13/14	11.4	<2
04/07/14	<1	<2	04/07/14	<1	<2	04/07/14	13.2	<2
07/01/14	<1	<2	07/01/14	<1	<2	07/01/14	19.9	<2
10/06/14	<1	<2	10/06/14	1.1	<2	10/06/14	15.3	<2
01/12/15	<1	<2	01/12/15	1.1	<2	01/12/15	13.5	<2
04/06/15	<1	<2	04/06/15	<1	<2	04/06/15	15.2	<2
07/01/15	<1	<2	07/01/15	<1	<2	07/01/15	14.5	<2
10/05/15	<1	<2	10/05/15	<1	<2	10/05/15	12.6	<2
01/11/16	<1	<2	01/11/16	<1	<2	01/11/16	10.9	<2
04/05/16	<1	<2	04/05/16	<1	<2	04/05/16	14.9	<2
07/11/16	<1	<2	07/11/16	<1	<2	04/13/16	9.8	na
10/04/16	<1	<2	10/04/16	<1	<2	07/11/16	14.5	<2
1/10/17	<1	<2	01/10/17	<1	<2	10/04/16	11.5	<2
4/4/17	<1	<2	04/04/17	<1	<2	01/10/17	10.3	<2
7/11/17	<1	<2	07/11/17	<1	<2	04/04/17	9.1	<2
10/3/17	<1	<2	10/03/17	<1	<2	07/11/17	7.7	<2
1/10/18	<1	<2	01/10/18	<1	<2	10/03/17	5.5	<2
4/10/18	<1	<2	04/10/18	<1	<2	01/10/18	6.7	<2
7/10/18	<1	<2	07/10/18	<1	<2	04/10/18	4.9	<2
10/9/18	<1	<2	10/09/18	<1	<2	07/10/18	3.7	<2
						10/09/18	5.1	<2

M45/4 *Upper Rho Aquifer Perforations 380-390 ft bgs*			**M45/5** *Main Aquifer Perforations 780-790 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/13/14	3	<2	01/13/14	<1	<2
04/07/14	3.5	<2	04/07/14	<1	<2
07/01/14	7.7	<2	04/08/14	<1	<2
07/07/14	7	na	07/07/14	na	na
01/12/15	4.1	<2	01/12/15	<1	<2
04/06/15	5.2	<2	04/06/15	<1	<2
07/01/15	1.5	<2	07/01/15	<1	<2
10/05/15	4.4	<2	10/05/15	<1	<2
10/19/15	2.8	<2	01/11/16	<1	<2
01/12/16	1.7	<2	04/05/16	<1	<2
04/05/16	<1	<2	07/11/16	<1	<2
04/13/16	1.6	na	10/04/16	<1	<2
07/11/16	3	<2	01/10/17	<1	<2
10/04/16	3	<2	04/04/17	<1	<2
01/10/17	<1	<2	07/11/17	<1	<2
04/04/17	<1	<2	10/03/17	<1	<2
07/11/17	1.3	<2	01/10/18	<1	<2
07/19/17	1.1	na	04/10/18	<1	<2
10/03/17	<1	<2	07/10/18	<1	<2
01/10/18	2.4	<2	10/09/18	<1	<2
04/10/18	1.8	<2			
07/10/18	1.6	<2			
10/09/18	1.2	<2			

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE H-5
MONITORING WELL OCWD-M46
1,4-dioxane and NDMA Concentrations, 2014 - 2018

M46A/1 *Lambda/Omicron Aquifers Perforations 350-370 ft bgs*			**M46/2** *Upper Rho Aquifer Perforations 420-430 ft bgs*			**M46/3** *Lower Rho Aquifer Perforations 515-535 ft bgs*			**M46/4** *Main Aquifer Perforations 640-660 ft bgs*			**M46/5** *Main Aquifer Perforations 890-910 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/27/14	<1	2.7	01/27/14	1.2	<2	01/27/14	<1	<2	01/27/14	<1	<2	01/27/14	1.7	<2
05/05/14	<1	2.6	02/12/14	<1	na	05/05/14	<1	<2	05/05/14	<1	<2	05/05/14	1.7	<2
07/15/14	<1	<2	03/03/14	<1	na	07/15/14	<1	<2	07/15/14	<1	<2	07/15/14	<1	<2
11/03/14	<1	<2	05/05/14	<1	<2	11/03/14	<1	<2	11/03/14	<1	<2	11/03/14	<1	<2
02/09/15	<1	3.8	07/10/14	<1	na	02/09/15	<1	<2	02/09/15	<1	<2	02/09/15	1.2	<2
05/04/15	<1	2.4	08/11/14	<1	<2	05/04/15	<1	<2	05/04/15	<1	<2	05/04/15	<1	<2
07/13/15	<1	2.6	11/03/14	<1	<2	07/13/15	<1	<2	07/13/15	<1	<2	07/13/15	1.1	<2
11/02/15	<1	2.1	02/09/15	<1	<2	11/02/15	<1	<2	11/02/15	<1	<2	11/02/15	<1	<2
01/27/16	<1	2.5	05/04/15	<1	<2	01/27/16	<1	<2	01/27/16	<1	<2	01/27/16	1.1	<2
05/03/16	<1	3.4	07/13/15	<1	<2	05/03/16	<1	<2	05/03/16	<1	<2	05/03/16	<1	<2
08/09/16	<1	<2	11/02/15	<1	<2	08/09/16	<1	<2	08/09/16	<1	<2	08/09/16	1.1	<2
11/01/16	<1	2.3	01/27/16	<1	<2	11/01/16	<1	<2	11/01/16	<1	<2	11/01/16	<1	<2
02/07/17	<1	3.3	05/03/16	<1	<2	02/07/17	<1	<2	02/07/17	<1	<2	02/07/17	1.3	<2
05/02/17	<1	<2	08/09/16	<1	<2	05/02/17	<1	<2	05/02/17	<1	<2	05/02/17	<1	<2
08/08/17	<1	2.7	11/01/16	<1	<2	08/08/17	<1	<2	08/08/17	<1	<2	08/08/17	1.2	<2
10/31/17	<1	2.2	02/07/17	<1	<2	10/31/17	<1	<2	10/31/17	<1	<2	10/31/17	1.4	<2
01/23/18	<1	2.2	05/02/17	<1	<2	01/23/18	<1	<2	01/23/18	<1	<2	01/23/18	<1	<2
05/07/18	<1	3.1	08/08/17	<1	<2	05/07/18	<1	<2	05/07/18	<1	<2	05/07/18	<1	<2
08/07/18	<1	2.5	10/31/17	<1	<2	08/07/18	<1	<2	08/07/18	<1	<2	08/07/18	1.1	<2
10/08/18	<1	2.8	01/23/18	<1	<2	10/08/18	<1	<2	10/08/18	<1	<2	10/08/18	1	<2
			05/07/18	<1	<2									
			08/07/18	<1	<2									
			10/08/18	<1	<2									

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE H-6
MONITORING WELL OCWD-M47
1,4-dioxane and NDMA Concentrations
2014 - 2018

M47/1 *Beta-III Aquifer Perforations 355-375 bgs*			**M47/2** *Upper Rho Aquifer Perforations 470-480 ft bgs*			**M47/3** *Lower Rho Aquifer Perforations 580-600 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/28/14	1.5	<2	01/28/14	2	<2	01/28/14	<1	<2
04/22/14	1.1	<2	04/22/14	1.7	<2	04/22/14	<1	<2
07/02/14	2.4	<2	07/02/14	1.2	<2	07/02/14	<1	<2
10/21/14	<1	<2	10/21/14	<1	<2	10/21/14	<1	<2
01/27/15	1.1	<2	01/27/15	<1	<2	01/27/15	<1	<2
04/21/15	<1	<2	04/21/15	<1	<2	04/21/15	<1	<2
07/01/15	1.1	<2	07/01/15	<1	<2	07/01/15	<1	<2
10/20/15	<1	<2	10/20/15	<1	<2	10/20/15	<1	<2
02/09/16	1.1	<2	02/09/16	<1	<2	02/09/16	<1	<2
04/19/16	<1	<2	04/19/16	<1	<2	04/19/16	<1	<2
07/27/16	<1	<2	07/27/16	<1	<2	07/27/16	<1	<2
10/18/16	<1	na	10/18/16	<1	na	10/18/16	<1	na
01/24/17	<1	<2	01/24/17	<1	<2	01/24/17	<1	<2
04/18/17	<1	<2	04/18/17	<1	<2	04/18/17	<1	<2
07/25/17	<1	<2	07/25/17	<1	<2	07/25/17	<1	<2
10/17/17	<1	<2	10/17/17	<1	<2	10/17/17	<1	<2
01/24/18	<1	<2	01/24/18	<1	<2	01/24/18	<1	<2
04/24/18	<1	<2	04/24/18	<1	<2	04/24/18	<1	<2
07/24/18	<1	<2	07/24/18	<1	<2	07/24/18	<1	<2
10/23/18	<1	<2	10/23/18	<1	<2	10/23/18	<1	<2

M47/4 *Main Aquifer Perforations 745-765 ft bgs*			**M47/5** *Main Aquifer Perforations 940-960 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/28/14	<1	<2	01/28/14	<1	<2
04/22/14	<1	<2	04/22/14	<1	<2
07/02/14	<1	<2	07/02/14	<1	<2
10/21/14	<1	<2	10/21/14	<1	<2
01/27/15	<1	<2	01/27/15	<1	<2
04/21/15	<1	<2	04/21/15	<1	<2
07/01/15	<1	<2	07/01/15	<1	<2
10/20/15	<1	<2	10/20/15	<1	<2
02/09/16	<1	<2	02/09/16	<1	<2
04/19/16	<1	<2	04/19/16	<1	<2
07/27/16	<1	<2	07/27/16	<1	<2
10/18/16	<1	na	10/18/16	<1	na
01/24/17	<1	<2	01/24/17	<1	<2
04/18/17	<1	<2	04/18/17	<1	<2
07/25/17	<1	<2	07/25/17	<1	<2
10/17/17	<1	<2	10/17/17	<1	<2
01/24/18	<1	<2	01/24/18	<1	<2
04/24/18	<1	<2	04/24/18	<1	<2
07/24/18	<1	<2	07/24/18	<1	<2
10/23/18	<1	<2	10/23/18	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE H-7
MONITORING WELL OCWD-M10
General Water Quality Data
2014 - 2018

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M10/1 Talbert, Alpha-I,II Perforations 80-160 ft bgs	04/21/14	0.069	25.7	238	110	<0.2	<0.002	3	0.21
	07/28/14	0.051	19.3	196	78.6	<0.2	<0.002	3.1	0.18
	10/20/14	0.067	22.9	208	83	<0.2	<0.002	3.5	0.22
	01/26/15	na	24.0	216	84.8	<0.2	<0.007	2.8	0.26
	04/20/15	0.070	29.9	231	96.6	0.3	<0.007	3.2	0.2
	07/27/15	0.053	21.1	208	80.8	<0.2	<0.007	4.6	0.2
	10/19/15	0.042	19.8	174	71	<0.2	0.007	6	0.16
	01/25/16	0.049	20.8	184	76.2	<0.2	0.002	1.23	0.22
	04/18/16	0.047	18.2	184	73.6	<0.2	<0.002	1.4	0.15
	07/25/16	0.033	14.2	164	59.5	<0.2	<0.002	1.63	0.14
	10/17/16	0.031	13.5	172	57.9	<0.2	0.002	1.4	0.13
	01/23/17	0.031	13.7	130	60	<0.2	0.003	1.48	0.13
	04/17/17	0.049	18	218	89.2	<0.2	0.004	1.24	0.17
	07/24/17	0.029	12.2	186	56.7	<0.2	0.003	1.5	0.13
	01/22/18	0.168	45.0	350	209	<0.2	<0.002	1.14	0.21
	04/23/18	0.208	51.5	424	255	na	na	1.14	0.24
	07/23/18	0.103	29.9	276	149	na	na	1.14	0.18
	10/22/18	0.048	16.4	184	85.4	<0.2	<0.002	1.38	0.17
M10/2 Alpha III Perforations 175-195 ft bgs	04/21/14	0.061	20.2	186	82.4	<0.2	<0.002	4.7	0.17
	07/28/14	0.046	16.4	152	61.8	<0.2	<0.002	4.3	0.21
	10/20/14	0.060	20.1	160	63.6	<0.2	<0.002	5.5	0.2
	01/26/15	na	27.9	200	83.8	<0.2	<0.007	4.2	0.22
	04/20/15	0.089	30.0	207	90.6	<0.2	<0.007	4.6	0.18
	07/27/15	0.060	20.7	186	75.2	<0.2	<0.007	7.3	0.17
	10/19/15	0.035	15.9	134	53.9	<0.2	<0.007	9.6	0.12
	01/25/16	0.029	14	110	40.9	<0.2	0.003	2.61	0.14
	04/18/16	0.033	14	124	40.2	<0.2	<0.002	2.51	0.1
	07/25/16	0.026	11.8	118	37.6	<0.2	<0.002	2.64	0.09
	10/17/16	0.022	9.4	104	31.7	<0.2	<0.002	2.32	0.09
	01/23/17	0.022	9.6	64	29.6	<0.2	<0.002	2.19	0.09
	04/17/17	0.023	10.1	102	30.7	<0.2	0.003	2.23	0.09
	07/24/17	0.027	11	98	38.2	<0.2	0.002	2.23	0.09
	10/16/17	0.027	11.4	104	46.0	<0.2	0.004	2.11	0.09
	01/22/18	0.029	11.4	130	48.8	<0.2	0.004	2.05	0.10
	04/23/18	0.222	53.2	387	227	na	na	1.45	0.28
	07/23/18	0.316	75.1	578	356	na	na	1.26	0.35
	10/22/18	0.124	32.0	270	164	0.3	<0.002	1.42	0.19
M10/3 Beta Perforations 215-240 ft bgs	04/21/14	0.118	45.7	314	155	<0.2	<0.002	0.5	0.35
	07/28/14	0.096	41.8	294	122	<0.2	0.03	<0.1	0.4
	10/20/14	0.115	41.4	296	122	<0.2	0.016	0.7	0.37
	01/26/15	na	43.7	302	127	<0.2	0.013	<0.4	0.56
	04/20/15	0.104	45.6	314	127	0.3	0.016	0.7	0.34
	07/27/15	0.106	44.2	300	124	<0.2	0.016	0.7	0.39
	10/19/15	0.097	43.3	318	116	<0.2	0.03	0.8	0.31
	01/25/16	0.095	42.5	284	116	<0.2	0.017	0.19	0.35
	04/18/16	0.110	45.7	304	123	<0.2	0.008	0.15	0.32
	07/25/16	0.101	41.3	270	109	<0.2	0.013	0.3	0.3
	10/17/16	0.105	42.3	298	115	<0.2	0.013	0.17	0.29
	01/23/17	0.101	42.3	268	113	<0.2	0.013	0.15	0.28
	04/17/17	0.106	42.3	300	124	<0.2	0.015	0.15	0.31
	07/24/17	0.105	40.6	262	106	<0.2	0.014	0.26	0.33
	10/16/17	0.109	43.1	298	123	<0.2	0.01	0.11	0.32
	01/22/18	0.176	55.7	390	198	<0.2	0.010	0.12	0.29
	04/23/18	0.191	57.6	378	205	na	na	0.22	0.32
	07/23/18	0.142	47.8	322	149	na	na	0.13	0.29
	10/22/18	0.106	39.1	274	113	<0.2	0.013	0.17	0.27

TABLE H-7
MONITORING WELL OCWD-M10
General Water Quality Data
2014 - 2018

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M10/4 Lambda, Omicron Perforations 280-305 ft bgs	04/21/14	0.018	9.8	98	24.5	<0.2	<0.002	<0.1	0.25
	07/28/14	0.020	9.3	94	25.3	<0.2	<0.002	<0.1	0.3
	10/20/14	0.024	11.9	102	28	<0.2	<0.002	<0.1	0.27
	01/26/15	na	12.9	120	32.6	0.3	<0.007	<0.4	0.3
	04/20/15	0.033	17.7	118	39.6	0.5	<0.007	0.6	0.25
	07/27/15	0.032	14.1	110	37	<0.2	<0.007	0.5	0.3
	10/19/15	0.019	11.7	112	32.7	<0.2	<0.007	<0.4	0.23
	01/25/16	0.020	11.9	86	30.5	<0.2	<0.002	<0.1	0.27
	04/18/16	0.026	11.8	98	30.8	<0.2	<0.002	0.1	0.22
	07/25/16	0.021	11.7	92	30	<0.2	<0.002	<0.1	0.2
	10/17/16	0.020	10.2	80	30.2	0.2	<0.002	<0.1	0.24
	01/23/17	0.018	9.4	102	30.9	0.2	<0.002	<0.1	0.2
	04/17/17	0.018	9.5	92	31	0.4	<0.002	<0.1	0.2
	07/24/17	0.018	9.2	76	29.7	<0.2	<0.002	<0.1	0.26
	10/16/17	0.017	9.1	112	31.6	0.2	<0.002	<0.1	0.23
	01/22/18	0.018	9.4	92	31.7	0.2	<0.002	<0.1	0.17
	04/23/18	0.024	9.1	95	31.4	na	na	<0.1	0.17
	07/23/18	0.017	8.9	88	30.3	na	na	<0.1	0.19
	10/22/18	0.016	8.4	78	30.2	<0.2	<0.002	<0.1	0.18

Note: Monitoring Well OCWD-M10 is located approximately 1300 feet north of the nearest injection well site (I-19).

TABLE H-8
MONITORING WELL OCWD-M11
General Water Quality Data
2014 - 2018

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
	01/29/14	0.192	53.2	416	262	<0.2	<0.002	3.7	0.56
	04/23/14	0.163	44.8	368	249	<0.2	<0.002	4.4	0.32
	07/29/14	0.146	41.9	356	233	<0.2	0.013	3.4	0.28
	10/22/14	0.054	15.4	195	112	<0.2	0.013	4.6	0.19
	01/28/15	na	13.2	184	98.9	<0.2	<0.007	6.1	0.17
	04/22/15	0.030	12.9	162	93.7	<0.2	<0.007	6.8	0.17
	07/28/15	0.030	11.9	158	88.6	<0.2	<0.007	7	0.15
M11/1	10/21/15	0.025	11.8	170	82.9	<0.2	<0.007	7.3	0.13
Talbert	01/27/16	0.023	11.4	172	80.9	<0.2	<0.002	1.6	0.2
Perforations	04/20/16	0.029	12.5	146	80.4	<0.2	<0.002	1.7	0.15
60-110 ft bgs	07/26/16	0.025	11.6	136	74.6	<0.2	<0.002	1.6	0.13
	10/19/16	0.023	9.9	160	69	<0.2	<0.002	1.3	0.11
	01/25/17	0.020	134	134	69	<0.2	<0.002	1.3	0.1
	04/19/17	0.021	130	130	73	<0.2	<0.002	1.3	0.12
	07/26/17	0.022	154	154	67	<0.2	<0.002	1.3	0.11
	10/18/17	0.021	156	156	89	<0.2	<0.002	1.1	0.17
	02/07/18	0.024	10.9	186	101	<0.2	<0.002	1.14	0.17
	04/25/18	0.030	11.8	172	103	na	na	1.04	0.20
	07/25/18	0.031	11.8	166	99	na	na	1.04	0.11
	10/24/18	0.082	23.8	166	130	<0.2	0.002	1.19	0.14
	01/29/14	0.137	36.7	302	178	<0.2	<0.002	7.4	0.27
	04/23/14	0.260	62.8	510	325	<0.2	<0.002	7	0.37
	07/29/14	0.141	37.4	330	197	<0.2	0.01	8.7	0.19
	10/22/14	0.066	17.3	181	99.1	<0.2	0.023	8.2	0.19
	01/28/15	na	15.3	164	79.2	<0.2	0.01	10.4	0.19
	04/22/15	0.046	17.1	166	90.4	<0.2	0.01	10	0.14
M11/2	07/28/15	0.026	11.7	122	61.4	<0.2	<0.007	11.4	0.11
Talbert, Alpha-III	10/21/15	0.017	10.9	122	49.9	<0.2	<0.007	11.6	0.06
Perforations	01/27/16	0.036	13.6	128	60.1	<0.2	0.003	2.64	0.1
125-155 ft bgs	04/20/16	0.026	11.9	130	62.9	<0.2	<0.002	2.3	0.09
	07/26/16	0.020	8.8	106	49.6	<0.2	<0.002	2.11	0.07
	10/19/16	0.018	8	112	43.5	<0.2	<0.002	1.83	0.07
	01/25/17	0.019	9	112	52.1	<0.2	<0.002	1.92	0.08
	04/19/17	0.048	17.2	158	82.5	<0.2	0.003	1.94	0.11
	07/26/17	0.026	10.2	142	53.7	<0.2	<0.002	1.82	0.08
	10/18/17	0.124	34.3	284	172	<0.2	<0.002	1.76	0.17
	02/07/18	0.236	64.3	526	333	<0.2	<0.002	2.05	0.34
	04/25/18	0.247	64.4	484	336	na	na	1.99	0.3
	07/25/18	0.233	63.2	488	310	na	na	1.93	0.23
	10/24/18	0.187	45.3	338	239	<0.2	<0.002	1.72	0.19
	01/29/14	0.015	7.8	84	18.5	0.2	<0.002	11.8	0.16
	04/23/14	0.014	8.1	84	22.1	<0.2	<0.002	10.8	0.12
	07/29/14	0.016	7.0	88	23.8	<0.2	<0.002	10.6	0.1
	10/22/14	0.018	7.8	89	26.1	0.2	<0.002	8.4	0.18
	01/28/15	na	8.6	94	31.3	0.2	<0.007	11.1	0.1
	04/22/15	0.017	9.8	82	30.1	0.4	<0.007	11.6	0.11
	07/28/15	0.020	9.1	86	28.7	<0.2	<0.007	12.3	0.1
M11/3	10/21/15	0.013	9.5	88	27.8	<0.2	<0.007	13.2	0.07
Beta-I, -II, -III	01/27/16	0.022	10.3	94	28	<0.2	<0.002	2.97	0.16
Perforations	04/20/16	0.018	10.6	89	29.6	<0.2	<0.002	3.07	0.09
170-225 ft bgs	07/26/16	0.019	10.1	82	30.7	0.5	<0.002	2.94	0.1
	10/19/16	0.015	7.9	86	28.6	<0.2	0.002	2.63	0.07
	01/25/17	0.016	8.5	90	29.2	<0.2	<0.002	2.65	0.07
	04/19/17	0.017	8.6	84	29.5	<0.2	<0.002	2.62	0.08
	07/26/17	0.018	8.2	112	28.4	<0.2	<0.002	2.52	0.08
	10/18/17	0.016	8.3	108	30.5	<0.2	<0.002	2.57	0.09
	02/07/18	0.017	8.1	96	8.1	<0.2	<0.002	2.54	0.12
	04/25/18	0.022	8.4	98	31.7	na	na	2.38	0.19
	07/25/18	0.021	8.2	102	30	na	na	2.27	0.06
	10/24/18	0.025	8.9	106	29.8	<0.2	<0.002	2.30	0.11

TABLE H-8
MONITORING WELL OCWD-M11
General Water Quality Data
2014 - 2018

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M11/4 Lambda, Omicron Perforations 260-290 ft bgs	01/29/14	0.014	6.9	83	31.1	<0.2	<0.002	7.4	0.19
	04/23/14	0.012	7.3	87	33.9	<0.2	<0.002	8	0.14
	07/29/14	0.014	6.8	78	34	<0.2	<0.002	7.7	0.09
	10/22/14	0.014	7.9	80.5	36	<0.2	0.007	8	0.17
	01/28/15	na	11.6	96	44.4	<0.2	<0.007	7.4	0.11
	04/22/15	0.073	23.4	131	71	<0.2	0.007	7.3	0.16
	07/28/15	0.114	32.7	176	103	<0.2	<0.007	7	0.17
	10/21/15	0.107	33.6	210	105	<0.2	<0.007	6.9	0.18
	01/27/16	0.110	33.6	166	101	<0.2	0.002	1.59	0.24
	04/20/16	0.093	31.3	189	97	<0.2	<0.002	1.73	0.15
	07/26/16	0.086	27.8	172	90.4	0.4	<0.002	1.64	0.18
	10/19/16	0.069	22.9	170	71	<0.2	<0.002	1.5	0.13
	01/25/17	0.063	21.2	188	65.9	<0.2	0.002	1.51	0.15
	04/19/17	0.050	17.6	142	55.4	<0.2	<0.002	1.51	0.14
	07/26/17	0.053	17.6	178	51.4	<0.2	<0.002	1.5	0.12
	10/18/17	0.052	18.5	144	54.6	<0.2	<0.002	1.51	0.12
	02/07/18	0.059	20.5	170	61.4	<0.2	<0.002	1.50	0.18
	04/25/18	0.044	15.2	134	49.1	na	na	1.51	0.23
	07/25/18	0.030	11.3	132	41.9	na	na	1.45	0.08
	10/24/18	0.034	10.9	104	40	<0.2	0.002	1.47	0.09

Note: OCWD-M11 is located approximately 950 feet north of the nearest injection well site (I-14).

TABLE H-9
MONITORING WELL OCWD-M19
General Water Quality Data
2014 - 2018

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M19/1 Talbert Perforations 60-110 ft bgs	04/08/14	0.33	81.7	580	378	<0.2	<0.002	4.01	0.28
	10/07/14	0.29	76.7	576	371	<0.2	0.003	2.99	na
	04/08/15	0.27	82.1	580	378	<0.2	<0.002	4.2	na
	10/07/15	0.27	78	656	383	<0.2	<0.002	2.82	na
	04/06/16	0.27	78.4	566	378	na	<0.002	2.47	na
	10/05/16	0.22	80.4	588	376	<0.2	<0.002	2.67	na
	02/23/17	0.37	79.9	588	404	<0.2	<0.002	2.52	na
	10/04/17	0.18	78.5	548	393	<0.2	<0.002	2.48	na
	04/11/18	0.3	77.8	512	389	<0.2	<0.002	3.01	na
	10/10/18	0.25	81.2	566	392	<0.2	<0.002	3.65	na
M19/2 Alpha Perforations Perforations 130-195 ft bgs	04/08/14	0.28	86	634	390	<0.2	0.004	4.48	0.23
	10/07/14	0.18	51.8	390	247	<0.2	<0.002	3.06	na
	04/08/15	0.14	17.9	168	82.3	<0.2	<0.002	2.35	na
	10/07/15	<0.1	19	174	84.3	<0.2	<0.002	2.35	na
	04/06/16	<0.1	18.3	161	82.6	na	<0.002	2.21	na
	10/05/16	<0.1	17.2	146	82	<0.2	<0.002	1.81	na
	02/23/17	<0.1	25	198	117	<0.2	<0.002	1.85	na
	10/04/17	<0.1	31.1	230	145	<0.2	<0.002	1.62	na
	04/11/18	<0.1	29.6	202	136	<0.2	<0.002	1.58	na
	10/10/18	0.13	36.5	258	184	<0.2	<0.002	1.77	na
M19/3 Beta Perforations 215-265 ft bgs	01/14/14	0.015	7.3	77	30.3	<0.2	<0.002	7.3	0.22
	04/08/14	0.083	31.5	234	116	<0.2	<0.002	7.0	0.24
	08/11/14	0.029	13.5	118	45.4	<0.2	<0.002	8.3	0.2
	10/07/14	0.025	12.9	104	37.7	<0.2	<0.002	8.9	0.19
	01/13/15	na	25.7	206	96.2	<0.2	<0.007	8.4	0.25
	04/08/15	0.037	18.1	132	52.3	<0.2	<0.007	9.8	0.21
	07/29/15	0.032	12.9	102	35	<0.2	<0.007	10.1	0.15
	10/07/15	0.026	13.4	106	42.2	<0.2	<0.007	10.2	0.13
	01/12/16	0.021	9.1	84	28.8	<0.2	<0.002	2.1	0.19
	04/06/16	0.001	6.8	69	27.1	<0.2	<0.002	1.62	0.11
	07/12/16	0.016	8.0	62	33.2	<0.2	<0.002	1.73	0.09
	10/05/16	0.019	9.7	94	44.7	<0.2	<0.002	1.86	0.09
	02/23/17	0.012	5.8	60	30.6	<0.2	<0.002	1.48	0.08
	04/05/17	0.010	5	58	28.2	<0.2	<0.002	1.31	0.08
	07/12/17	0.014	6.1	80	31.7	<0.2	<0.002	1.42	0.08
	10/04/17	0.016	6	62	32.8	<0.2	<0.002	1.41	0.08
	02/08/18	0.011	4.8	64	31.3	<0.3	0.004	1.17	0.09
	04/11/18	<0.01	4.6	60	32.8	na	na	1.09	0.15
	07/11/18	<0.01	7.1	76	37.1	na	na	1.64	0.08
	10/10/18	0.018	7.4	79	42.9	<0.2	<0.002	1.43	0.06

Note: OCWD-M19 is located approximately 500 feet north of the nearest injection well site (I-5).
na = not analyzed

TABLE H-10
MONITORING WELL OCWD-M45
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M45/1 Alpha-III, Beta-I,II Perforations 195-205 ft bgs	01/13/14	0.401	90.2	704	466	<0.2	0.3	11.2	0.51
	04/07/14	0.404	91.6	728	473	<0.2	0.3	9.7	0.58
	07/01/14	0.400	89.6	720	462	<0.2	0.194	12.5	0.5
	10/06/14	0.388	90.3	724	461	<0.2	0.227	9.2	0.46
	01/12/15	na	92.3	744	470	<0.2	0.194	9.4	0.54
	04/06/15	0.401	94.1	718	468	<0.2	0.315	9.3	0.46
	07/01/15	0.388	92.2	764	442	<0.2	0.122	9.3	0.51
	10/05/15	0.392	93.3	784	470	<0.2	0.345	8.5	0.43
	01/11/16	0.389	93.5	690	453	<0.2	0.107	1.72	0.49
	04/05/16	0.402	94.0	698	454	<0.2	0.043	1.8	0.43
	07/11/16	0.384	92.3	678	433	<0.2	0.103	1.64	0.4
	10/04/16	0.362	85.7	644	437	<0.2	0.075	1.55	0.35
	01/10/17	0.379	87.7	514	462	<0.2	0.103	1.45	0.39
	04/04/17	0.377	90.5	722	441	<0.2	0.154	1.36	0.46
	07/11/17	0.367	90.1	652	419	<0.2	0.06	1.78	0.43
	10/03/17	0.369	86.0	668	467	<0.2	0.063	1.72	0.52
	01/23/18	0.387	91.0	732	466	<0.2	0.047	1.95	0.37
	05/07/18	0.395	90.2	720	459	na	na	1.83	0.37
	08/07/18	0.407	91.1	710	454	na	na	1.98	0.37
	10/08/18	0.405	90.3	708	417	<0.2	0.085	1.98	0.37
M45/2 Beta-III Perforations 250-260 ft bgs	01/13/14	0.046	15.3	128	59.4	<0.2	0.2	8.4	0.2
	04/07/14	0.043	15.4	146	57.7	<0.2	0.2	9.8	0.16
	07/01/14	0.044	14.5	148	63.4	<0.2	0.187	7.3	0.14
	10/06/14	0.052	17.3	154	68.5	<0.2	0.158	7.4	0.16
	01/12/15	na	19.3	160	73.8	<0.2	0.191	7.8	0.2
	04/06/15	0.046	16.6	149	65.2	<0.2	0.227	9	0.19
	07/01/15	0.040	15.6	136	57.1	<0.2	0.154	11	0.15
	10/05/15	0.039	15.4	140	53.9	<0.2	0.187	11.4	0.15
	01/11/16	0.044	16.5	120	53.9	<0.2	0.084	2.39	0.16
	04/05/16	0.036	15.8	126	54.2	<0.2	0.06	2.71	0.11
	07/11/16	0.036	13.8	124	48	<0.2	0.047	2.62	0.12
	10/04/16	0.032	12.5	122	47	<0.2	0.043	2.48	0.11
	01/10/17	0.033	13.0	116	46.8	<0.2	0.046	2.31	0.11
	04/04/17	0.029	12.3	110	46.4	<0.2	0.048	2.47	0.1
	07/11/17	0.034	12.6	134	44.4	<0.2	0.036	2.39	0.4
	10/03/17	0.030	12.3	114	46.8	<0.2	0.062	2.14	0.18
	01/10/18	0.041	14.8	130	60.2	<0.2	0.062	2.18	0.09
	04/10/18	0.038	14.4	126	60.4	na	na	2.19	0.12
	07/10/18	0.030	13.3	132	56.1	na	na	2.05	0.09
	10/09/18	0.040	13.3	132	58.7	<0.2	0.029	1.82	0.09
M45/3 Omicron Perforations 335-345 ft bgs	01/13/14	0.141	50.2	314	111	<0.2	<0.002	<0.1	0.45
	04/07/14	0.142	53.5	350	119	<0.2	<0.002	<0.1	0.47
	07/01/14	0.148	53.8	350	121	<0.2	<0.002	<0.1	0.44
	10/06/14	0.170	51.7	336	123	<0.2	<0.002	<0.1	0.4
	01/12/15	na	50.9	332	118	<0.2	<0.007	0.4	0.42
	04/06/15	0.159	54.8	350	125	<0.2	<0.007	0.6	0.45
	07/01/15	0.159	53.8	332	124	<0.2	<0.007	0.5	0.48
	10/05/15	0.129	47.2	340	114	<0.2	<0.007	<0.4	0.38
	01/11/16	0.127	44.3	322	104	<0.2	<0.002	<0.1	0.37
	04/05/16	0.124	45.6	294	112	<0.2	<0.002	<0.1	0.58
	07/11/16	0.133	43.5	302	118	<0.2	<0.002	<0.1	0.35
	10/04/16	0.129	42.4	298	110	<0.2	<0.002	<0.1	0.31
	01/10/17	0.116	39.1	272	105	<0.2	<0.002	<0.1	0.28
	04/04/17	0.122	43.5	292	112	<0.2	<0.002	<0.1	0.33
	07/11/17	0.083	30.9	248	81.6	<0.2	<0.002	<0.1	0.31
	10/03/17	0.066	25.2	232	78.8	<0.2	<0.002	<0.1	0.41
	01/10/18	0.086	31.5	248	91.8	<0.2	<0.002	<0.1	0.25
	04/10/18	0.067	26.5	232	81.1	na	na	<0.1	0.29
	07/10/18	0.044	18.5	204	64	na	na	<0.1	0.24
	10/09/18	0.058	22.0	196	70.6	<0.2	<0.002	<0.1	0.25

TABLE H-10
MONITORING WELL OCWD-M45
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M45/4 Upper Rho Perforations 380-390 ft bgs	01/13/14	0.042	17.0	140	48.6	<0.2	<0.002	<0.1	0.39
	04/07/14	0.043	18.5	176	52.2	<0.2	<0.002	<0.1	0.37
	07/01/14	0.077	30.6	230	76.4	<0.2	<0.002	<0.1	0.42
	10/06/14	0.053	20.8	172	53.1	<0.2	<0.002	<0.1	0.32
	01/12/15	na	18.3	176	47.6	<0.2	<0.007	0.6	0.33
	04/06/15	0.069	33.6	185	57.2	<0.2	<0.007	<0.4	0.34
	07/01/15	0.025	12.7	140	41.6	<0.2	<0.007	0.5	0.31
	10/05/15	0.059	24.5	208	63.9	<0.2	<0.007	<0.4	0.34
	01/12/16	0.036	15.1	148	41.9	<0.2	<0.002	<0.1	0.27
	04/05/16	0.021	12.2	115	41.4	<0.2	<0.002	<0.1	0.24
	07/11/16	0.040	17.5	136	52	<0.2	<0.002	<0.1	0.25
	10/04/16	0.040	16.7	154	53.2	<0.2	<0.002	<0.1	0.23
	01/10/17	0.022	10.7	110	39.7	<0.2	<0.002	<0.1	0.23
	04/04/17	0.022	11.2	116	41.4	<0.2	<0.002	<0.1	0.22
	07/11/17	0.025	14.9	118	42.7	<0.2	<0.002	<0.1	0.21
	10/03/17	0.018	10.1	118	42.1	<0.2	<0.002	<0.1	0.29
	01/10/18	0.035	15.8	154	57.1	0.3	<0.002	<0.1	0.10
	04/10/18	0.032	13.8	134	51.2	na	na	<0.1	0.21
	07/10/18	0.027	13.4	132	47.5	na	na	<0.1	0.22
	10/09/18	0.022	9.9	108	42.9	<0.2	<0.002	<0.1	0.20
M45/5 Main Perforations 780-790 ft bgs	01/13/14	0.115	12.6	264	26	0.6	<0.002	<0.1	5.4
	04/07/14	0.042	12.7	300	27.4	0.7	<0.002	<0.1	4.56
	07/01/14	0.117	12.5	284	27.1	0.8	0.023	<0.1	5.36
	10/06/14	0.128	12.9	294	27.2	0.7	0.026	<0.1	5.78
	01/12/15	na	13.3	302	35.8	0.8	<0.007	<0.4	5.6
	04/06/15	0.129	15.6	288	28.1	0.9	0.023	0.7	5.92
	07/01/15	0.124	13.5	306	27.3	0.4	0.026	<0.4	5.92
	10/05/15	0.119	13.2	316	28.3	0.4	<0.07	<0.4	5.78
	01/11/16	0.127	13.3	298	27.5	0.6	<0.002	<0.1	5.43
	04/05/16	0.125	13.2	270	29.3	0.5	<0.002	<0.1	6.14
	07/11/16	0.141	13.4	284	28.6	0.7	0.006	<0.1	6.08
	10/04/16	0.14	13.1	298	29	0.8	0.007	<0.1	6.22
	01/10/17	0.135	13.3	290	30.9	0.7	<0.002	<0.1	5.98
	04/04/17	0.136	13.9	300	30	0.7	<0.002	<0.1	5.86
	07/11/17	0.148	13.8	316	28.5	0.6	0.007	<0.1	6.26
	10/03/17	0.141	13.5	300	28.9	0.7	0.007	<0.1	5.69
	01/10/18	0.145	13.8	316	30.4	0.8	0.009	0.18	6.63
	04/10/18	0.194	13.5	290	30.9	na	na	<0.1	5.86
	07/10/18	0.149	13.8	298	30.5	na	na	<0.1	6.66
	10/09/18	0.153	13.5	302	29.9	0.6	0.007	<0.1	7.0

Note: OCWD-M45 is located approximately 2900 feet north of the nearest injection well site (I-15).

TABLE H-11
MONITORING WELL OCWD-M46
General Water Quality Data
2014 - 2018

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M46A/1 Lambda/Omicron Perforations 350-370 ft bgs	01/27/14	0.012	7.5	93	44.9	0.2	0	7.6	0.15
	05/05/14	0.012	7.2	92	44.8	<0.2	0	7.2	0.08
	07/15/14	0.001	6.5	86	41.6	<0.2	0.0007	6.5	0.14
	11/03/14	0.001	8.1	93.5	42.4	<0.2	0.0007	7.3	0.12
	02/09/15	na	8.2	56	46.9	<0.2	<0.007	8.3	0.18
	05/04/15	0.013	9.4	91	45.2	<0.2	<0.007	9.4	0.14
	07/13/15	0.015	7.9	102	44.2	<0.2	<0.007	9	0.11
	11/02/15	0.020	9.7	96	46	<0.2	<0.007	9.8	0.09
	01/27/16	0.019	10.3	106	45	<0.2	<0.002	2.29	0.17
	05/03/16	0.020	10.2	94	46.6	<0.2	<0.002	2.23	0.08
	08/09/16	0.017	10.2	96	45.5	<0.2	<0.002	2	0.07
	11/01/16	0.016	7.6	92	42.4	<0.2	<0.002	1.73	0.06
	02/07/17	0.016	7.9	92	44.1	<0.2	0.003	1.74	0.17
	05/02/17	0.015	7.6	87.5	42.9	<0.2	0.003	1.79	0.1
	08/08/17	0.014	8.5	66	41.1	<0.2	<0.002	1.66	0.06
	10/31/17	0.012	6.4	88	42.2	<0.2	<0.002	1.51	0.06
	01/23/18	0.011	5.8	80	42.0	<0.2	<0.002	1.39	0.43
	05/07/18	0.018	6.4	92	39.9	na	na	1.45	0.05
	08/07/18	0.011	5.6	71	39.8	na	na	1.36	0.06
	10/08/18	0.014	5.3	76	38.8	<0.2	<0.002	1.18	0.06
M46/2 Upper Rho Perforations 420-430 ft bgs	01/27/14	0.033	13.8	124	57.2	<0.2	<0.002	7.5	0.2
	05/05/14	0.020	10.0	108	49.9	<0.2	<0.002	7.7	0.12
	08/11/14	0.029	12.2	112	55	<0.2	<0.002	7.3	0.13
	11/03/14	0.025	12.0	115	51.2	<0.2	<0.002	8.3	0.22
	02/09/15	na	12.9	52	62.3	<0.2	<0.007	8.3	0.16
	05/04/15	0.032	14.9	122	61.8	<0.2	<0.007	9.5	0.15
	07/13/15	0.034	14.8	132	61	<0.2	<0.007	9.1	0.12
	11/02/15	0.052	15.5	136	65.3	<0.2	<0.007	9.2	0.1
	01/27/16	0.034	14.2	112	58.1	<0.2	0.002	2.07	0.16
	05/03/16	0.032	13.7	119	59.8	<0.2	<0.002	2.02	0.11
	08/09/16	0.032	13.2	134	60.5	<0.2	<0.002	1.87	0.08
	11/01/16	0.029	12.5	118	57.1	<0.2	<0.002	1.79	0.08
	02/07/17	0.027	11.8	124	55.4	<0.2	0.002	1.73	0.11
	05/02/17	0.024	10.5	118	49.7	<0.2	0.003	1.66	0.08
	08/08/17	0.023	10.4	100	49.4	<0.2	<0.002	1.64	0.08
	10/31/17	0.021	8.8	106	45.7	<0.2	<0.002	1.56	0.12
	01/23/18	0.014	6.0	74	34.6	<0.2	<0.002	1.27	0.12
	05/07/18	0.024	8.7	118	46	na	na	1.44	0.06
	08/07/18	0.017	8.6	82	46.7	na	na	1.61	0.06
	10/08/18	0.020	8.3	94	44.2	<0.2	<0.002	1.5	0.05

TABLE H-11
MONITORING WELL OCWD-M46
General Water Quality Data
2014 - 2018

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M46/3 Lower Rho Perforations 515-535 ft bgs	01/27/14	0.041	17.3	168	53.9	<0.2	<0.002	1.6	0.3
	05/05/14	0.041	17.8	180	54.5	<0.2	<0.002	1.2	0.21
	07/15/14	0.040	16.8	172	51.6	<0.2	<0.002	1.3	0.22
	11/03/14	0.040	17.2	183	50	<0.2	<0.002	1.7	0.48
	02/09/15	na	16.4	164	51.9	<0.2	<0.007	1.3	0.24
	05/04/15	0.035	16.4	178	50.2	<0.2	<0.007	1.2	0.18
	07/13/15	0.034	15.8	184	51.7	<0.2	0.01	1.4	0.20
	11/02/15	0.052	14.3	174	44.7	<0.2	<0.007	1	0.14
	01/27/16	0.03	13.5	106	41.8	<0.2	0.002	0.25	0.16
	05/03/16	0.03	13	136	42.4	<0.2	<0.002	0.23	0.14
	08/09/16	0.029	12.5	154	41.1	<0.2	<0.002	0.22	0.21
	11/01/16	0.027	12.1	168	40.8	<0.2	<0.002	0.2	0.13
	02/07/17	0.025	11.7	146	39.3	<0.2	0.004	0.2	0.23
	05/02/17	0.026	12.1	150	39.1	<0.2	0.003	0.26	0.15
	08/08/17	0.022	11.6	134	37.1	<0.2	<0.002	0.23	0.12
	10/31/17	0.025	11.6	151	38.9	<0.2	<0.002	0.19	0.17
	01/23/18	0.025	11.3	160	37.0	<0.2	<0.002	0.17	0.12
	05/07/18	0.028	11.3	150	35.7	na	na	0.19	0.1
	08/07/18	0.023	11.6	144	34.8	na	na	0.24	0.11
	10/08/18	0.027	11.5	136	32.9	<0.2	<0.002	0.2	0.12
M46/4 Main Perforations 640-660 ft bgs	01/27/14	0.050	16.8	208	16.4	0.4	<0.002	<0.1	1.1
	05/05/14	0.055	18.2	226	18	0.3	<0.002	<0.1	1.12
	07/15/14	0.054	17.2	220	17	<0.2	<0.002	<0.1	0.88
	11/03/14	0.063	18.0	229	16.8	<0.2	<0.002	<0.1	1.12
	02/09/15	na	17.9	214	17.1	<0.2	<0.4	<0.007	1.22
	05/04/15	0.057	18.4	238	18.2	0.5	0.6	<0.007	1.26
	07/13/15	0.055	17.2	234	18.4	<0.2	<0.4	0.007	1.19
	11/02/15	0.059	16	200	17.7	0.2	<0.4	0.007	1.04
	01/27/16	0.054	16.4	214	16.7	<0.2	0.003	<0.1	1.19
	05/03/16	0.057	15.8	188	16.6	<0.2	<0.002	<0.1	1.09
	08/09/16	0.065	15.8	220	16.8	<0.2	<0.002	<0.1	1.05
	11/01/16	0.057	15.6	214	17	<0.2	<0.002	<0.1	1.07
	02/07/17	0.056	15.4	222	17	0.2	0.002	0.11	1.13
	05/02/17	0.06	16.1	214	16.4	<0.2	0.003	<0.1	1.04
	08/08/17	0.057	15.1	220	15.6	<0.2	<0.002	<0.1	1.13
	10/31/17	0.056	14.7	234	16.5	<0.2	<0.002	<0.1	1.03
	01/23/18	0.056	14.4	200	16.4	<0.2	<0.002	<0.1	0.96
	05/07/18	0.061	14.5	226	15.6	na	na	<0.1	1.08
	08/07/18	0.053	14.6	196	16.3	na	na	<0.1	1.11
	10/08/18	0.059	14.5	204	16.5	<0.2	<0.002	<0.1	1.02

TABLE H-11
MONITORING WELL OCWD-M46
General Water Quality Data
2014 - 2018

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M46/5 Main Perforations 890-910 ft bgs	01/27/14	0.046	14.8	218	12.7	0.6	<0.002	<0.1	1.92
	05/05/14	0.043	14.1	232	14	0.4	<0.002	<0.1	1.86
	07/15/14	0.044	13.5	220	12.9	0.4	<0.002	<0.1	1.3
	11/03/14	0.044	14.7	231	13.3	0.3	0.01	<0.1	1.71
	02/09/15	na	14.7	206	13.6	0.4	0.01	<0.4	1.78
	05/04/15	0.045	14.6	228	14.3	0.3	0.007	0.6	1.99
	07/13/15	0.046	14.5	222	13.9	0.3	0.01	<0.4	1.99
	11/02/15	0.048	14.5	234	13.7	0.4	0.01	<0.4	1.7
	01/27/16	0.043	14.7	228	13.4	0.4	0.004	<0.1	1.85
	05/03/16	0.044	14.4	216	13.2	0.4	<0.002	<0.1	1.76
	08/09/16	0.051	15.5	206	13.6	0.4	<0.002	<0.1	1.82
	11/01/16	0.046	14.6	236	13.4	0.4	0.002	<0.1	1.78
	02/07/17	0.045	14.5	220	14	0.4	0.004	<0.1	1.78
	05/02/17	0.046	14.3	222	13.5	0.4	0.004	<0.1	1.64
	08/08/17	0.043	14.7	192	12.9	0.2	0.002	<0.1	1.73
	10/31/17	0.045	14.7	238	13.9	0.4	0.002	<0.1	1.68
	01/23/18	0.046	14.5	208	13.7	0.4	0.004	<0.1	1.41
	05/07/18	0.01	14.6	228	13	na	na	<0.1	1.91
	08/07/18	0.051	14.8	194	13.6	na	na	<0.1	1.87
	10/08/18	0.01	14.9	216	14	0.4	<0.002	<0.1	1.64

TABLE H-12
MONITORING WELL OCWD-M47
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
	01/28/14	0.026	13.6	200	56.3	0.2	<0.002	<0.1	0.26
	04/22/14	0.022	12.1	176	53.7	<0.2	<0.002	<0.1	0.2
	07/02/14	0.028	12.7	176	55.9	<0.2	<0.002	<0.1	0.19
	10/21/14	0.026	12.0	167	49.5	<0.2	<0.002	<0.1	0.3
	01/27/15	na	10.1	158	45.5	<0.2	<0.007	<0.4	0.23
	04/21/15	0.017	11.4	150	43.7	<0.2	<0.007	0.6	0.2
M47/1	07/01/15	0.020	10.5	152	47.7	<0.2	<0.007	0.5	0.19
Beta-III	10/20/15	0.016	9.5	156	43.8	<0.2	<0.007	<0.4	0.15
Perforations	02/09/16	0.022	9.1	148	40.3	<0.2	<0.002	<0.1	0.16
355-375 ft bgs	04/19/16	0.023	10.6	140	40.7	<0.2	<0.002	<0.1	0.18
	07/27/16	0.024	10.7	136	42.6	0.2	<0.002	<0.1	0.15
	10/18/16	0.025	10.7	156	42.4	<0.2	<0.002	<0.1	0.16
	01/24/17	0.027	11.9	164	40.7	<0.2	<0.002	<0.1	0.17
	04/18/17	0.024	11.4	132	38	<0.2	<0.002	<0.1	0.18
	07/25/17	0.024	13.1	114	38.6	<0.2	<0.002	0.12	0.14
	10/17/17	0.023	22.6	144	38.1	<0.2	<0.002	<0.1	0.19
	01/24/18	0.023	11	124	38.1	<0.2	<0.002	<0.1	0.14
	04/24/18	0.025	11.5	130	38.8	na	na	<0.1	0.2
	07/24/18	0.025	11.8	140	40.1	na	na	<0.1	0.13
	10/23/18	0.029	12	112	39.9	<0.2	<0.002	<0.1	0.16
	01/28/14	0.095	30.6	236	125	<0.2	<0.002	9.1	0.24
	04/22/14	0.109	34.1	258	143	<0.2	<0.002	8.5	0.2
	07/02/14	0.088	28.7	240	129	<0.2	0.069	8.1	0.17
	10/21/14	0.073	22.6	191	94.6	<0.2	0.026	8.8	0.17
	01/27/15	na	19.3	188	89.6	<0.2	0.026	9.1	0.21
M47/2	04/21/15	0.037	16.4	162	77	<0.2	0.02	10	0.18
Upper Rho	07/01/15	0.039	15.6	150	73.7	<0.2	0.023	10	0.19
Perforations	10/20/15	0.029	14.7	162	70	<0.2	0.049	10.1	0.14
470-480 ft bgs	02/09/16	0.027	13.5	146	64.3	<0.2	0.005	2.33	0.13
	04/19/16	0.028	13.9	140	62.2	<0.2	0.008	2.39	0.1
	07/27/16	0.028	12.6	122	60.5	<0.2	0.005	2.13	0.1
	10/18/16	0.026	11.8	138	59.7	<0.2	0.005	1.9	0.26
	01/24/17	0.026	11.8	124	57.8	<0.2	0.004	1.84	0.09
	04/18/17	0.026	12.5	136	58.3	<0.2	0.006	1.94	0.1
	07/25/17	0.026	11.6	106	55	<0.2	<0.002	1.81	0.09
	10/17/17	0.024	12.4	140	57.2	<0.2	0.003	1.75	0.11
	01/24/18	0.024	10.6	124	58.4	<0.2	0.004	1.66	0.09
	04/24/18	0.027	10.7	120	57.7	na	na	1.61	0.07
	07/24/18	0.027	10.1	132	55.8	na	na	1.5	0.08
	10/23/18	0.030	10.9	92	58.9	<0.2	0.002	1.51	0.09

TABLE H-12
MONITORING WELL OCWD-M47
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
M47/3 Lower Rho Perforations 580-600 ft bgs	01/28/14	0.052	19.2	234	73.8	<0.2	<0.002	<0.1	0.26
	04/22/14	0.051	19.0	222	74.7	<0.2	<0.002	<0.1	0.17
	07/02/14	0.050	18.4	224	70.6	<0.2	<0.002	<0.1	0.2
	10/21/14	0.054	19.4	219	68.8	<0.2	<0.002	0.6	0.23
	01/27/15	na	20.4	230	77.5	<0.2	<0.007	<0.4	0.5
	04/21/15	0.046	19.9	206	72	<0.2	<0.007	0.6	0.13
	07/01/15	0.052	20.4	226	74	<0.2	<0.007	0.5	0.14
	10/20/15	0.047	19.6	206	73.9	0.2	<0.007	<0.4	0.12
	02/09/16	0.052	19.2	214	71.7	<0.2	<0.002	<0.1	0.3
	04/19/16	0.050	19.7	230	71.8	<0.2	<0.002	<0.1	0.12
	07/27/16	0.051	19.1	214	73.4	<0.2	<0.002	<0.1	0.1
	10/18/16	0.047	18.3	212	70.1	<0.2	<0.002	<0.1	0.08
	01/24/17	0.045	17.5	206	69.5	<0.2	<0.002	<0.1	0.12
	04/18/17	0.041	16.8	220	65.6	<0.2	<0.002	<0.1	0.18
	07/25/17	0.041	15.2	186	63.4	<0.2	<0.002	<0.1	0.09
	10/17/17	0.037	15.5	216	66.3	<0.2	<0.002	<0.1	0.07
	01/24/18	0.038	14.5	210	65.5	<0.2	<0.002	<0.1	0.06
	04/24/18	0.040	14.6	196	65.6	na	na	<0.1	0.09
	07/24/18	0.055	14.2	208	64.4	na	na	<0.1	0.08
	10/23/18	0.043	14.6	188	65.4	<0.2	<0.002	<0.1	0.09
M47/4 Main Perforations 745-765 ft bgs	01/28/14	0.041	12.8	218	20.7	0.3	<0.002	<0.1	1.00
	04/22/14	0.041	13.3	212	22.3	0.2	<0.002	<0.1	1.03
	07/02/14	0.041	12.5	214	20.7	<0.2	<0.002	<0.1	1.03
	10/21/14	0.051	13.2	213	20.8	<0.2	<0.002	<0.1	1.02
	01/27/15	na	13.0	224	21.5	0.3	<0.007	<0.4	1.12
	04/21/15	0.038	13.2	212	22.6	0.4	<0.007	<0.4	1.15
	07/01/15	0.040	12.8	216	22	<0.2	0.007	0.5	1.13
	10/20/15	0.036	12.6	244	23.1	<0.2	0.01	<0.4	1.18
	02/09/16	0.043	12.1	226	21.7	<0.2	<0.002	<0.1	1.15
	04/19/16	0.044	12.8	210	21.7	<0.2	<0.002	0.1	0.76
	07/27/16	0.042	12.8	212	22.4	0.3	0.002	<0.1	1.08
	10/18/16	0.041	12.3	208	22.7	0.3	0.002	<0.1	1.1
	01/24/17	0.039	12.5	218	22.2	<0.2	0.003	<0.1	1.03
	04/18/17	0.038	12.9	222	23.3	0.2	0.003	<0.1	0.93
	07/25/17	0.044	12.3	186	21.6	<0.2	<0.002	<0.1	0.87
	10/17/17	0.037	12.8	230	22.8	<0.2	<0.002	<0.1	0.83
	01/24/18	0.037	12.1	224	22.9	0.2	<0.002	<0.1	0.75
	04/24/18	0.038	12.2	228	22.3	na	na	<0.1	0.8
	07/24/18	0.048	12.1	226	23	na	na	<0.1	0.76
	10/23/18	0.043	12.3	194	23	<0.2	0.002	<0.1	0.8

TABLE H-12
MONITORING WELL OCWD-M47
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
	01/28/14	0.058	13.1	232	11.3	0.4	<0.002	<0.1	2.93
	04/22/14	0.061	13.1	222	12.2	0.4	<0.002	<0.1	3.11
	07/02/14	0.060	12.5	212	11.2	0.4	0.016	<0.1	3.86
	10/21/14	0.072	13.2	216	11.3	0.4	0.02	<0.1	2.99
	01/27/15	na	12.9	236	12.1	0.5	<0.007	<0.4	3.38
	04/21/15	0.056	13.2	224	12.3	0.6	0.016	<0.4	3.52
	07/01/15	0.059	13.0	228	12.2	0.2	0.02	0.5	3.54
M47/5	10/20/15	0.052	12.8	250	11.4	0.4	<0.007	<0.4	2.45
Main	02/09/16	0.059	12.3	230	11.2	0.3	0.005	<0.1	3.2
Perforations	04/19/16	0.054	12.9	222	11.3	0.3	0.005	<0.1	2.76
940-960 ft bgs	07/27/16	0.059	12.9	240	11.5	0.5	0.006	<0.1	2.99
	10/18/16	0.057	12.6	238	12.6	0.5	0.005	<0.1	3.3
	01/24/17	0.056	12.9	234	11.3	0.3	<0.002	<0.1	2.75
	04/18/17	0.055	13.2	236	10.9	0.4	0.006	<0.1	2.89
	07/25/17	0.059	12.4	204	10.7	0.3	0.005	<0.1	2.76
	10/17/17	0.054	14.7	238	11.2	0.4	0.005	<0.1	2.85
	01/24/18	0.054	12.6	222	11.4	0.4	0.005	<0.1	2.81
	04/24/18	0.057	12.6	226	11.3	na	na	<0.1	2.97
	07/24/18	0.073	12.6	232	11.4	na	na	<0.1	2.2
	10/23/18	0.065	12.8	204	11.6	0.3	0.005	<0.1	2.3

Note: OCWD-M47 is located approximately 2,250 feet northeast of the nearest injection well site (I-26).

Appendix I

Groundwater Quality Data at the Anaheim Forebay

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

GWRS 2018 Quarterly Sampling Dates
OCWD Water Quality Department
ANAHEIM FOREBAY - GROUNDWATER

Monitoring Well	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AM-7/1	02/21/2018	05/21/2018	08/22/2018	11/07/2018
AM-8/1	02/21/2018	05/21/2018	08/22/2018	11/07/2018
AM-10/1	02/21/2018	05/22/2018	08/23/2018	11/07/2018
AMD-10/1-5	02/07/2018	05/08/2018	08/08/2018	11/05/2018
AMD-12/1-5	02/20/2018	05/22/2018	08/21/2018	11/06/2018
OCWD-KB1/1	02/06/2018	05/08/2018	08/08/2018	11/05/2018

Notes for Appendix I Tables:

► Water quality data are summarized for compliance monitoring wells AM-7, AM-8, AM-10, AMD-10, AMD-12, and also a non-compliance monitoring well OCWD-KB1 in the following tables.

► Listed dates (above) are the quarterly compliance monitoring dates; other samples may have been collected during the year. Detections of organic chemicals are reported for all samples collected in 2018 and are not limited to the quarterly compliance samples.

► Results listed in the table for each quarter are the range of the minimum to maximum value detected at the well location, which may consist of one to five well casings. Figures and report text list the well ID (e.g., AMD-10) and casing number (e.g., AMD-10 has five well casings: AMD-10/1, AMD-10/2, AMD-10/3, AMD-10/4 and AMD10/5), as appropriate.

► Appendices B & C contain a list of all methods and reportable detection limits (RDL).

► Detailed data reports are available upon request.

► The more stringent value in the range of secondary MCLs is used in the tables (e.g., <MCL) for TDS, electrical conductivity (EC), chloride and sulfate.

► MCL: Maximum Contaminant Level

► N/A: Not applicable

► ND: Not detected at reportable detection limit (RDL)

► NL: SWRCB DDW (formerly CDPH) Notification Level

► NR: Not Required

► NS: Not sampled

► TR: Trace

GWRS 2018 Quarterly Sampling Dates
OCWD Water Quality Department
ANAHEIM FOREBAY - GROUNDWATER

Notes for Appendix F Tables (continued):

► A comprehensive suite of tests covering inorganics, metals, volatile organics (VOCs), synthetic organic compounds (SOCs), radiological and microbial parameters were analyzed at 35 permit-specified groundwater monitoring wells since the commencement of the GWRS treatment facility. In June 2010, OCWD proposed a revised groundwater monitoring frequency from quarterly to annually for selected analytes that have reported no detections. The proposed reduced frequency of testing was (1) based on real-time data for analytes reported as non-detect at the reporting detection limit, (2) supported by two Independent Advisory Panels having oversight for the GWRS project and the Santa Ana River (SARMON) long-term monitoring program, and (3) a condition of the GWRS permit to routinely review data and based on results, to modify the groundwater monitoring program every two years or sooner with approval by the RWQCB and SWRCB DDW (formerly CDPH - July 2014 CDPH moved to the SWRCB with a new name, Division of Drinking Water).

The revised monitoring frequency was approved by the RWQCB (3/14/2011) and SWRCB DDW (9/20/2010) and consists of reduction in asbestos, dioxin, selected SOCs, and radionuclides monitoring from quarterly to annually (see Table 1) for monitoring well locations. Julio Lara/RWQCB advised that monitoring for these analytes are not permit required but OCWD voluntarily performed the monitoring. OCWD elected to conduct comprehensive testing at the start-up of GWRS; however, with years of a robust database for these non-compliance targets (asbestos, dioxin, EPA 625), OCWD concurred with the RWQCB and ceased testing for these analytes in January 2014. Samples may have been collected for other analytes (cyanide, some radionuclides, etc.) but consensus is to cease testing and use resources more effectively in the future. Comprehensive testing was performed during the first quarter 2011 and served as the “annual comprehensive testing” and "initial anchor date." Future “annual comprehensive testing” rotated sequentially through the quarters (e.g., 2Q2012, 3Q2013, 4Q2014, etc.).

Table 1 Talbert Barrier and Forebay Area GWRS Groundwater Monitoring Well Approved Revised Monitoring Program[1] Inorganic, Organic, and Radiological Analytes					
Q - Year	**Comprehensive[2]**	**Reduced[3,4,5]**	**Q - Year**	**Comprehensive[2]**	**Reduced[3,4,5]**
Q1 - 2015	x		Q1 - 2018	x	
Q2 - 2015		x	Q2 - 2018		x
Q3 - 2015		x	Q3 - 2018		x
Q4 - 2015		x	Q4 - 2018		x
Q1 - 2016		x	Q1 - 2019		x
Q2 - 2016	x		Q2 - 2019	x	
Q3 - 2016		x	Q3 - 2019		x
Q4 - 2016		x	Q4 - 2019		x
Q1 - 2017		x	Q1 - 2020		x
Q2 - 2017		x	Q2 - 2020		x
Q3 - 2017	x		Q3 - 2020	x	
Q4 - 2017		x	Q4 - 2020		x

[1]Approved RWQCB (03/14/2011) and CDPH (09/20/10)

[2]Comprehensive: OCWD voluntarily screens for inorganic and organic analytes and radionuclides beyond the permit specific analytes

[3]Reduced: Annual asbestos, cyanide, selected SOC's, EPA 625, and radionuclides

[4]GWRS IAP Meeting 08/27/13: Panel Concurs to cease monitoring for asbestos and dioxin based on years of non-detections

[5]GWRS IAP Meeting 08/29/17: Panel concurs to reduce select inorganic and organic monitoring. In addition, Panel concurs to cease select inorganic and organic voluntary monitoring.

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	AM-7 Qtr 1	AM-7 Qtr 2	AM-7 Qtr 3	AM-7 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	1.9	2.6	1.6	2.2
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	1.6	2.6	2.4	1.6
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	1.5	1.1 - 2.4	2.2	1.2 - 1.3
Barium (Ba), ug/L	OCWD	1000	32.6	25.2	41	85.9
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	0.13	0.13	0.13	0.11
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND	ND	ND	ND
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	ND	1
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	0.51	0.52 - 0.66	0.64	0.25 - 0.27
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.004	0.003 - 0.004	NR	0.003 - 0.006
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND	1.1
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	0.9	1	0.9	2.2 - 3
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	5	5
Electrical Conductivity (EC), um/cm	OCWD	900	444	341 - 551	508	898 - 942
Iron (Fe), ug/L	OCWD	300	207	102	113	136
Manganese (Mn), ug/L	OCWD	50	5.9	4.1	8.1	8.8
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	5.4	3.7 - 4.3	7.7	7.9 - 12
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	2	ND	1	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	240	184 - 330	282	548 - 570
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.4	0.4	0.6	1.3
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	1.3	1.7
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.15	0.15	0.15	0.16
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	3.4	4.2	3.8	2.9
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD/ WeckLab	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
Dacthal Acid Metabolites (tDCPA), ug/L	OCWD	N/A	ND	NR	NR	NR
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	**Description**	**Lab**	**AM-7 Qtr 1**	**AM-7 Qtr 2**	**AM-7 Qtr 3**	**AM-7 Qtr 4**
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	NR	NR	NR	ND
508	Chlorinated Pesticides	WeckLab	NR	NR	NR	ND
515.4	Chlorinated Acids	OCWD	ND	NR	NR	NR
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	NR	NR	NR	ND

* Reduced 525.2 list of analytes (525-R)

AM-7/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/21/2018	10:25	Chloroform (CHCl3)	0.9	ug/L	0.5
2/21/2018	10:25	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/21/2018	10:55	Chloroform (CHCl3)	1.0	ug/L	0.5
5/21/2018	10:55	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/22/2018	9:50	Chloroform (CHCl3)	0.9	ug/L	0.5
8/22/2018	9:50	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/7/2018	10:35	Chloroform (CHCl3)	3.0	ug/L	0.5
11/7/2018	10:35	Total Trihalomethanes (TTHMs)	3.0	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/7/2018	10:35	Chloroform (CHCl3)	2.2	ug/L	0.1
11/7/2018	10:35	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.1

AM-7/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/7/2018	10:35	Sucralose (SUCRAL)	191	ng/L	100
11/7/2018	10:35	Sulfamethoxazole (SULTHZ)	2.0	ng/L	1

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	AM-8 Qtr 1	AM-8 Qtr 2	AM-8 Qtr 3	AM-8 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	1.2	1.4	1.3	1.7
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	1	1	1.4	ND
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	ND	ND	1.2	ND
Barium (Ba), ug/L	OCWD	1000	19.3	30.1	33.5	35.9
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	0.43	0.35	0.3	0.31
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND	ND	ND	ND
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	1.01	0.78 - 0.89	0.99	0.51 - 0.83
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.017	0.015 - 0.018	NR	0.017 - 0.02
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND	ND
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	0.6	0.8	0.6	0.6 - 0.7
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	5	5
Electrical Conductivity (EC), um/cm	OCWD	900	307	411 - 449	427	442 - 494
Iron (Fe), ug/L	OCWD	300	116	268	209	449
Manganese (Mn), ug/L	OCWD	50	6.2	8.8	9.7	11.5
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	6	8 - 9.7	7.7	6.8 - 9.2
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	2	1
Total Dissolved Solids (TDS), mg/L	OCWD	500	150	228 - 272	240	214 - 276
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.3	0.4	0.5	1
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	1.5	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.21	0.2	0.19	0.17
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	3.1	2.7	3.2	2.6
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD / WeckLab	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
Dacthal Acid Metabolites (tDCPA), ug/L	OCWD	N/A	ND	NR	NR	NR
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	AM-8 Qtr 1	AM-8 Qtr 2	AM-8 Qtr 3	AM-8 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	NR	NR	NR	ND
508	Chlorinated Pesticides	WeckLab	NR	NR	NR	ND
515.4	Chlorinated Acids	OCWD	ND	NR	NR	NR
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	NR	NR	NR	ND

* Reduced 525.2 list of analytes (525-R)

AM-8/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/21/2018	9:45	Chloroform (CHCl3)	0.6	ug/L	0.5
2/21/2018	9:45	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/21/2018	9:55	Chloroform (CHCl3)	0.8	ug/L	0.5
5/21/2018	9:55	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/22/2018	9:20	Chloroform (CHCl3)	0.6	ug/L	0.5
8/22/2018	9:20	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/7/2018	11:55	Chloroform (CHCl3)	0.7	ug/L	0.5
11/7/2018	11:55	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/7/2018	11:55	Chloroform (CHCl3)	0.6	ug/L	0.1
11/7/2018	11:55	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.1

AM-8/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/7/2018 11:55	Atrazine (ATRAZ)	0.0010	ug/L	0.001
11/7/2018 11:55	Simazine (SIMAZ)	0.0100	ug/L	0.005
11/7/2018 11:55	Sucralose (SUCRAL)	373	ng/L	100
11/7/2018 11:55	Sulfamethoxazole (SULTHZ)	10.1	ng/L	1

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	AM-10 Qtr 1	AM-10 Qtr 2	AM-10 Qtr 3	AM-10 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	5.1	2.6	4.4	7.1
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	2	1.1	2.1	1.1
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	1.6	1.3	1.8 - 2	1.1
Barium (Ba), ug/L	OCWD	1000	6.4	7.1	9.2	15.1
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	0.32	0.29	0.22	0.19
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND	ND	ND	0.2
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	1.07	1.13	1.53 - 1.55	1.48
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.003	NR	0.003	0.004
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND	ND
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	1	1	1.8	1.6 - 1.7
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	ND	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	104	102	122 - 124	193
Iron (Fe), ug/L	OCWD	300	70.7	162	59.1	112
Manganese (Mn), ug/L	OCWD	50	1.9	4.9	2.8	5.8
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	1.5	1.3	2.2 - 2.4	2.4
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	2	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	62	62	69 - 75	105
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.3	0.1	0.2	0.8
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	ND	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.24	0.21	0.25	0.27
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	5.7	4.6	4.1	3.4
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD / WeckLab	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
Dacthal Acid Metabolites (tDCPA), ug/L	OCWD	N/A	ND	NR	NR	NR
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	AM-10 Qtr 1	AM-10 Qtr 2	AM-10 Qtr 3	AM-10 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	NR	NR	NR	ND
508	Chlorinated Pesticides	WeckLab	NR	NR	NR	ND
515.3	Chlorinated Acids	WeckLab	ND	NR	NR	NR
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2/525-R	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	NR	NR	NR	ND

* Reduced 525.2 list of analytes (525-R)

AM-10/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/21/2018	11:25	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
2/21/2018	11:25	Chloroform (CHCl3)	1.0	ug/L	0.5
2/21/2018	11:25	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/22/2018	12:30	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
5/22/2018	12:30	Chloroform (CHCl3)	1.0	ug/L	0.5
5/22/2018	12:30	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/23/2018	9:50	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.5
8/23/2018	9:50	Chloroform (CHCl3)	1.3	ug/L	0.5
8/23/2018	9:50	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5
9/12/2018	9:30	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.5
9/12/2018	9:30	Chloroform (CHCl3)	1.3	ug/L	0.5
9/12/2018	9:30	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/7/2018	13:05	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
11/7/2018	13:05	Chloroform (CHCl3)	1.6	ug/L	0.5
11/7/2018	13:05	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

AM-10/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/7/2018	13:05	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.1
11/7/2018	13:05	Chloroform (CHCl3)	1.2	ug/L	0.1
11/7/2018	13:05	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/7/2018	13:05	Diuron (DIURON)	0.0060	ug/L	0.005
11/7/2018	13:05	Simazine (SIMAZ)	0.0050	ug/L	0.005

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	AMD-10 Qtr 1	AMD-10 Qtr 2	AMD-10 Qtr 3	AMD-10 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	ND - 2.9	ND - 5.9	ND - 1.6	ND - 3.8
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 7.9	ND - 4.8	ND - 8.6	ND - 2.8
Arsenic (dissolved)* (As-DIS), ug/L	OCWD	N/A	2.3 - 8	ND - 5.4	1.3 - 7.9	1 - 3.8
Barium (Ba), ug/L	OCWD	1000	6.4 - 95.6	6.6 - 94.3	7.6 - 94.9	36 - 91.9
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND - 2.1	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	0.1 - 0.5	0.12 - 0.55	ND - 0.57	ND - 0.58
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND	ND	ND	ND
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND - 4	ND - 2.2	ND - 2.1	ND - 1.5
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	0.45 - 1.21	0.34 - 1.05	0.21 - 0.95	0.17 - 0.81
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.016 - 0.221	0.017 - 0.049	NR	0.004 - 0.145
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND - 1.5	ND - 1.2
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	0.5 - 1.4	0.25 - 1.5	ND - 1.7	0.25 - 2.8
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND - 12	ND - 12	ND - **15**	Mar-35
Electrical Conductivity (EC), um/cm	OCWD	900	147 - **999**	105 - **1,000**	143 - **969**	346 - **969**
Iron (Fe), ug/L	OCWD	300	67.4 - **526**	22.2 - **3,160**	27.7 - **513**	91.5 - **1,020**
Manganese (Mn), ug/L	OCWD	50	4.1 - **65.5**	3 - **96.8**	5.2 - **61.3**	6.8 - **75.3**
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	3.4 - 65.5	1.1 - 64	5.7 - 65.8	6.3 - 72.6
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	1 - 4	ND - 8	ND - 8	ND - 4
Total Dissolved Solids (TDS), mg/L	OCWD	500	92 - **640**	50 - **626**	110 - **626**	196 - **614**
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.3 - 1.8	0.1 - 2.4	0.2 - 2.6	0.3 - **5**
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	ND - 1.5	ND - 2
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.18 - 0.24	0.16 - 0.24	0.16 - 0.25	0.15 - 0.24
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	ND - 8.6	ND - 6.2	ND - 5.8	ND - 2.9
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD / WeckLab	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
Dacthal Acid Metabolites (tDCPA), ug/L	OCWD	N/A	ND	NR	NR	NR
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	AMD-10 Qtr 1	AMD-10 Qtr 2	AMD-10 Qtr 3	AMD-10 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	NR	ND	NR	ND
508	Chlorinated Pesticides	WeckLab	NR	NR	NR	ND
515.4	Chlorinated Acids	OCWD	ND	NR	NR	NR
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	NR	NR	NR	ND

* Reduced 525.2 list of analytes (525-R)

AMD-10/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	9:30	Chloroform (CHCl3)	1.3	ug/L	0.5
2/7/2018	9:30	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/16/2018	10:00	Chloroform (CHCl3)	1.1	ug/L	0.5
4/16/2018	10:00	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5
5/8/2018	10:00	Chloroform (CHCl3)	1.1	ug/L	0.5
5/8/2018	10:00	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/8/2018	9:45	Chloroform (CHCl3)	1.7	ug/L	0.5
8/8/2018	9:45	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	10:05	Chlorobenzene (CLBENZ)	TR	ug/L	0.5
11/5/2018	10:05	Chloroform (CHCl3)	2.8	ug/L	0.5
11/5/2018	10:05	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5
12/11/2018	10:30	Chloroform (CHCl3)	2.8	ug/L	0.5
12/11/2018	10:30	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	10:05	Chloroform (CHCl3)	1.8	ug/L	0.1

AMD-10/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 551.1

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/5/2018 10:05	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.1

METHOD: CEC

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/5/2018 10:05	Sucralose (SUCRAL)	260	ng/L	100
11/5/2018 10:05	Sulfamethoxazole (SULTHZ)	1.7	ng/L	1

AMD-10/2
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	10:35	Chloroform (CHCl3)	1.4	ug/L	0.5
2/7/2018	10:35	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/16/2018	11:10	Chloroform (CHCl3)	1.3	ug/L	0.5
4/16/2018	11:10	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5
5/8/2018	11:00	Chloroform (CHCl3)	1.5	ug/L	0.5
5/8/2018	11:00	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/8/2018	12:40	Chloroform (CHCl3)	1.0	ug/L	0.5
8/8/2018	12:40	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	11:15	Chlorobenzene (CLBENZ)	TR	ug/L	0.5
11/5/2018	11:15	Chloroform (CHCl3)	1.4	ug/L	0.5
11/5/2018	11:15	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.5
12/11/2018	11:20	Chloroform (CHCl3)	1.7	ug/L	0.5
12/11/2018	11:20	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	11:15	Chloroform (CHCl3)	1.1	ug/L	0.1

AMD-10/2
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 551.1

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/5/2018 11:15	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.1

METHOD: CEC

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/5/2018 11:15	Sucralose (SUCRAL)	156	ng/L	100
11/5/2018 11:15	Sulfamethoxazole (SULTHZ)	2.5	ng/L	1

AMD-10/3
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	12:20	Chloroform (CHCl3)	0.5	ug/L	0.5
2/7/2018	12:20	Total Trihalomethanes (TTHMs)	0.5	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/8/2018	12:15	Chloroform (CHCl3)	TR	ug/L	0.5
5/8/2018	12:15	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	12:30	Chlorobenzene (CLBENZ)	TR	ug/L	0.5
11/5/2018	12:30	Chloroform (CHCl3)	TR	ug/L	0.5
11/5/2018	12:30	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5
12/11/2018	12:25	Chloroform (CHCl3)	TR	ug/L	0.5
12/11/2018	12:25	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	12:30	Chloroform (CHCl3)	0.3	ug/L	0.1
11/5/2018	12:30	Total Trihalomethanes (TTHMs)	0.3	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	12:30	Carbamazepine (CBMAZP)	3.5	ng/L	1
11/5/2018	12:30	Diuron (DIURON)	0.0060	ug/L	0.005
11/5/2018	12:30	Simazine (SIMAZ)	0.0100	ug/L	0.005
11/5/2018	12:30	Sucralose (SUCRAL)	444	ng/L	100
11/5/2018	12:30	Sulfamethoxazole (SULTHZ)	7.4	ng/L	1

AMD-10/4
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/7/2018 13:05	Chloroform (CHCl3)	0.9	ug/L	0.5
2/7/2018 13:05	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
5/8/2018 12:35	Chloroform (CHCl3)	1.2	ug/L	0.5
5/8/2018 12:35	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
8/8/2018 11:35	Chloroform (CHCl3)	0.8	ug/L	0.5
8/8/2018 11:35	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/5/2018 13:10	Chlorobenzene (CLBENZ)	TR	ug/L	0.5
11/5/2018 13:10	Chloroform (CHCl3)	0.8	ug/L	0.5
11/5/2018 13:10	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5
12/11/2018 13:05	Chloroform (CHCl3)	0.8	ug/L	0.5
12/11/2018 13:05	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/5/2018 13:10	Chloroform (CHCl3)	0.7	ug/L	0.1
11/5/2018 13:10	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.1

AMD-10/4
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/5/2018 13:10	Atrazine (ATRAZ)	0.0010	ug/L	0.001
11/5/2018 13:10	Carbamazepine (CBMAZP)	5.8	ng/L	1
11/5/2018 13:10	Diuron (DIURON)	0.0050	ug/L	0.005
11/5/2018 13:10	Primidone (PRIMDN)	2.7	ng/L	1
11/5/2018 13:10	Simazine (SIMAZ)	0.0280	ug/L	0.005
11/5/2018 13:10	Sucralose (SUCRAL)	857	ng/L	100
11/5/2018 13:10	Sulfamethoxazole (SULTHZ)	18.1	ng/L	1

AMD-10/5
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2018	10:40	Chloroform (CHCl3)	0.9	ug/L	0.5
2/7/2018	10:40	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/8/2018	11:05	Chloroform (CHCl3)	1.1	ug/L	0.5
5/8/2018	11:05	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/8/2018	10:50	Chloroform (CHCl3)	0.9	ug/L	0.5
8/8/2018	10:50	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	11:20	Chlorobenzene (CLBENZ)	TR	ug/L	0.5
11/5/2018	11:20	Chloroform (CHCl3)	1.1	ug/L	0.5
11/5/2018	11:20	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5
12/11/2018	11:35	Chloroform (CHCl3)	1.1	ug/L	0.5
12/11/2018	11:35	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	11:20	Chloroform (CHCl3)	0.8	ug/L	0.1
11/5/2018	11:20	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.1

AMD-10/5

Organic Detections by Method

Year 2018, Quarter 4

METHOD: *CEC*

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
11/5/2018	11:20	Atrazine (ATRAZ)	0.0020	ug/L	0.001
11/5/2018	11:20	Carbamazepine (CBMAZP)	3.4	ng/L	1
11/5/2018	11:20	Diuron (DIURON)	0.0080	ug/L	0.005
11/5/2018	11:20	Primidone (PRIMDN)	2.8	ng/L	1
11/5/2018	11:20	Simazine (SIMAZ)	0.0500	ug/L	0.005
11/5/2018	11:20	Sucralose (SUCRAL)	329	ng/L	100
11/5/2018	11:20	Sulfamethoxazole (SULTHZ)	14.5	ng/L	1

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	AMD-12 Qtr 1	AMD-12 Qtr 2	AMD-12 Qtr 3	AMD-12 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	ND - 2.4	ND - 3.4	ND - 3.2	1 - 10.9
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 1.3	ND - 3.4	1 - 2.2	ND - 1.7
Arsenic (dissolved)* (As-DIS), ug/L	OCWD	N/A	ND - 1.2	ND - 4.8	1.7 - 1.9	ND - 1.8
Barium (Ba), ug/L	OCWD	1000	9.9 - 80.2	9.4 - 80.2	11.5 - 81.5	10 - 104
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND - 2.4
Fluoride (F), mg/L	OCWD	2	ND - 0.53	0.16 - 0.54	ND - 0.53	ND - 0.69
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND	ND	ND - 0.22	ND - 0.26
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND - 4.7	1.2 - 6	1.8 - 5.7	1.2 - 4.3
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	0.54 - 1.4	0.59 - 1.22	0.36 - 1.13	0.22 - 1.1
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND	ND	NR	ND - 0.004
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	ND - 1.3	ND - 1.3
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	ND - 1.6	ND - 1.4	ND - 1.7	ND - 2
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	NR	ND	ND - 1	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	164 - **958**	143 - **931**	176 - **929**	164 - **956**
Iron (Fe), ug/L	OCWD	300	ND - 10.9	ND - 12.3	ND - 10.2	ND - 11.2
Manganese (Mn), ug/L	OCWD	50	ND - 1.7	ND - 1.1	ND - 1.7	ND - 1.1
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 1.6	ND - 1.1	ND - 1.6	ND - 1
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	102 - **578**	84 - **598**	98 - **552**	120 - **626**
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.2	ND - 0.1	ND - 0.1	0.2 - 0.7
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	1 - 3	ND - 2.5
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.2 - 0.25	0.17 - 0.23	0.19 - 0.25	0.14 - 0.25
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	2.4 - 4.5	2.2 - 6	2.8 - 4.6	2.3 - 4.6
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD / WeclkLab	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
Dacthal Acid Metabolites (tDCPA), ug/L	OCWD	N/A	ND	NR	NR	NR
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	AMD-12 Qtr 1	AMD-12 Qtr 2	AMD-12 Qtr 3	AMD-12 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	NR	NR	NR	ND
508	Chlorinated Pesticides	WeckLab	NR	NR	NR	ND
515.4	Chlorinated Acids	OCWD	ND	NR	NR	NR
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
537	PFAS Compounds	OCWD	NR	NR	NR	ND - Detections
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	NR	NR	NR	ND

* Reduced 525.2 list of analytes (525-R)

AMD-12/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
2/20/2018	9:35	Chloroform (CHCl3)	1.6	ug/L	0.5
2/20/2018	9:35	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
5/22/2018	9:40	Chloroform (CHCl3)	1.2	ug/L	0.5
5/22/2018	9:40	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
8/21/2018	9:20	Chloroform (CHCl3)	1.7	ug/L	0.5
8/21/2018	9:20	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
11/6/2018	10:00	Chloroform (CHCl3)	2.0	ug/L	0.5
11/6/2018	10:00	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
11/6/2018	10:00	Chloroform (CHCl3)	1.7	ug/L	0.1
11/6/2018	10:00	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.1

AMD-12/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: ***CEC***

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	10:00	Sucralose (SUCRAL)	102	ng/L	100
11/6/2018	10:00	Sulfamethoxazole (SULTHZ)	2.0	ng/L	1

AMD-12/2
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2018	10:30	Chloroform (CHCl3)	1.2	ug/L	0.5
2/20/2018	10:30	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/22/2018	10:30	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
5/22/2018	10:30	Chloroform (CHCl3)	1.4	ug/L	0.5
5/22/2018	10:30	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/21/2018	10:05	Chloroform (CHCl3)	1.4	ug/L	0.5
8/21/2018	10:05	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	11:00	Chloroform (CHCl3)	1.1	ug/L	0.5
11/6/2018	11:00	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	11:00	Bromodichloromethane (CHBrCl)	0.1	ug/L	0.1
11/6/2018	11:00	Chloroform (CHCl3)	1.0	ug/L	0.1
11/6/2018	11:00	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.1

AMD-12/2
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/6/2018 11:00	Simazine (SIMAZ)	0.0070	ug/L	0.005

AMD-12/3
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2018	11:40	Chloroform (CHCl3)	0.8	ug/L	0.5
2/20/2018	11:40	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/22/2018	11:20	Chloroform (CHCl3)	0.8	ug/L	0.5
5/22/2018	11:20	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/21/2018	11:10	Chloroform (CHCl3)	0.7	ug/L	0.5
8/21/2018	11:10	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	12:05	Chloroform (CHCl3)	0.6	ug/L	0.5
11/6/2018	12:05	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

METHOD: 537

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	12:05	Perfluoro octane sulfonic acid (PFOS)	5.4	ng/L	4
11/6/2018	12:05	Perfluoro octanoic acid (PFOA)	4.6	ng/L	4
11/6/2018	12:05	Perfluorohexanoic acid (PFHxA)	4.7	ng/L	4

AMD-12/3
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	12:05	Chloroform (CHCl3)	0.6	ug/L	0.1
11/6/2018	12:05	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	12:05	Carbamazepine (CBMAZP)	3.7	ng/L	1
11/6/2018	12:05	Diuron (DIURON)	0.0050	ug/L	0.005
11/6/2018	12:05	Primidone (PRIMDN)	2.0	ng/L	1
11/6/2018	12:05	Simazine (SIMAZ)	0.0140	ug/L	0.005
11/6/2018	12:05	Sucralose (SUCRAL)	395	ng/L	100
11/6/2018	12:05	Sulfamethoxazole (SULTHZ)	12.1	ng/L	1

METHOD: UNKWQAN

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	12:05	PFOA + PFOS (PFOAOS)	10	ng/L	4

AMD-12/4
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 537

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	11:55	Perfluoro butane sulfonic acid (PFBS)	5.5	ng/L	4
11/6/2018	11:55	Perfluoro hexane sulfonic acid (PFHxS)	4.5	ng/L	4
11/6/2018	11:55	Perfluoro octane sulfonic acid (PFOS)	7.0	ng/L	4
11/6/2018	11:55	Perfluoro octanoic acid (PFOA)	6.6	ng/L	4
11/6/2018	11:55	Perfluorohexanoic acid (PFHxA)	7.0	ng/L	4

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	11:55	Atrazine (ATRAZ)	0.0010	ug/L	0.001
11/6/2018	11:55	Carbamazepine (CBMAZP)	14.3	ng/L	1
11/6/2018	11:55	Diuron (DIURON)	0.0090	ug/L	0.005
11/6/2018	11:55	Primidone (PRIMDN)	5.2	ng/L	1
11/6/2018	11:55	Simazine (SIMAZ)	0.0380	ug/L	0.005
11/6/2018	11:55	Sucralose (SUCRAL)	1860	ng/L	100
11/6/2018	11:55	Sulfamethoxazole (SULTHZ)	27.0	ng/L	1

METHOD: UNKWQAN

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	11:55	PFOA + PFOS (PFOAOS)	13.6	ng/L	4

AMD-12/5
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2018	10:20	Chloroform (CHCl3)	TR	ug/L	0.5
2/20/2018	10:20	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/22/2018	10:20	Chloroform (CHCl3)	TR	ug/L	0.5
5/22/2018	10:20	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2018, Quarter 4

METHOD: 537

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	10:40	Perfluoro butane sulfonic acid (PFBS)	4.5	ng/L	4
11/6/2018	10:40	Perfluoro octane sulfonic acid (PFOS)	6.6	ng/L	4
11/6/2018	10:40	Perfluoro octanoic acid (PFOA)	5.4	ng/L	4

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	10:40	Chloroform (CHCl3)	0.1	ug/L	0.1
11/6/2018	10:40	Total Trihalomethanes (TTHMs)	0.1	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/6/2018	10:40	Atrazine (ATRAZ)	0.0030	ug/L	0.001
11/6/2018	10:40	Carbamazepine (CBMAZP)	17.9	ng/L	1
11/6/2018	10:40	Primidone (PRIMDN)	5.7	ng/L	1
11/6/2018	10:40	Simazine (SIMAZ)	0.0850	ug/L	0.005
11/6/2018	10:40	Sucralose (SUCRAL)	1720	ng/L	100
11/6/2018	10:40	Sulfamethoxazole (SULTHZ)	27.2	ng/L	1

AMD-12/5
Organic Detections by Method

Year 2018, Quarter 4

METHOD: ***UNKWQAN***

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/6/2018 10:40	PFOA + PFOS (PFOAOS)	12	ng/L	4

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	OCWD-KB1 Qtr 1	OCWD-KB1 Qtr 2	OCWD-KB1 Qtr 3	OCWD-KB1 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	2.8	8.1	2.2	2.4
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND	1.4	ND	ND
Arsenic (dissolved)* (As-DIS), ug/L	OCWD	N/A	ND	1.4	ND	ND
Barium (Ba), ug/L	OCWD	1000	15.8	4.7	66.2	73.8
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	0.14	0.26	ND	0.11
Hexavalent Chromium (CrVI), ug/L	OCWD	10	0.24	0.25	ND	ND
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	1.6	1.2
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	1.24	1.39	ND	0.24
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND	NR	NR	ND
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND	1.7	1.3
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	1	1	1.7	1.8 - 2.4
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM),	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	359	143	**979**	**968**
Iron (Fe), ug/L	OCWD	300	ND	ND	ND	ND
Manganese (Mn), ug/L	OCWD	50	ND	ND	ND	ND
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND	ND	ND	ND
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	208	78	612	620
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.1	0.1	ND	0.2
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	1.6	2.5
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.14	0.2	0.16	0.13
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	2.6	4.9	2	1.8
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD / WeckLab	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
Dacthal Acid Metabolites (tDCPA), ug/L	OCWD	N/A	ND	NR	NR	NR
EPTC (EPTC), ug/L	OCWD	N/A	ND	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	OCWD-KB1 Qtr 1	OCWD-KB1 Qtr 2	OCWD-KB1 Qtr 3	OCWD-KB1 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	NR	NR	NR	ND
508	Chlorinated Pesticides	WeckLab	NR	NR	NR	ND
515.4	Chlorinated Acids	OCWD	ND	NR	NR	NR
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND*	NR	NR	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND - Detections
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	NR	NR	NR	ND

* Reduced 525.2 list of analytes (525-R)

OCWD-KB1/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/6/2018	9:35	Chloroform (CHCl3)	1.0	ug/L	0.5
2/6/2018	9:35	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/8/2018	10:10	Chloroform (CHCl3)	1.0	ug/L	0.5
5/8/2018	10:10	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/8/2018	12:55	Chloroform (CHCl3)	1.7	ug/L	0.5
8/8/2018	12:55	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	11:20	Chloroform (CHCl3)	2.4	ug/L	0.5
11/5/2018	11:20	Total Trihalomethanes (TTHMs)	2.4	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	11:20	Chloroform (CHCl3)	1.8	ug/L	0.1
11/5/2018	11:20	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.1

OCWD-KB1/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2018	11:20	Sucralose (SUCRAL)	530	ng/L	100
11/5/2018	11:20	Sulfamethoxazole (SULTHZ)	1.6	ng/L	1

Appendix J

Anaheim Forebay Monitoring Well Groundwater Quality

1,4-Dioxane, NDMA and Selected Constituents

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

TABLE J-1
OCWD MONITORING WELL AM-7
1,4-dioxane and NDMA Concentrations
2014 - 2018

AM-7/1 *Shallow Aquifer* *Perforations: 210-225 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
02/10/14	<1	<2
05/19/14	<1	<2
08/25/14	<1	<2
11/17/14	<1	<2
2/23/2015	<1	<2
5/19/2015	<1	<2
8/10/2015	<1	<2
11/16/2015	<1	<2
2/22/2016	<1	<2
5/16/2016	<1	<2
8/22/2016	<1	<2
11/16/2016	<1	na
2/23/2017	<1	<2
5/17/2017	<1	<2
8/23/2017	<1	<2
11/7/2018	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-2
OCWD MONITORING WELL AM-8
1,4-dioxane and NDMA Concentrations
2014 - 2018

AM-8/1 *Shallow Aquifer* *Perforations: 268-285 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
02/10/14	<1	<2
05/19/14	<1	<2
08/25/14	<1	<2
11/17/14	<1	<2
2/23/2015	<1	<2
5/19/2015	<1	<2
8/10/2015	<1	<2
11/16/2015	<1	<2
2/22/2016	<1	<2
5/16/2016	<1	<2
8/22/2016	<1	<2
11/16/2016	<1	na
2/23/2017	<1	<2
5/17/2017	<1	<2
8/23/2017	<1	<2
11/7/2018	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-3
OCWD MONITORING WELL AMD-10
1,4-dioxane and NDMA Concentrations
2014- 2018

AMD-10/1 *Principal Aquifer* *Perforations: 292-312 ft bgs*			**AMD-10/2** *Principal Aquifer* *Perforations: 440-460 ft bgs*			**AMD-10/3** *Principal Aquifer* *Perforations: 550-570 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
02/11/14	<1	<2	02/11/14	<1	<2	02/11/14	<1	<2
05/19/14	<1	<2	05/19/14	<1	<2	05/19/14	<1	<2
08/26/14	<1	<2	08/26/14	<1	<2	08/26/14	<1	<2
11/05/14	<1	<2	11/05/14	<1	<2	11/05/14	<1	<2
02/11/15	<1	<2	02/11/15	<1	<2	02/11/15	<1	<2
05/06/15	<1	<2	05/06/15	<1	<2	05/06/15	<1	<2
08/26/15	<1	<2	08/26/15	<1	<2	08/26/15	<1	<2
11/04/15	<1	<2	11/04/15	<1	<2	11/04/15	<1	<2
02/10/16	<1	<2	02/10/16	<1	<2	02/10/16	<1	<2
05/04/16	<1	<2	05/04/16	<1	<2	05/04/16	<1	<2
08/10/16	<1	<2	08/10/16	<1	<2	08/10/16	<1	<2
11/02/16	<1	<2	11/02/16	<1	<2	11/02/16	<1	<2
02/08/17	<1	<2	02/08/17	<1	<2	02/08/17	<1	<2
05/03/17	<1	<2	05/03/17	<1	<2	05/03/17	<1	<2
08/09/17	<1	<2	08/09/17	<1	<2	08/09/17	<1	<2
04/16/18	<1	na	04/16/18	<1	na	04/16/18	na	na
11/05/18	<1	<2	11/05/18	<1	<2	11/05/18	<1	<2

AMD-10/4 *Principal Aquifer* *Perforations: 774-794 ft bgs*			**AMD-10/5** *Principal Aquifer* *Perforations: 934-954 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
02/11/14	<1	<2	02/11/14	<1	<2
05/19/14	<1	<2	05/19/14	<1	<2
08/26/14	<1	<2	08/26/14	<1	<2
11/05/14	<1	<2	11/05/14	<1	<2
02/11/15	<1	<2	02/11/15	<1	<2
05/06/15	<1	<2	05/06/15	<1	<2
08/26/15	<1	<2	08/26/15	<1	<2
11/04/15	<1	<2	11/04/15	<1	<2
02/10/16	<1	<2	02/10/16	<1	<2
05/04/16	<1	<2	05/04/16	<1	<2
08/10/16	<1	<2	08/10/16	<1	<2
11/02/16	<1	<2	11/02/16	<1	<2
02/08/17	<1	<2	02/08/17	<1	<2
05/03/17	<1	<2	05/03/17	<1	<2
08/09/17	<1	<2	08/09/17	<1	<2
04/16/18	na	na	04/16/18	na	na
11/05/18	<1	<2	11/05/18	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-4
OCWD MONITORING WELL AMD-12
1,4-dioxane and NDMA Concentrations
2014 - 2018

AMD-12/1 *Principal Aquifer* *Perforations: 300-350 ft bgs*			**AMD-12/2** *Principal Aquifer* *Perforations: 490-520 ft bgs*			**AMD-12/3** *Principal Aquifer* *Perforations: 595-615 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
02/25/14	<1	<2	02/25/14	<1	<2	02/25/14	<1	<2
05/20/14	<1	<2	05/20/14	<1	<2	05/20/14	<1	<2
08/12/14	<1	<2	08/12/14	<1	<2	08/12/14	<1	<2
11/18/14	<1	<2	11/18/14	<1	<2	11/18/14	<1	<2
02/24/15	<1	<2	02/24/15	<1	<2	02/24/15	<1	<2
06/02/15	<1	<2	05/20/15	<1	<2	05/20/15	<1	<2
09/08/15	<1	<2	08/12/15	<1	<2	08/12/15	<1	<2
12/15/15	<1	<2	11/17/15	<1	<2	11/17/15	<1	<2
02/23/16	<1	<2	03/08/16	<1	<2	02/23/16	<1	<2
05/17/16	<1	<2	05/17/16	<1	<2	05/17/16	<1	<2
08/23/16	<1	<2	08/23/16	<1	<2	08/23/16	<1	<2
11/15/16	<1	na	11/15/16	<1	na	11/15/16	<1	na
02/22/17	<1	<2	2/22/2017	<1	<2	2/22/2017	<1	<2
05/16/17	<1	<2	5/16/2017	<1	<2	5/16/2017	<1	<2
08/22/17	<1	<2	8/22/2017	<1	<2	8/22/2017	<1	<2
11/06/18	<1	<2	11/06/18	<1	<2	11/06/18	<1	<2

AMD-12/4 *Principal Aquifer* *Perforations: 725-745 ft bgs*			**AMD-12/5** *Principal Aquifer* *Perforations: 940-960 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
02/25/14	<1	<2	02/25/14	<1	<2
05/20/14	<1	<2	05/20/14	<1	<2
08/12/14	<1	<2	08/12/14	<1	<2
11/18/14	<1	<2	11/18/14	<1	<2
02/24/15	<1	<2	02/24/15	<1	<2
05/20/15	<1	<2	05/20/15	<1	<2
08/12/15	<1	<2	08/12/15	<1	<2
11/17/15	<1	<2	11/17/15	<1	<2
02/23/16	<1	<2	02/23/16	<1	<2
05/17/16	<1	<2	05/17/16	<1	<2
08/23/16	<1	<2	08/23/16	<1	<2
11/15/16	<1	na	11/15/16	<1	na
02/22/17	<1	<2	02/22/17	<1	<2
05/16/17	<1	<2	05/16/17	<1	<2
08/22/17	<1	<2	08/22/17	<1	<2
11/06/18	<1	<2	11/06/18	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-5
OCWD MONITORING WELL KB1
1,4-dioxane and NDMA Concentrations
2014 - 2018

KB1 *Shallow Aquifer* *Perforations: 180-200 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
02/11/14	<1	<2
05/19/14	<1	<2
08/12/14	<1	<2
11/05/14	<1	<2
02/11/15	<1	<2
05/06/15	<1	<2
08/26/15	<1	<2
11/04/15	<1	<2
02/10/16	<1	<2
05/04/16	<1	<2
08/10/16	<1	<2
11/02/16	<1	<2
02/08/17	<1	<2
05/03/17	<1	<2
08/09/17	<1	<2
11/05/18	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-6
OCWD MONITORING WELL AM-10
1,4-dioxane and NDMA Concentrations
2014 - 2018

AM-10/1 *Shallow Aquifer* *Perforations: 217-235 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
02/11/14	na	na
05/19/14	na	na
08/12/14	na	na
11/05/14	na	na
02/11/15	na	na
05/06/15	na	na
08/26/15	na	na
11/04/15	na	na
03/08/16	<1	<2
06/14/16	<1	<2
09/20/16	<1	<2
12/06/16	<1	<2
03/07/17	<1	<2
06/13/17	<1	<2
11/14/17	<1	<2
11/07/18	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-7
OCWD MONITORING WELL AM-7
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
AM-7/1 Shallow Perforations 210-225 ft bgs	01/21/14	na	58.0	208	na	na	<0.002	3.9	0.34
	02/10/14	0.213	31.7	224	105	<0.2	<0.002	3.7	0.35
	03/18/14	na	91.5	286	na	na	<0.002	2.3	0.52
	04/15/14	na	80.2	306	na	na	<0.002	3.1	0.44
	05/19/14	0.138	77.5	422	216	<0.2	<0.002	2.1	0.68
	06/10/14	na	80.2	468	na	na	<0.002	2.3	0.77
	06/24/14	na	79.9	546	260	<0.2	<0.002	1.6	0.95
	07/22/14	na	79.2	510	na	na	0.01	1.4	1.05
	08/25/14	0.074	74.8	512	261	<0.2	0.007	1.9	0.80
	09/18/14	na	80.4	536	na	na	0.007	1.7	0.81
	10/21/14	na	78.4	546	na	na	0.01	2.2	0.78
	11/17/14	0.053	75.8	560	261	<0.2	0.007	1.7	0.78
	12/08/14	na	65.6	476	na	na	0.013	3.5	0.69
	01/20/15	na	87.2	566	na	na	0.007	1.6	0.79
	02/23/15	0.089	91.0	708	261	<0.2	0.013	3.4	0.85
	03/16/15	na	91.3	572	na	na	0.016	4.9	0.91
	04/14/15	na	75.6	424	na	na	0.023	6.6	0.82
	05/19/15	0.084	58.2	344	146	<0.2	0.02	8.1	0.66
	06/23/15	na	37.0	222	na	na	0.016	9.6	0.46
	07/21/15	na	42.4	256	na	na	0.023	9.2	0.48
	08/10/15	0.065	47.4	258	127	<0.2	0.013	8.1	0.54
	09/16/15	na	50.2	328	na	na	0.023	7.2	0.53
	10/13/15	na	36.2	266	na	na	0.016	8.3	0.36
	11/16/15	0.039	36.1	312	107	<0.2	0.023	8.2	0.38
	12/08/15	na	49.0	340	na	na	0.02	6.3	0.46
	02/22/16	0.047	41.8	278	109	<0.2	0.005	1.46	0.39
	04/20/16	na	15.8	150	na	na	0.004	1.68	0.19
	05/16/16	0.021	14.8	138	42	<0.2	0.004	1.6	0.18
	06/20/16	na	8.5	94	na	na	0.004	1.49	0.14
	08/22/16	0.013	7.9	68	20.2	0.5	0.005	1.62	0.25
	10/10/16	na	12.4	128	na	na	0.005	1.46	0.19
	11/16/16	0.018	11.1	90	31.5	<0.2	0.006	1.6	0.13
	12/12/16	na	8.6	94	na	na	0.006	1.56	0.16
	02/23/17	0.017	9.7	92	26.2	<0.2	0.004	1.78	0.18
	04/11/17	na	57.8	290	na	na	0.005	1.47	0.64
	05/17/17	0.074	54.3	320	165	<0.2	0.004	1.58	0.73
	06/20/17	na	54.7	314	na	na	0.005	1.73	1.11
	08/23/17	0.073	37.7	208	132	<0.2	0.004	0.95	0.88
	10/03/17	na	28.1	178	na	na	0.003	0.46	0.75
	11/15/17	0.026	32.5	208	97.4	<0.2	0.003	0.46	0.54
	12/13/17	na	30.7	134	na	na	0.003	0.24	0.69
	02/21/18	0.064	42.5	240	136	<0.2	0.004	0.51	0.48
	04/18/18	na	29.9	184	na	na	0.004	0.66	0.31
	05/21/18	0.189	32.8	202	106	na	na	0.64	0.32
	06/14/18	na	53.9	330	na	na	0.003	0.52	0.38
	08/22/18	0.081	46.4	282	150	na	na	0.64	0.35
	10/17/18	na	88.4	564	na	na	0.003	0.27	0.66
	11/07/18	0.065	89.6	570	303	<0.2	0.004	0.26	0.68
	12/11/18	na	81.4	548	na	na	0.006	0.25	0.66

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-8
OCWD MONITORING WELL AM-8
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
AM-8/1 Shallow Perforations 268-285 ft bgs	01/21/14	na	30.5	192	na	na	0.1	6.8	0.56
	02/10/14	0.065	32.1	178	69.3	<0.2	<0.002	7.6	0.27
	03/18/14	na	47.6	222	na	na	<0.002	7.1	0.40
	04/15/14	na	55.6	238	na	na	<0.002	5.8	0.31
	05/19/14	0.168	65.1	278	128	<0.2	0.043	5	0.34
	06/10/14	na	70.4	318	na	na	<0.002	4.7	0.40
	07/22/14	na	70.3	330	na	na	0.053	4.3	0.48
	08/25/14	0.143	68.3	344	150	<0.2	0.056	6.9	0.39
	09/18/14	na	71.2	354	na	na	0.072	6.6	0.44
	10/21/14	na	74.9	380	na	na	0.072	6	0.49
	11/17/14	0.123	68.6	416	195	<0.2	0.046	4.3	0.50
	12/08/14	na	72.9	450	na	na	0.046	4	0.60
	01/20/15	na	78.5	486	na	na	0.039	2.8	0.59
	02/23/15	0.094	75.6	500	242	<0.2	0.046	2.8	0.59
	03/16/15	na	78.1	512	na	na	0.039	2.7	0.56
	04/14/15	na	83.5	552	na	na	0.043	2.5	0.60
	05/19/15	0.105	84.1	536	264	<0.2	0.046	3.2	0.63
	06/23/15	na	81.8	558	na	na	0.056	3.4	0.70
	07/21/15	na	81.2	522	na	na	0.056	3.5	0.62
	08/10/15	0.093	79	486	264	<0.2	0.043	3.3	0.64
	09/16/15	na	76.3	530	na	na	0.049	3.6	0.58
	10/13/15	na	71.6	492	na	na	0.053	4	0.50
	11/16/15	0.085	72.1	484	219	0.3	0.053	4.1	0.55
	12/08/15	na	71.2	478	na	na	0.056	4.4	0.55
	02/22/16	0.058	59.4	368	175	<0.2	0.015	1.25	0.45
	04/20/16	na	59.6	398	na	na	0.015	1.26	0.43
	05/16/16	0.046	47.7	344	148	<0.2	0.016	1.41	0.36
	06/20/16	na	55	368	na	na	0.015	1.37	0.41
	08/22/16	0.07	53.5	338	162	0.6	0.016	1.29	0.41
	10/10/16	na	43.6	318	na	na	0.015	1.39	0.36
	11/16/16	0.031	29.2	240	92.7	<0.2	0.014	1.51	0.23
	12/12/16	na	22.8	206	na	na	0.012	1.55	0.19
	02/23/17	0.022	14.7	142	41.9	<0.2	0.013	1.64	0.16
	04/11/17	na	16.6	140	na	na	0.011	1.59	0.15
	05/17/17	0.03	23	166	50.6	<0.2	0.01	1.57	0.62
	06/20/17	na	28.2	184	na	na	0.01	1.58	0.26
	08/23/17	0.046	32.6	222	78.8	<0.2	0.014	1.56	0.36
	10/03/17	na	28.8	156	na	na	0.014	1.37	0.33
	11/14/17	0.048	28.2	168	74.4	<0.2	0.014	1.22	0.32
	12/13/17	na	27.8	180	na	na	0.014	1.16	0.33
	02/21/18	0.046	28.0	150	75.6	<0.2	0.017	1.01	0.34
	04/18/18	na	42.9	228	na	na	0.018	0.78	0.54
	05/21/18	0.078	46.0	256	114	na	na	0.86	0.38
	06/14/18	na	45.6	272	na	na	0.015	0.89	0.39
	08/22/18	0.068	39.6	240	109	na	na	0.99	0.36
	10/17/18	na	41.8	252	na	na	0.02	0.83	0.38
	11/07/18	0.075	42.2	214	114	<0.2	0.017	0.70	0.37
	12/11/18	na	43.3	276	na	na	0.017	0.51	0.52

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-9
OCWD MONITORING WELL AMD-10
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
AMD-10/1 Principal Perforations 292-312 ft bgs	02/11/14	0.016	8.7	80	17	<0.2	0.1	7	0.16
	04/15/14	na	5.2	70	na	na	0.1	7.1	0.09
	05/19/14	0.015	11.6	87	28	<0.2	0.062	6.6	0.12
	06/10/14	na	40.8	256	na	na	0.1	4.1	0.43
	08/26/14	0.042	51.6	370	215	<0.2	0.046	4.6	0.5
	10/21/14	na	22.2	154	na	na	0.053	7.7	0.29
	11/05/14	0.023	26.6	189	82	<0.2	0.062	6.8	0.26
	12/09/14	na	18.7	138	na	na	0.059	9.1	0.21
	02/11/15	na	11.2	96	25	<0.2	0.089	8.1	0.14
	04/14/15	na	15.8	101	na	na	0.079	9.7	0.12
	05/06/15	0.019	11.7	91	25.5	<0.2	0.158	11	0.1
	06/23/15	na	15.4	110	na	na	0.089	11.2	0.09
	08/26/15	0.022	12.2	94	34.1	<0.2	0.089	10.1	0.09
	10/12/15	na	12.1	90	na	na	0.092	10.3	0.08
	11/04/15	0.020	11.2	64	29.7	<0.2	0.112	10.1	0.09
	12/08/15	na	21	146	na	na	0.085	8.4	0.19
	02/10/16	0.022	10.9	114	36.9	<0.2	0.024	1.92	0.1
	04/11/16	na	6.6	68	na	na	0.022	1.57	0.07
	05/04/16	0.011	6	73	23.4	<0.2	0.022	1.44	0.06
	06/20/16	na	90.9	570	na	na	0.006	0.33	0.78
	08/10/16	0.065	77.1	526	305	<0.2	0.008	0.5	0.69
	10/10/16	na	13.5	132	na	na	0.011	1.63	0.15
	11/02/16	0.023	19.8	190	55.5	<0.2	0.016	1.55	0.14
	12/12/16	na	14.8	122	na	na	0.017	1.73	0.11
	02/08/17	0.016	11.2	96	24.9	<0.2	0.023	1.62	0.1
	04/10/17	na	46.4	250	na	na	0.021	1.43	0.45
	05/03/17	0.047	33.3	210	85.2	<0.2	0.023	1.47	0.38
	06/21/17	na	7.2	87.5	na	na	0.017	1.21	0.09
	08/09/17	0.026	10.2	88	31.7	<0.2	0.016	1.02	0.15
	10/24/17	na	32.3	178	na	na	0.006	0.31	0.42
	11/01/17	0.061	36.6	202	110	<0.2	0.005	0.29	0.44
	12/13/17	na	64.2	382	na	na	0.008	0.4	0.48
	02/07/18	0.017	10.2	118	49.8	<0.2	0.016	1.17	0.15
	04/16/18	na	4.8	50	na	na	0.017	0.95	0.06
	05/08/18	0.016	4.7	64	23.2	na	na	0.92	0.1
	06/11/18	na	33.6	196	na	na	0.017	0.74	0.24
	08/08/18	0.062	88.8	598	361	na	na	0.281	0.69
	10/15/18	na	88.1	562	na	na	0.004	0.31	0.64
	11/05/18	0.070	90	588	297	<0.2	0.005	0.27	0.7
	12/11/18	na	86.7	588	na	na	0.006	0.17	0.7

TABLE J-9
OCWD MONITORING WELL AMD-10
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
AMD-10/2 Principal Perforations 440-460 ft bgs	02/11/14	0.092	55.4	324	140	<0.2	0.3	6.9	0.51
	05/19/14	0.114	41.7	214	74.9	<0.2	0.194	5.1	0.31
	08/26/14	0.088	48.2	274	108	0.3	0.23	4.5	0.45
	11/05/14	0.084	67.4	422	185	<0.2	0.168	4	0.59
	02/11/15	na	32.8	280	106	<0.2	0.161	6.9	0.32
	05/06/15	0.033	37.3	290	120	<0.2	0.187	7	0.30
	08/26/15	0.048	36.9	232	103	<0.2	0.164	7.9	0.35
	11/04/15	0.039	39.1	268	105	0.3	0.227	7.4	0.36
	02/10/16	0.019	15.9	138	45.6	<0.2	0.045	2.12	0.15
	04/11/16	na	14.3	114	na	na	0.055	2.1	0.11
	05/04/16	0.027	19.5	162	49.9	<0.2	0.052	1.89	0.16
	06/20/16	na	36.0	232	na	na	0.06	1.64	0.26
	08/10/16	0.027	18.4	138	53.5	<0.2	0.066	1.46	0.17
	10/10/16	na	61.7	374	na	na	0.063	0.72	0.48
	11/02/16	0.065	76.9	532	249	<0.2	0.046	0.63	0.57
	12/12/16	na	48.4	486	na	na	0.057	1.04	0.38
	02/08/17	0.021	16.9	154	64.3	<0.2	0.068	1.55	0.13
	04/10/17	na	20.5	162	na	na	0.041	1.61	0.14
	05/03/17	0.023	21.8	168	75	<0.2	0.061	1.5	0.17
	06/21/17	na	32.2	178	na	na	0.054	1.35	0.22
	08/09/17	0.061	25.5	188	91.4	<0.2	0.084	1.25	0.18
	10/24/17	na	11.6	126	na	na	0.045	1.26	0.12
	11/01/17	0.018	11.3	113	49.3	<0.2	0.04	1.28	0.20
	12/13/17	na	8.4	95	na	na	0.038	1.33	0.08
	02/07/18	0.021	10.2	92	36.6	<0.2	0.042	1.21	0.13
	04/16/18	na	16.6	124	na	na	0.049	1.01	0.15
	05/08/18	0.032	17.4	122	54.8	na	na	1.05	0.15
	06/11/18	na	15.9	140	na	na	0.045	1.03	0.13
	08/08/18	0.012	6.0	110	32.9	na	na	0.95	0.08
	10/15/18	na	35.2	196	na	na	0.034	0.81	0.24
	11/05/18	0.054	56.2	334	183	<0.2	0.038	0.61	0.38
	12/11/18	na	62.7	432	na	na	0.049	0.51	0.46
AMD-10/3 Principal Perforations 550-570 ft bgs	02/11/14	0.192	81.6	436	189	<0.2	0.3	1.5	0.99
	05/19/14	0.195	88.9	444	189	<0.2	0.437	4.5	0.86
	08/26/14	0.181	93.2	462	201	<0.2	0.45	5.3	0.87
	11/05/14	0.216	92.6	470	202	<0.2	0.46	4.7	0.89
	02/11/15	na	96.8	514	206	<0.2	0.355	3	0.81
	05/06/15	0.182	93.4	498	213	<0.2	0.358	2.9	0.82
	08/26/15	0.113	88.1	526	253	<0.2	0.296	2.2	0.91
	11/04/15	0.090	88.1	562	256	0.6	0.306	1.9	0.93
	02/10/16	0.096	87.2	580	249	<0.2	0.096	0.52	0.97
	05/04/16	0.088	89.9	598	267	<0.2	0.083	0.44	0.94
	08/10/16	0.103	89.3	608	274	<0.2	0.082	0.44	0.88
	11/02/16	0.102	92.6	624	266	<0.2	0.098	0.47	0.84
	02/08/17	0.099	90.9	560	258	<0.2	0.1	0.75	0.89
	05/03/17	0.089	90.2	560	267	<0.2	0.089	0.64	0.9
	08/09/17	0.075	83.6	620	273	<0.2	0.055	0.55	0.82
	11/01/17	0.085	89.7	512	276	<0.2	0.064	0.63	0.8
	02/07/18	0.091	73.7	498	221	<0.2	0.076	1.2	0.72
	04/16/18	na	na	na	na	na	na	na	na
	05/08/18	0.092	50.4	328	139	na	na	0.94	0.6
	06/11/18	na	na	na	na	na	na	na	na
	08/08/18	0.060	36.6	256	88.3	na	na	0.4	0.5
	10/15/18	na	na	na	na	na	na	na	na
	11/05/18	0.066	45	300	111	<0.2	0.034	0.55	0.52

TABLE J-9
OCWD MONITORING WELL AMD-10
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
AMD-10/4 Principal Perforations 774-794 ft bgs	02/11/14	0.144	99.2	600	274	<0.2	0.6	6.4	0.81
	05/19/14	0.160	87.1	516	241	<0.2	0.473	3.8	0.68
	08/26/14	0.174	85.1	480	210	0.2	0.496	3.8	0.62
	11/05/14	0.196	86.6	470	203	<0.2	0.529	4.4	0.57
	02/11/15		93.4	522	209	<0.2	0.519	5.3	0.6
	05/06/15	0.211	96.3	506	221	<0.2	0.44	5	0.54
	08/26/15	0.178	92.5	480	223	<0.2	0.338	3.1	0.54
	11/04/15	0.168	91	482	233	0.5	0.44	2.4	0.58
	02/10/16	0.117	88.8	584	241	<0.2	0.089	0.43	0.61
	05/04/16	0.097	88.4	590	261	<0.2	0.098	0.44	0.63
	08/10/16	0.101	89.9	612	271	<0.2	0.102	0.41	0.65
	11/02/16	0.092	90.4	652	268	<0.2	0.095	0.39	0.62
	02/08/17	0.095	94.5	608	279	<0.2	0.086	0.31	0.69
	05/03/17	0.105	95.2	590	269	<0.2	0.097	0.37	0.66
	08/09/17	0.104	96.1	666	270	<0.2	0.091	0.55	0.62
	11/01/17	0.097	94.9	600	289	<0.2	0.12	0.48	0.63
	02/07/18	0.086	97.8	640	308	<0.2	0.099	0.45	0.61
	04/16/18	na	na	na	na	na	na	na	na
	05/08/18	0.094	97.1	626	288	na	na	0.34	0.59
	06/11/18	na	na	na	na	na	na	na	na
	08/08/18	0.078	89.5	626	254	na	na	0.23	0.57
	10/15/18	na	na	na	na	na	na	na	na
	11/05/18	0.088	87.4	572	273	<0.2	0.093	0.48	0.57
AMD-10/5 Principal Perforations 934-954 ft bgs	02/11/14	0.156	98.4	608	293	<0.2	1.2	7.7	0.58
	05/19/14	0.164	97.2	586	299	<0.2	1.169	6.6	0.53
	06/24/14	na	97.9	606	291	<0.2	0.164	5.7	0.57
	08/26/14	0.15	99.5	596	294	<0.2	1.495	6.1	0.50
	11/05/14	0.179	93.6	598	284	<0.2	1.258	5.6	0.51
	02/11/15	na	97.9	642	286	<0.2	1.212	5.4	0.48
	05/06/15	0.162	97.1	596	287	<0.2	1.081	5.8	0.46
	08/26/15	0.163	95.6	546	277	<0.2	1.041	5	0.44
	11/04/15	0.187	96.1	552	267	0.5	1.11	5.2	0.44
	2/10/2016	0.172	93.9	548	258	<0.2	0.268	0.91	0.43
	5/4/2016	0.17	94.5	550	252	<0.2	0.264	0.89	0.43
	8/10/2016	0.176	93.4	574	258	<0.2	0.277	0.7	0.44
	11/2/2016	0.145	93.0	618	254	<0.2	0.269	0.65	0.45
	2/8/2017	0.145	93.2	564	265	<0.2	0.259	0.65	0.46
	5/3/2017	0.141	92.9	568	263	<0.2	0.227	0.65	0.46
	8/9/2017	0.129	93.0	598	262	<0.2	0.187	0.54	0.46
	11/1/2017	0.127	94.3	544	273	<0.2	0.192	0.49	0.47
	2/7/2018	0.122	99.2	612	284	<0.2	0.221	0.48	0.47
	4/16/2018	na	na	na	na	na	na	na	na
	5/8/2018	0.123	94.8	520	275	na	na	0.41	0.46
	6/11/2018	na	na	na	na	na	na	na	na
	8/8/2018	0.099	93.5	608	255	na	na	0.21	0.47
	10/15/2018	na	na	na	na	na	na	na	na
	11/5/2018	0.094	95.6	614	295	<0.2	0.145	0.32	0.49

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-10
OCWD MONITORING WELL AMD-12
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
AMD-12/1 Principal Perforations 300-350 ft bgs	01/21/14	na	11.7	78	na	na	<0.002	7.2	0.77
	02/25/14	0.027	13.1	91	18	<0.2	<0.002	7.3	0.16
	03/18/14	na	11.1	84	na	na	<0.002	7.2	0.21
	04/15/14	na	7.6	73	na	na	<0.002	7.3	0.10
	05/20/14	0.013	8.4	76	16.4	<0.2	<0.002	6.8	0.12
	06/10/14	na	15.1	112	na	na	<0.002	6.4	0.15
	07/22/14	na	52.1	336	na	na	<0.002	2.9	0.56
	08/12/14	0.052	63.3	412	200	<0.2	<0.002	2	0.61
	09/18/14	na	67.7	436	na	na	<0.002	2.3	0.77
	10/21/14	na	57.3	422	na	na	<0.002	4.2	0.54
	11/18/14	0.033	46.5	371	184	<0.2	<0.002	5.4	0.39
	12/08/14	na	46.6	344	na	na	<0.002	5.8	0.41
	1/20/2015	na	36.8	290	na	na	<0.007	7.5	0.37
	2/24/2015	0.029	25.4	198	84.4	<0.2	<0.007	8.5	0.20
	3/16/2015	na	29.9	198	na	na	<0.007	8.4	0.24
	4/14/2015	na	31.6	192	na	na	<0.007	8.8	0.22
	5/20/2015	0.04	26.8	188	61.2	<0.2	<0.007	8.9	0.20
	6/23/2015	na	20.7	150	na	na	<0.007	10	0.18
	7/21/2015	na	16.5	126	na	na	0.007	11.2	0.14
	8/12/2015	0.023	15.5	102	32.3	<0.2	<0.007	11.3	0.13
	9/16/2015	na	14.2	124	na	na	<0.007	10.4	0.13
	10/13/2015	na	12.9	98	na	na	<0.007	10.2	0.09
	11/17/2015	0.022	13.4	112	27.3	<0.2	<0.007	10.2	0.08
	12/8/2015	na	13	98	na	na	<0.007	10.3	0.17
	2/23/2016	0.029	34.1	210	79.3	<0.2	<0.002	1.59	0.23
	4/20/2016	na	18.2	160	na	na	<0.002	1.92	0.14
	5/17/2016	0.024	11.7	115	33.3	<0.2	<0.002	1.76	0.09
	6/20/2016	na	27.7	168	na	na	<0.002	1.3	0.21
	8/23/2016	0.07	81.1	538	296	<0.2	<0.002	0.47	0.62
	10/10/2016	na	60.9	452	na	na	<0.002	0.78	0.48
	11/15/2016	0.036	41.5	358	163	<0.2	<0.002	1.19	0.33
	12/12/2016	na	36.3	286	na	na	<0.002	1.34	0.26
	2/22/2017	0.024	22.5	182	72	<0.2	<0.002	1.63	0.2
	4/11/2017	na	23.2	152	na	na	<0.002	1.53	0.15
	5/16/2017	0.054	40.4	234	74.2	<0.2	<0.002	1.47	0.29
	6/20/2017	na	44	238	na	na	<0.002	1.52	0.39
	8/22/2017	0.029	16.5	138	42.6	<0.2	<0.002	1.28	0.18
	10/3/2017	na	20	130	na	na	<0.002	0.68	0.34
	11/15/2017	0.059	26.9	174	59.2	<0.2	<0.002	0.40	0.1
	12/13/2017	na	45.4	256	na	na	<0.002	0.26	0.39
	2/20/2018	0.056	56.3	350	191	<0.2	<0.002	0.54	0.49
	4/18/2018	na	20.8	154	na	na	<0.002	0.99	0.20
	5/22/2018	0.021	9.4	114	41	na	na	1.02	0.17
	6/14/2018	na	6.7	84	na	na	<0.002	1.01	0.06
	8/21/2018	0.059	69.2	418	228	na	na	0.36	0.46
	10/15/2018	na	92.7	586	na	na	<0.002	0.28	0.65
	11/6/2018	0.069	92.4	626	342	<0.2	<0.002	0.27	0.67
	12/11/2018	na	87.1	568	na	na	0.004	0.22	0.67

TABLE J-10
OCWD MONITORING WELL AMD-12
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
AMD-12/2 Principal Perforations 490-520 ft bgs	02/25/14	0.057	33.5	222	82.5	<0.2	<0.002	7.30	0.30
	05/20/14	0.045	24.7	178	65.7	<0.2	<0.002	7.30	0.18
	08/12/14	0.064	25.9	156	53.3	0.3	<0.002	6.00	0.18
	11/18/14	0.032	21.2	161	46.8	<0.2	<0.002	6.40	0.31
	02/24/15	0.042	38.2	278	120	<0.2	<0.007	6.60	0.29
	05/20/15	0.035	28.5	238	80.5	<0.2	<0.007	7.90	0.22
	08/12/15	0.028	25.6	208	73.3	<0.2	<0.007	8.50	0.22
	11/17/15	0.028	22.7	170	50.2	<0.2	<0.007	9.30	0.13
	03/08/16	0.024	18.5	136	45.1	<0.2	<0.002	2.20	0.13
	05/17/16	0.028	13.7	125	33.6	<0.2	<0.002	2.05	0.12
	08/23/16	0.026	16.6	128	37.7	0.4	<0.002	1.86	0.53
	11/15/16	0.03	28.8	174	58.6	<0.2	<0.002	1.24	0.21
	02/22/17	0.028	28.4	212	94.3	<0.2	<0.002	1.45	0.22
	05/16/17	0.022	19.6	162	59.9	<0.2	<0.002	1.69	0.17
	08/22/17	0.028	26.1	188	73	<0.2	<0.002	1.48	0.17
	11/15/17	0.022	16.2	158	60.8	<0.2	<0.002	1.33	<0.05
	2/20/2018	0.016	9.4	102	38	<0.2	<0.002	1.40	0.20
	4/18/2018	na	na	na	na	na	na	na	na
	5/22/2018	0.027	12.3	104	36.1	na	na	1.22	0.14
	6/14/2018	na	na	na	na	na	na	na	na
	8/21/2018	0.021	11.4	98	44	na	na	1.13	0.13
	10/15/2018	na	na	na	na	na	na	na	na
	11/6/2018	0.02	10.3	120	38.6	<0.2	0.003	1.10	0.11
AMD-12/3 Principal Perforations 595-615 ft bgs	02/25/14	0.176	79.2	416	184	<0.2	<0.002	3.70	0.77
	05/20/14	0.185	81.7	396	179	<0.2	<0.002	4.90	0.68
	08/12/14	0.182	82.9	438	189	<0.2	<0.002	5.00	0.65
	11/18/14	0.203	86.4	430	171	<0.2	<0.002	4.80	0.60
	02/24/15	0.187	88.2	448	199	<0.2	<0.007	4.20	0.59
	05/20/15	0.168	89.6	490	202	<0.2	<0.007	4.00	0.67
	08/12/15	0.13	85.1	482	231	<0.2	<0.007	4.00	0.67
	11/17/15	0.091	82.4	540	237	<0.2	<0.007	3.20	0.65
	02/23/16	0.087	81.2	546	239	<0.2	<0.002	0.80	0.68
	05/17/16	0.086	79.9	514	236	<0.2	<0.002	0.92	0.63
	08/23/16	0.088	76	494	229	<0.2	<0.002	0.89	0.57
	11/15/16	0.091	80.6	530	218	<0.2	<0.002	0.85	0.6
	02/22/17	0.092	80.2	476	213	<0.2	<0.002	1.01	0.58
	05/16/17	0.084	84.1	528	230	<0.2	<0.002	0.97	0.61
	08/22/17	0.068	74.6	520	225	<0.2	<0.002	0.94	0.56
	11/15/17	0.064	77.2	516	236	<0.2	<0.002	0.71	0.37
	2/20/2018	0.076	79.7	484	235	<0.2	<0.002	0.86	0.55
	4/18/2018	na	na	na	na	na	na	na	na
	5/22/2018	0.096	65.3	432	181	na	na	1.15	0.47
	6/14/2018	na	na	na	na	na	na	na	na
	8/21/2018	0.069	41.7	314	142	na	na	1.06	0.36
	10/15/2018	na	na	na	na	na	na	na	na
	11/6/2018	0.064	36.1	284	102	<0.2	0.003	1.00	0.35
AMD-12/4 Principal Perforations 725-745 ft bgs	02/25/14	0.13	99.8	578	262	<0.2	<0.002	6.5	1.12
	05/20/14	0.142	93.2	600	259	<0.2	<0.002	4.9	0.88
	08/12/14	0.16	90.7	534	242	<0.2	<0.002	3.6	0.96
	11/18/14	0.185	85.7	526	225	<0.2	<0.002	4.5	0.85
	02/24/15	0.187	92.5	480	206	<0.2	<0.007	5.6	0.83
	05/20/15	0.203	95.6	512	210	<0.2	<0.007	5.6	0.82
	08/12/15	0.203	95	478	210	<0.2	<0.007	4.9	0.81
	11/17/15	0.197	93.8	516	208	<0.2	0.007	3.8	0.76
	02/23/16	0.17	92.4	476	212	<0.2	<0.002	<0.002	0.97
	05/17/16	0.147	90.9	524	220	0.2	<0.002	<0.002	0.81
	08/23/16	0.142	92.3	520	238	0.5	<0.002	<0.002	0.84
	11/15/16	0.108	90.2	582	243	<0.2	<0.002	<0.002	0.87
	02/22/17	0.097	90	562	253	<0.2	<0.002	0.57	0.89
	05/16/17	0.099	92.1	588	251	<0.2	<0.002	0.65	1.05
	08/22/17	0.099	91.2	580	254	<0.2	<0.002	0.69	0.83
	11/15/17	0.096	92	584	269	<0.2	<0.002	0.81	0.67
	2/20/2018	0.09	92.1	578	281	<0.2	<0.002	0.62	0.83
	4/18/2018	na	na	na	na	na	na	na	na
	5/22/2018	0.106	93	598	260	na	na	0.60	0.79
	6/14/2018	na	na	na	na	na	na	na	na
	8/21/2018	0.091	85.5	548	273	na	na	0.82	0.72
	10/15/2018	na	na	na	na	na	na	na	na
	11/6/2018	0.093	77.4	532	236	<0.2	0.003	1.01	0.74

TABLE J-10
OCWD MONITORING WELL AMD-12
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
	02/25/14	0.126	96.7	582	263	<0.2	<0.002	5.20	0.92
	05/20/14	0.134	96	602	278	<0.2	<0.002	6.40	0.88
	08/12/14	0.132	96.7	588	272	<0.2	<0.002	5.80	0.87
	11/18/14	0.139	90.8	580	266	<0.2	<0.002	6.20	0.81
	02/24/15	0.152	94.4	542	275	<0.2	<0.007	6.10	0.8
	05/20/15	0.163	93.4	578	244	<0.2	<0.007	6.20	0.8
	08/12/15	0.164	92.9	522	241	<0.2	<0.007	6.50	0.86
	11/17/15	0.161	92.7	556	235	<0.2	<0.007	6.10	0.65
AMD-12/5 Principal Perforations 940-960 ft bgs	02/23/16	0.178	90.3	534	228	<0.2	<0.002	0.75	0.63
	05/17/16	0.166	93.3	510	224	0.2	<0.002	1.17	0.6
	08/23/16	0.185	91.9	514	235	<0.2	<0.002	0.97	0.56
	11/15/16	0.15	91.8	556	236	<0.2	<0.002	0.92	0.59
	02/22/17	0.141	91.3	518	240	<0.2	<0.002	0.87	0.6
	05/16/17	0.134	92.6	556	241	<0.2	<0.002	0.83	0.6
	08/22/17	0.132	93.2	538	249	<0.2	<0.002	0.73	0.6
	11/15/17	0.129	95.7	568	270	<0.2	<0.002	0.77	0.42
	2/20/2018	0.124	92.5	560	263	<0.2	<0.002	0.63	0.69
	4/18/2018	na	na	na	na	na	na	na	na
	5/22/2018	0.134	93.5	552	244	na	na	0.59	0.60
	6/14/2018	na	na	na	na	na	na	na	na
	8/21/2018	0.112	92.7	570	276	na	na	0.59	0.60
	10/15/2018	na	na	na	na	na	na	na	na
	11/6/2018	0.112	94.9	263	269	<0.2	0.002	0.62	0.70

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-11
OCWD MONITORING WELL KB1
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
OCWD-KB1 Shallow Perforations 180-200 ft bgs	1/7/2014	na	96.2	308	na	na	<0.002	0.01	0.76
	2/4/2014	na	42.8	186	na	na	<0.002	1.22	0.78
	2/11/2014	0.085	63.0	380	157	<0.2	<0.002	0.75	0.89
	3/18/2014	na	81.9	582	na	na	<0.002	0.28	1.43
	4/15/2014	na	85.9	582	na	na	<0.002	0.54	1.28
	5/19/2014	0.057	79.5	562	272	<0.2	<0.002	0.29	1.28
	6/10/2014	na	71.3	530	na	na	<0.002	0.6	1.10
	7/16/2014	na	79.0	562	na	na	<0.002	0.34	1.05
	8/12/2014	0.064	73.9	520	240	<0.2	<0.002	0.43	0.84
	9/17/2014	na	80.8	596	na	na	<0.002	0.24	1.06
	10/21/2014	na	85.3	596	na	na	<0.002	0.31	1.16
	11/5/2014	0.053	83.9	612	272	<0.2	<0.002	0.32	1.04
	12/9/2014	na	82.3	588	na	na	<0.002	0.6	1.03
	2/11/2015	na	82.5	476	229	0.2	<0.007	5.3	2.31
	3/16/2015	na	63.3	452	na	na	<0.007	5.5	1.35
	4/14/2015	na	49.1	326	na	na	<0.007	7.5	0.92
	5/6/2015	0.042	29.5	214	71.8	<0.2	<0.007	10.6	0.87
	6/17/2015	na	65.5	490	na	na	<0.007	4.9	0.82
	7/20/2015	na	12.3	106	na	na	<0.007	10.9	0.42
	8/26/2015	0.054	41.8	238	104	<0.2	<0.007	7.1	0.43
	9/24/2015	na	59.1	398	na	na	<0.007	5.4	0.62
	10/13/2015	na	28.4	204	na	na	<0.007	9.4	0.31
	11/4/2015	0.022	12.7	86	25.8	0.2	<0.007	9.9	0.22
	12/8/2015	na	54.7	384	na	na	0.01	4.6	0.59
	2/10/2016	0.014	6.3	88	20.6	<0.2	<0.002	1.63	0.16
	5/4/2016	0.015	10	90	39.6	<0.2	<0.002	1.48	0.12
	8/10/2016	0.014	7.8	74	35	<0.2	<0.002	1.82	0.09
	11/2/2016	0.018	11.6	126	53.3	<0.2	0.002	1.93	0.12
	2/8/2017	0.092	68.8	388	213	0.3	<0.002	1.36	1.76
	5/3/2017	0.094	62.2	362	194	<0.2	<0.002	2.07	1.63
	8/9/2017	0.052	22	132	65.5	<0.2	<0.002	0.36	1.05
	11/1/2017	0.054	41.5	286	163	<0.2	<0.002	0.66	0.56
	2/6/2018	0.05	29	208	86	<0.2	<0.002	1.24	0.40
	5/8/2018	0.025	7.7	78	22	na	na	1.39	0.22
	8/8/2018	0.063	91.1	612	289	na	na	0.01	0.78
	11/5/2018	0.063	92.7	620	273	<0.2	<0.002	0.24	0.96

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-12
OCWD MONITORING WELL AM-10
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
AM-10 Principal Perforations 300-350 ft bgs	1/21/2014	na	na	na	na	na	na	na	na
	2/25/2014	na	na	na	na	na	na	na	na
	3/18/2014	na	na	na	na	na	na	na	na
	4/15/2014	na	na	na	na	na	na	na	na
	5/20/2014	na	na	na	na	na	na	na	na
	6/10/2014	na	na	na	na	na	na	na	na
	7/22/2014	na	na	na	na	na	na	na	na
	8/12/2014	na	na	na	na	na	na	na	na
	9/18/2014	na	na	na	na	na	na	na	na
	10/21/2014	na	na	na	na	na	na	na	na
	11/18/2014	na	na	na	na	na	na	na	na
	12/8/2014	na	na	na	na	na	na	na	na
	1/20/2015	na	na	na	na	na	na	na	na
	2/24/2015	na	na	na	na	na	na	na	na
	3/16/2015	na	na	na	na	na	na	na	na
	4/14/2015	na	na	na	na	na	na	na	na
	5/20/2015	na	na	na	na	na	na	na	na
	6/23/2015	na	na	na	na	na	na	na	na
	7/21/2015	na	na	na	na	na	na	na	na
	8/12/2015	na	na	na	na	na	na	na	na
	9/16/2015	na	na	na	na	na	na	na	na
	10/13/2015	na	na	na	na	na	na	na	na
	11/17/2015	na	na	na	na	na	na	na	na
	12/8/2015	na	na	na	na	na	na	na	na
	1/19/2016	na	29.3	192	na	<0.2	0.004	1.94	0.26
	3/8/2016	0.034	34.6	248	112	<0.2	0.004	1.64	0.24
	6/14/2016	0.019	10	106	33	<0.2	0.004	1.77	0.14
	9/20/2016	0.017	8	78	28.2	<0.2	0.004	1.59	0.16
	12/6/2016	0.016	8.8	86	28	<0.2	0.005	1.79	0.09
	3/7/2017	0.015	8.2	88	32	<0.2	0.003	1.74	0.09
	6/13/2017	0.011	5.8	66	23.4	<0.2	0.002	1.29	0.12
	9/19/2017	na	6.8	74.5	na	na	0.003	1.44	0.05
	11/14/2017	0.013	6.2	79.5	27.7	<0.2	0.003	1.37	0.09
	12/5/2017	0.023	6.1	51	26.7	<0.2	0.003	1.36	<0.05
	2/21/2018	0.011	5.1	62	26	<0.2	0.003	1.07	0.07
	5/22/2018	0.022	5.5	62	27.5	na	na	1.13	0.07
	8/23/2018	0.015	7.4	69	35.3	na	na	1.55	0.05
	9/12/2018	na	7.4	75	na	na	0.003	1.53	0.06
	11/7/2018	0.023	16.4	105	57.6	<0.2	0.004	1.48	0.11

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

Appendix K

Groundwater Quality Data at the Mid-Basin Area

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

GWRS 2018 Quarterly Sampling Dates

OCWD Water Quality Department

DEMONSTRATION MID-BASIN INJECTION (MBI) PROJECT

GROUNDWATER

Monitoring Well	Qtr 1	Qtr 2	Qtr 3	Qtr 4
SAR-10/1-4	03/20/2018	06/18/2018	09/05/2018	12/03/2018
SAR-11/1-3	03/19/2018	06/18/2018	09/05/2018	12/03/2018

Notes for Appendix K Tables:

► Water quality data are summarized in the following tables for monitoring wells SAR-10/1-4 and SAR-11/1-3. These wells are non-compliance monitoring wells and were constructed as part of OCWD's Demonstration Mid-Basin Injection (MBI) Project to comply with existing SWRCB DDW's (formerly CDPH) draft recycled water recharge project regulations. The monitoring wells will provide water quality data located between the point of injection (Mid-Basin Injection Well MBI-1 is located 80 feet upgradient of SAR-10) and the nearest downgradient municipal production wells IRWD-12 and IRWD-17. SAR-10 and SAR-11 collectively consist of 7 multi-depth nested wells to monitor multiple zones within the Principal aquifer receiving GWRS FPW injected water at MBI-1. SAR-10/1-4 was constructed in May 2012 and SAR-11/1-3 in November 2011. Dedicated pumps were installed in each casing prior to routine monitoring. Baseline monitoring continued in 2015 to establish ambient groundwater conditions before and after injection of FPW at MBI-1. MBI-1 began injection FPW on April 15, 2015.

► Listed dates (above) are the 2018 dates of quarterly baseline monitoring activities.

► Results listed in the table for each quarter are the range of the minimum and maximum values detected at the well location, which may consist of one to four well casings. Figures and report text list the well ID (e.g. SAR-10) and casing number (e.g., SAR-10/1, SAR-10/2, SAR-10/3 and SAR-10/4), as appropriate.

► Appendices B & C contain a list of all methods and reportable detection limits (RDL).

► Detailed data reports are available upon request.

► The more stringent value in the range of secondary MCLs is used in the tables (e.g., <MCL) for TDS, electrical conductivity (EC), chloride and sulfate.

► MCL: Maximum Contaminant Level

► N/A: Not applicable

► ND: Not detected at reportable detection limit (RDL)

► NL: SWRCB DDW (formerly CDPH) Notification Level

► NR: Not Required

► NS: Not sampled

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	SAR-10 Qtr 1	SAR-10 Qtr 2	SAR-10 Qtr 3	SAR-10 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	14.6 - 93.5	9.3 - 111	9.8 - 32.8	10.4 - 74.5
Aluminum (dissolved) (Al-DIS), ug/L	OCWD	N/A	7.9 - 23.1	6.8 - 24.5	9.6 - 28.1	9.2 - 31.8
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 6.1	ND - 4.8	ND - 5.7	ND - 6.2
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	ND - 6.2	ND - 5.2	ND - 5.3	ND - 6.1
Barium (Ba), ug/L	OCWD	1000	10.2 - 29.5	10.8 - 34.9	11.3 - 33.4	11.7 - 26.5
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	ND - 0.12	ND - 0.1	ND	ND - 0.11
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.25	ND - 0.32	ND - 0.36	ND
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 1.1	ND - 1.55	ND - 1.51	ND - 1.24
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.008	NR	NR	ND - 0.006
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 1.8	ND	ND - 2	ND - 1.2
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	ND - 1.2	ND - 3.4	ND - 2.9	ND - 2.9
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	105 - 140	119 - 149	120 - 190	100 - 148
Iron (Fe), ug/L	OCWD	300	ND - 182	ND - 49.3	ND - 23.4	ND - 86.2
Manganese (Mn), ug/L	OCWD	50	1.1 - 4.6	ND - 4.4	ND - 4.4	ND - 4.6
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 4.5	ND - 4.2	ND - 4.5	ND - 4.3
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	60 - 82	55 - 96	72 - 114	60 - 98
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.1 - 1.6	0.2 - 1.1	0.1 - 0.9	0.2 - 1.9
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	ND	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.22 - 0.25	0.21 - 0.27	0.23 - 0.27	0.22 - 0.28
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	ND - 6.2	ND - 5.1	ND - 5.3	ND - 6.1
Vanadium (dissolved) (V-DIS), ug/L	OCWD	N/A	ND - 6.4	ND - 5.1	ND - 6.2	ND - 5.8
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
EPTC (EPTC), ug/L	OCWD	N/A	NR	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	NR	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	SAR-10 Qtr 1	SAR-10 Qtr 2	SAR-10 Qtr 3	SAR-10 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND	ND	ND	ND
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	NR	NR	NR	ND
537	PFAS Compounds	OCWD	ND	NR	NR	NR
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < NL

SAR-10/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2018 11:20	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
3/20/2018 11:20	Chloroform (CHCl3)	1.2	ug/L	0.5
3/20/2018 11:20	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2018 11:20	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
6/18/2018 11:20	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
6/18/2018 11:20	Chloroform (CHCl3)	1.6	ug/L	0.5
6/18/2018 11:20	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
6/18/2018 11:20	n-Nitrosodimethylamine (NDMA)	4.1	ng/L	2

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
9/5/2018 11:10	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
9/5/2018 11:10	Chloroform (CHCl3)	1.2	ug/L	0.5
9/5/2018 11:10	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
9/5/2018 11:10	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5

SAR-10/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	11:35	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
12/3/2018	11:35	Chloroform (CHCl3)	1.7	ug/L	0.5
12/3/2018	11:35	Total Trihalomethanes (TTHMs)	2.3	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	11:35	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.1
12/3/2018	11:35	Chloroform (CHCl3)	1.2	ug/L	0.1
12/3/2018	11:35	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	11:35	n-Nitrosodimethylamine (NDMA)	4.5	ng/L	2

SAR-10/2
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2018 11:15	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
3/20/2018 11:15	Chloroform (CHCl3)	1.0	ug/L	0.5
3/20/2018 11:15	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2018 11:15	n-Nitrosodimethylamine (NDMA)	2.5	ng/L	2

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
6/18/2018 11:45	Bromodichloromethane (CHBrCl)	1.2	ug/L	0.5
6/18/2018 11:45	Chloroform (CHCl3)	2.3	ug/L	0.5
6/18/2018 11:45	Total Trihalomethanes (TTHMs)	3.4	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
6/18/2018 11:45	n-Nitrosodimethylamine (NDMA)	6.0	ng/L	2

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
9/5/2018 12:20	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.5
9/5/2018 12:20	Chloroform (CHCl3)	2.1	ug/L	0.5
9/5/2018 12:20	Total Trihalomethanes (TTHMs)	2.9	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
9/5/2018 12:20	n-Nitrosodimethylamine (NDMA)	5.5	ng/L	2

SAR-10/2
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	11:20	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
12/3/2018	11:20	Chloroform (CHCl3)	2.0	ug/L	0.5
12/3/2018	11:20	Total Trihalomethanes (TTHMs)	2.9	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	11:20	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.1
12/3/2018	11:20	Chloroform (CHCl3)	1.2	ug/L	0.1
12/3/2018	11:20	Dibromochloromethane (CHBr2C)	0.2	ug/L	0.1
12/3/2018	11:20	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	11:20	n-Nitrosodimethylamine (NDMA)	5.6	ng/L	2

SAR-10/3
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
3/20/2018 12:35	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
6/18/2018 10:45	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
9/5/2018 11:25	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
12/3/2018 10:05	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
12/3/2018 10:05	n-Nitrosodimethylamine (NDMA)	2.3	ng/L	2

SAR-10/4
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2018	10:10	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
3/20/2018	10:10	Chloroform (CHCl3)	0.8	ug/L	0.5
3/20/2018	10:10	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2018	10:10	n-Nitrosodimethylamine (NDMA)	2.9	ng/L	2

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2018	9:40	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
6/18/2018	9:40	Chloroform (CHCl3)	1.9	ug/L	0.5
6/18/2018	9:40	Total Trihalomethanes (TTHMs)	2.6	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2018	9:40	n-Nitrosodimethylamine (NDMA)	4.4	ng/L	2

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/5/2018	10:05	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
9/5/2018	10:05	Chloroform (CHCl3)	2.1	ug/L	0.5
9/5/2018	10:05	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/5/2018	10:05	n-Nitrosodimethylamine (NDMA)	4.1	ng/L	2

SAR-10/4
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	10:25	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
12/3/2018	10:25	Chloroform (CHCl3)	1.4	ug/L	0.5
12/3/2018	10:25	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	10:25	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.1
12/3/2018	10:25	Chloroform (CHCl3)	1.1	ug/L	0.1
12/3/2018	10:25	Dibromochloromethane (CHBr2C)	0.1	ug/L	0.1
12/3/2018	10:25	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	10:25	n-Nitrosodimethylamine (NDMA)	5.9	ng/L	2

Summary of All 2018 Water Quality Testing for Regulated and Unregulated Chemicals

Category	Lab	MCL	SAR-11 Qtr 1	SAR-11 Qtr 2	SAR-11 Qtr 3	SAR-11 Qtr 4
Primary Drinking Water Standards - Inorganic						
Aluminum (Al), ug/L	OCWD	1000	3.4 - 8	4.9 - 10.8	2.1 - 8.4	3.6 - 8.9
Aluminum (dissolved) (Al-DIS), ug/L	OCWD	N/A	1.1 - 8.3	1 - 9.9	1.8 - 9	2.1 - 9
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	2.1 - 4.7	ND - 4	1.7 - 4.3	2.1 - 4.3
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	2 - 4.7	1 - 3.8	1.5 - 4.3	2.2 - 4.7
Barium (Ba), ug/L	OCWD	1000	16.6 - 34.4	16.4 - 33	15.7 - 37.3	17.2 - 30.8
Beryllium (Be), ug/L	OCWD	4	ND	ND	ND	ND
Cadmium (Cd), ug/L	OCWD	5	ND	ND	ND	ND
Chromium (Cr), ug/L	OCWD	50	ND - 1.7	ND - 2.6	ND - 3.6	ND - 1.7
Fluoride (F), mg/L	OCWD	2	0.14 - 0.55	0.14 - 0.53	0.17 - 0.49	ND - 0.57
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.25	ND - 0.26	ND - 0.22	ND - 0.28
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND - 4	ND - 1.9	1.3 - 2.7	ND - 1.2
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 1.33	ND - 1.18	ND - 1.21	ND - 1.49
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.002	NR	NR	0.003 - 0.004
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 5	ND - 3	ND - 6	ND - 3.9
Thallium (Tl), ug/L	OCWD	2	ND	ND	ND	ND
Primary Drinking Water Standards - Organic						
1,2,3-Trichloropropane (123TCP), ug/L	OCWD	0.005	ND	ND	ND	ND
Primary Drinking Water Standards - Disinfection By-Products						
Total Trihalomethanes (TTHMs), ug/L	OCWD	80	ND - 3	ND - 2.9	ND - 2	ND - 2.2
Primary Drinking Water Standards - Biological						
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	NR	NR	ND
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	137 - 282	128 - 267	138 - 308	124 - 250
Iron (Fe), ug/L	OCWD	300	17.5 - 47.3	11.3 - 25.9	7.9 - 25.2	11.7 - 27.2
Manganese (Mn), ug/L	OCWD	50	ND - 8.3	ND - 7.1	ND - 6.8	ND - 6.8
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 7.1	ND - 7.2	ND - 6.7	ND - 6.2
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND - 1	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	89.5 - 172	72 - 154	84 - 176	85 - 156
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.2 - 0.3	0.2 - 0.5	0.2 - 0.5	0.2 - 0.3
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	ND	ND	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.13 - 0.26	0.13 - 0.23	0.13 - 0.22	0.15 - 0.25
Dichlorodifluoromethane (CCl2F2), ug/L	OCWD	N/A	ND	ND	ND	ND
Ethyl tert-butyl ether (ETBE), ug/L	OCWD	N/A	ND	ND	ND	ND
Tert-amyl methyl ether (TAME), ug/L	OCWD	N/A	ND	ND	ND	ND
tert-butyl alcohol (TBA), ug/L	OCWD	N/A	ND	ND	ND	ND
Vanadium (V), ug/L	OCWD	N/A	ND - 10.1	ND - 11	ND - 9.6	ND - 11.1
Vanadium (dissolved) (V-DIS), ug/L	OCWD	N/A	ND - 9.8	ND - 11	ND - 10.3	ND - 10.8
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	NR	NR	NR	ND
4,4'-DDE (DDE), ug/L	OCWD	N/A	NR	NR	NR	ND
Acetochlor (ACETOC), ug/L	OCWD	N/A	NR	NR	NR	ND
EPTC (EPTC), ug/L	OCWD	N/A	NR	NR	NR	ND
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	NR	NR	NR	ND
Terbacil (TRBACL), ug/L	OCWD	N/A	NR	NR	NR	ND

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2018 Volatile and Semi-Volatile Water Quality Chemicals

Method	Description	Lab	SAR-11 Qtr 1	SAR-11 Qtr 2	SAR-11 Qtr 3	SAR-11 Qtr 4
14DIOX	1,4-Dioxane Analytical Procedure	OCWD	ND	ND	ND	ND
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	NR	NR	NR	ND
537	PFAS Compounds	OCWD	ND	NR	NR	NR
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	NR	NR	NR	ND < MCL
CEC	Chemicals of Emerging Concern	OCWD	NR	NR	NR	ND
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND < NL	ND < NL	ND	ND < NL

SAR-11/1
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/19/2018	9:05	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
3/19/2018	9:05	Chloroform (CHCl3)	1.0	ug/L	0.5
3/19/2018	9:05	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2018	11:45	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
6/18/2018	11:45	Chloroform (CHCl3)	1.2	ug/L	0.5
6/18/2018	11:45	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/5/2018	9:00	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
9/5/2018	9:00	Chloroform (CHCl3)	0.7	ug/L	0.5
9/5/2018	9:00	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	9:20	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
12/3/2018	9:20	Chloroform (CHCl3)	1.0	ug/L	0.5
12/3/2018	9:20	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	9:20	Bromodichloromethane (CHBrCl)	0.4	ug/L	0.1
12/3/2018	9:20	Chloroform (CHCl3)	0.8	ug/L	0.1

SAR-11/1
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 551.1

Sample Date &	*Time*	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
12/3/2018	9:20	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.1

SAR-11/2
Organic Detections by Method

Year 2018, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/19/2018	10:20	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
3/19/2018	10:20	Chloroform (CHCl3)	2.0	ug/L	0.5
3/19/2018	10:20	Total Trihalomethanes (TTHMs)	3.0	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/19/2018	10:20	n-Nitrosodimethylamine (NDMA)	3.5	ng/L	2

Year 2018, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2018	10:50	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.5
6/18/2018	10:50	Chloroform (CHCl3)	1.9	ug/L	0.5
6/18/2018	10:50	Total Trihalomethanes (TTHMs)	2.9	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2018	10:50	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2

Year 2018, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/5/2018	9:55	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
9/5/2018	9:55	Chloroform (CHCl3)	1.4	ug/L	0.5
9/5/2018	9:55	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.5

SAR-11/2
Organic Detections by Method

Year 2018, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	10:10	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
12/3/2018	10:10	Chloroform (CHCl3)	1.6	ug/L	0.5
12/3/2018	10:10	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	10:10	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.1
12/3/2018	10:10	Chloroform (CHCl3)	1.3	ug/L	0.1
12/3/2018	10:10	Dibromochloromethane (CHBr2C)	0.1	ug/L	0.1
12/3/2018	10:10	Total Trihalomethanes (TTHMs)	2.1	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/3/2018	10:10	n-Nitrosodimethylamine (NDMA)	3.4	ng/L	2

Appendix L

Mid-Basin Injection Area Monitoring Well Groundwater Quality

1,4-Dioxane, NDMA and Selected Constituents

Orange County Water District
Groundwater Replenishment System
2018 Annual Report

TABLE L-1
OCWD MONITORING WELL SAR-10
1,4-dioxane and NDMA Concentrations
2014- 2018

SAR-10/1 *Upper Rho Aquifer* *Perforations: 590-600 ft bgs*			**SAR-10/2** *Lower Rho Aquifer* *Perforations: 690-710 ft bgs*			**SAR-10/3** *Main Aquifer* *Perforations: 800-820 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
3/25/2014	<1	<2	3/25/2014	<1	<2	3/25/2014	<1	<2
6/18/2014	<1	<2	6/18/2014	<1	<2	6/18/2014	<1	<2
9/23/2014	<1	<2	9/23/2014	<1	<2	9/23/2014	<1	<2
12/1/2014	<1	<2	12/1/2014	<1	<2	12/1/2014	<1	<2
3/23/2015	<1	<2	3/23/2015	<1	<2	3/23/2015	<1	<2
6/17/2015	<1	2.2	6/17/2015	<1	7.8	6/17/2015	<1	<2
7/15/2015	na	4.9	7/15/2015	na	8.6	7/15/2015	na	3
7/28/2015	na	4.5	7/28/2015	na	3.5	7/28/2015	na	3.2
8/12/2015	na	3.2	8/12/2015	na	6.6	8/12/2015	na	3.7
8/24/2015	na	7.7	8/24/2015	na	9.5	8/24/2015	na	3.8
9/8/2015	<1	8.2	9/8/2015	<1	10.7	9/8/2015	<1	3
9/23/2015	na	7.7	9/23/2015	na	6.1	9/23/2015	na	4.9
10/8/2015	na	9.6	10/8/2015	na	9.7	10/8/2015	na	3
10/20/2015	na	5.8	10/20/2015	na	6.6	10/20/2015	na	4
11/5/2015	na	4.8	11/5/2015	na	4.7	11/5/2015	na	3.9
11/19/2015	na	3.2	11/19/2015	na	3.8	11/19/2015	na	3.4
11/30/2015	<1	3.7	11/30/2015	<1	2.7	11/30/2015	<1	2.8
12/15/2015	na	<2	12/15/2015	na	<2	12/15/2015	na	2.2
12/29/2015	na	2.4	12/29/2015	na	2.3	12/29/2015	na	<2
1/20/2016	na	2.2	1/20/2016	na	2.3	1/20/2016	na	<2
2/24/2016	na	2.8	2/24/2016	na	3	2/24/2016	na	<2
3/22/2016	<1	<2	3/22/2016	<1	<2	3/22/2016	<1	<2
4/13/2016	na	<2	4/13/2016	na	<2	4/13/2016	na	<2
5/31/2016	<1	<2	5/31/2016	<1	2	5/31/2016	<1	<2
6/22/2016	na	3.6	6/22/2016	na	5.2	6/22/2016	na	<2
7/27/2016	na	4	7/27/2016	na	6	7/27/2016	na	<2
9/7/2016	<1	3.4	9/7/2016	<1	5.9	9/7/2016	<1	2.3
12/7/2016	<1	5.8	12/7/2016	<1	5.8	12/7/2016	<1	3.2
3/21/2017	<1	2.6	3/21/2017	<1	3.1	3/21/2017	<1	<2
5/30/2017	<1	<2	5/30/2017	<1	<2	5/30/2017	<1	<2
9/6/2017	<1	<2	9/6/2017	<1	2.1	9/6/2017	<1	<2
12/4/2017	<1	2.8	12/4/2017	<1	3	12/4/2017	<1	<2
3/20/2018	<1	2.6	3/20/2018	<1	2.5	3/20/2018	<1	<2
6/18/2018	<1	4.1	6/18/2018	<1	6	6/18/2018	<1	<2
9/5/2018	<1	<2	9/5/2018	<1	5.5	9/5/2018	<1	<2
12/3/2018	<1	4.5	12/3/2018	<1	5.6	12/3/2018	<1	2.3

TABLE L-1
OCWD MONITORING WELL SAR-10
1,4-dioxane and NDMA Concentrations
2014- 2018

SAR-10/4 *Main Aquifer* *Perforations: 1,100-1,115 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
3/25/2014	<1	<2
6/18/2014	<1	<2
9/23/2014	<1	<2
12/1/2014	<1	<2
3/23/2015	<1	<2
6/17/2015	<1	6.2
7/15/2015	na	7.6
7/28/2015	na	<2
8/24/2015	na	9.2
9/8/2015	<1	6.6
9/23/2015	na	3.1
10/8/2015	na	9.2
10/20/2015	na	5.8
11/5/2015	na	5
11/19/2015	na	3.9
11/30/2015	<1	2.5
12/15/2015	na	2.5
12/29/2015	na	<2
1/20/2016	na	2
2/24/2016	na	2.8
3/22/2016	<1	<2
4/13/2016	na	<2
5/31/2016	<1	3.4
6/22/2016	na	5.8
7/27/2016	na	5.3
9/7/2016	<1	4.3
12/7/2016	<1	5.2
3/21/2017	<1	2.9
5/30/2017	<1	<2
9/6/2017	<1	2.4
12/4/2017	<1	6.6
3/20/2018	<1	2.9
6/18/2018	<1	4.4
9/5/2018	<1	4.1
12/3/2018	<1	5.9

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE L-2
OCWD MONITORING WELL SAR-11
1,4-dioxane and NDMA Concentrations
2014 - 2018

SAR-11/1 *Upper Rho Aquifer* *Perforations: 592-602 ft bgs*			**SAR-11/2** *Lower Rho Aquifer* *Perforations: 675-690 ft bgs*			**SAR-11/3** *Main Aquifer* *Perforations: 1,100-1,110 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)	Date	1,4-dioxane (ug/L)	NDMA (ng/L)
3/24/2014	<1	<2	3/24/2014	<1	<2	3/24/2014	<1	<2
6/16/2014	<1	<2	6/16/2014	<1	<2	6/16/2014	<1	<2
9/22/2014	<1	<2	9/22/2014	<1	<2	9/22/2014	<1	<2
12/1/2014	<1	<2	12/1/2014	<1	<2	12/1/2014	<1	<2
3/24/2015	<1	<2	3/24/2015	<1	<2	3/24/2015	<1	<2
6/16/2015	<1	<2	6/16/2015	<1	<2	6/16/2015	<1	<2
9/9/2015	<1	<2	9/9/2015	<1	<2	9/9/2015	<1	<2
11/30/2015	<1	<2	11/30/2015	<1	2.7	11/30/2015	<1	<2
1/20/2016	na	<2	1/20/2016	na	2.2	1/20/2016	na	<2
2/24/2016	na	<2	2/24/2016	na	2.4	2/24/2016	na	<2
3/21/2016	<1	<2	3/21/2016	<1	<2	3/21/2016	<1	<2
4/13/2016	na	<2	4/13/2016	na	<2	4/13/2016	na	<2
6/1/2016	<1	<2	6/1/2016	<1	<2	6/1/2016	<1	<2
6/22/2016	na	<2	6/22/2016	na	<2	6/22/2016	na	<2
7/27/2016	na	<2	7/27/2016	na	<2	7/27/2016	na	<2
9/6/2016	<1	<2	9/6/2016	<1	<2	9/6/2016	<1	<2
12/5/2016	<1	<2	12/5/2016	<1	2.6	12/5/2016	<1	<2
3/20/2017	<1	<2	3/20/2017	<1	2.7	3/20/2017	<1	<2
5/31/2017	<1	<2	5/31/2017	<1	2.5	5/31/2017	<1	<2
9/5/2017	<1	<2	9/5/2017	<1	<2	9/5/2017	<1	<2
12/4/2017	<1	<2	12/4/2017	<1	<2	12/4/2017	<1	<2
3/19/2018	<1	<2	3/19/2018	<1	3.5	3/19/2018	<1	<2
6/18/2018	<1	<2	6/18/2018	<1	2.2	6/18/2018	<1	<2
9/5/2018	<1	<2	9/5/2018	<1	<2	9/5/2018	<1	<2
12/3/2018	<1	<2	12/3/2018	<1	3.4	12/3/2018	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE L-3
OCWD MONITORING WELL SAR-10
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
SAR-10/1 Upper Rho Perforations 590-600 ft bgs	3/25/2014	0.042	14.1	38.2	256	147	<0.2	0.002	0.14	0.35
	6/18/2014	0.042	13.7	39.6	250	143	<0.2	<0.002	0.14	0.82
	9/23/2014	0.045	14.4	39.7	266	150	<0.2	<0.002	0.21	0.76
	12/1/2014	0.038	15.1	38.7	264	153	<0.2	<0.002	0.24	0.25
	1/26/2015	na	14.6	38.7	268	na	na	0.004	0.19	0.23
	2/17/2015	na	15.1	38.5	262	na	na	<0.002	0.25	0.19
	3/23/2015	0.046	15.3	38.7	270	157	<0.2	<0.002	0.24	0.16
	4/13/2015	na	15.7	39.7	270	na	na	0.023	0.28	0.24
	4/30/2015	na	15.5	38.3	264	na	na	0.005	0.24	0.16
	5/12/2015	na	15	38.4	262	na	na	0.011	0.21	0.17
	5/26/2015	0.045	14.6	36.7	254	na	na	0.013	0.18	0.16
	6/10/2015	na	12.2	16	176	na	na	0.068	0.18	0.22
	6/17/2015	0.029	12	16	134	75.5	<0.2	0.198	0.3	0.24
	6/30/2015	na	11.6	14.5	134	na	na	0.267	0.3	0.27
	7/15/2015	na	11	6.7	100	na	na	0.198	1.15	0.33
	7/28/2015	na	12.5	15.3	150	na	na	0.096	0.88	0.21
	8/12/2015	na	11.7	7.9	96	na	na	0.055	0.94	0.28
	8/24/2015	na	12.6	12.3	126	na	na	0.049	1.35	0.21
	9/8/2015	0.02	11.1	6.2	132	49	<0.2	0.064	1.46	0.2
	9/23/2015	na	11.4	5.3	106	na	na	0.093	1.6	0.23
	10/8/2015	na	10.9	5.2	108	na	na	0.076	1.63	0.22
	10/20/2015	na	10.3	5.3	124	na	na	0.077	1.55	0.24
	11/5/2015	na	10.6	6	92	na	na	0.091	1.48	0.28
	11/19/2015	na	8.7	6.1	110	na	na	0.088	1.31	0.26
	11/30/2015	0.035	9.1	5.9	92	42.7	<0.2	0.087	1.26	0.24
	12/15/2015	na	8.6	6.7	94	na	na	0.08	1.26	0.26
	12/29/2015	na	8.4	6.1	104	na	na	0.075	1.13	0.23
	1/20/2016	na	7.3	6.5	74	na	na	0.044	0.9	0.28
	2/24/2016	na	7	7.1	107	na	na	0.028	0.84	0.25
	3/22/2016	0.017	6	6.3	77	44.2	<0.2	0.03	0.68	0.24
	4/13/2016	na	6.2	6.7	82	na	na	0.023	0.7	0.24
	5/31/2016	0.016	6.8	7	88	45.8	<0.2	0.025	0.79	0.19
	6/22/2016	na	7.1	8	92	na	na	0.044	0.62	0.15
	7/27/2016	na	8.2	8.5	82	na	na	0.009	1.06	0.16
	9/7/2016	0.017	8.2	7.7	98	47.2	<0.2	0.019	1.09	0.13
	12/7/2016	0.014	7	7.1	138	50.5	<0.2	0.01	1.05	0.12
	3/21/2017	0.012	5.2	7.3	90	53.6	<0.2	0.017	0.68	0.18
	5/8/2017	na	5.6	7.6	94	51.6	na	0.009	0.8	0.17
	5/30/2017	0.013	5.5	6.5	84	46.8	<0.2	0.004	0.86	0.08
	9/6/2017	0.023	6.4	6.3	78	47.2	<0.2	0.005	0.88	0.09
	12/4/2017	0.015	5.8	6.5	69	49.3	<0.2	0.01	0.85	0.08
	3/20/2018	0.001	5	6.7	82	51.7	<0.2	0.008	0.58	0.1
	6/18/2018	0.012	6.7	6.7	96	51.5	na	na	0.99	0.07
	9/5/2018	0.015	6.6	8.7	114	63.8	na	na	0.62	0.11
	12/3/2018	0.012	5.1	5.3	75	45.6	<0.2	0.006	0.86	0.07

TABLE L-3
OCWD MONITORING WELL SAR-10
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
SAR-10/2 Lower Rho Perforations 690-710 ft bgs	3/25/2014	0.046	15.9	40.4	260	152	<0.2	<0.002	0.36	0.16
	6/18/2014	0.045	15.4	41.6	260	155	<0.2	<0.002	0.35	0.12
	9/23/2014	0.05	15.6	40.9	268	155	<0.2	<0.002	0.42	0.19
	12/1/2014	0.043	16.4	40	264	156	<0.2	<0.002	0.48	0.11
	1/26/2015	na	15.6	40.3	280	na	na	<0.002	0.43	0.2
	2/17/2015	na	16.6	40.5	274	na	na	<0.002	0.49	0.13
	3/23/2015	0.051	16.5	40	276	162	0.2	<0.002	0.48	0.1
	4/13/2015	na	17.2	41.4	238	na	na	<0.002	0.51	0.09
	4/30/2015	na	16.5	34.1	254	na	na	0.031	0.93	0.11
	5/12/2015	na	12	6.5	160	na	na	0.243	1.92	0.12
	5/26/2015	0.021	10.2	1	118	na	na	0.009	2.34	0.09
	6/10/2015	na	9.4	0.6	104	na	na	<0.002	2.21	0.09
	6/17/2015	0.017	10.2	0.6	98	44.5	<0.2	<0.002	2.21	0.11
	6/30/2015	na	11.5	0.9	90	na	na	0.002	2.39	0.09
	7/15/2015	na	11.2	0.7	92	na	na	0.004	2.36	0.11
	7/28/2015	na	11.8	0.7	96	na	na	<0.002	2.27	0.08
	8/12/2015	na	11.7	1.6	86	na	na	<0.002	2.58	0.11
	8/24/2015	na	11.7	0.6	84	na	na	0.002	2.5	0.07
	9/8/2015	0.016	11.1	0.6	78	40.7	<0.2	0.003	2.34	0.08
	9/23/2015	na	10.9	0.05	88	na	na	<0.002	2.39	0.07
	10/8/2015	na	9.7	0.05	94	na	na	0.002	2.29	0.07
	10/20/2015	na	10.2	0.05	96	na	na	<0.002	2.26	0.09
	11/5/2015	na	9.7	0.7	70	na	na	0.002	2.25	0.1
	11/19/2015	na	8.2	0.5	82	na	na	0.003	2.06	0.09
	11/30/2015	0.036	8.3	0.6	80	37.5	<0.2	0.002	1.99	0.08
	12/15/2015	na	7.9	0.7	74	na	na	<0.002	2.12	0.09
	12/29/2015	na	7.7	0.05	76	na	na	0.002	1.99	0.07
	1/20/2016	na	6.7	0.05	71	na	na	<0.002	1.71	0.07
	2/24/2016	na	6.1	0.6	81	na	na	<0.002	1.51	0.07
	3/22/2016	0.011	5.7	0.6	73	35.7	<0.2	<0.002	1.38	0.08
	4/13/2016	na	5.6	0.05	63	na	na	<0.002	1.47	0.06
	5/31/2016	0.015	6.4	0.05	68	39.5	<0.2	<0.002	1.55	0.06
	6/22/2016	na	7.1	0.6	62	na	na	<0.002	1.6	0.1
	7/27/2016	na	8.1	0.6	74	na	na	<0.002	1.8	0.22
	9/7/2016	0.015	7.7	0.05	82	40.1	<0.2	<0.002	1.83	0.06
	12/7/2016	0.011	6.7	0.05	70	39.5	<0.2	0.003	1.67	0.06
	3/21/2017	0.01	4.5	0.05	62	36.7	<0.2	0.002	1.18	0.07
	5/30/2017	0.01	5	0.5	64	38.5	<0.2	<0.002	1.3	<0.05
	9/6/2017	0.02	6.1	0.7	60	38.6	<0.2	<0.002	1.36	0.06
	12/4/2017	0.011	4.8	0.05	62	36.2	<0.2	<0.002	1.21	<0.05
	3/20/2018	<0.01	4.6	0.6	60	39	<0.2	0.002	1	0.06
	6/18/2018	0.011	7	0.05	55	42.4	na	na	1.55	<0.05
	9/5/2018	0.011	6.5	0.7	72	41.8	na	na	1.47	<0.05
	12/3/2018	0.011	5	0.6	61	38.1	<0.2	0.003	1.17	<0.05

TABLE L-3
OCWD MONITORING WELL SAR-10
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
SAR-10/3 Main Perforations 800-820 ft bgs	3/25/2014	0.043	15.3	42.2	264	153	<0.2	<0.002	<0.1	0.29
	6/18/2014	0.045	15	44.1	264	157	<0.2	<0.002	<0.1	0.22
	9/23/2014	0.047	15.3	43.6	250	153	<0.2	<0.002	<0.1	0.25
	12/1/2014	0.036	15.9	42.6	270	154	<0.2	<0.002	<0.1	0.22
	1/26/2015	na	17.3	43.2	292	na	na	<0.002	<0.1	0.27
	2/17/2015	na	15.9	42.8	236	na	na	<0.002	<0.1	0.13
	3/23/2015	0.045	16.4	42.9	278	164	<0.2	<0.002	<0.1	0.19
	4/13/2015	na	16.6	43.7	296	na	na	<0.002	<0.1	0.62
	4/30/2015	na	16.7	43.5	276	na	na	<0.002	0.12	0.19
	5/12/2015	na	18	44.6	282	na	na	<0.002	0.17	0.17
	5/26/2015	0.043	15.3	34.7	260	na	na	<0.002	0.12	0.19
	6/10/2015	na	13.8	27.3	214	na	na	<0.002	<0.1	0.17
	6/17/2015	0.031	12.9	23.4	184	106	<0.2	0.004	0.12	0.17
	6/30/2015	na	11.1	12.2	160	na	na	0.012	0.12	0.19
	7/15/2015	na	10.7	9.8	142	na	na	0.014	<0.1	0.27
	7/28/2015	na	10.5	10	132	na	na	0.003	0.12	0.21
	8/12/2015	na	11.2	8.8	116	na	na	<0.002	0.19	0.22
	8/24/2015	na	11.3	10	114	na	na	0.002	<0.1	0.18
	9/8/2015	0.02	11.2	9.8	144	50.7	<0.2	<0.002	<0.1	0.21
	9/23/2015	na	11.5	10.1	108	na	na	<0.002	<0.1	0.17
	10/8/2015	na	11.2	9.6	108	na	na	<0.002	<0.1	0.16
	10/20/2015	na	10.8	9.2	128	na	na	<0.002	<0.1	0.19
	11/5/2015	na	10.7	9.5	106	na	na	<0.002	<0.1	0.18
	11/19/2015	na	10.5	9.3	98	na	na	0.002	<0.1	0.28
	11/30/2015	0.024	10.4	9.4	100	47.2	<0.2	<0.002	<0.1	0.18
	12/15/2015	na	9.9	9.6	112	na	na	<0.002	<0.1	0.18
	12/29/2015	na	9.7	9.4	100	na	na	<0.002	<0.1	0.15
	1/20/2016	na	9.2	9.3	88	na	na	<0.002	<0.1	0.16
	2/24/2016	na	8.1	10.3	107	na	na	<0.002	<0.1	0.16
	3/22/2016	0.017	7.3	11.1	99	44.1	<0.2	<0.002	<0.1	0.16
	4/13/2016	na	6.5	10.9	81	42.4	<0.2	<0.002	<0.1	0.16
	5/31/2016	0.015	5.8	10.2	86	na	na	<0.002	<0.1	0.11
	6/22/2016	na	5.9	10.1	88	na	na	<0.002	<0.1	0.13
	7/27/2016	na	6.4	10.6	94	na	na	<0.002	<0.1	0.12
	9/7/2016	0.014	7.5	10.9	92	45.8	<0.2	<0.002	<0.1	0.11
	12/7/2016	0.014	7.6	10.8	90	47.3	<0.2	<0.002	<0.1	0.13
	3/21/2017	0.012	6.5	12.3	92	48.8	<0.2	<0.002	<0.1	0.11
	5/30/2017	<0.01	5.1	12	82	44.9	<0.2	<0.002	<0.1	0.1
	9/6/2017	0.014	5.4	10.5	70	48	<0.2	<0.002	<0.1	0.1
	12/4/2017	0.014	5.7	11.3	64	50.1	<0.2	<0.002	<0.1	0.09
	3/20/2018	<0.01	4.9	11.3	76	49.2	<0.2	<0.002	<0.1	0.13
	6/18/2018	<0.01	5.1	10.7	92	49.4	na	na	<0.1	0.09
	9/5/2018	0.012	6.6	11.8	86	55.5	na	na	<0.1	0.08
	12/3/2018	0.015	6.8	11.6	98	54.9	<0.2	<0.002	<0.1	0.11

TABLE L-3
OCWD MONITORING WELL SAR-10
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
SAR-10/4 Main Perforations 1,100-1,115 ft bgs	3/25/2014	0.045	16.4	44.3	266	162	<0.2	<0.002	<0.1	0.24
	6/18/2014	0.034	15.4	42.6	256	151	<0.2	<0.002	<0.1	0.13
	9/23/2014	0.049	16.1	45.4	272	161	<0.2	<0.002	<0.1	0.22
	12/1/2014	0.042	16.6	44.0	276	162	<0.2	<0.002	<0.1	0.17
	1/26/2015	na	16.4	44.7	288	na	na	<0.002	<0.1	0.21
	2/17/2015	na	16.8	44.7	270	na	na	<0.002	<0.1	0.17
	3/23/2015	0.053	17.0	44.8	282	169	<0.2	<0.002	0.10	0.13
	4/13/2015	na	17.1	45.3	252	na	na	<0.002	<0.1	0.14
	4/30/2015	na	12.4	15.4	150	na	na	0.099	1.23	0.24
	5/12/2015	na	10.1	4.2	92	na	na	0.042	2.08	0.20
	5/26/2015	0.018	10.0	5.0	100	na	na	0.028	2.01	0.15
	6/10/2015	na	9.2	5.6	82	na	na	0.021	1.97	0.14
	6/17/2015	0.018	9.7	4.8	72	37	<0.2	0.021	2.33	0.16
	6/30/2015	na	10.5	5.5	86	na	na	0.033	2.25	0.18
	7/15/2015	na	10.2	6.7	92	na	na	0.079	2.00	0.23
	7/28/2015	na	11.4	7.1	86	na	na	0.154	2.13	0.16
	8/12/2015	na	10.6	5.4	82	na	na	0.176	2.37	0.16
	8/24/2015	na	11.8	6.0	82	na	na	0.249	1.94	0.16
	9/8/2015	0.016	11.0	6.0	98	44.4	<0.2	0.266	1.88	0.16
	9/23/2015	na	11.3	10.0	112	na	na	<0.002	<0.1	0.20
	10/8/2015	na	8.9	5.3	92	na	na	0.094	2.18	0.12
	10/20/2015	na	9.9	5.5	96	na	na	0.085	2.15	0.13
	11/5/2015	na	8.9	5.8	80	na	na	0.089	2.07	0.13
	11/19/2015	na	8.4	7.3	96	na	na	0.093	1.75	0.14
	11/30/2015	0.026	8.4	9.3	102	47.6	<0.2	0.139	1.62	0.11
	12/15/2015	na	8.6	8.8	96	na	na	0.081	1.93	0.15
	12/29/2015	na	7.4	7.8	82	na	na	0.052	1.67	0.10
	1/20/2016	na	7.0	8.5	60	na	na	0.047	1.44	0.11
	2/24/2016	na	5.9	7.3	82	na	na	0.029	1.41	0.11
	3/22/2016	<0.01	5.8	6.7	74	45.8	<0.2	0.034	1.25	0.10
	4/13/2016	na	5.9	5.0	72	na	na	0.043	1.32	0.10
	5/31/2016	0.015	6.7	5.5	84	45.6	<0.2	0.027	1.40	0.07
	6/22/2016	na	7.2	6.8	84	na	na	0.024	1.51	0.08
	7/27/2016	na	7.8	6.0	72	na	na	0.015	1.77	0.34
	9/7/2016	0.014	7.7	5.6	78	46.4	<0.2	0.016	1.78	0.07
	12/7/2016	0.011	6.4	7.5	74	47	<0.2	0.014	1.42	0.07
	3/21/2017	0.01	4.5	6.5	74	43.3	<0.2	0.008	1.13	0.07
	5/30/2017	0.01	5.0	5.3	68	42.2	<0.2	0.008	1.29	0.06
	9/6/2017	0.015	6.0	5.9	64	40.6	<0.2	0.010	1.31	0.06
	12/4/2017	<0.01	4.6	5.7	36	39.8	<0.2	0.006	1.15	0.05
	3/20/2018	<0.01	4.8	4.6	62	41.3	<0.2	0.004	1.10	0.05
	6/18/2018	<0.01	7.6	4.6	88	44	na	na	1.55	0.05
	9/5/2018	0.014	6.2	2.8	74	42.2	na	na	1.51	0.06
	12/3/2018	0.011	4.8	3.0	60	37.5	<0.2	<0.002	1.24	0.05

TABLE L-4
OCWD MONITORING WELL SAR-11
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
SAR-11/1 Upper Rho Perforations 592-602 ft bgs	3/24/2014	0.038	13.2	36.7	238	143	<0.2	<0.002	<0.1	0.22
	6/16/2014	0.038	12.3	40	272	150	<0.2	<0.002	<0.1	0.11
	9/22/2014	0.043	13.2	39.2	262	145	<0.2	<0.002	0.16	0.13
	12/1/2014	0.029	13.3	36.6	266	147	<0.2	<0.002	0.18	0.12
	3/24/2015	0.041	13.5	36.9	250	145	<0.2	<0.002	0.17	0.13
	5/26/2015	0.047	13.4	36.7	260	na	na	<0.002	0.19	0.13
	6/10/2015	na	13.4	37.4	270	na	na	<0.002	0.15	0.12
	6/16/2015	0.042	13.7	37	260	148	<0.2	<0.002	0.2	0.15
	6/30/2015	na	13.4	36.9	232	na	na	<0.002	0.17	0.14
	7/15/2015	na	15.3	38.7	246	na	na	0.004	0.25	0.11
	7/28/2015	na	14.3	38.3	250	na	na	<0.002	0.2	0.11
	8/12/2015	na	15.5	37.8	248	na	na	<0.002	0.3	0.21
	8/24/2015	na	13.2	36.6	252	na	na	<0.002	0.15	0.12
	9/9/2015	0.04	13.6	37.1	232	151	<0.2	<0.002	0.15	0.11
	9/23/2015	na	13.5	37.1	282	na	na	<0.002	0.19	0.21
	10/8/2015	na	13.6	37.3	286	na	na	<0.002	0.13	0.1
	10/20/2015	na	13.3	36.8	276	na	na	<0.002	0.14	0.11
	11/5/2015	na	13.6	37.2	266	na	na	<0.002	0.15	0.13
	11/19/2015	na	13.6	37.3	284	na	na	0.002	0.14	0.21
	11/30/2015	0.047	13.8	37.2	284	143	<0.2	<0.002	0.18	0.08
	12/15/2015	na	13.4	37	270	na	na	<0.002	0.14	0.17
	12/29/2015	na	13.5	37	252	na	na	<0.002	0.15	0.12
	1/20/2016	na	13.3	36.1	242	na	na	<0.002	0.18	0.09
	2/24/2016	na	13.5	36.1	252	na	na	<0.002	0.22	0.12
	3/21/2016	0.039	13.4	35.4	248	143	<0.2	<0.002	0.25	0.08
	4/13/2016	na	13.1	33.9	238	na	na	<0.002	0.29	0.09
	6/1/2016	0.023	13	32.3	246	137	<0.2	<0.002	0.41	0.11
	6/22/2016	na	13.2	32.4	226	na	na	<0.002	0.44	0.11
	7/27/2016	na	12.6	28.4	214	na	na	<0.002	0.58	0.14
	9/6/2016	0.035	12.7	26.8	220	121	<0.2	<0.002	0.66	0.06
	12/5/2016	0.031	11.2	23.4	212	111	<0.2	<0.002	0.78	0.11
	1/19/2017	na	10.9	22	220	na	na	<0.002	0.77	0.08
	3/20/2017	0.026	10.5	19.5	186	97.4	<0.2	<0.002	0.93	0.09
	5/31/2017	0.026	10.8	20.5	186	95.9	<0.2	<0.002	0.89	0.07
	9/5/2017	0.024	9.6	15.7	174	89.4	<0.2	<0.002	1.0	0.31
	12/4/2017	0.022	9.3	14.8	132	84.3	<0.2	<0.002	1.06	<0.05
	3/19/2018	0.022	9.5	17.3	172	89.5	<0.2	<0.002	0.83	0.07
	6/18/2018	<0.01	8.9	15.9	154	85.8	na	na	0.8	0.05
	9/5/2018	0.028	9.9	20.6	176	92.5	na	na	0.56	0.05
	12/3/2018	0.024	8.8	14.2	156	78.5	<0.2	0.003	0.92	0.06

TABLE L-4
OCWD MONITORING WELL SAR-11
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
SAR-11/2 Lower Rho Perforations 675-690 ft bgs	3/24/2014	0.041	14	38	246	135	<0.2	<0.002	0.23	0.19
	6/16/2014	0.04	13.3	40.1	262	141	<0.2	<0.002	0.20	0.15
	9/22/2014	0.045	13.9	39.1	262	138	<0.2	<0.002	0.30	0.14
	12/1/2014	0.033	14.2	37.3	254	140	<0.2	<0.002	0.33	0.13
	3/24/2015	0.047	14.4	37.6	258	142	<0.2	0.002	<0.1	<0.05
	5/26/2015	0.049	14.9	38	268	na	na	<0.002	0.38	0.13
	6/10/2015	na	14.9	38.4	270	na	na	<0.002	0.35	0.15
	6/16/2015	0.043	14.9	38.3	258	148	<0.2	<0.002	0.37	0.11
	6/30/2015	na	15.1	37.9	250	na	na	<0.002	0.39	0.16
	7/15/2015	na	15.5	39	258	na	na	0.003	0.42	0.13
	7/28/2015	na	15.2	37.8	248	na	na	<0.002	0.48	0.11
	8/12/2015	na	15	35	248	na	na	<0.002	0.63	0.12
	8/24/2015	na	14.1	30.3	240	na	na	<0.002	0.88	0.11
	9/9/2015	0.032	13.3	25.2	234	134	<0.2	<0.002	1.03	0.10
	9/23/2015	na	12.4	18.9	238	na	na	<0.002	1.50	0.10
	10/8/2015	na	12	14.6	214	na	na	<0.002	1.62	0.08
	10/20/2015	na	11.8	12.4	204	na	na	<0.002	1.71	0.08
	11/5/2015	na	12	11.1	228	na	na	<0.002	1.84	0.17
	11/19/2015	na	11.7	9.9	190	na	na	0.003	1.91	0.08
	11/30/2015	0.028	12.1	9.7	188	93.1	<0.2	0.003	1.99	0.09
	12/15/2015	na	11.7	9.1	190	na	na	0.002	1.96	0.11
	12/29/2015	na	11.6	8.7	170	na	na	0.003	1.95	0.08
	1/20/2016	na	11.3	7.6	170	na	na	<0.002	1.97	0.12
	2/24/2016	na	10.9	6.9	155	na	na	<0.002	1.95	0.12
	3/21/2016	0.019	10.3	6.1	142	79.1	<0.2	<0.002	1.97	0.08
	4/13/2016	na	9.8	5.6	151	na	na	<0.002	1.95	0.09
	6/1/2016	0.022	8.7	5.2	148	74.6	<0.2	<0.002	1.73	0.08
	6/22/2016	na	8.5	5.5	148	na	na	<0.002	1.69	0.42
	7/27/2016	na	7.7	5	132	na	na	<0.002	1.54	0.10
	9/6/2016	0.016	7.4	4.4	138	68.1	<0.2	<0.002	1.46	0.07
	12/5/2016	0.015	7.9	3.6	112	64.4	<0.2	0.002	1.62	0.07
	1/19/2017	na	7.8	3.2	124	na	na	0.002	1.70	0.07
	3/20/2017	0.015	8	2.5	120	63.2	<0.2	0.002	1.79	0.13
	5/31/2017	0.013	7.4	2.3	124	59.5	<0.2	<0.002	1.70	0.11
	9/5/2017	0.01	7.3	2	98	56.6	<0.2	<0.002	1.35	0.07
	12/4/2017	0.013	5.9	1.8	51	58	<0.2	<0.002	1.40	<0.05
	3/19/2018	0.011	5.8	1.5	104	55	<0.2	0.002	1.33	0.10
	6/18/2018	0.011	5.2	1.2	91	53.8	na	na	1.18	0.06
	9/5/2018	0.011	5.4	1.4	100	50.9	na	na	1.21	<0.05
	12/3/2018	0.014	6.5	1.3	100	54.2	<0.2	0.004	1.49	<0.05

TABLE L-4
OCWD MONITORING WELL SAR-11
2014 - 2018 General Water Quality Data

Aquifer	Date	Bromide (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Total Hardness (mg/L)	TKN (mg/L)	Nitrite-N (mg/L)	Nitrate-N (mg/L)	TOC (mg/L)
SAR-11/3 Main Perforations 1,100-1,110 ft bgs	03/24/14	0.034	11.9	35.8	200	63.2	<0.2	<0.002	<0.1	0.18
	06/16/14	0.033	11.2	38.6	222	65.3	<0.2	<0.002	<0.1	0.08
	09/22/14	0.036	11.6	36.9	216	63.1	<0.2	<0.002	<0.1	0.11
	12/01/14	0.030	11.9	35.5	224	63.8	<0.2	<0.002	<0.1	0.09
	03/24/15	0.043	14.3	38.7	236	83.6	<0.2	<0.002	0.10	0.10
	05/26/15	0.052	14.9	40	260	na	na	<0.002	<0.1	0.12
	06/10/15	na	14.8	40.1	258	na	na	<0.002	<0.1	0.12
	06/16/15	0.044	15.1	40.5	258	85.3	0.2	<0.002	<0.1	0.10
	06/30/15	na	15	39.5	242	na	na	<0.002	<0.1	0.11
	07/15/15	na	15	34.7	240	na	na	0.003	<0.1	0.11
	07/28/15	na	13.5	26.8	182	na	na	<0.002	<0.1	0.45
	08/12/15	na	12.3	21.6	182	na	na	<0.002	0.11	0.27
	08/24/15	na	11.9	19.9	172	na	na	<0.002	<0.1	0.13
	09/09/15	0.026	12	17.6	158	48.1	<0.2	<0.002	<0.1	0.19
	09/23/15	na	11.8	14.9	160	na	na	<0.002	<0.1	0.14
	10/08/15	na	11.5	13.2	164	na	na	<0.002	<0.1	0.14
	10/20/15	na	11.7	12.6	150	na	na	<0.002	<0.1	0.12
	11/05/15	na	11.9	12.6	136	na	na	<0.002	<0.1	0.15
	11/19/15	na	11.6	12.1	144	na	na	0.002	<0.1	0.15
	11/30/15	0.025	11.5	11.3	142	31.7	<0.2	<0.002	<0.1	0.12
	12/15/15	na	11.2	10.7	132	na	na	<0.002	<0.1	0.13
	12/29/15	na	11.1	9.4	138	na	na	<0.002	<0.1	0.14
	01/20/16	na	10.8	8.7	106	na	na	<0.002	<0.1	0.15
	02/24/16	na	10.5	8	110	na	na	<0.002	<0.1	0.13
	03/21/16	0.017	9.8	9.1	115	27	<0.2	<0.002	<0.1	0.13
	04/13/16	na	9	9.6	108	na	na	<0.002	<0.1	0.13
	06/01/16	0.02	7.6	8.3	98	25.1	<0.2	<0.002	<0.1	0.12
	06/22/16	na	7.4	8.7	100	na	na	<0.002	<0.1	0.23
	07/27/16	na	7	8.1	94	na	na	<0.002	<0.1	0.14
	09/06/16	0.015	7.3	8.3	94	26.5	<0.2	<0.002	<0.1	0.10
	12/05/16	0.016	7.8	6.7	90	26.5	<0.2	<0.002	<0.1	0.11
	01/19/17	na	8.9	9.7	120	na	na	<0.002	<0.1	0.10
	03/20/17	0.014	7.4	8.1	92	25.1	<0.2	<0.002	<0.1	0.12
	05/31/17	0.012	6.1	8.7	90	24.3	<0.2	<0.002	<0.1	0.09
	09/05/17	0.012	5.6	6.6	64	27.6	<0.2	<0.002	<0.1	0.11
	12/04/17	0.014	5.9	8.3	74	30.3	<0.2	<0.002	<0.1	<0.05
	03/19/18	0.011	5.6	11	89.5	32.1	<0.2	<0.002	<0.1	0.07
	06/18/18	0.013	5.13	8.62	72	28.2	na	na	<0.1	0.08
	09/05/18	0.013	6.7	9.3	84	27.8	na	na	<0.1	0.07
	12/03/18	0.015	6.7	7.9	85	38.1	<0.2	0.003	<0.1	0.09

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed