2019
ANNUAL REPORT

GWRS
GROUNDWATER REPLENISHMENT SYSTEM

ORANGE COUNTY WATER DISTRICT

SINCE 1933

Groundwater Replenishment System

2019 Annual Report

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Order Nos. R8-2008-0058, R8-2014-0054, R8-2016-0051 and R8-2019-0007

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Cover photo courtesy of OCWD - GWRS Final Expansion construction in the MF area in May 2020.

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 2019. 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 downgradient monitoring wells; and
- Two non-potable water 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 water 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]),

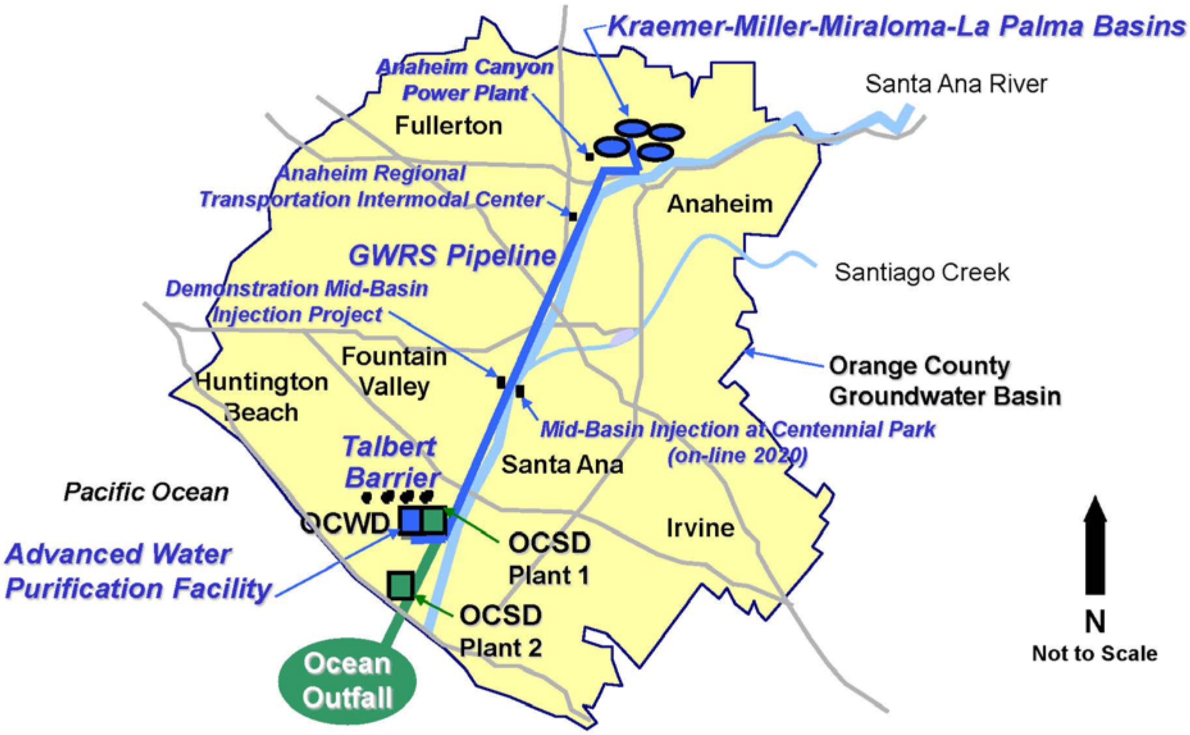


Figure ES-1. Groundwater Replenishment System Location Map

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%. During 2019, most of the purified recycled water produced by the AWPF was injected at the Talbert Barrier and percolated at K-M-M-L Basins; a lesser volume was injected at the DMBI Project and supplied to non-potable water customers.

The Talbert Barrier consists of a series of 36 injection well sites, I1 through I36, that are supplied by pipelines from the AWPF Barrier Pump Station. Depending on their location and construction the barrier injection wells inject purified recycled water into one or more aquifers generally grouped into three zones: shallow, intermediate, and deep. 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 GWRS 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 GWRS 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 2019 the AWPF produced a total of approximately 33,521 million gallons (MG), or 102,872 acre-feet (AF) (126,891,000 cubic meters [m^3]), of purified recycled water to prevent seawater intrusion, replenish the Basin, and supply non-potable users. This represents an increase of more than 6% from the 2018 calendar year production when the AWPF production was restricted by the GWRS Pipeline Rehabilitation Project. A breakdown of the 2019 purified recycled water production and discharge by location is presented in Table ES-1 and illustrated on Figure ES-2.

Table ES-1. 2019 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	23.6	8,613	26,432	25.7%
Kraemer Basin	1.8	644	1,978	1.9%
Miller Basin	0.0	0	0	0.0%
Miraloma Basin	13.5	4,935	15,144	14.7%
La Palma Basin	51.1	18,661	57,269	55.7%
DMBI Project	1.8	642	1,970	1.9%
Anaheim CPP	<0.1	21	64	0.1%
ARTIC	<0.1	5	15	<0.1%
Total	**91.8**	**33,521**	**102,872**	**100%**

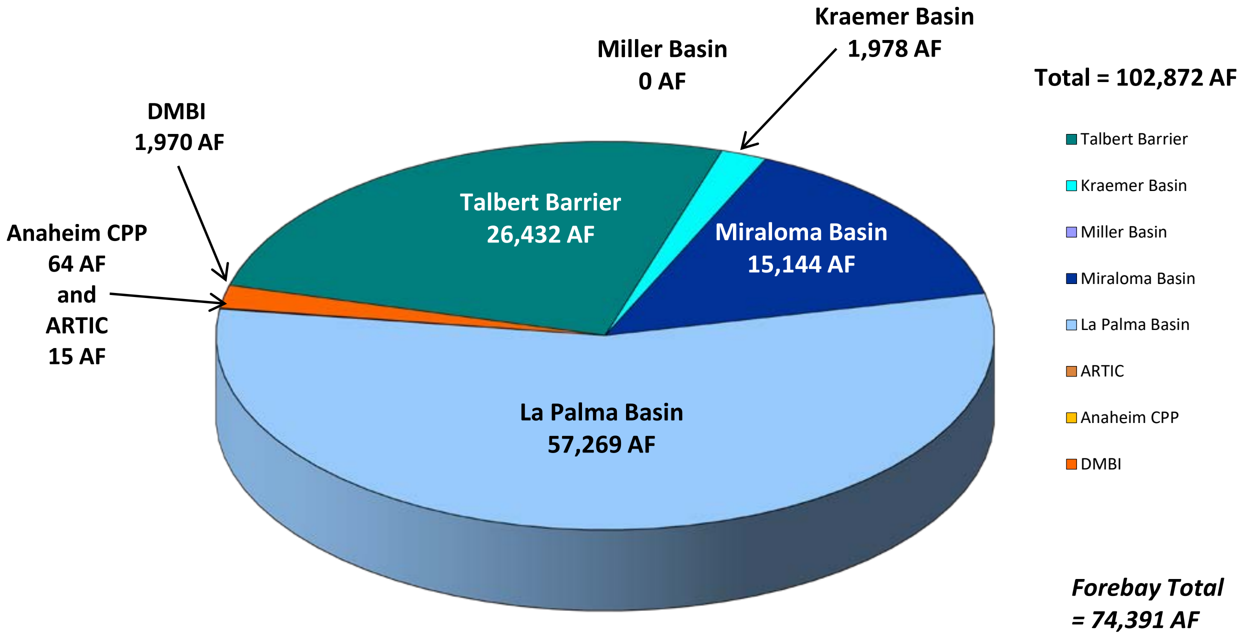


Figure ES-2. 2019 Purified Recycled Water Volume

In terms of average daily flows, the AWPF produced approximately 91.8 MGD (348,000 m^3/day) of purified recycled water in 2019. Figure ES-3 illustrates the average daily AWPF production by month with the reuse location.

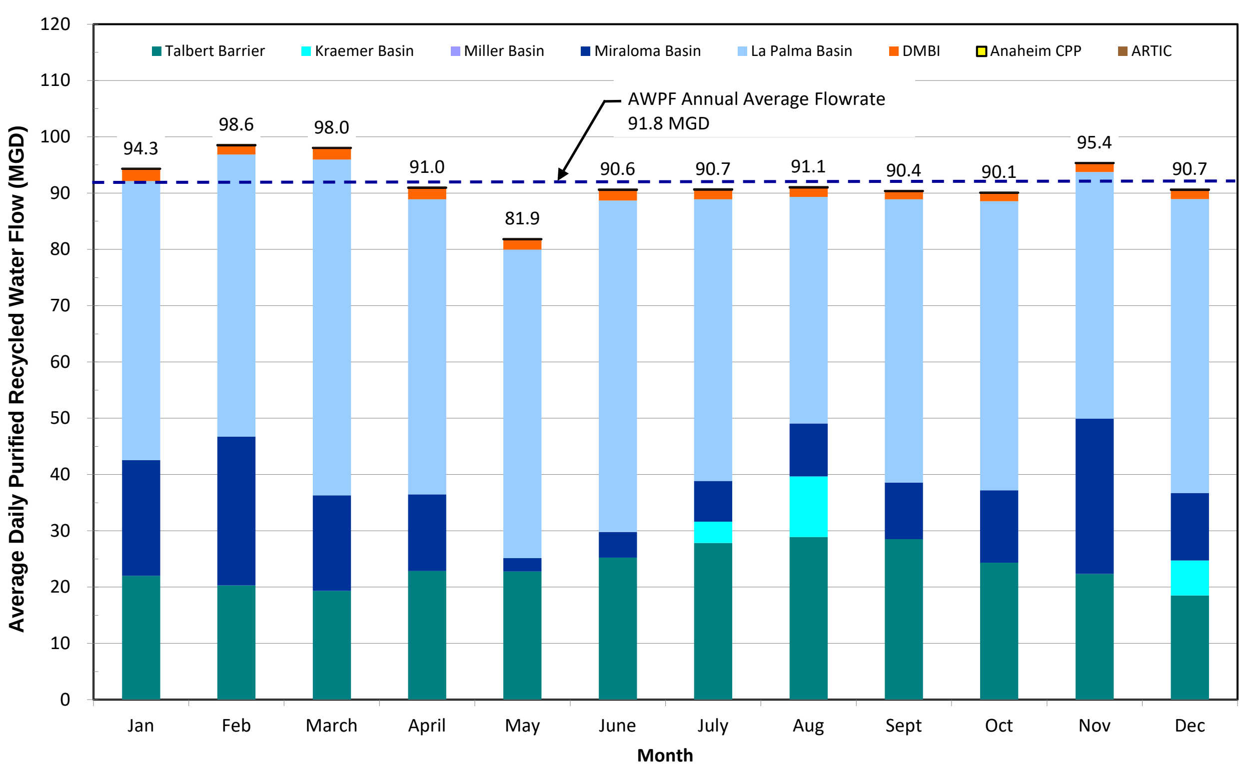


Figure ES-3. 2019 Average Daily Purified Recycled Water Flow By Month

In comparison with prior years, the 2019 GWRS total purified recycled water production achieved a record high, 33,521 MG (102,872 AF or 126,891,000 m^3), as illustrated on Figure ES-4.

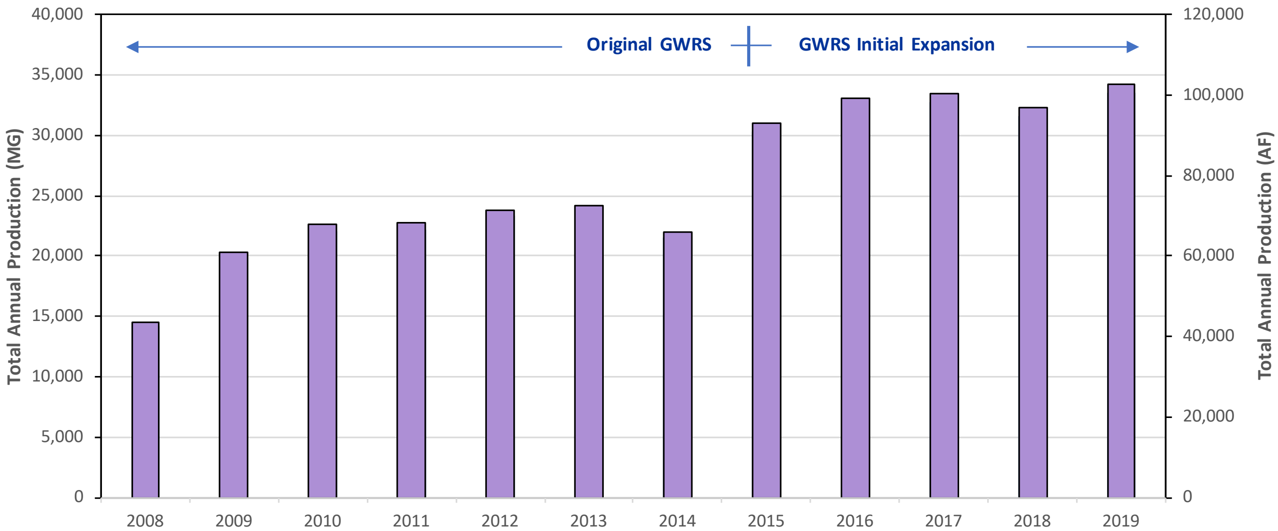


Figure ES-4. Historical GWRS Purified Recycled Water Production Since 2008

The AWPF treatment processes operated well 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. Concentrations of organic contaminants, 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 currently thought to pose any significant public health risk. During 2019 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 2019 in comparison to the requirements.

Overall, the AWPF was on-line approximately 363 days in 2019 (99.4% of the year). The AWPF was off-line for almost two days in May for scheduled equipment inspections and preventive maintenance. The AWPF shut down three times due to brief unplanned power outages (less than four hours per event). In response to a planned power reduction, the AWPF operated at reduced capacity for nearly four hours in September. For approximately 49 hours in December, the AWPF operated at a reduced rate supplying only the Talbert Barrier while the GWRS Pipeline was temporarily shut down to repair leaking mechanical flanges.

Table ES-2. 2019 Average Purified Recycled Water Quality

Parameter Name	Units [1]	FPW [2,3]	Permit Limit
Electrical Conductivity	µmhos/cm	98 [4]	900
Total Dissolved Solids	mg/L	49	500
pH	units	8.5 [4]	6 – 9
Chloride	mg/L	5.2	55
Total Nitrogen	mg/L	0.8	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	1.9	N/A [6]
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	0.11	0.5 [7]
Total Coliform	MPN/100 mL	<1 [5]	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 2019. 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 Not applicable is abbreviated as N/A.

7 20-sample running average; see Section 2.2.8 and Appendix A for more information.

Table ES-3. Summary of GWRS Minimum Pathogen Log Reduction Credits Achieved in 2019

Pathogen	Minimum Log Reduction Requirements[1]	Minimum Daily Pathogen Log Reduction Value Achieved in 2019[2]					
		OCSD Plant 1[3]	MF and Cl_2 [4]	RO[5]	UV/AOP[6]	Underground Retention [7]	Total[8]
Giardia cysts	10	0	4.14	1.90	6.00	0	12.3
Cryptosporidium oocysts	10	0	4.14	1.90	6.00	0	12.3
Viruses	12	0	0	1.90	6.00	4 (5)	12.0

1 Per Title 22 Water Recycling Criteria (CCR, 2018).

2 Minimum daily log reduction value achieved by each process in 2019. 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.

3 No pathogen reduction credits taken for secondary treatment.

4 Minimum daily LRVs for Giardia cysts and Cryptosporidium oocysts achieved by MF with chlorination occurred on 11/13/2019. No virus reduction credit taken for MF with chlorination.

5 Minimum daily pathogen LRVs achieved by RO occurred on 8/1-2/2019.

6 Minimum daily pathogen LRVs achieved by UV/AOP occurred on 1/1-12/31/2019.

7 Minimum daily virus LRV credit of 4-log for underground retention time from 1/1-7/31/2019 and 9/1-12/31/2019. Minimum daily virus LRV credit of 5-log for underground retention time from 8/1-31/2019.

8 Total daily minimum LRV for all processes in 2019. Totals are not additive per footnote 2.

Talbert Barrier Operations

The Talbert Barrier injection supply in 2019 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 and City of Fountain Valley (FV) potable water were also injected at the barrier. Of the total annual volume of approximately 8,615 MG (26,438 AF; 32,611,000 m^3) of injection water, the vast majority (99.91%), approximately 8,613 MG (26,432 AF; 32,604,000 m^3), was GWRS purified recycled water. Only about 1.9 MG (6 AF; 7,400 m^3) of potable water were injected at the barrier during 2019. 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 2019 was 23.6 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 2019 due to a constant, reliable purified recycled water supply and on-going rehabilitation and backwashing of the injection wells. On an annual basis, large injection volumes were directed to the west and east ends of the barrier. Several injection wells were kept off-line on standby for much of 2019 as they were not all needed to maintain groundwater elevations protective for seawater intrusion control due to relatively high Basin conditions.

Table ES-4. 2019 GWRS Injection at the Talbert Barrier

Water Source	Flow Rate	Volume (rounded)			Description
	(Avg. MGD)	(MG)	(AF)	(m^3)	
Purified recycled water	23.6	8,613	26,432	32,604,000	GWRS finished product water (FPW)
OC-44 Potable water	<0.1	2	6	6,900	Imported water from MWD OC-44 turnout
FV Potable water	<0.1	<1	<1	500	Blend of imported water and groundwater from City of Fountain
Total	**23.6**	**8,615**	**26,438**	**32,611,000**	

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 proximity to the barrier. Groundwater level (piezometric elevation) measurements as well as groundwater quality monitoring for an extensive list of parameters were conducted during 2019 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 2019, groundwater quality at all the Talbert Barrier compliance monitoring wells complied with all Federal and State Primary Drinking Water Standards. Groundwater quality testing at the compliance monitoring wells during 2019 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 2019. 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 2019. All barrier monitoring well sites except M19 and M47 had one or more aquifer zones with 1,4-dioxane concentrations that were above the DDW Notification Level (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 Response Level (RL) of 35 μg/L for drinking water systems; these detections are a legacy of Water Factory 21 injection prior to GWRS. In contrast, NDMA was only detected in two monitoring wells during 2019 at M46A/1 and M19/3, and both were 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. 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 2019: (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 2019. A total volume of approximately 38,598 MG (118,454 AF; 146,111,000 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 2019:

- Kraemer Basin received approximately 644 MG (1,978 AF; 2,439,000 m^3), or 1.8 MGD on average;
- Miller Basin received no purified recycled water;
- Miraloma Basin received approximately 4,935 MG (15,144 AF; 18,680,000 m^3), or 13.5 MGD on average; and
- La Palma Basin received approximately 18,661 MG (57,269 AF; 70,641,000 m^3), or 51.1 MGD on average.

Table ES-5. 2019 GWRS Spreading in the Vicinity of Kraemer-Miller-Miraloma-La Palma Basins

Water Source[1]	Flow Rate	Volume (rounded)			Description
	(Avg. MGD)	(MG)	(AF)	(m^3)	
Purified recycled water[2]	66.4	24,240	74,391	91,760,000	GWRS finished product water (FPW) delivered
Other water[3]	39.2	14,318	43,940	54,199,000	SAR water and/or imported water percolated
Spreading basin storage[4]		(40)	(123)	(152,000)	Water in recharge basin storage at the end of calendar year
Total	**105.6**	**38,598**	**118,454**	**146,111,000**	

[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 either retained in the spreading basins that has not yet percolated or drained from prior volumes in the spreading basins 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 2019, 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 did not receive any GWRS water in 2019.

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 proximity to Kraemer Basin and long historical record. Groundwater level measurements as well as groundwater quality monitoring for an extensive list of parameters were conducted during 2019 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. During 2019, groundwater quality at all the Forebay compliance 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 2019. Groundwater quality testing during 2019 at two compliance monitoring well sites, AM-8 and AMD-10, revealed some results above the Federal and State Secondary Drinking Water Standards for apparent color, odor, iron, and manganese. Corrosion of the mild steel well casings at those two sites was likely the contributing factor causing the Secondary ML exceedances for total iron. All the other Secondary MCL exceedances at AM-8 and AMD-10 during 2019 were consistent with the historic monitoring data and were not associated with the presence of GWRS purified recycled water.

DMBI Project Operation

The DMBI Project began injection of purified recycled water that is delivered via the GWRS 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 2019 approximately 642 MG (1,970 AF; 2,430,000 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 2019. Frequent backwash pumping of MBI-1 totaled approximately 8 MG (26 AF; 32,000 m^3) during 2019, representing 1.3% of MBI-1 injection.

Overall, in 2019 the MBI-1 injection rate averaged 1.8 MGD with a weekly backwash pumping frequency. The 2019 injection volume was highest (approximately 2.5 MGD) at the beginning of January to test the injection capacity of MBI-1, and then gradually reduced to approximately 1.5 MGD at the end of the month. The remainder of 2019 the inject rate ranged from approximately 1.8 to 2.1 MGD except for a two-week performance test at 1.0 MGD without backwash. MBI-1 was off-line for approximately two days in early May due to an AWPF shutdown, three days in both early October and early November for operational testing reasons, and two days in mid-December while the GWRS Pipeline leak was repaired. On an annual basis the 2019 DMBI Project injection rate was 14% higher than the prior year.

Building upon the success of the DMBI Project, OCWD installed four additional MBI well sites at nearby Centennial Park and two new downgradient nested monitoring wells between 2017 and 2019. Injection of GWRS purified recycled water at the four new MBI Centennial Park wells began in March 2020.

Groundwater Monitoring at the DMBI Project

Groundwater monitoring for the DMBI Project began in 2012 and continued through 2019. Two monitoring wells, SAR-10 and SAR-11 are located downgradient from MBI-1 along the southeasterly flow path towards the closest downgradient 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 2019, 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.

Groundwater at monitoring well sites SAR-10 and SAR-11 was sampled and analyzed for NDMA and 1,4-dioxane during 2019. The 1,4-dioxane results continued to be non-detect at both sites during 2019. During 2019, NDMA concentrations in all zones of SAR-10 ranged from below the RDL (2 ng/L) to 6 ng/L, remaining below the NL (10 ng/L). These NDMA concentrations at SAR-10 during 2019 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 hydraulic gradient direction likely occurred during the second half of 2018 due to pump development and testing of the four new MBI wells in Centennial Park, altering the local groundwater flow direction and resulting in older GWRS water to migrate to SAR-10 shortly thereafter during 2019. The NDMA concentrations in all zones at SAR-11 were consistently lower than those at SAR-10 due to mixing via dispersive transport for the longer travel time to SAR-11 and possible biodegradation. NDMA concentrations in all zones of SAR-11 ranged from non-detect to 4 ng/L.

Conclusions

The GWRS operated during 2019 in compliance with its permit, producing a total of 33,521 MG (102,872 AF; 126,891,000 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 over 72% 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 a record high 91.8 MGD (348,000 m^3/day) of purified recycled water and was on-line approximately 99.4% of the time in 2019.

During 2019 OCWD continued construction of 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 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 also provide a water source for non-potable uses.

This introductory section of the 2019 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 2019 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 2019 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 2019:

- 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 GWRS Pipeline;
- DMBI Project, consisting of demonstration well MBI-1 supplied by the GWRS 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 GWRS 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 2018-2019 and were placed on-line in March 2020.

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.

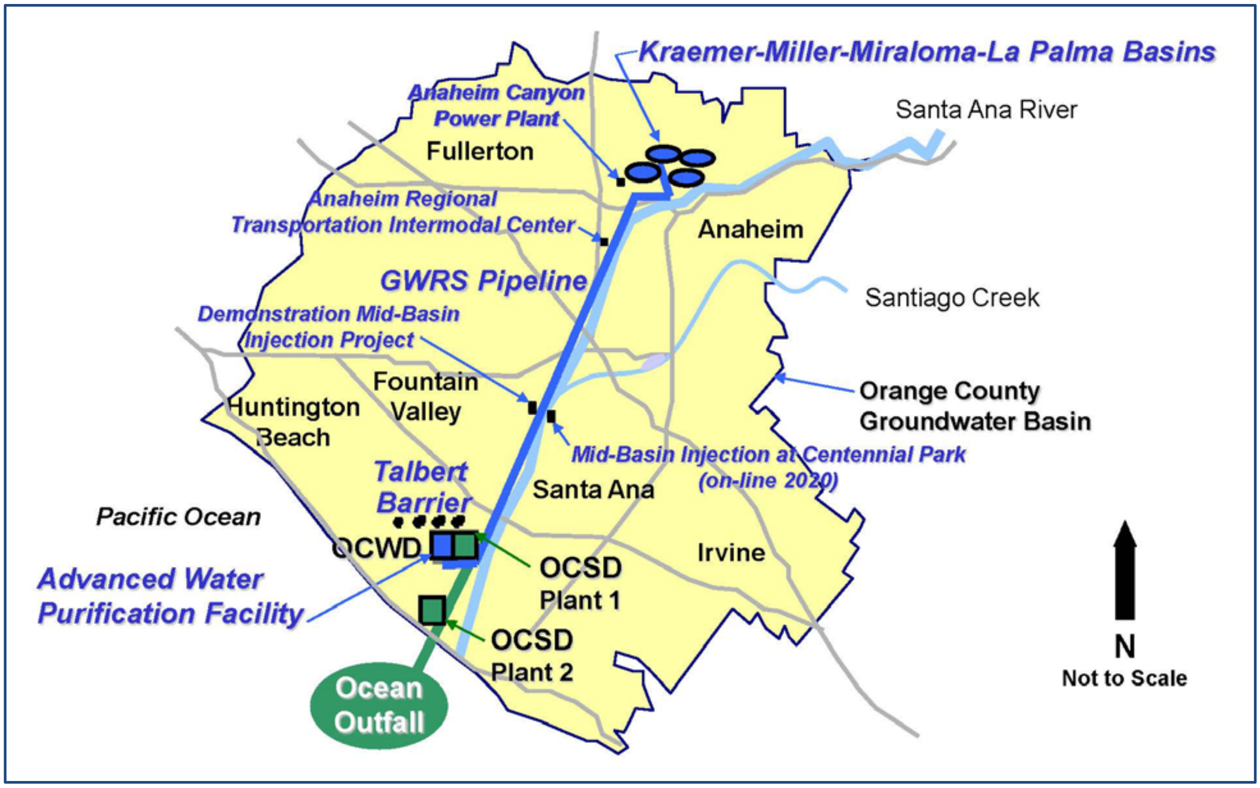


Figure 1-1. Groundwater Replenishment System Location Map

During 2019 the AWPF produced high-quality, purified recycled water averaging a finished water production rate of 91.8 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 2019 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. 2019 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	23.6	8,613	26,432	25.7%
Kraemer Basin	1.8	644	1,978	1.9%
Miller Basin	0.0	0	0	0.0%
Miraloma Basin	13.5	4,935	15,144	14.7%
La Palma Basin	51.1	18,661	57,269	55.7%
DMBI Project	1.8	642	1,970	1.9%
Anaheim CPP	<0.1	21	64	0.1%
ARTIC	<0.1	5	15	<0.1%
Total	**91.8**	**33,521**	**102,872**	**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 have recently been completed to improve its solids thickening and dewatering capability and support its liquid treatment capacity.

OCSD also operates Treatment Plant No. 2 (Plant 2) 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, 2018), 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 achieving partial denitrification.

Solids handling at Plant 1 consists of thickening centrifuges, anaerobic digestion, holding tanks, dewatering centrifuges, 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) completed in 2019 include two sets of centrifuges for: (1) co-thickening primary sludge and waste activated sludge, and (2) digested biosolids dewatering.

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.

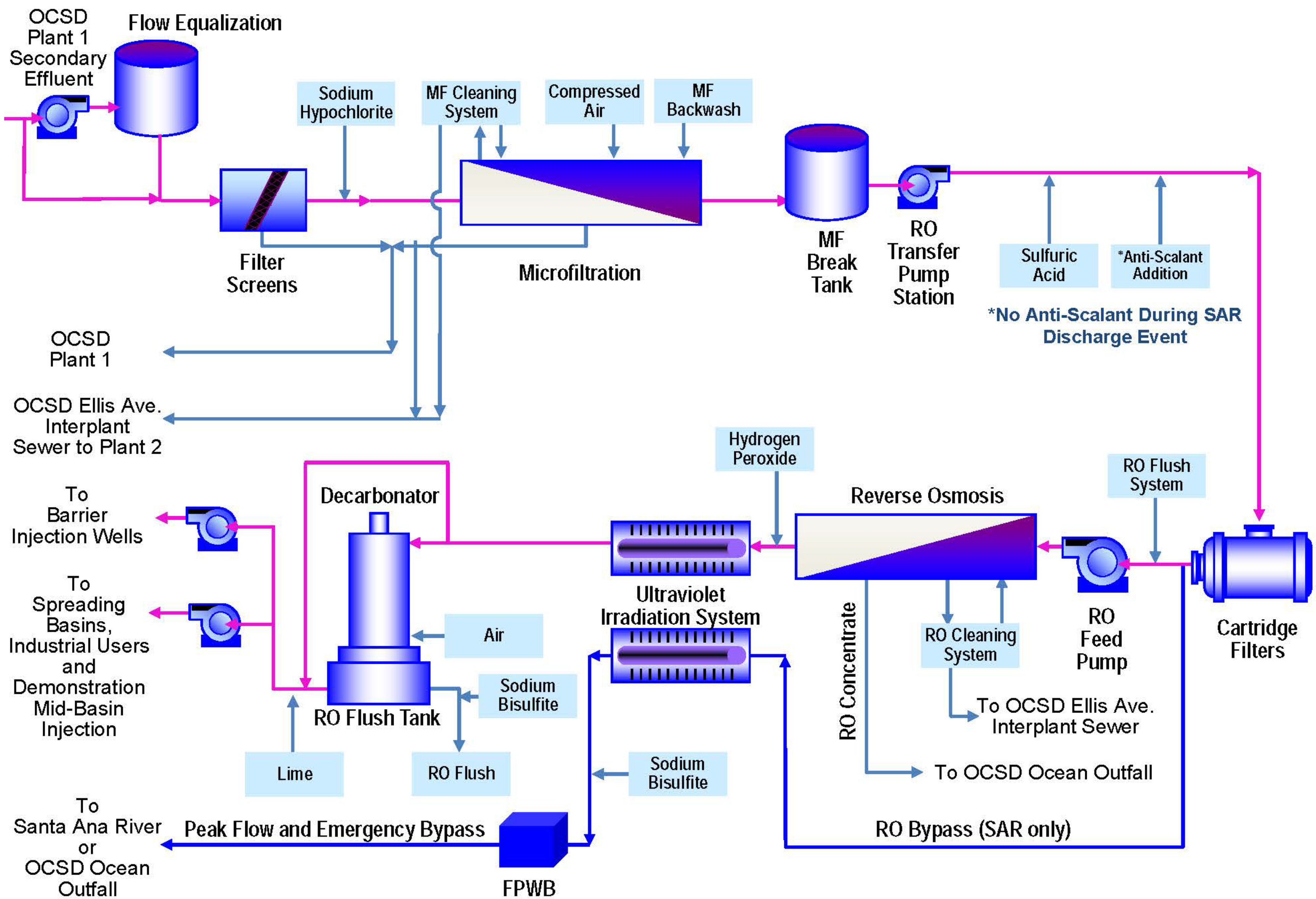


Figure 1-3. GWRS AWPF Process Flow Diagram

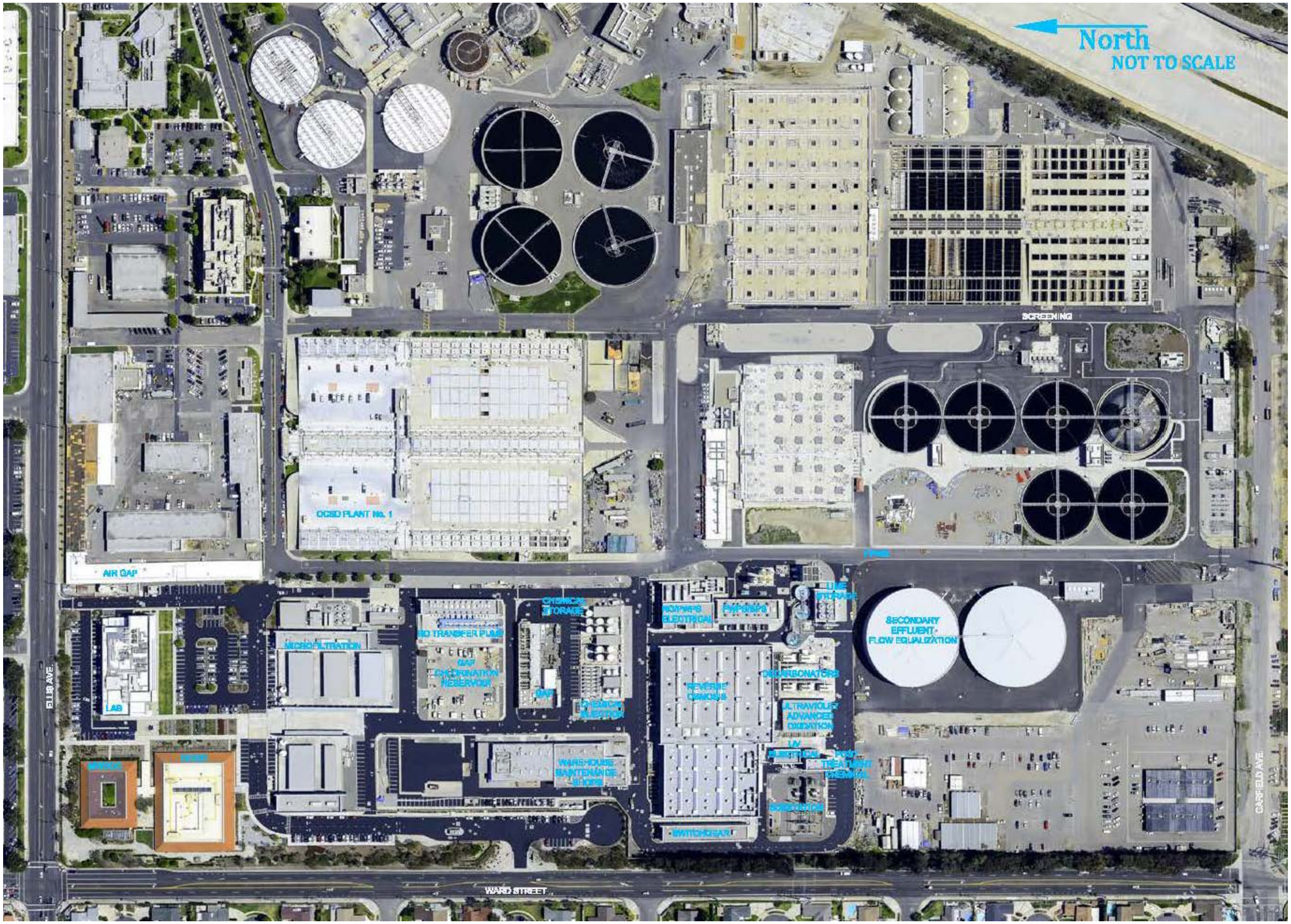


Figure 1-4. AWPF Site Layout

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 1-5, 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 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 the "modern injection wells."

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.

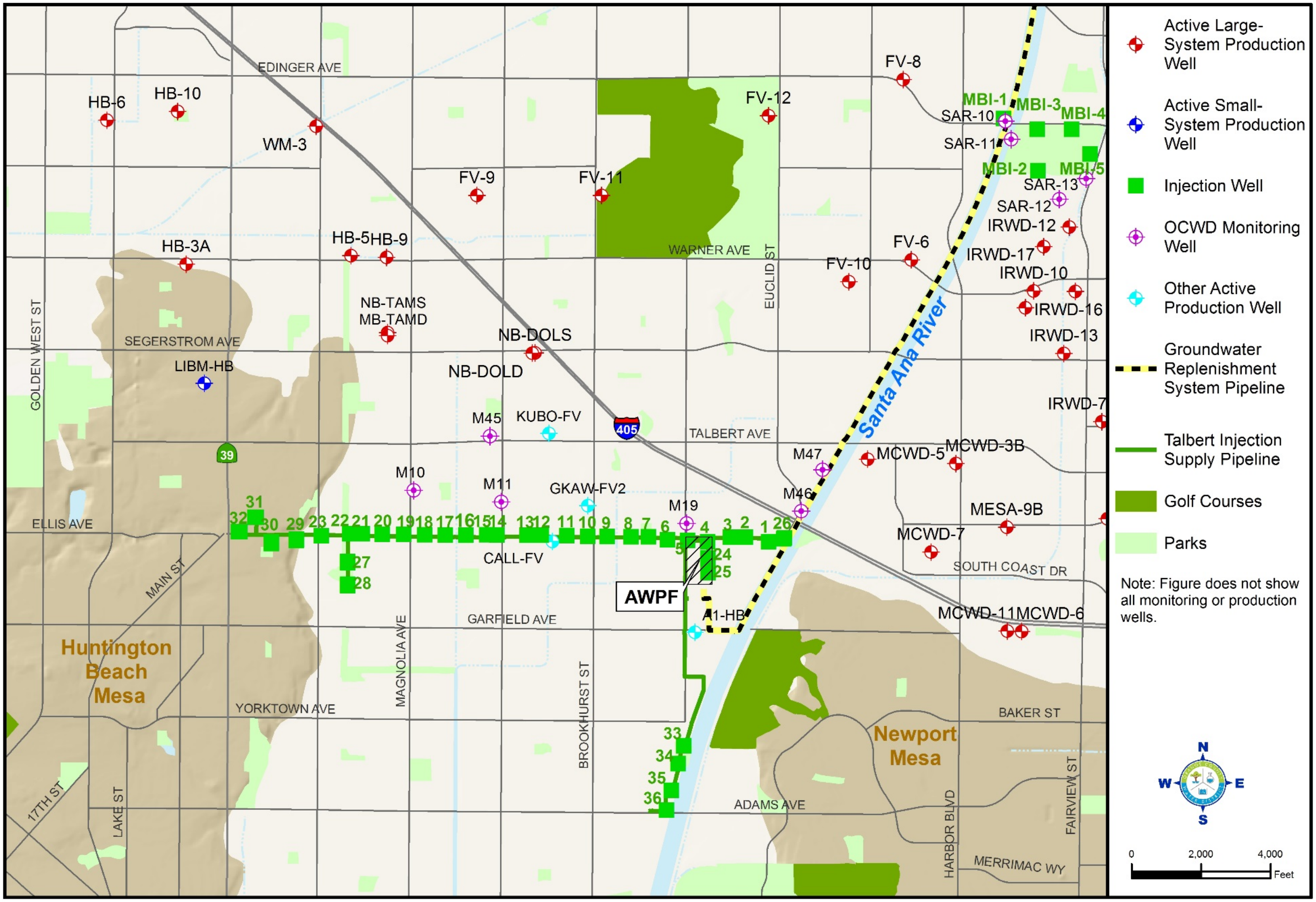


Figure 1-5. GWRS AWPF, Talbert Barrier and DMBI Project Location Map

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 1-5 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 State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) approved revisions to the monitoring plan in 2011 and 2018. Frequency changes allow 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 a few of the 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.

In 2018, the GWRS groundwater monitoring program approved by the RWQCB and DDW (RWQCB, 2018 and DDW, 2018a) represented an "alternative approach" to the requirements established in the groundwater recharge regulations (CCR, 2018) by recognizing OCWD's long-term history of groundwater monitoring. Since 2018, groundwater monitoring for total coliform is no longer required, and the required frequency for groundwater monitoring for total nitrogen (except for nitrate and nitrite), thiobencarb and foaming agents (methylene blue substances [MBAS]) has been reduced from quarterly to annually.

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 1-6 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).

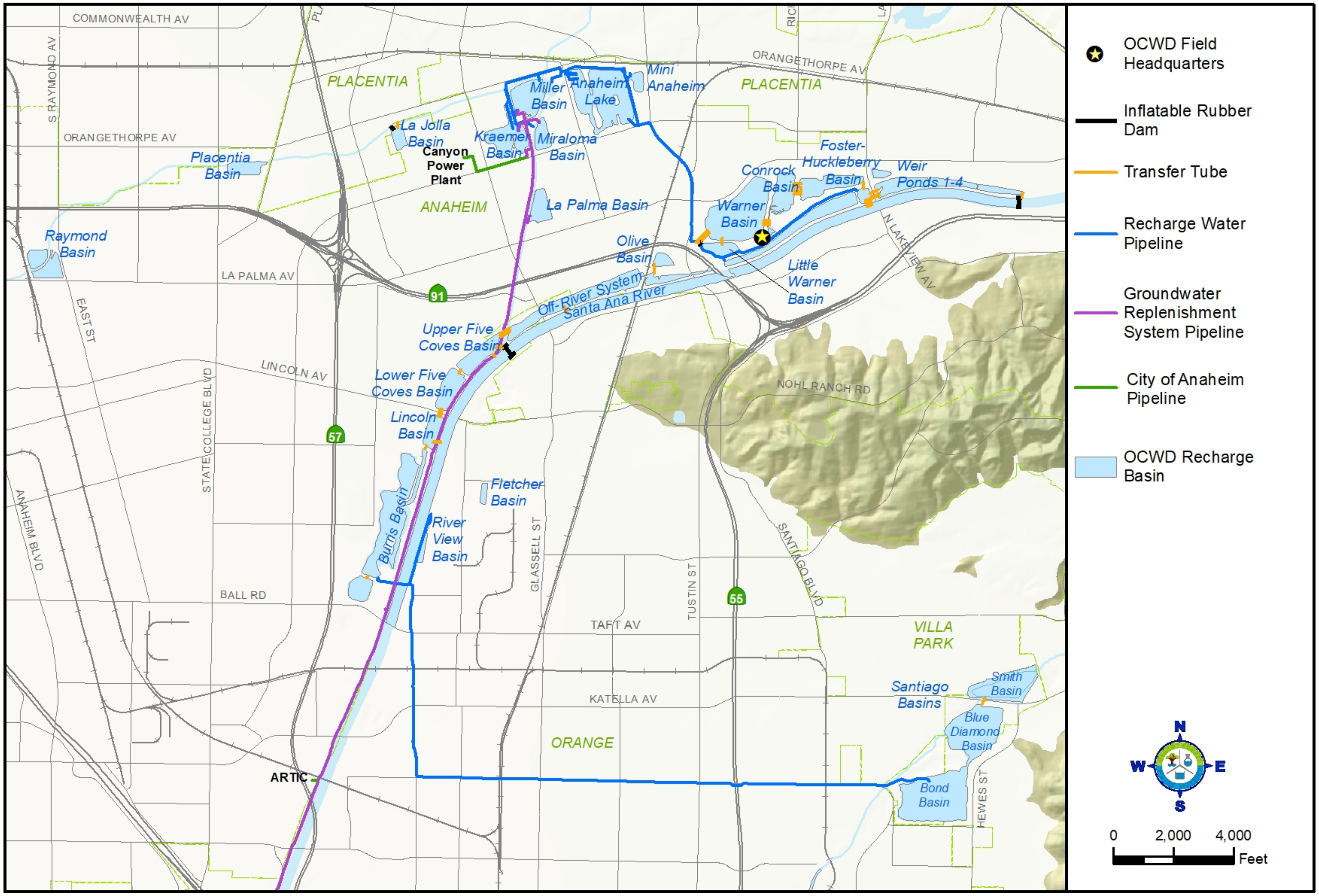


Figure 1-6. Surface Water Recharge Facilities

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 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.

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 GWRS 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 GWRS 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.

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 2019) 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). The groundwater monitoring program for the Anaheim Forebay area was revised in 2018, when requirements for total coliform monitoring were eliminated and the frequency for monitoring other analytes was changed from quarterly to annually based on a long period of no detections (RWQCB, 2018 and DDW, 2018a).

Listed below, the monitoring well sites are located west-southwest of K-M-M-L Basins as shown on Figure 1-7. Except for monitoring well site AM-10, the monitoring well sites are located downgradient of K-M-M-L Basins on a flow path towards the nearest domestic drinking water Well SCWC-PLJ2.

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 continue to be assessed.

- 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 receives water primarily from La Palma Basin.
- 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 underground travel time of one month from Kraemer Basin, three months from Miller Basin, and two months from Miraloma 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

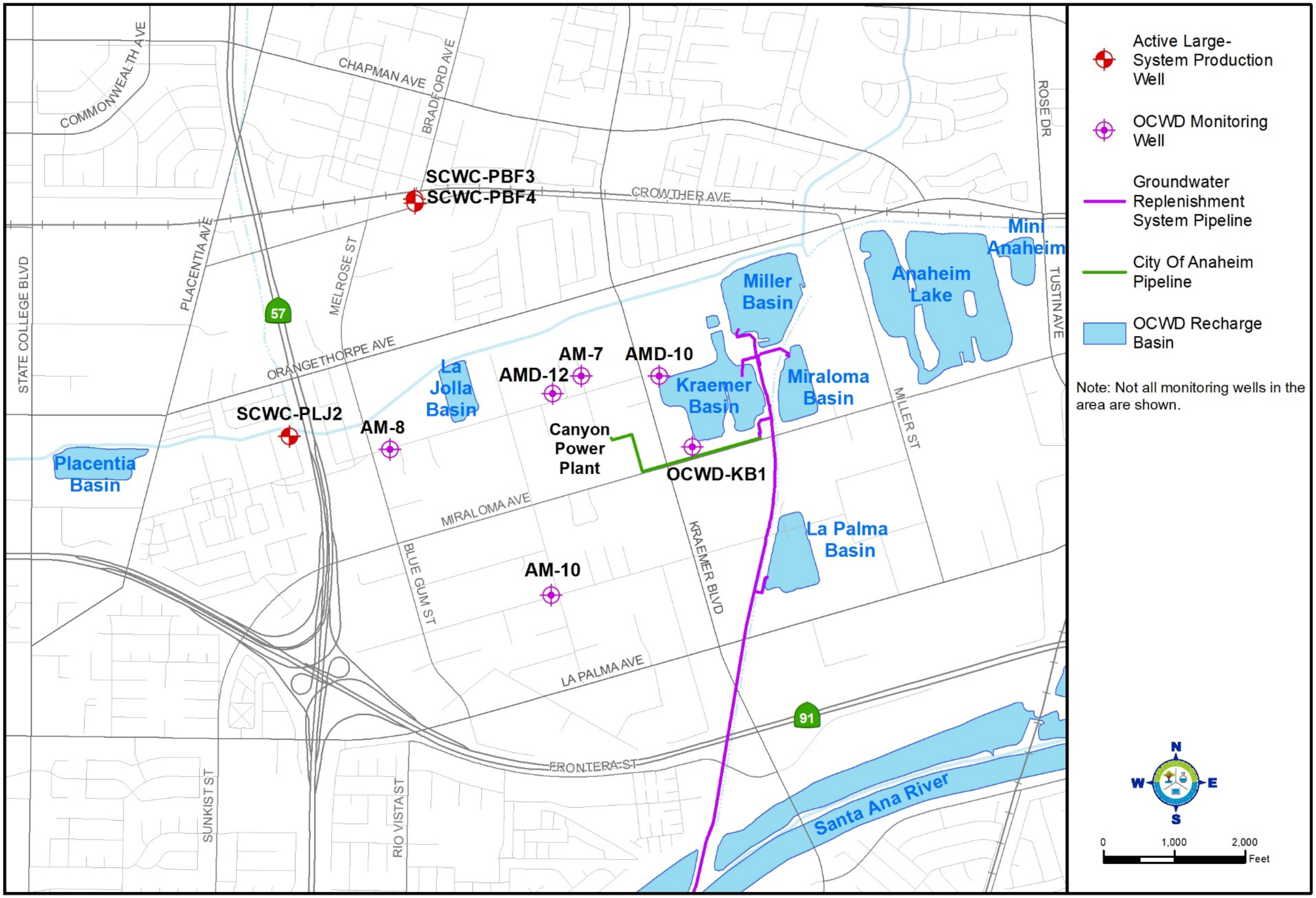


Figure 1-7. Selected Forebay Monitoring and Production Well Locations

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 has been operating the DMBI Project since April 2015 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 was placed on-line in March 2020.

Located in the central area of the Basin in the cities of Fountain Valley and Santa Ana as shown on Figure 1-8, 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 GWRS Pipeline. Following completion of the 2018 GWRS Pipeline Rehabilitation Project, a higher injection rate of approximately 1.7 to 2 MGD was able to be maintained at MBI-1 in 2019 due to a reduction in clogging material from epoxy coating 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).

Information 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 1-8). DMBI Project operating data were used to support the permitting of the MBI Centennial Park Project. Two additional monitoring wells were constructed just south of Centennial Park in late 2017 to support the four MBI wells. These two monitoring wells, SAR-12 and SAR-13 are strategically located downgradient of the MBI wells along a flow path towards municipal production wells IRWD-12 and IRWD-17.

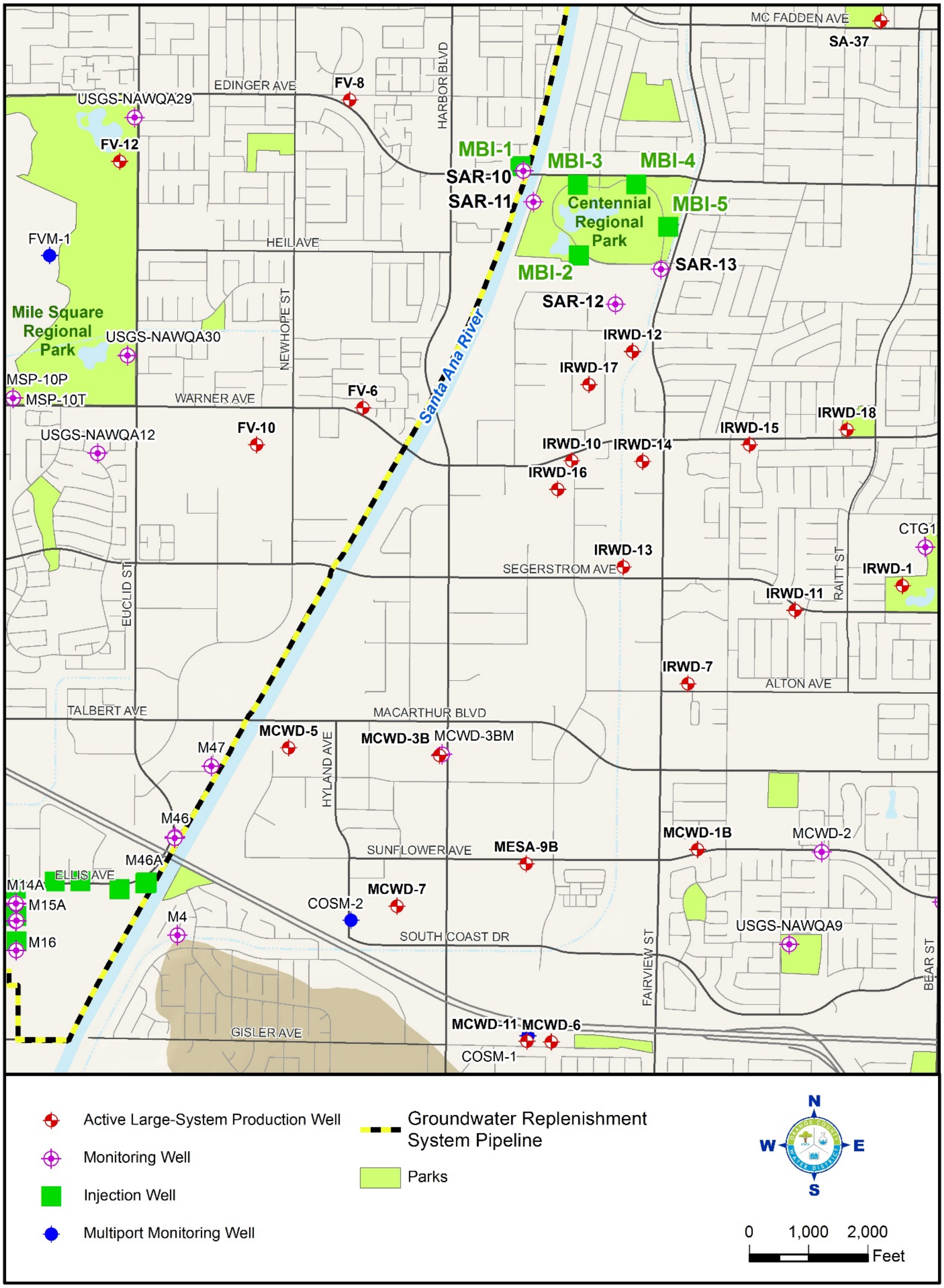


Figure 1-8. DMBI Project Location Map

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 1-9, WF-21 was originally designed as a 15-MGD capacity advanced water treatment (AWT) facility to reclaim secondary treated wastewater 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 1-9. 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 1-10 shows the IWF-21 facilities.

Figure 1-10. 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 GWRS 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 in Centennial Park just to the southeast of the existing DMBI Project and were placed on-line in spring 2020.

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 construction began in 2019; when 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 2019 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 the 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 began injection in spring 2020 (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). Further revisions to the GWRS groundwater monitoring and reporting program were approved by the RWQCB and DDW in 2018 that removed total coliform monitoring and reduced the frequency for selected analytes with no detections from quarterly to annually (RWQCB, 2018 and DDW, 2018a).

Table 1-2 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 2019 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 1-11.

Figure 1-11. Philip L. Anthony Water Quality Laboratory

Table 1-2. 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]	≤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 1-2. 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 1-2. 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 met on September 26-27, 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 1-3.

Table 1-3. 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.	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 September 2019.

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 2018 an updated OOP reflecting procedures to demonstrate compliance with pathogenic microorganism control regulations (CCR, 2018) 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 twelfth year of operation. This section summarizes the performance of the AWPF during 2019:

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

2.1 Purified Recycled Water Volume and Flows

During 2019 the AWPF produced a total of approximately 33,521 MG, or 102,872 AF, of purified recycled water to help prevent seawater intrusion and replenish the Basin. On an annual average basis, the AWPF produced approximately 91.8 MGD of purified recycled water for injection, recharge, and industrial uses in 2019. 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.

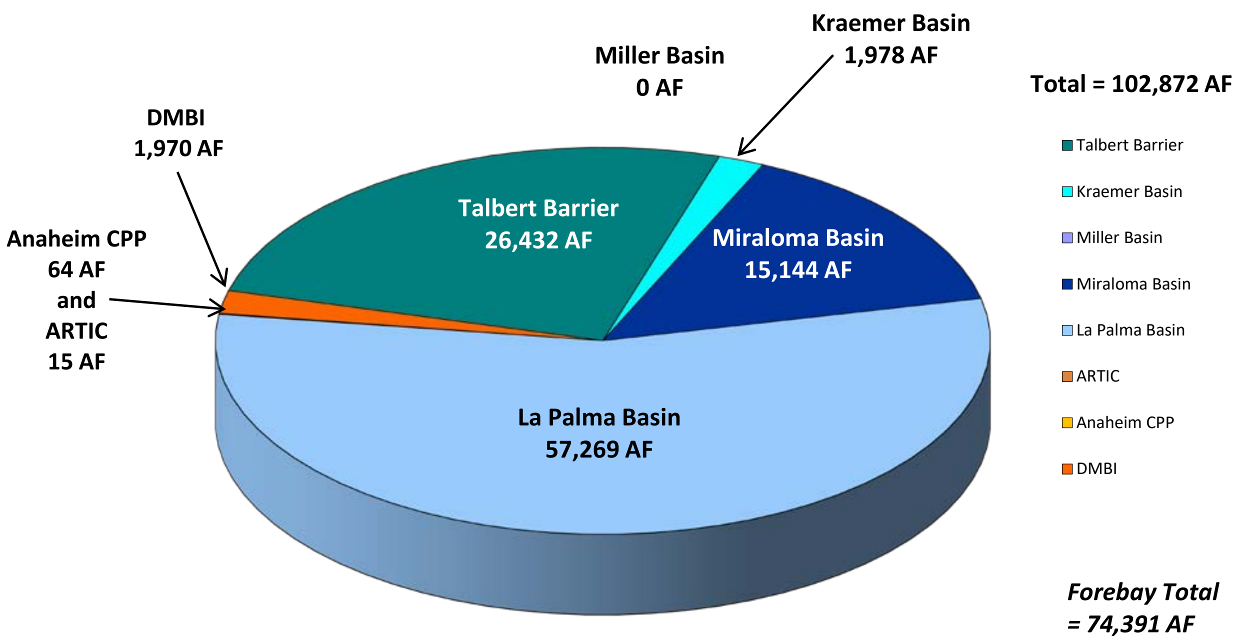


Figure 2-1. 2019 Purified Recycled Water Volume

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 May when the AWPF was shut down to complete scheduled inspections of electrical systems and perform preventive maintenance (May 6-8).

Overall during 2019, the AWPF was on-line 99.4% of the time with daily average purified recycled water production ranging from 0.0 MGD (on May 7 due to a planned plant outage for maintenance activities) up to 99.6 MGD (on March 2) 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 2019.

AWPF influent (Q1) flow is metered and its quality is monitored for selected constituents 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 2.2.1.2.

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.

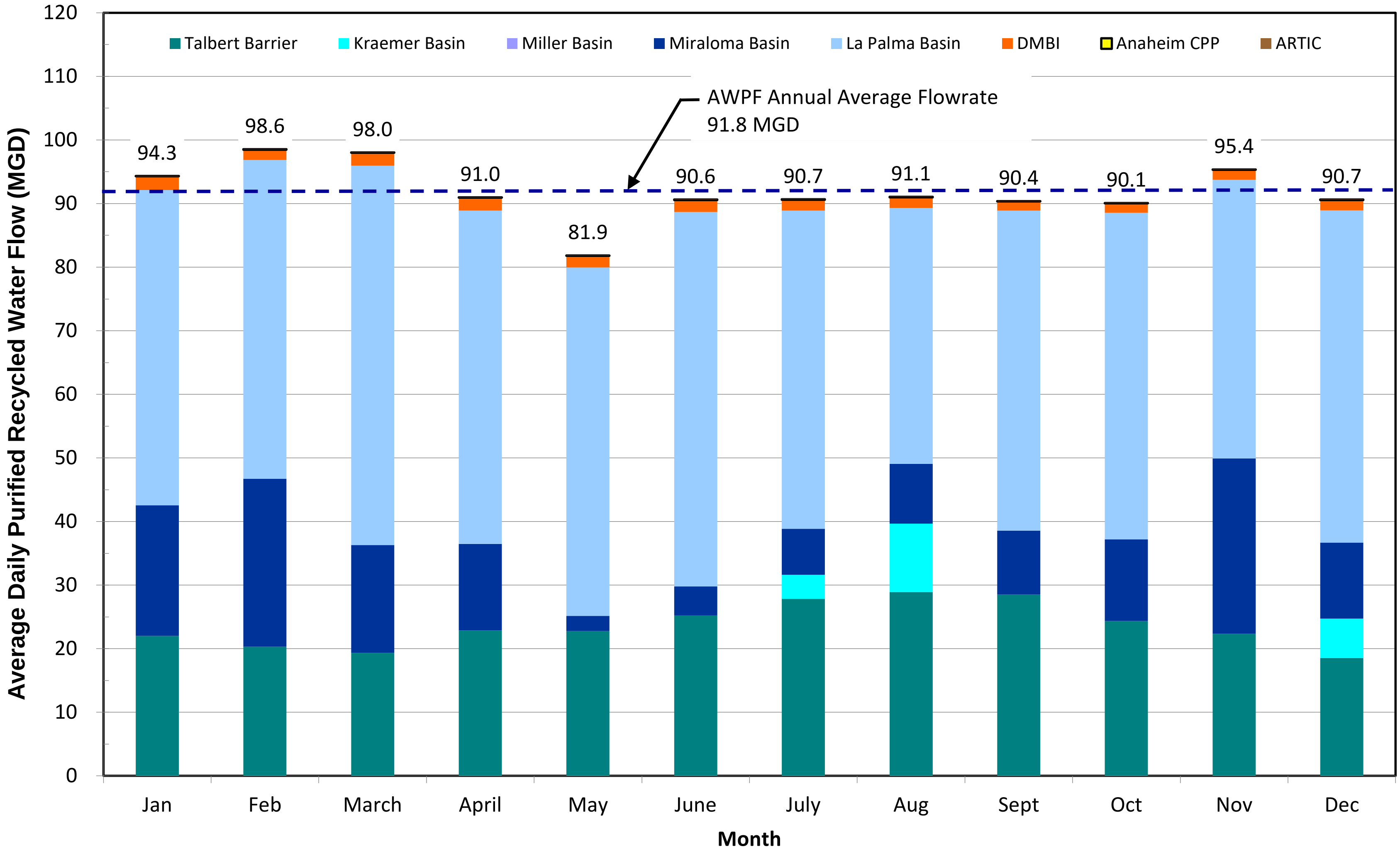


Figure 2-2. 2019 Average Daily Purified Recycled Water Flow by Month

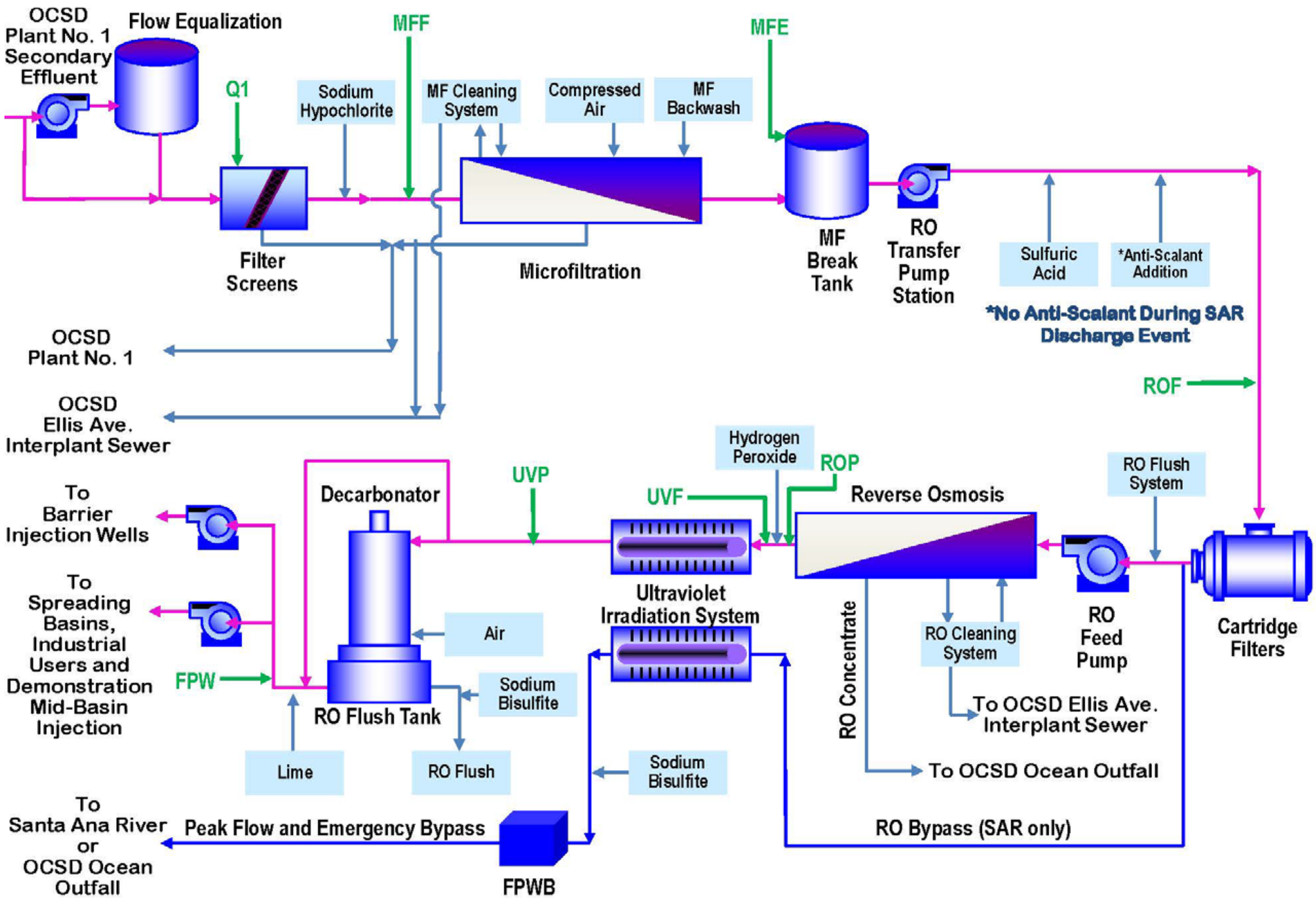


Figure 2-3. AWPF Process Sampling Locations Diagram

Except for turbidity and transmittance, all permit-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 2019 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 2019. The performance of individual treatment processes measured by water quality is discussed later in this section.

It is interesting to compare 2019 average Q1 and FPW quality for selected constituents with average values in 2018 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 2019 as compared to the previous year.

The average Q1 total dissolved solids (TDS) concentration essentially stayed the same in 2018 (989 mg/L) as in 2019 (986 mg/L). The average Q1 chloride levels were unchanged from 2018 (298 mg/L) to 2019 (298 mg/L). For the FPW quality, average TDS levels decreased slightly from 2018 (53 mg/L) to 2019 (49 mg/L). Average FPW chloride concentrations very slightly decreased from 2018 (5.3 mg/L) to 2019 (5.2 mg/L).

Average Q1 total suspended solids levels remained effectively unchanged in 2018 (6.4 mg/L) as in 2019 (6.5 mg/L). Likewise, average Q1 turbidity was steady from 2018 (1.5 Nephlometric Turbidity Units (NTU)) to 2019 (1.6 NTU).

The average Q1 total nitrogen concentration slightly decreased from 2018 (12.9 mg/L) to 2019 (12.0 mg/L). The average FPW total nitrogen concentration decreased from 2018 (1.0 mg/L) to 2019 (0.8 mg/L).

The average Q1 TOC concentration remained unchanged in 2018 (9.5 mg/L) as in 2019 (9.5 mg/L). The average FPW TOC concentration was about the same in 2018 (0.10 mg/L) as in 2019 (0.11 mg/L), as determined by laboratory samples.

The annual average concentration of N-nitrosodimethylamine (NDMA) in the Q1 source water increased noticeably from 2018 (27.7 nanograms per liter (ng/L)) to 2019 (47.1 ng/L). The FPW average NDMA concentration increased slightly from 2018 (1.6 ng/L) to 2019 (1.9 ng/L). Like the

Table 2-1. 2019 Average Water Quality[1]

Parameter Name	Units	Q1	MFF	MFE	ROF	ROP	UVP	FPW	Permit Limit
Electrical Conductivity	umhos/cm	1,699	1,721[2]	1,730	1,720[2]	33[2]	38	98[2]	900
Total Dissolved Solids	mg/L	986	na	na	1,005	17	na	49	500[3]
Suspended Solids	mg/L	6.5	9.6	<1	na	na	na	na	N/A
Turbidity	NTU	1.6	3.27[2]	0.08[2]	0.10[2]	0.07[4]	na	0.07[2]	≤0.2 / ≤0.5
Ultraviolet percent transmittance (%UVT) @254nm	%	na	na	68.7	na	97.71[4]	na	na	>90
pH	UNITS	7.3	7.12[2]	7.3	6.90[2]	5.48[2]	5.7	8.50[2]	6 - 9
Total Hardness (as CaCO3)	mg/L	312	na	na	307	<1	na	33.9	240[3]
Calcium	mg/L	80.5	na	na	79.3	<0.5	na	13.7	N/A
Magnesium	mg/L	27.0	na	na	26.5	<0.5	na	<0.5	N/A
Sodium	mg/L	232	na	na	226	5.9	na	5.7	45
Potassium	mg/L	19.0	na	na	18.7	0.1	na	0.1	N/A
Bromide	mg/L	na	na	na	na	na	na	0.01	N/A
Chloride	mg/L	298	na	na	294	5.0	na	5.2	55
Sulfate	mg/L	188	na	na	200	0.6	na	0.5	100
Hydrogen Peroxide	mg/L	na	na	na	na	na	2.2	2.1	N/A
Bicarbonate (as CaCO3)	mg/L	na	na	na	178	7.8	na	38.0	N/A
Nitrate Nitrogen	mg/L	8.64	na	na	na	0.73	na	0.67	3[3]
Nitrite Nitrogen	mg/L	0.691	na	0.505	na	0.003	na	0.033	1[3]
Ammonia Nitrogen	mg/L	1.3	na	na	na	0.3	na	0.1	N/A
Organic Nitrogen	mg/L	1.4	na	na	na	0.05	na	0.02	N/A
Total Nitrogen	mg/L	12.0	na	na	na	na	na	0.8	5
Phosphate Phosphorus	mg/L	0.52	na	na	na	na	na	<0.01	N/A
Iron	ug/L	302	na	na	110	<5	na	<5	300
Manganese	ug/L	52.6	na	na	54.8	<1	na	<1	50
Aluminum	ug/L	6.2	na	na	2.7	0.6	na	1.0	200[3]
Arsenic	ug/L	0.6	na	na	0.4	<1	na	<1	10
Barium	ug/L	45.3	na	na	45.5	<1	na	<1	1,000
Boron	mg/L	0.40	na	na	0.41	0.25	na	0.24	N/A
Cadmium	ug/L	<1	na	na	<1	<1	na	<1	5
Chromium	ug/L	0.3	na	na	0.2	0.19	na	<1	50
Copper	ug/L	7.9	na	na	9.5	0.4	na	<1	1,000[3]
Cyanide	ug/L	3.1	na	na	<5	<5	na	<5	150
Fluoride	mg/L	0.97	na	na	na	na	na	<0.1	2
Lead	ug/L	<1	na	na	1.0	<1	na	<1	15
Mercury	ug/L	<1	na	na	<1	<1	na	<1	2
Nickel	ug/L	4.7	na	na	4.8	<1	na	<1	100
Perchlorate	ug/L	na	na	na	na	na	na	<2.5	6
Selenium	ug/L	1.1	na	na	1.2	<1	na	<1	50
Silica	mg/L	21.0	na	na	21.4	<1	na	0.3	N/A
Silver	ug/L	<1	na	na	<1	<1	na	<1	100
Zinc	ug/L	15.3	na	na	21.7	<1	na	<1	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	47.1	na	na	36.9	12.3	0.3	1.9	N/A
1,4-Dioxane	ug/L	1.4	na	na	1.5	<1	<1	<1	N/A
Perfluorooctanoic Acid	ng/L	na	na	na	15.1	<4	na	<4	N/A
Perfluorooctane Sulfonic Acid	ng/L	na	na	na	19.3	<4	na	<4	N/A
Total Trihalomethanes	ug/L	0.3	na	na	16.0	5.7	4.9	3.4	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	38	<3	na	<3	15
Total Organic Carbon (unfiltered)	mg/L	9.53	9.27	na	7.70	0.11	0.17	0.11	0.5[3]
Surfactants (MBAS)	mg/L	0.20	na	na	0.20	<0.02	na	<0.02	0.5
Total Coliform	MPN/100 mL	294,196	24,842	0.15	na	<1	<1	<1	2.2
Escherichia coli (E. coli)	MPN/100 mL	65,460	3,411	<1	na	<1	na	<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 2018 and 2019 Average Water Quality[1]

Parameter Name	Units	2018 Q1	2019 Q1	2018 FPW	2019 FPW	Permit Limit
Electrical Conductivity	umhos/cm	1,709	1,699	100[2]	98[2]	900
Total Dissolved Solids	mg/L	989	986	53	49	500[3]
Suspended Solids	mg/L	6.4	6.5	na	na	N/A
Turbidity	NTU	1.5	1.6	0.08[2]	0.07[2]	≤0.2 / ≤0.5
Ultraviolet percent transmittance (%UVT) @254nm	%	na	na	na	na	>90
pH	UNITS	7.3	7.3	8.47[2]	8.50[2]	6 - 9
Total Hardness (as CaCO3)	mg/L	297	312	34.1	33.9	240[3]
Calcium	mg/L	76.4	80.5	13.7	13.7	N/A
Magnesium	mg/L	25.9	27.0	<0.5	<0.5	N/A
Sodium	mg/L	223	232	6.1	5.7	45
Potassium	mg/L	19.2	19.0	0.2	0.1	N/A
Bromide	mg/L	na	na	<0.1	0.01	N/A
Chloride	mg/L	298	298	5.3	5.2	55
Sulfate	mg/L	178	188	0.3	0.5	100
Hydrogen Peroxide	mg/L	na	na	2.1	2.1	N/A
Bicarbonate (as CaCO3)	mg/L	na	na	38.1	38.0	N/A
Nitrate Nitrogen	mg/L	8.81	8.64	0.81	0.67	3[3]
Nitrite Nitrogen	mg/L	0.844	0.691	0.042	0.033	1[3]
Ammonia Nitrogen	mg/L	2.0	1.3	0.2	0.1	N/A
Organic Nitrogen	mg/L	1.3	1.4	0.02	0.02	N/A
Total Nitrogen	mg/L	12.9	12.0	1.0	0.8	5
Phosphate Phosphorus	mg/L	0.36	0.52	<0.01	<0.01	N/A
Iron	ug/L	368	302	<5	<5	300
Manganese	ug/L	70.5	52.6	<1	<1	50
Aluminum	ug/L	7.8	6.2	1.2	1.0	200[3]
Arsenic	ug/L	0.2	0.6	<1	<1	10
Barium	ug/L	33.7	45.3	<1	<1	1,000
Boron	mg/L	0.39	0.40	0.235	0.24	N/A
Cadmium	ug/L	<1	<1	<1	<1	5
Chromium	ug/L	<1	0.3	<1	<1	50
Copper	ug/L	6.2	7.9	<1	<1	1,000[3]
Cyanide	ug/L	<5	3.1	<5	<5	150
Fluoride	mg/L	0.91	0.97	<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	4.7	<1	<1	100
Perchlorate	ug/L	na	na	<2.5	<2.5	6
Selenium	ug/L	0.5	1.1	<1	<1	50
Silica	mg/L	20.6	21.0	0.4	0.3	N/A
Silver	ug/L	<1	<1	<1	<1	100
Zinc	ug/L	15.5	15.3	0.6	<1	5,000
1,2,3-Trichloropropane	ug/L	<0.005	<0.005	<0.005	<0.005	0.005
N-nitrosodimethylamine	ng/L	27.7	47.1	1.6	1.9	N/A
1,4-Dioxane	ug/L	1.8	1.4	<1	<1	N/A
Perfluorooctanoic Acid	ng/L	9.5	na	<4	<4	N/A
Perfluorooctane Sulfonic Acid	ng/L	14.5	na	<4	<4	N/A
Total Trihalomethanes	ug/L	0.3	0.3	3.0	3.4	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	9.53	9.53	0.10	0.11	0.5[3]
Surfactants (MBAS)	mg/L	0.17	0.20	<0.02	<0.02	0.5
Total Coliform	MPN/100 mL	796,310	294,196	0.26	<1	2.2
Escherichia coli (E. coli)	MPN/100 mL	224,940	65,460	<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.

55 FPW samples analyzed for NDMA in 2018, none of the 56 FPW samples analyzed for NDMA in 2019 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 2018 (1.8 µg/L) to 2019 (1.4 µg/L). The FPW average 1,4-dioxane concentrations in both 2018 and 2019 were below the reportable detection level (RDL) of 1 µg/L; furthermore, all individual FPW sample results during 2018 and 2019 were below the RDL and DDW NL of 1 µg/L for 1,4-dioxane.

2.2.1 Source Water in 2019

The AWPF feedwater (Q1) was a variable blend of AS and TF effluents from OCSD Plant No. 1. In 2019, source water exhibited consistently low turbidity and nitrogen levels because of the NdN operation of the AS facilities.

2.2.1.1 Secondary Effluent Flow Equalization and Influent Screening

Like 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 2-4, 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 GWRS 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 2-4. Secondary Effluent Flow Equalization (SEFE) Tanks and Pump Station

2.2.1.2 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 2019, the Q1 source water to the AWPF consisted of 38,100 MG of AS effluent and 8,649 MG of TF effluent, as illustrated on Figure 2-5, for a total annual influent flow of 46,749 MG. On an annual average daily flow basis, the AWPF had available approximately 104.4 MGD of AS effluent and 23.7 MGD of TF effluent, for a total of 128.1 MGD of available source water. The volume of TF effluent made up just over 19% of the total influent during 2019; however, the day-to-day operation varied with TF effluent making up from 9.1% (May 8) to 24.3% (February 14) of the AWPF source water.

Figure 2-6 shows the average daily flow rate of AS effluent and TF effluent for each month during 2019. Of the influent flow stream, about 1,484 MG, or 4.1 MGD on average, was not recycled and was returned to OCSD via the influent weir overflow at the screening facility. The return flow in 2019 was lower than that in 2018 (3,488 MG or 9.6 MGD on average) due to the AWPF's increased production after completion of the 2018 GWRS Pipeline Rehabilitation Project. The net total MFF flow during 2019 was approximately 45,265 MG or an annual average daily flow of 124.1 MGD.

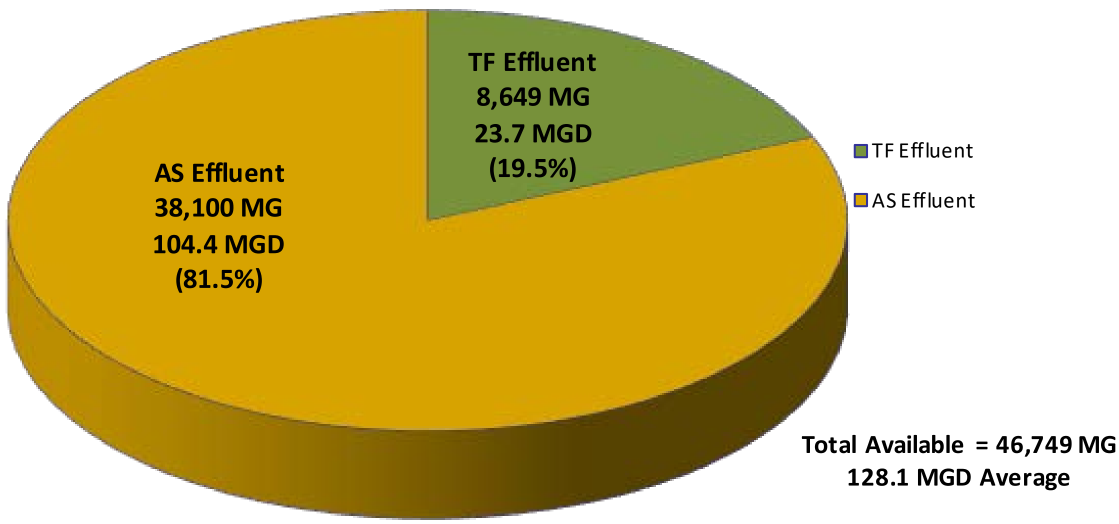


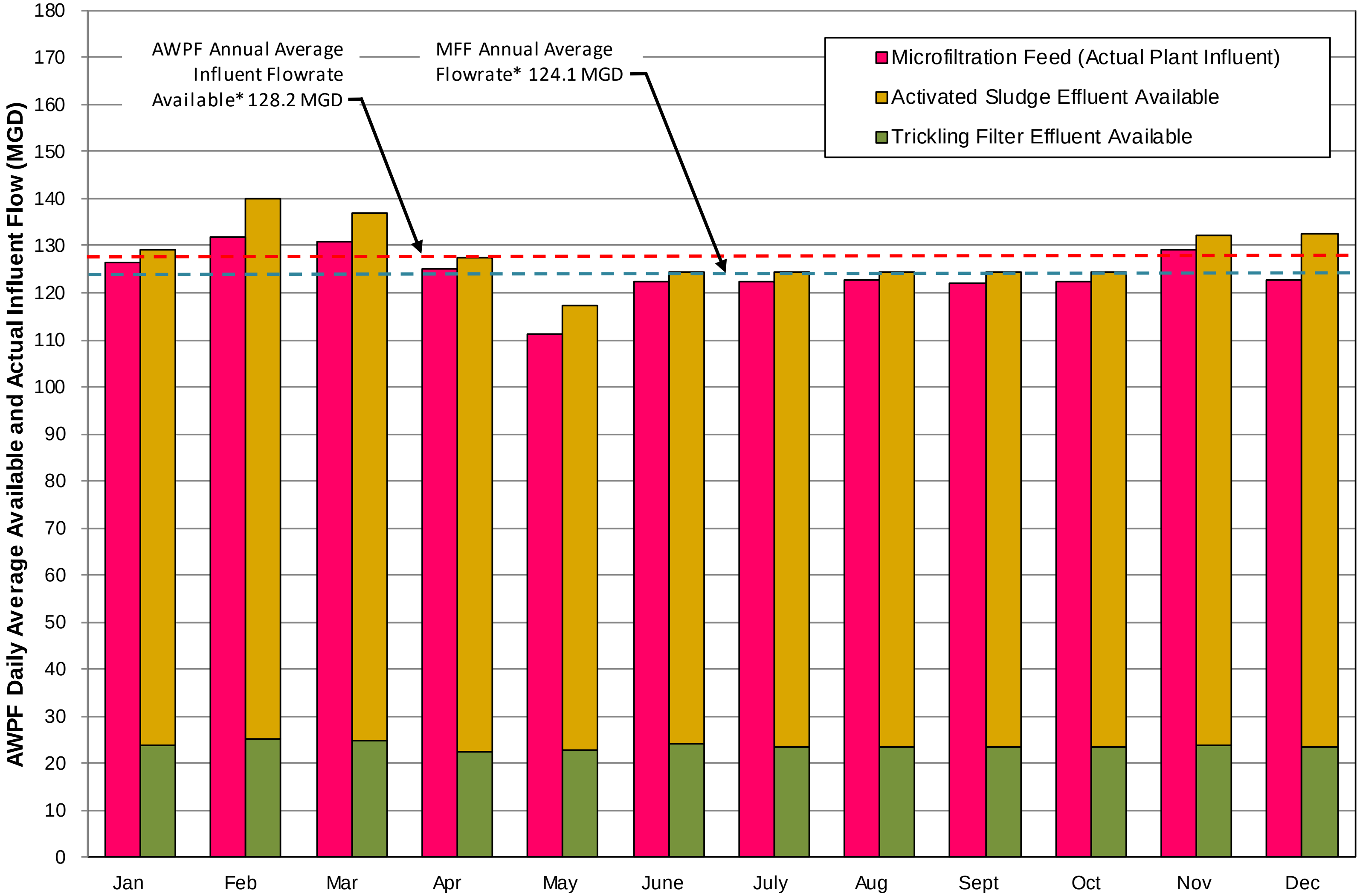
Figure 2-5. 2019 AWPF Average Influent Flow Sources and Volumes

2.2.1.3 Source Water Turbidity and Ammonia-Nitrogen

In 2019 the AWPF feedwater (Q1) turbidity ranged between 0.9 and 5.4 NTU (based on grab samples), averaging 1.6 NTU and indicating that the 5.4 NTU value represents an outlier. Total suspended solids concentrations in the AWPF feedwater (Q1) ranged from 3.5 to 12 mg/L, which is exceptional for secondary effluent.

The average Q1 total nitrogen level remained low (12.0 mg/L) and the corresponding ammonia-nitrogen concentration was 1.3 mg/L due to the blend of non-nitrified TF effluent and AS effluent from the OCSD AS facilities operating in the NdN mode. Indigenous 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 2019 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 beginning in mid-July through December, except for a few periodically higher results. In response, the sodium hypochlorite dose in the MFF was adjusted to minimize the ROF free chlorine residual level. The MFF sodium hypochlorite dose was typically at 8 to 9 mg/L in 2019. 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.



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

Figure 2-6. 2019 AWPF Influent Sources and Average Flows by Month

2.2.2 MF System Performance in 2019

2.2.2.1 MF System Facilities

MF removes suspended and colloidal solids, including bacteria and protozoa, and serves as a pretreatment step before the RO process. Screened secondary effluent flows by gravity to below-grade MF cells, pictured on Figure 2-7. Of the total 36 MF cells, 34 cells feature polypropylene hollow-fiber membranes with a nominal pore size of 0.2 micrometers (microns) and two cells (E03 and E04, see Section 2.3.5) feature polyvinylidene difluoride (PVDF) hollow-fiber membranes with a nominal pore size of 0.1 microns. 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 polypropylene membranes are periodically cleaned-in-place using citric acid and sodium hydroxide with a proprietary chemical to remove foulants and restore membrane performance. The PVDF membranes are periodically cleaned-in-place using sodium hypochlorite and citric acid with maintenance washes. Waste backwash is returned to OCSD Plant 1 for treatment. MF CIP spent cleaning solutions are sent to OCSD Plant 2.

Figure 2-7. MF System

2.2.2.2 MF System Performance

Table 2-3 summarizes the monthly MF system performance for 2019 in terms of turbidity reduction. The daily average MFF turbidity ranged from 2.00 to 5.74 NTU based on daily averages of on-line turbidimeter readings taken upstream of the MF process. The annual average on-line MFF turbidity was 3.27 NTU. The OCSD Plant No. 1 original AS1 plant (Project P1-82) and the newer AS2 plant (Project No. P1-102) have operated in the NdN mode achieving partial denitrification since 2010 and 2012, respectively; as a result of these operational changes at Plant No. 1, low MFF turbidity has been reliably achieved, demonstrating the benefits of biological NdN.

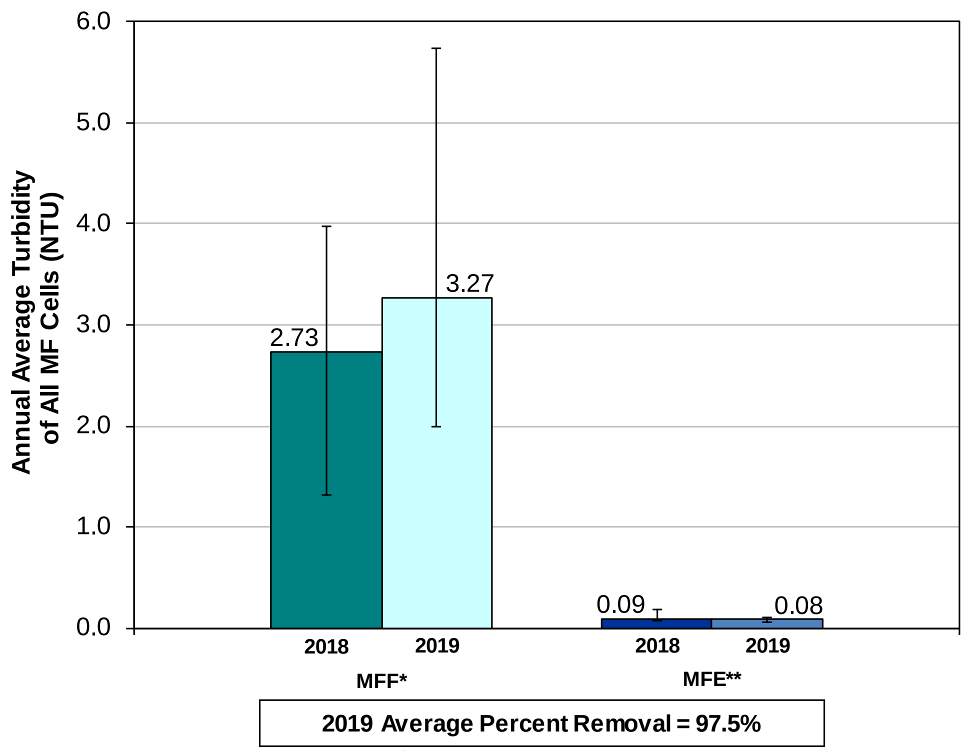
The daily average MFE turbidity during 2019 ranged from 0.06 to 0.11 NTU, with an annual average turbidity of 0.08 NTU based on on-line turbidimeter readings taken on the bulk MFE stream entering the MF Break Tank. Continuous readings from nine turbidimeters (one per bank of four MF cells) are averaged to determine the daily average MFE turbidity. This represents an average turbidity removal rate for the MF process of 97.5% during 2019.

Figure 2-8 presents the annual average turbidity reduction achieved by the MF system in 2019 and compares it with the MF system performance during 2018. Overall, the average turbidity removal rate of 97.5% in 2019 was higher than the 96.7% removal rate in 2018. Review of the average monthly performance reveals consistently stable average MFF turbidities with minor seasonal variation throughout 2019. Indicated by the black bars representing the minimum and maximum daily average turbidities by year on Figure 2-8, the range in MFF turbidity was higher in 2019 (2.00 to 5.74 NTU) as compared with that in 2018 (1.32 to 3.97 NTU).

Table 2-3. 2019 MF Performance

Month	Turbidity			
	MF Feed MFF[1]		MF Effluent MFE[1]	
	Avg. (NTU)	Max (NTU)	Avg. (NTU)	Max (NTU)
January	2.86	3.73	0.08	0.10
February	3.37	4.97	0.09	0.10
March	3.34	3.98	0.09	0.10
April	3.47	4.95	0.09	0.10
May	3.96	5.74	0.08	0.11
June	3.35	3.98	0.08	0.09
July	3.41	4.28	0.07	0.09
August	3.00	3.57	0.07	0.08
September	3.20	3.78	0.08	0.09
October	3.11	3.74	0.08	0.09
November	3.12	4.22	0.08	0.09
December	3.10	3.45	0.08	0.09
Annual Average	3.27	---	0.08	---
Maximum	---	5.74	---	0.11
Average % Removal	97.5%			

[1] Based on daily average turbidity readings from MFF and MFE on-line turbidimeters. Values shown represent the monthly average for all MF cells. Shown above, bulk MFE is monitored as it enters the MF Break Tank. 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 2-8. 2019 MF Turbidity Removal Performance

2.2.3 RO System Performance in 2019

2.2.3.1 RO System Facilities

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 2-9, 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 2-9. RO System

2.2.3.2 RO System Performance

The three-stage RO process is designed to remove inorganic and organic compounds as well as bacteria and virus pathogens, producing up to 100 MGD of product water at a recovery rate of approximately 85%. Monthly performance data for the RO process in 2019 for key constituents, EC and TOC, are summarized in Table 2-4. Regarding salinity removal in 2019, the ROF EC averaged 1,712 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 2019.

Table 2-4. 2019 RO Performance

	Electrical Conductivity[1,2]				Total Organic Carbon[3]			
	RO Feed ROF		RO Product ROP		RO Feed ROF		RO Product ROP	
Month	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	1710	1920	30	33	7.47	8.15	0.07	0.11
February	1828	1890	29	31	7.45	8.18	0.10	0.19
March	1788	1800	28	30	7.57	8.22	0.09	0.15
April	1843	1910	32	34	7.89	8.52	0.11	0.16
May	1682	1770	34	36	8.16	8.66	0.11	0.19
June	1690	1740	35	35	7.85	10.10	0.12	0.21
July	1744	1880	40	43	7.68	9.26	0.13	0.30
August	1710	1730	43	44	7.60	9.08	0.13	0.18
September	1633	1680	43	46	7.57	7.91	0.12	0.28
October	1670	1720	42	44	7.86	8.70	0.12	0.26
November	1655	1680	41	42	7.72	8.21	0.14	1.25
December	1630	1680	35	40	7.61	8.03	0.11	0.29
Annual Average	1712	---	36	---	7.70	---	0.11	---
Maximum	---	1920	---	46	---	10.10	---	1.25
Average % Removal	97.9%				98.5%			

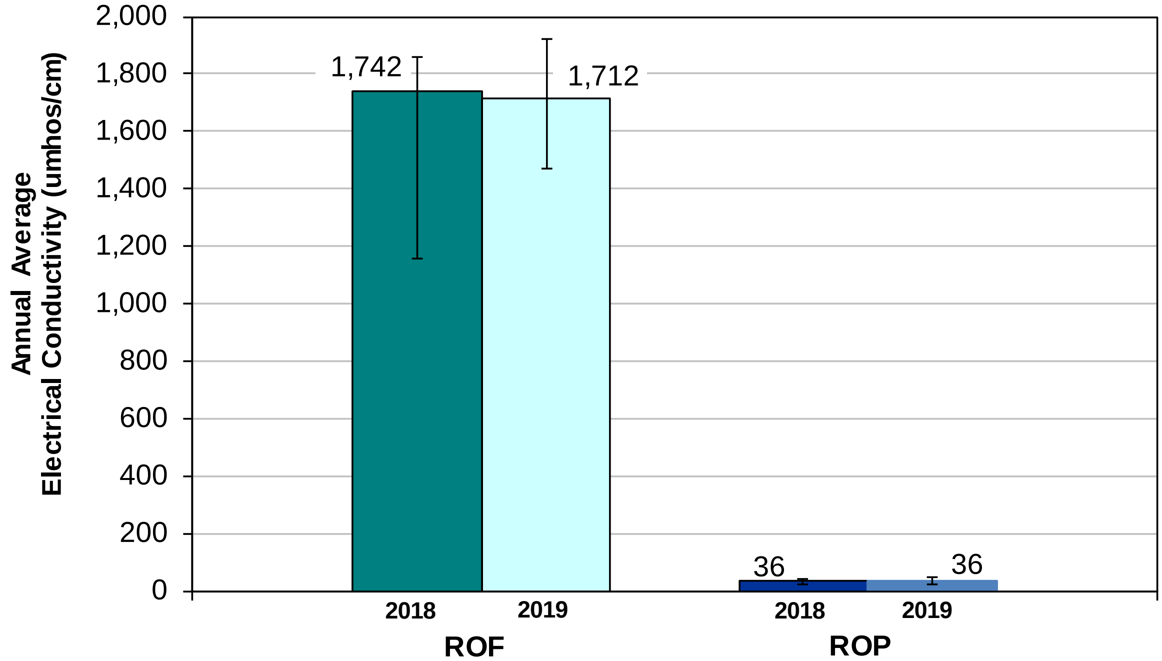
[1] Electrical Conductivity (EC) data for RO are not normalized with respect to ROF pressure or temperature

[2] EC semi-weekly grab sample results

[3] TOC daily grab sample results

Figure 2-10 presents the 2019 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 2018 and 2019 at 97.9%.

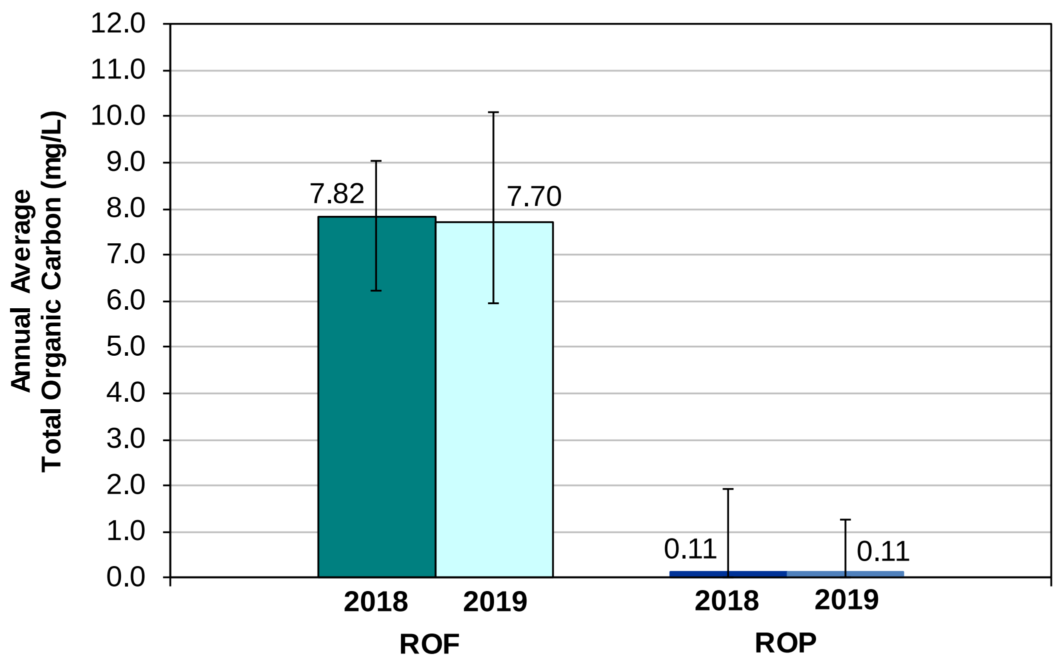
Figure 2-11 presents the annual average TOC removal performance of the RO system, comparing 2018 and 2019 results. The average TOC removal of 98.5% in 2019 was the same as the prior year. In general, this TOC removal performance indicates rejection rates remained fairly constant over this period.



2019 Average Percent Removal = 97.9%

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

Figure 2-10. 2019 RO Electrical Conductivity Removal Performance



2019 Average Percent Removal = 98.5%

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

Figure 2-11. 2019 RO Total Organic Carbon Removal Performance

The TOC concentration in the ROF based on daily grab samples averaged 7.70 mg/L in 2019, which is nearly the same as the 7.82 mg/L average observed in 2018. The ROF TOC concentration range in 2019 was wider than in the prior year, from 5.94 to 10.10 mg/L as shown by the vertical black bars on Figure 2-11. The TOC concentration in the ROP based on daily grab samples averaged 0.11 mg/L during 2019, ranging from non-detectable (less than the RDL of 0.05 mg/L) to 1.25 mg/L. Only a single ROP TOC result was significantly higher than the other 2019 values (1.25 mg/L on November 19); all other 2019 ROP TOC results were equal to or less than 0.3 mg/L. Sample contamination is suspected for this ROP TOC outlier because the corresponding FPW TOC results were unremarkable (0.13 mg/L on November 19).

2.2.4 UV / AOP Performance in 2019

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 UV/AOP System Facilities

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 2-12 shows a photo of two UV trains.

2.2.4.2 Disinfection

Regarding disinfection through the entire AWPF in 2019, total coliform levels in the Q1 averaged approximately 294,200 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 approximately 24,840 MPN/100 mL, representing an average total coliform removal of 1.1 log achieved by disinfection. MF treatment further reduced the average total coliform levels to less than 1 MPN/100 mL in the MFE with one exception (3 MPN/100 mL on May 8). Total coliform levels were 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.

Figure 2-12. UV/AOP System

Concentrations of E. coli were diminished by adding sodium hypochlorite upstream of the MF process in 2019. (See Table 2-1 presented earlier.) The Q1 E. coli level averaged approximately 65,460 MPN/100 mL, and the MFF E. coli levels averaged approximately 3,411 MPN/100 mL following disinfection. The average MFE results for E. coli further declined to less than 1 MPN/100 mL in 2019.

2.2.4.3 NDMA Removal

Besides disinfection, a key performance criterion for the UV/AOP system relates to destruction of NDMA as shown in Table 2-5 and illustrated on Figure 2-13. The 2019 average concentration of NDMA in the UVF was approximately 12.7 ng/L, based on weekly grab samples ranging from 4.1 to 23.1 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 2019 was approximately 47.1 ng/L, ranging from non-detectable levels (using a laboratory method with an RDL of 10 ng/L) to as high as 110 ng/L.

Table 2-5. 2019 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	56.8	87.0	10.0	12.7	<2	<2
February	64.6	80.2	10.5	12.0	<2	3.0
March	53.9	67.3	8.8	12.8	<2	<2
April	38.5	43.5	10.7	17.9	<2	<2
May	36.2	47.9	12.8	13.7	<2	<2
June	39.2	48.4	14.5	17.2	<2	<2
July	37.8	49.2	16.4	19.4	<2	2.4
August	44.8	57.3	17.7	23.1	<2	<2
September	66.4	100.0	16.3	20.5	<2	<2
October	56.3	110.0	13.5	16.0	<2	<2
November	36.8	60.0	10.2	15.1	<2	<2
December	37.9	49.8	11.1	21.6	<2	<2
Annual Average	47.1	---	12.7	---	<2	---
Maximum	---	110.0	---	23.1	---	3.0
Average % Removal (by UV/AOP)	97.7%					
Average Log Removal (by UV/AOP)	1.6					

[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".

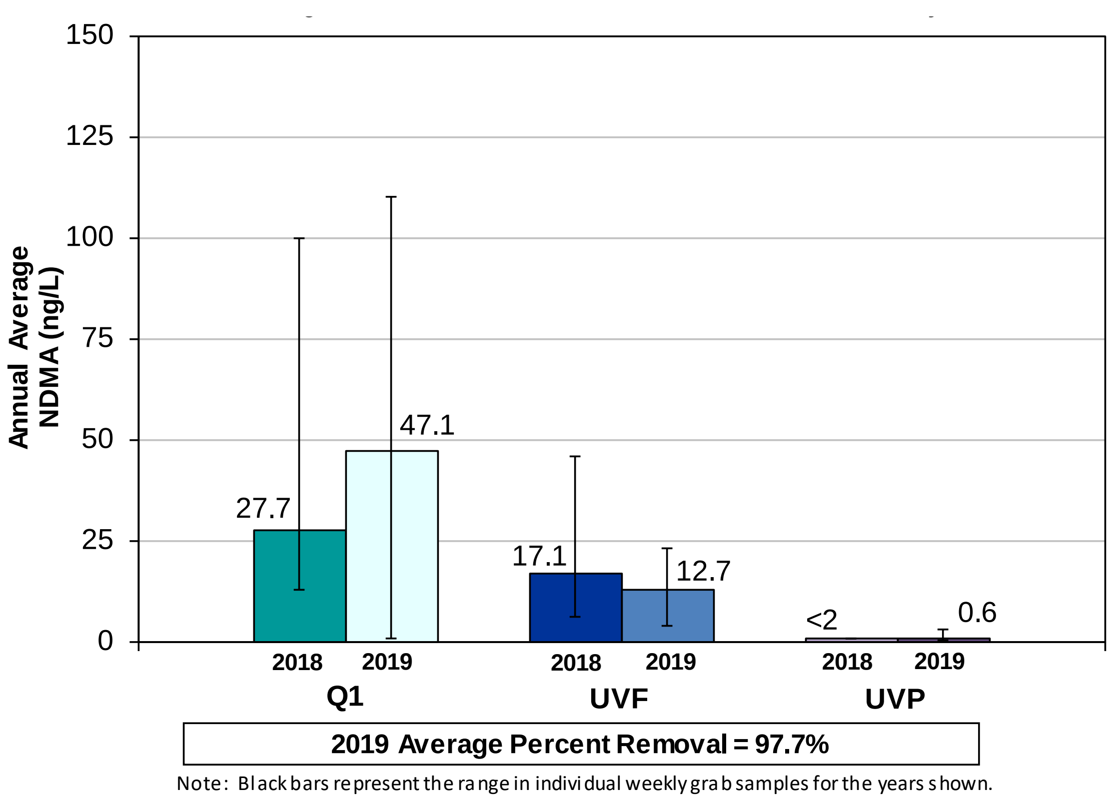


Figure 2-13. 2019 UV/AOP NDMA Removal Performance

With two exceptions, all UVP NDMA results in 2019 were non-detect (using a laboratory method with an RDL of 2 ng/L): 3.0 ng/L on February 8 and 2.4 ng/L on July 5. Overall, comparison of the average UVF and UVP NDMA concentrations in 2019, the UV/AOP system attained an average NDMA removal rate of 97.7%, or a 1.6 log reduction if 10% of the detection limit is assigned to the non-detect values.

It is interesting to note that the addition of sodium hypochlorite in the MFF stream appears to create NDMA at times. For example, on July 5 the Q1 NDMA concentration was 16.9 ng/L as compared to that in the ROF stream at 28.1 ng/L. Tracking the NDMA levels on July 5 reveals the NDMA concentration in the ROP stream was 10.4 ng/L, indicating that it was partially removed by the RO process. On July 5, the UVF NDMA concentration was 11.4 ng/L and the UVP NDMA concentration was reduced to 2.4 ng/L by UV/AOP treatment. Review of the UV/AOP operations records on July 5 yielded no unusual events occurred; the average %UVT was 98% and the UV EED averaged 0.25 kWh/kgal with a hydrogen peroxide dose of 3.0 mg/L and total UV/AOP flowrate of 86.9 MGD on July 5. The FPW NDMA concentration on July 5 was 3.2 ng/L, indicating possible reformation had occurred. As presented in Section 2.3.10, the ROF NDMA concentration is higher than that in the ROP/UVF because the RO process removes a portion of the NDMA. Following UV/AOP treatment, the average NDMA concentration in the UVP was non-detect (less than 2 ng/L) in all but two samples as noted above.

In 2019, all FPW NDMA results were below the DDW notification level for NDMA (10 ng/L). The highest NDMA concentration in the Q1 stream, 110 ng/L, occurred on October 25, 2019. The NDMA concentration in the FPW on that date was 4.5 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. For example, the highest daily concentration of NDMA in the FPW occurred on February 1, yet NDMA was non-detectable in the UVP stream. Low concentrations of NDMA in the FPW, below the DDW notification level (10 ng/L), were detected periodically throughout 2019, whereas UVP NDMA concentrations were consistently non-detect with only two exceptions (see above) throughout the year.

Potential causes include reformation of NDMA from previously photolyzed NDMA and/or formation of “new” NDMA from precursor compounds, 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. It is also believed that removal of NDMA precursors may be a function of RO membrane age.

2.2.4.4 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 2-14 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 1.4 µg/L, ranging from non-detect (< 1 µg/L) to 3.7 µg/L.

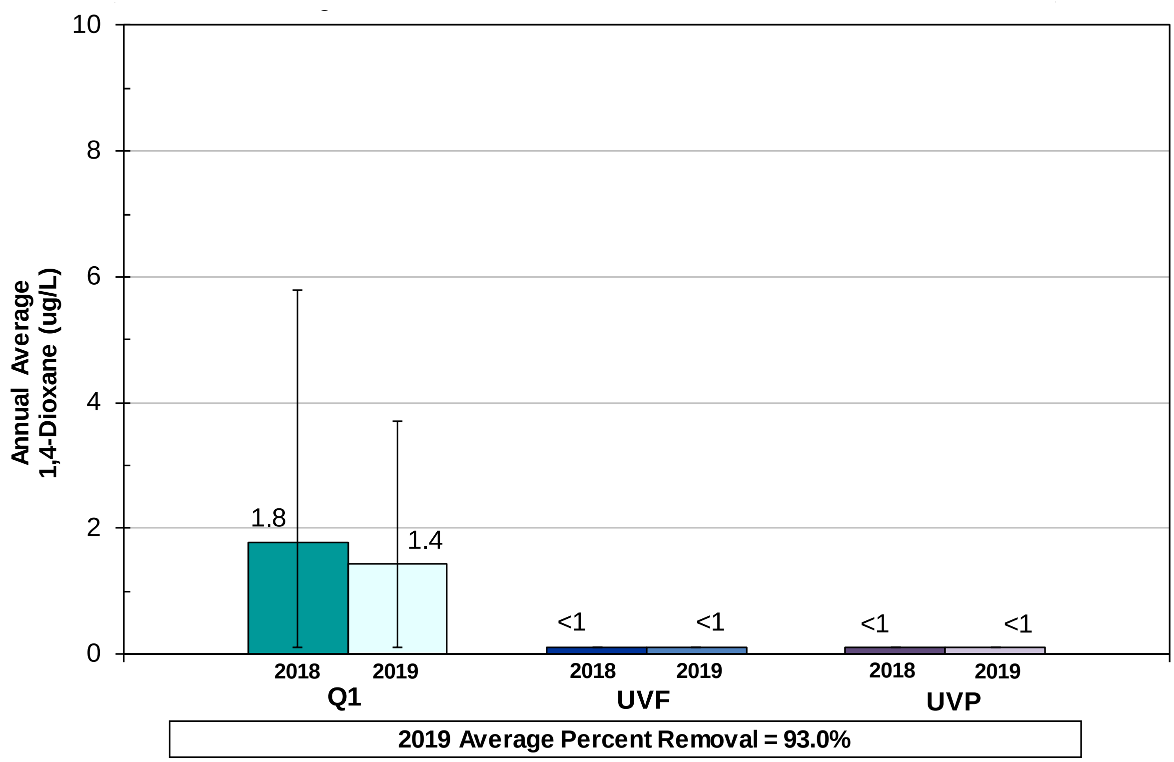
As illustrated by the black vertical bars on Figure 2-14, the 2019 maximum of 3.7 µg/L from all weekly Q1 grab samples was less than the corresponding maximum of 5.8 µg/L in 2018. The FPW 1,4-dioxane concentrations during 2018 and 2019 were consistently non-detect (<1 µg/L). Overall, the RO/UV/AOP processes achieved an average 93.0% removal of 1,4-dioxane during 2019 (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 2019. The overall percent removal was lower in 2019 (93.0%) in comparison with that in 2018 (94.4%) because the Q1 average 1,4-dioxane concentration was lower in 2019 (1.4 µg/L) than in 2018 (1.8 µg/L), and the UVP 1,4-dioxane concentrations were non-detect (<1 µg/L). This decreased the percent removal for 2019, when in effect, the level of treatment remained outstanding. The RO/UV/AOP processes achieved a 1.2 log removal of 1,4-dioxane during 2019.

Table 2-6. 2019 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	1.8	2.4	<1	<1	<1	<1
February	1.5	2.0	<1	<1	<1	<1
March	1.5	1.8	<1	<1	<1	<1
April	1.7	1.8	<1	<1	<1	<1
May	1.4	1.7	<1	<1	<1	<1
June	1.0	1.4	<1	<1	<1	<1
July	1.3	1.4	<1	<1	<1	<1
August	1.8	3.7	<1	<1	<1	<1
September	0.9	1.3	<1	<1	<1	<1
October	1.3	1.4	<1	<1	<1	<1
November	1.4	1.5	<1	<1	<1	<1
December	1.7	2.0	<1	<1	<1	<1
Annual Average	1.4	---	<1	---	<1	---
Maximum	---	3.7	---	<1	---	<1
Average % Removal (RO/UV/AOP System) [2]	93.0%					
Average Log Removal (RO/UV/AOP System) [2]	1.2					

[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 2-14. 2019 RO/UV/AOP 1,4-Dioxane Removal Performance

2.2.5 Decarbonation and Lime Stabilization Systems

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 by six forced-draft decarbonators to raise the pH of the finished product water (FPW). Figure 2-15 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.

Figure 2-15. Decarbonation System

Hydrated lime (calcium hydroxide) is added to neutralize the remaining carbon dioxide, add alkalinity, raise pH, and thereby stabilize the FPW. Figure 2-16 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 2-16. Lime Post-Treatment System

2.2.6 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 GWRS Pipeline. Laterals from the GWRS 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 2-17. 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 2-17. Barrier and Product Water Pump Stations

2.2.7 Total Nitrogen Removal in 2019

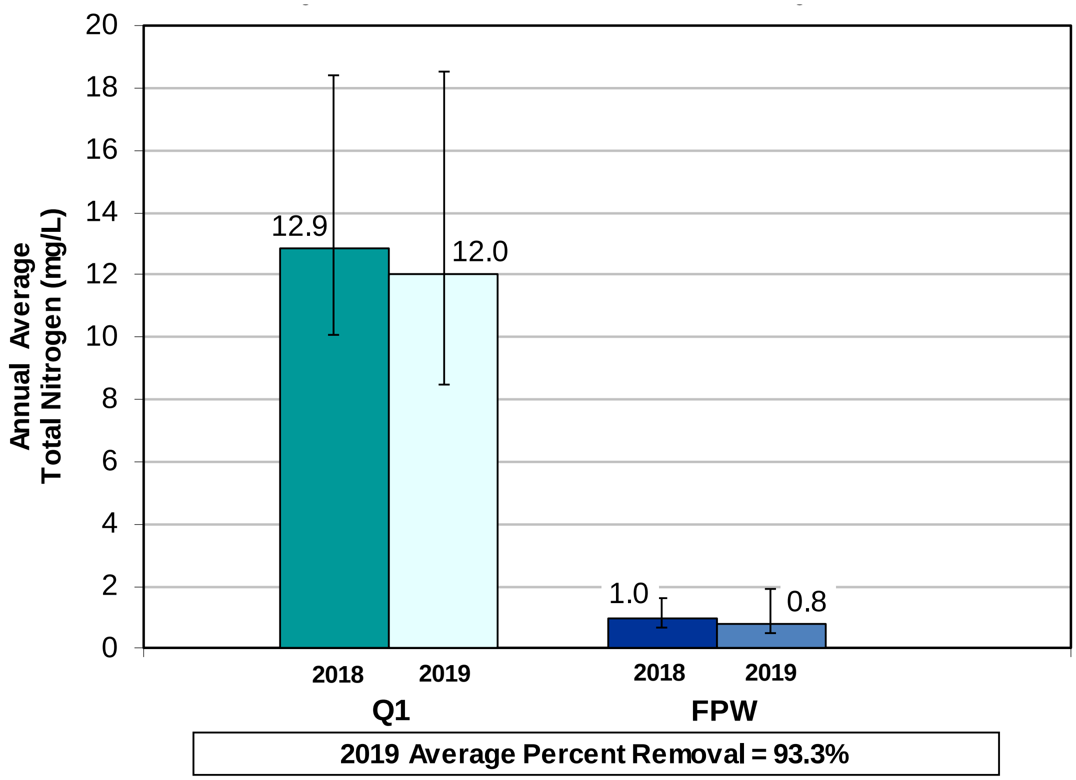
Monthly performance data for AWPF total nitrogen removal are summarized in Table 2-7 and Figure 2-18. On an annual basis, the Q1 total nitrogen concentration (sum of ammonia, nitrite, nitrate, and organic nitrogen, all expressed as nitrogen) averaged approximately 12.0 mg/L during 2019. Low total nitrogen 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% as compared with average Q1 total nitrogen levels in 2008-2009 of approximately 26 to 28 mg/L. In 2019, this lower influent total nitrogen concentration helped the AWPF to achieve consistently low concentrations of total nitrogen levels in the FPW, ranging from approximately 0.5 to 1.9 mg/L based on individual samples. Overall, the annual average FPW total nitrogen concentration remained consistently low over the past two years, 1.0 mg/L in 2018 and 0.8 mg/L in 2019. 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 2-18 presents the 2019 annual average total nitrogen reduction performance of the AWPF and compares it with that achieved in the previous year.

Figure 2-19 illustrates the FPW total nitrogen concentration during 2019, showing it was typically less than 1.0 mg/L, which was well below the total nitrogen permit limit of 5 mg/L. Three samples yielded higher results, total nitrogen concentrations of 1.1, 1.2, and 1.9 mg/L, that were still well below the permit limit. The FPW sampling frequency for total nitrogen analyses is semi-weekly, generally about three days apart.

Table 2-7. 2019 AWPF Total Nitrogen Removal Performance

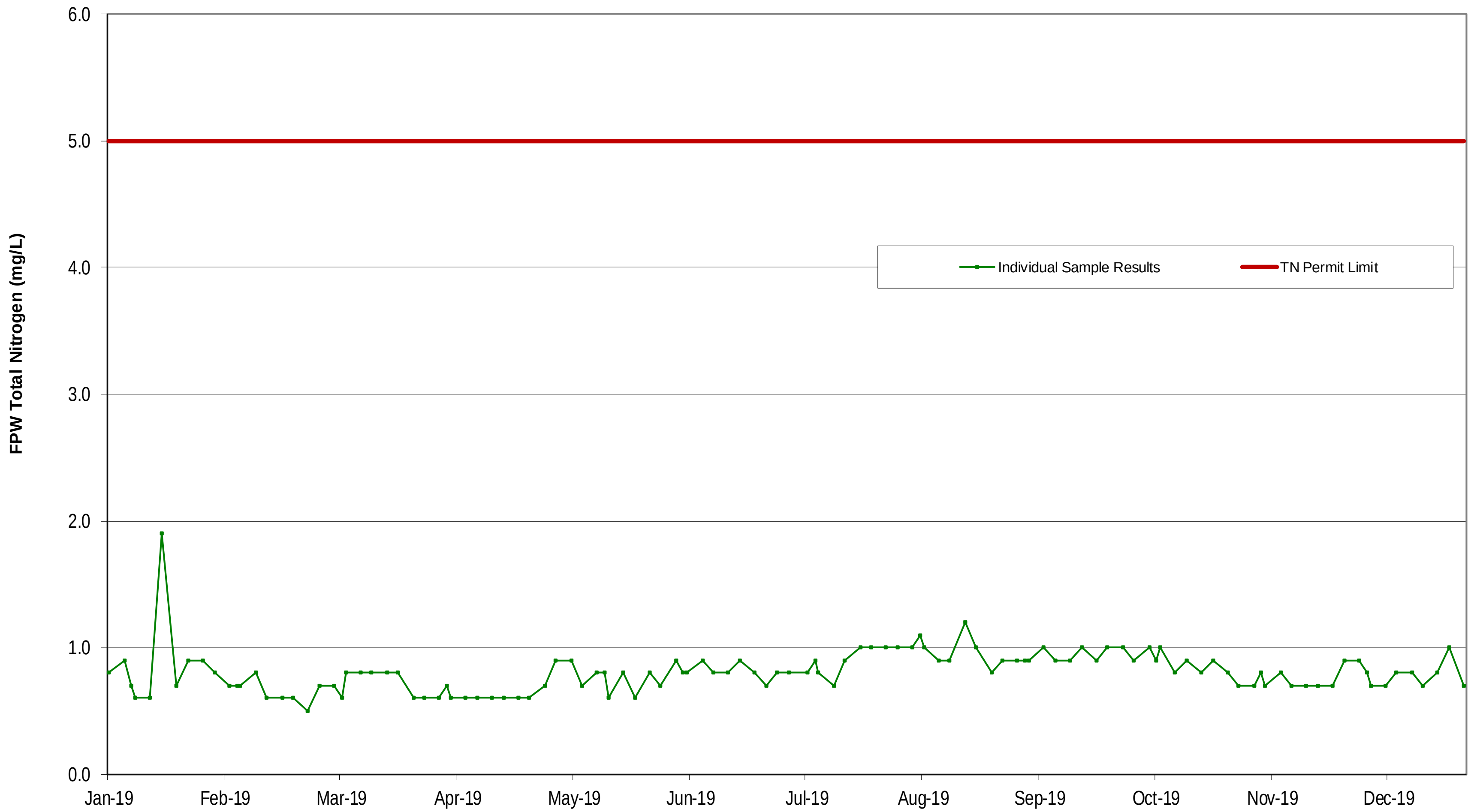
Month	Total Nitrogen[1] Secondary Effluent Q1 Avg. (mg/L)	Total Nitrogen[1] Secondary Effluent Q1 Max. (mg/L)	Total Nitrogen[1] AWPF Effluent FPW Avg. (mg/L)	Total Nitrogen[1] AWPF Effluent FPW Max. (mg/L)
January	10.9	13.7	0.9	1.9
February	11.4	13.2	0.7	0.8
March	14.1	16.2	0.7	0.8
April	13.9	17.0	0.6	0.7
May	14.5	17.1	0.8	0.9
June	13.5	18.5	0.8	0.9
July	11.1	11.2	0.9	1.0
August	11.0	11.4	1.0	1.2
September	10.8	11.4	0.9	1.0
October	11.2	11.7	0.9	1.0
November	10.7	11.3	0.7	0.9
December	11.6	12.1	0.8	1.0
Annual Average	12.0	---	0.8	---
Maximum	---	18.5	---	1.9
Average % Removal	93.3%			

[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 2-18. 2019 AWPF Total Nitrogen Removal Performance



Note: Reportable Detection Limit is 0.3 mg/L using Method X1-351.2

Figure 2-19. 2019 Purified Recycled Water Total Nitrogen

2.2.8 Total Organic Carbon Removal in 2019

Figure 2-20 shows the TOC concentration in the FPW during 2019 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 0.11 mg/L. The running 4-sample average TOC concentration in the FPW was also approximately 0.11 mg/L.

As illustrated on Figure 2-20, the daily composite sample FPW TOC result was sharply elevated on September 25, 2019 (1.05 mg/L). On September 25, neither the ROP grab sample TOC result (0.11 mg/L), nor the on-line, continuous TOC analyzer on the ROP stream (0.066 mg/L average) revealed any abnormally high readings to corroborate the elevated FPW composite sample result. Investigations were unable to find a direct source for the FPW TOC spike; it was suspected that a sampling error or contamination may have been the source of the September 25 FPW TOC spike. This one-day spike caused the subsequent four-sample running averages for FPW TOC to increase (up to 0.35 mg/L); however, the four sample running averages remained below the 0.5 mg/L TOC limit.

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 2019, 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 2019. 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

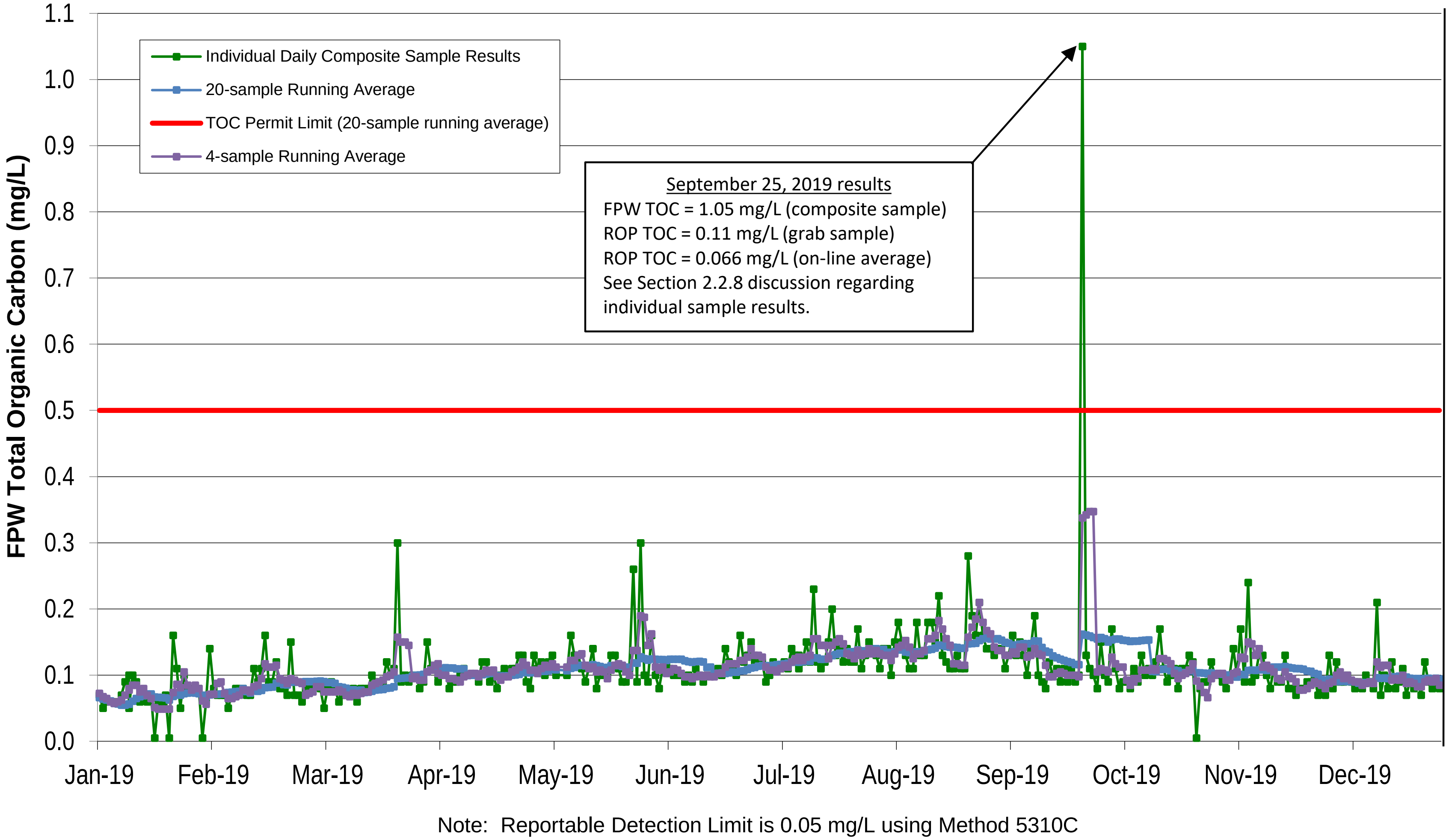


Figure 2-20. 2019 Purified Recycled Water Total Organic Carbon

acceptance and completion of the GWRS Initial Expansion construction project followed on July 31, 2015.

The AWPF was on-line nearly 363 days in 2019 (about 99.4% of the year). Appendix D contains descriptions of all plant shutdowns during the year. The AWPF was completely off-line almost two days in May (May 6-8) for inspection of electrical systems and preventive maintenance on equipment and valves.

The AWPF experienced three unexpected power outages in 2019 that resulted in AWPF shutdowns. The longest outage of 3.5 hours occurred on January 20. It appears that the unplanned outages were caused by maintenance activities from the regional electrical power utility Southern California Edison (SCE).

On September 4, the AWPF reduced production to 15 MGD but did not completely shut down for almost four 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 Enel X program now calls for a load reduction such that total power demand is 5 Megawatts or less during a curtailment event. 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 2019. The AWPF experienced no shutdowns or process interruptions for six months of 2019: June and August through December. For 49 hours in mid-December, the AWPF operated at a reduced production rate supplying approximately 20 MGD to the barrier while the GWRS Pipeline was shut down temporarily for repairs of leaking mechanical flanges. Overall, the AWPF operated well during 2019 and produced a record volume of purified recycled water. 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 2019. OCWD has a total of 21 operations staff, of which all 21 are certified operators and five who have the highest certification level (5). 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, 2018), pressure decay test (PDT) results were added as an indicator of MF membrane integrity. Since 2017 and in response to comments from DDW (DDW, 2017), the critical control points and critical limits have been used to demonstrate daily pathogen log reduction values for compliance with the groundwater recharge regulations (CCR, 2018). 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 process control system (PCS) showing how the AWPF operation compared with the critical limits listed above during 2019. 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).

Performance evaluation of the 2019 AWPF operations with respect to critical control points yields the following observations:

1. **MFF chlorine residual** (as chloramine) averaged 4.0 mg/L during 2019 (See Appendix E, Figure E-1). While high and low values were detected, 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. Numerous MFF chlorine residual readings below the 3 mg/L target (lowest was 2.3 mg/L) or above the 5 mg/L upper target (highest was 5.8 mg/L) were observed. The sodium hypochlorite dose was adjusted from time to time to control MF membrane fouling. The MFF chlorine residual generally decreased during 2019.

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.

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 2019 average chlorine residual was 3.1 mg/L. The maximum ROF chlorine residual was approximately 4.4 mg/L in late April. The minimum ROF chlorine residual was 1.5 mg/L in early May when the AWPF was restarted following a brief scheduled shutdown. In general, the ROF chlorine residual trended slightly downwards during 2019.

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 6 NTU (See Appendix E, Figure E-3). The MFF turbidity averaged 3.3 NTU and ranged from 2.0 to 5.7 NTU, indicative of the superior AWPF feedwater quality received from OCSD's Plant No. 1 during 2019.

4. **MFE turbidity** was below the target of 0.15 NTU throughout 2019 (See Appendix E, Figure E-4). The maximum bulk MFE turbidity (at the MF Break Tank entrance) was 0.11 NTU in early May following the brief AWPF shutdown. The MFE turbidity of all MF trains (bulk) ranged between 0.08 and 0.11 NTU and averaged 0.08 NTU for 2019.

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 0.07 NTU and ranged between 0.05 and 0.09 NTU during 2019.

6. **MF TMP** readings were within the target operating range of 3 to 12.5 pounds per square inch (psi) in 2019, except for one reading that fell below the minimum range (See Appendix E, Figure E-6). On December 20, only 16 of the 36 MF cells were in service because the AWPF operated at a reduced production rate supplying approximately 20 MGD to the barrier while the GWRS Pipeline was shut down temporarily for repairs as noted above. The lowest daily average TMP reading (average for all operational MF cells) was approximately 3.4 psi in early September. The highest daily average TMP reading (average for all operational MF cells) was approximately 8.5 psi at the end of December. The annual average TMP for all operational MF cells in 2019 was 5.1 psi. In 2019 the daily average TMP readings of individual operating MF cells ranged from a minimum of 1.3 psi to a maximum of 10.6 psi.

7. **Daily average MF PDT** results were 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 0.19 to 0.24 psi/minute during 2019. A steady gradual increasing trend was observed during 2019. Section 2.3.5.2 discusses MF PDT readings as they pertain to pathogen log reduction value (LRV) calculations.

8. **ROP electrical conductivity** (EC) exhibited only minor seasonal changes during 2019 with all readings well below the maximum 95 µmhos/cm target (See Appendix E, Figure E-8). During 2019 the ROP EC varied from lows of 23 µmhos/cm in late March to highs of 44 µmhos/cm in May and August, and then decreased to 23 µmhos/cm in late December. On an annual average basis, the ROP EC was 33 µmhos/cm in 2019.

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 2019. The ROP TOC concentration ranged from 0.01 to 0.07 mg/L based on on-line readings. The annual average ROP TOC concentration was 0.04 mg/L in 2019. 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 2019 (See Appendix E, Figure E-10). On-line %UVT values in 2019 ranged between 96.7% and 99.1%. The overall average %UVT in 2019 was 97.7%.

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 2019 the UV system EED varied from a low of 0.233 kWh/kgal to a high of 0.336 kWh/kgal. Elevated EED levels (0.303 to 0.336 kWh/kgal) occurred in mid-December when the AWPF operated at a reduced production rate supplying only the barrier while the GWRS Pipeline was shut down temporarily for repairs. The overall annual average EED was 0.258 kWh/kgal in 2019.

12. **Average UV train power levels** were above the minimum 74 kW consumption level for all trains (A through M) throughout 2019 (See Appendix E, Figure E-12). The individual UV trains generally operated at average power levels between 80 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 256 mJ/cm^2 occurred in late August; the highest calculated UV dose of 342 mJ/cm^2 occurred on December 20 during the temporary AWPF flow reduction to supply only the barrier while repairs were made on the GWRS Pipeline. The average calculated UV dose during 2019 was 275 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 consistently within the allowable range of 6 to 9 on a daily average basis (See Appendix E, Figure E-14). The daily average FPW pH measured on-line ranged from approximately 8.1 to 8.9; 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 to convey more wastewater to Plant No. 1 for treatment.

The SALS operated with three of the four pumps in service with only minor interruptions enabling Plant No. 1 to produce an ample supply of secondary effluent for the AWPF to operate at or close to its full purified recycled water production. OCSD systematically completed repairs in off-line pumps to correct vibration issues; by the end of 2019 only one pump remained to be modified.

OCSD had several reductions in flow at Plant No. 1 in 2019 due to construction projects. Wastewater flows normally tributary to Plant No. 1 were diverted to Plant No. 2 while work on the Newhope-Placentia trunk sewer was completed; this reduced feedwater flows to the AWPF by up to 5 MGD for nearly three months in early 2019.

OCSD inspected the Plant No. 1 headworks gates in mid-2018, which temporarily reduced secondary effluent flows available for the AWPF. Following the winter rainy season, OCSD resumed inspections of the headworks gates in spring 2019, which reduced available AWPF source water flows by up to 30 MGD for several days on multiple occasions.

A short-term reduction in source water for the AWPF was scheduled in fall 2019 when OCSD diverted wastewater to Plant No.2 to support testing at its Plant No. 1 Main Sewage (Influent) Pump Station.

In late 2019 OCSD completed a collection system project that diverted more wastewater to Plant No. 1 for treatment, which increased source water flows for the AWPF.

2.3.4 Source Water Quality

Source water quality was outstanding in 2019. The Plant No. 1 AS process generally produces secondary effluent with low nitrogen and turbidity levels because of the NdN operation. The AS process continued to experience filamentous growth problems that began in 2018. To help alleviate these issues, OCSD increased the primary effluent flow to the AS facilities during the night; this operational modification involved reducing the nighttime flow to the trickling filters and returning to normal daytime TF flows. Fortunately, the AS/NdN process upset caused no outstanding source water quality problems for the AWPF and potential MF membrane fouling was controlled by adjusting the MFF sodium hypochlorite dosage.

OCWD and OCSD coordinated closely to address source water quality issues such as the MFF turbidity spike that resulted from an inadvertently closed Return Activated Sludge (RAS) valve on one of the secondary clarifiers at Plant No. 1; the sludge blanket rose in the clarifier, overflowed the weir and increased the source water turbidity to 20-25 NTU. The entire event lasted less than an hour and the MF system handled the elevated MFF turbidity by completing about six normal backwash cycles.

OCSD continued conducting TF clarifier cleanings at night up to three times per month throughout 2019. 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 2019 with notable activities that included sodium hypochlorite dosage adjustments, corrective actions for elevated PDTs, valves actuator repairs, and performance tests comparing operating parameters for polypropylene membranes and PVDF membranes.

Adjustments in the sodium hypochlorite dosage to the MFF stream were made from time to time to maintain chloramination in response to seasonal membrane fouling trends 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 maintaining the %UVT above 95%. In general, sodium hypochlorite dosages ranged between 7.5 and 10.0 mg/L during 2019.

Elevated PDTs were experienced periodically in some MF cells and investigations led to corrective actions and repairs. Most of the elevated PDT issues were investigated (mapping and pinning) and corrected so the cell could be returned to service. A few elevated PDTs were more challenging. For example, elevated PDTs in one Train C cell were persistent despite investigations (mapping and pinning). Subsequently Train C was taken off-line to replace vacuum supply valves on two cells; unfortunately, the valve replacements failed to correct the elevated PDTs. Further investigations (mapping) continued until elevated PDT issue was corrected, and the Train C cell was returned to service. At no time during 2019 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.

Repeated valve failures were experienced at MF Trains A, B, and C in mid-2019 that required rebuilding the positioner assemblies inside the valve actuators. Initially, condensation in the control air supply was suspected as the cause, but water accumulations were not found in the compressed air receiver tanks. Repairs by OCWD instrumentation staff corrected the problem and the three trains were returned to service.

Performance tests comparing the existing polypropylene membranes with PVDF membranes were conducted during 2019 to help determine which type of membrane to install for the GWRS Final Expansion. MF Cell E01 with polypropylene membranes was used for the test; filtration rates were varied, and intermediate maintenance washes were evaluated to control TMP levels and achieve the targeted 21-day cleaning frequency. PVDF membranes from two manufacturers were installed in two existing MF cells (replacing polypropylene membranes) to conduct a full-scale demonstration. Scinor PVDF membranes in MF Cell E04 began operation in September 2018, and Evoqua PVDF membranes in MF Cell E03 began operation in January 2019. PVDF membranes typically operate at higher filtration rates and with longer runtimes between cleanings than polypropylene membranes. Various adjustments in filtration rates and maintenance washes were made to optimize the performance of the two PVDF membrane cells. Based on the test results, PVDF membranes were selected for the GWRS Final Expansion.

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.

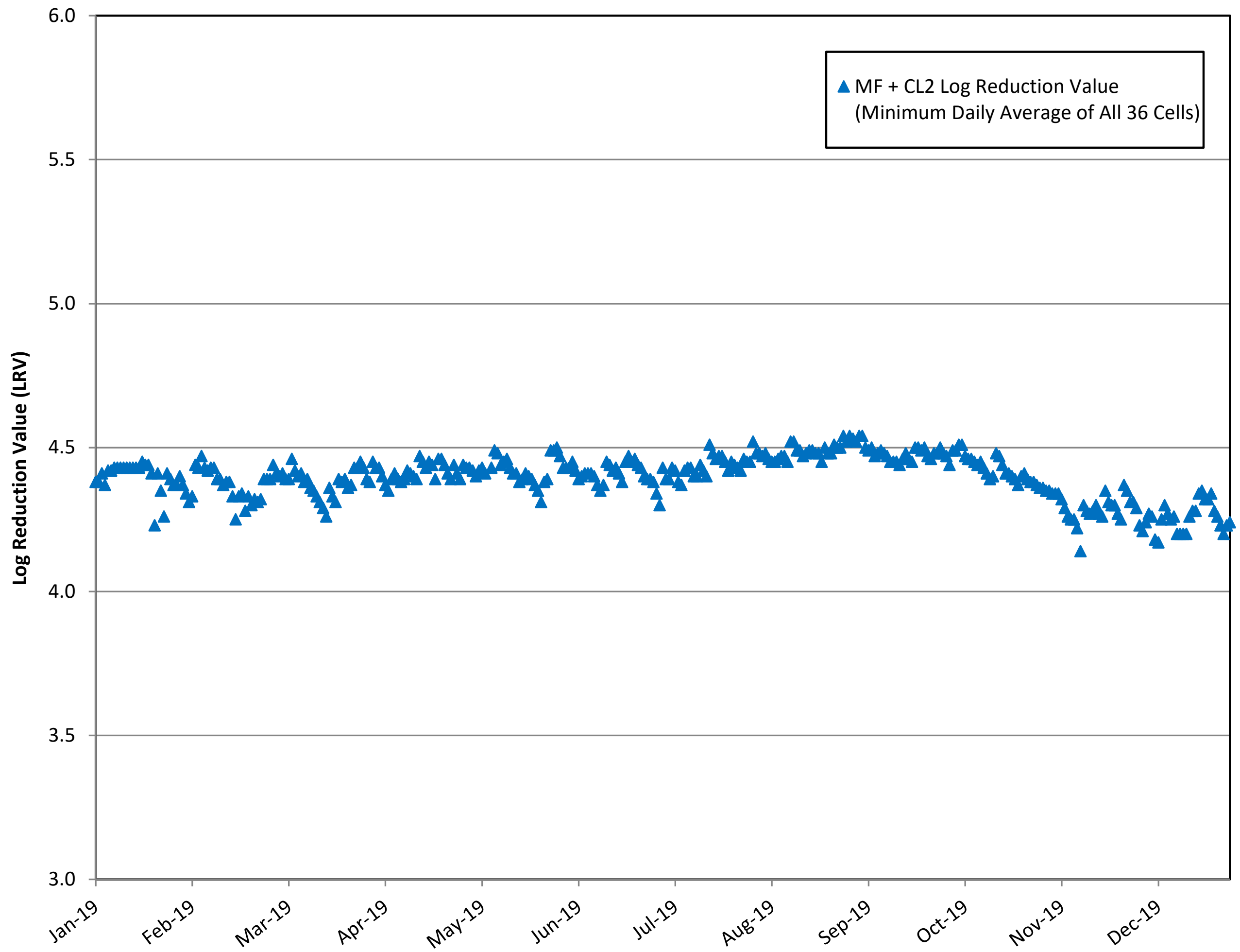
Monthly reports are submitted to DDW documenting the daily pathogen log reduction values achieved by the MF process. Appendix F contains copies of the 2019 monthly reports submitted to DDW and the RWQCB documenting pathogenic microorganism control achieved by GWRS.

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 3.27 NTU was consistently reduced through the MF process to an MFE turbidity of 0.08 NTU, which is equivalent to a 97.5% reduction (See Table 2-3, Figure 2-8, and Appendix F). The maximum MFE turbidity reading was 0.11 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 2019 (See Appendix E, Figure E-7). A detailed review of the MF operating records shows that three cells in Trains B and C exhibited persistent PDT values above the target level (0.25 psi/minute), necessitating extensive investigations to correct the issues and return the cells to service. OCWD tracks the daily PDT results for each MF cell to recognize trends and confirm membrane integrity.

Figure 2-21 graphically illustrates the minimum daily average log reduction values for *Giardia* cysts and *Cryptosporidium* oocysts achieved by the MF process (all 36 MF cells) in 2019. (See Appendix F for monthly reports). The lowest minimum daily average log reduction value achieved in 2019 for these pathogens by the MF process (all 36 MF cells) was 4.1-log. The average daily minimum log reduction value achieved in 2019 for these pathogens was 4.4-log (based on the minimum daily average log reduction value of all 36 MF cells). 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 2019.



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

Figure 2-21. MF Log Reduction Values in 2019: *Giardia* Cysts and *Cryptosporidium* Oocysts (Minimum Daily Average of All 36 MF Cells)

2.3.6 RO System Operation and Performance

The RO system performed well during 2019, and highlights are described below.

2.3.6.1 RO System Operation

Beginning in mid-2015 and continuing through 2019, the three stage 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 May 2018 experienced increasing differential pressures apparently caused by biofouling in June 2019. To alleviate the pressure increases, the cartridge filters were systematically soaked with sodium hypochlorite solution for approximately four hours and then flushed to control biofouling. Unfortunately, this cleaning regime yielded minimal improvement in the rising differential pressures in the cartridge filters.

2.3.6.2 RO System TOC Analyzers

The ROF and ROP on-line TOC analyzers instability issues that began in mid-2017 continued through 2019. OCWD had installed redundant ROF and ROP on-line TOC analyzers in early 2018. All four analyzers showed intermittent spikes of false high and low TOC readings despite being recalibrated; in addition to spikes, comparisons between the two ROP TOC on-line analyzers exposed substantial differences between their readings (approximately 20 µg/L).

OCWD continued to work with the TOC analyzer supplier to resolve the instability issues in 2019. In late April one of the ROP TOC on-line analyzers was replaced with a temporary portable TOC analyzer so that the supplier could investigate its operation. The portable TOC analyzer remained in service on the ROP stream until mid-June when it was removed and a new on-line ROP TOC analyzer was installed. The supplier updated the firmware for the all four of the TOC analyzers in June, which improved their instability issues to some extent, but did not fully resolve the intermittent spikes of false TOC readings. Investigations are continuing to improve the on-line ROF and ROC TOC monitoring reliability. Fortunately, the intermittent ROP TOC spike events during 2019 were brief and none resulted in a GWRS permit exceedance.

2.3.6.3 RO System Third-Stage Fouling

Table 2-9 summarizes the membrane types and installation dates in the RO System.

Third-stage fouling was observed in six RO units with Hydranautics ESPA2-LD membranes in Trains B, C, and D that had been installed between December 2015 and March 2016. In February 2019 third stage membranes from Unit C02 were sent to the antiscalant supplier for autopsies and cleaning trials to evaluate a more effective proprietary cleaning solution. Results of the investigation found that the foulant was a blend of inorganic (69%) and organic (31%) materials.

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
	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.

Cleaning with high pH solution followed by low pH solution removed the foulant but caused the membranes to have decreased salt rejection. Additional C02 Unit membranes were subsequently removed and sent for autopsies and cleaning trials to optimize the cleaning regime and control fouling. OCWD continues to evaluate other antiscalants at the AWPF Engineering/Research Center's pilot testing facility.

2.3.6.4 RO System Energy Recovery Devices

All three of the Train F ERDs and two of the three Train G ERDs were in service operating at their design set points during 2019. RO Unit G03's ERD began leaking at its pump shaft mechanical seal in late 2018 and was taken out of service. The G03 ERD was sent to the manufacturer for repairs in 2019 and returned to service in the last quarter of the year.

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 (one duty and one standby) continuously monitor the bulk (common header) ROP flow stream, providing full redundancy. 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 2-22 shows the daily average on-line ROF and ROP TOC results in 2019. Figure 2-23 illustrates the minimum daily average pathogen log reduction values achieved by the RO process based on TOC monitoring in 2019 as reported to DDW and the RWQCB; Appendix F includes monthly pathogen reduction reports in 2019.

Except for14 days in 2019, the pathogen log reduction values demonstrated by the RO process were greater than 2.00-log based on on-line TOC readings. On August 1-10 and August 13-16, the pathogen log reduction values dipped to as low as 1.90-log using on-line TOC readings. A review of the on-line TOC values on those dates revealed that the primary cause of the low pathogen log reduction values was due to daily average ROF TOC concentrations being slightly below normal average ROF TOC concentrations; the secondary cause was slightly elevated ROP TOC values on a few days. (See Appendix F, p. F-65 and p. F-71 for details.) Slightly higher ROP TOC values are common when water temperature increases. The highest feed water temperatures typically occur in August of each year. It appears that this combination of slightly lower on-line ROF TOC readings and slightly higher on-line ROP TOC readings resulted in the apparent decrease in calculated pathogen log reduction values from August 1-10 and August 13-16. Instability issues with the on-line ROF and ROP TOC analyzers described in Section 2.3.6.2 may have been a factor in the RO process performance for pathogen reduction during August.

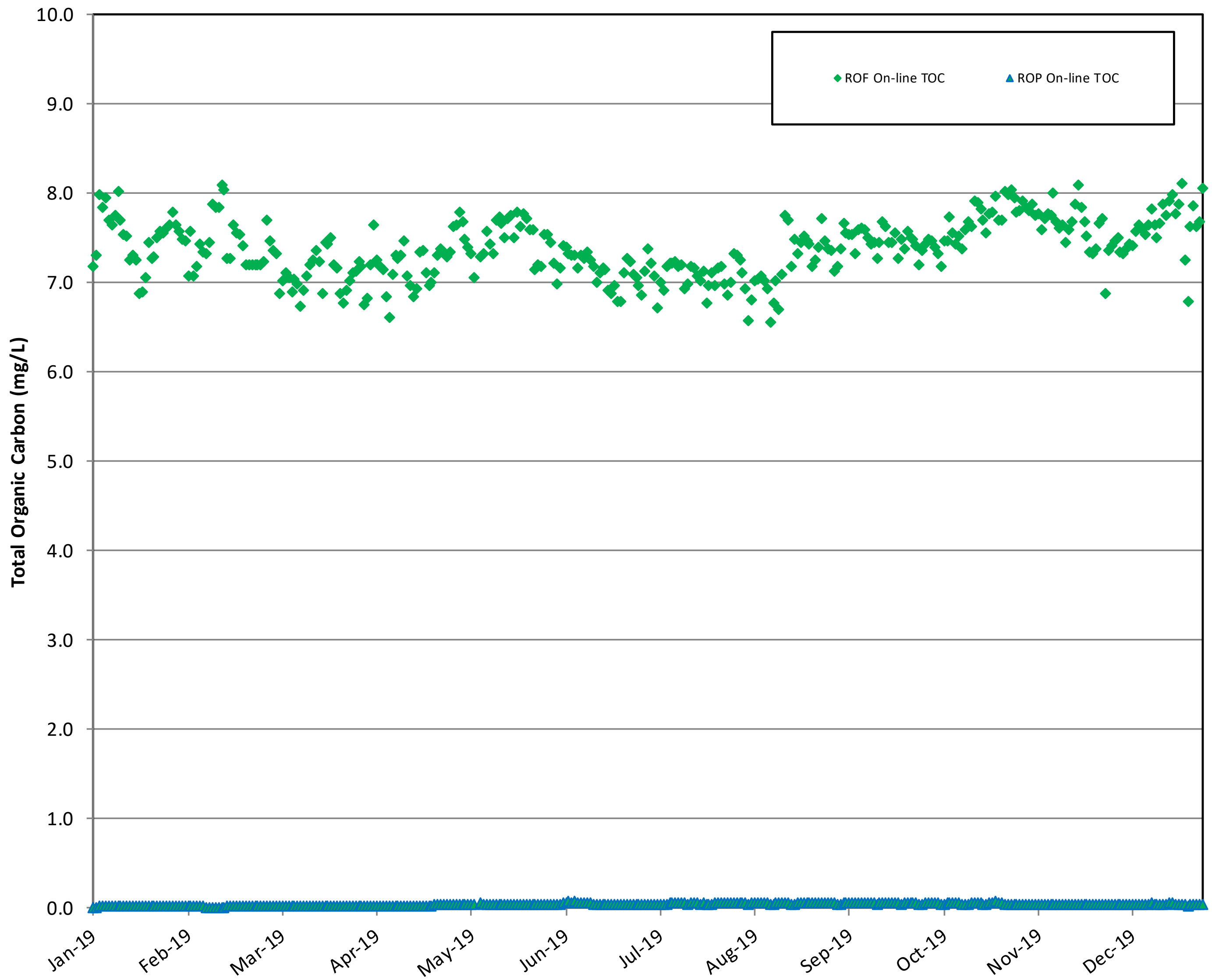


Figure 2-22. TOC Reduction Achieved by the RO Process in 2019

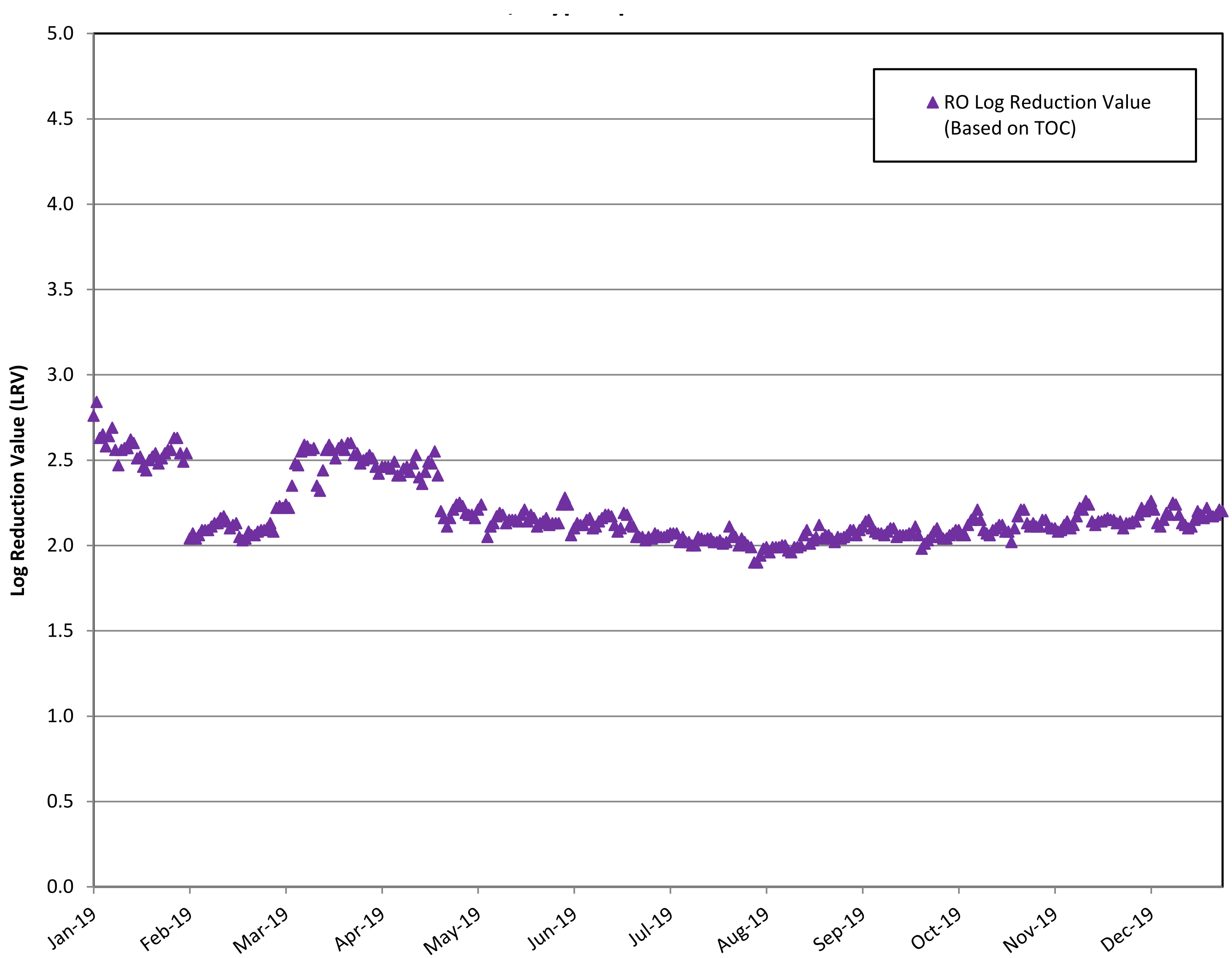


Figure 2-23. RO Log Reduction Values in 2019: *Giardia* Cysts, *Cryptosporidium* Oocysts, and Virus

2.3.7 Ultraviolet/Advanced Oxidation Process Operation and Performance

2.3.7.1 UV/AOP System Operation

The UV/AOP system operated well and few operational challenges were experienced in 2019. The AWPF typically operated with 13 UV trains and with five to six reactors each on-line during 2019. The targeted hydrogen peroxide dose was 3 mg/L, and the UVF and UVP hydrogen peroxide residual concentrations were monitored. 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.

Low UV intensity readings with no lamps of ballasts out of service were occasionally observed in multiple UV Trains and reactors. The UV intensity issues were typically corrected by (1) replacing the sensors' viewing windows, (2) replacing UV lamps, or (3) replacing faulty controls components for specific UV lamps.

The UV transmittance analyzer reading twice suddenly dropped to less than the target 95% for a few minutes, which caused all UV trains and reactors to come on-line in the "safe mode" at 100% power. One of these events occurred during the normal weekly switch in DPW dilution carrier water lines; the other event was caused by a dirty analyzer and failed lamp. After addressing these issues and the UV transmittance returned to greater than 95%, the UV trains were sequentially restarted and reset to the normal operating mode.

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).

Operating records for 2019 show that the monthly average calculated EED ranged from 0.233 to 0.336 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 2019 was above the minimum 95% target, for two brief excursions 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. 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 2019. Figure 2-24 illustrates the daily LRV credits achieved by the UV/AOP system in 2019.

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.

Hydrated lime (in the form of calcium hydroxide) 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.

A Tekkem lime delivery system began operation in late 2014 replacing the original GWRS lime delivery system. The Tekkem system 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.

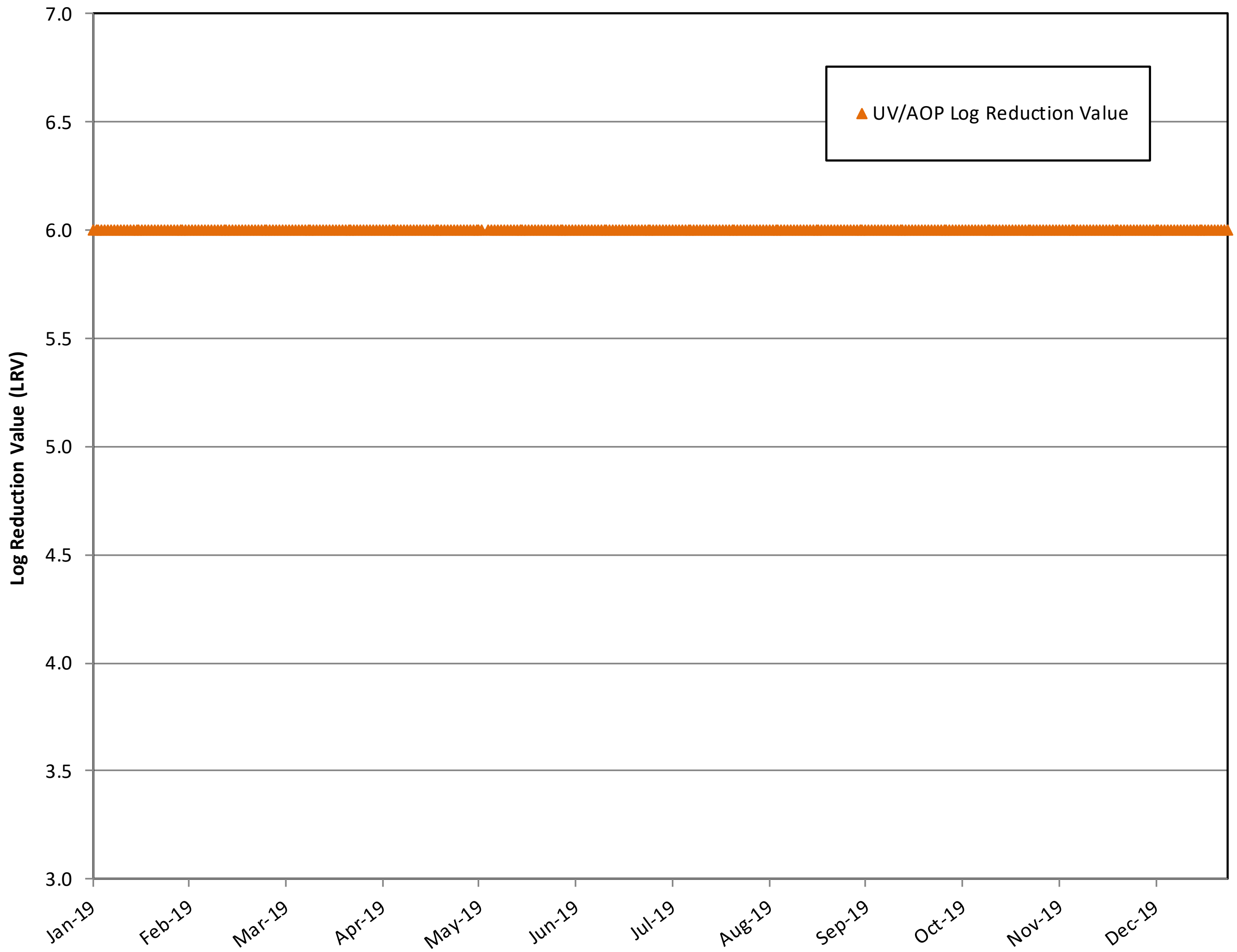


Figure 2-24. UV/AOP Log Reduction Values in 2019: *Giardia* Cysts, *Cryptosporidium* Oocysts and Virus

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; most 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 2019 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 flow ranged from 65% to 85% of the AWPF production in 2019.

The lime dose averaged 26 mg/L, with brief intermittent reductions to as low as 24 mg/L for FPW pH control. The FPW pH was maintained between 8.1 and 8.9, with an average of 8.5 based on grab samples in 2019.

2.3.9 Summary of GWRS Pathogen Log Reduction Monitoring in 2019

Table 2-10 summarizes the minimum daily total pathogen log reduction credits achieved by GWRS in 2019, demonstrating compliance with the Title 22 Water Recycling Regulations (CCR, 2018). Figure 2-25 illustrates the minimum daily total pathogen log reduction values.

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, 2018), 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 more than 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 more than six months (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, 2018), GWRS therefore provides at least 4-log reduction of viruses after surface spreading and direct injection. As noted in Table 2-10, 4-log virus reduction credits for underground retention time were taken during 2019, except in August when 5-log virus reduction credits were taken. The additional 1-log virus reduction credit for underground retention time was achieved because no drinking water wells are located beyond the primary and secondary buffer areas. The 5-log virus reduction credit for underground retention time enabled GWRS to make up for the lower virus reduction credits achieved by the RO process in August 2019. (See Section 2.3.6.5)

Table 2-10. Summary of GWRS Minimum Pathogen Log Reduction Credits Achieved in 2019

Pathogen	Minimum Log Reduction Requirements[1]	Minimum Daily Pathogen Log Reduction Value Achieved in 2019[2]					
		OCSD Plant 1[3]	MF and Cl_2[4]	RO[5]	UV/AOP[6]	Underground Retention Time[7]	Total[8]
Giardia cysts	10	0	4.14	1.90	6.00	0	12.3
Cryptosporidium oocysts	10	0	4.14	1.90	6.00	0	12.3
Viruses	12	0	0	1.90	6.00	4 (5)	12.0

[1] Per Title 22 Water Recycling Criteria (CCR, 2018).

[2] Minimum daily log reduction value achieved by each process in 2019. 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 (4.14-log) occurred on 11/13/19. RO LRV was 2.12-log on 11/13/19.) See Appendix F for details.

[3] No pathogen reduction credits taken for secondary treatment.

[4] Minimum daily LRVs for Giardia cysts and Cryptosporidium oocysts achieved by MF with chlorination occurred on 11/13/2019. No virus reduction credit taken for MF with chlorination. See Appendix F for details.

[5] Minimum daily pathogen LRVs achieved by RO occurred on 8/1-2/2019. See Appendix F for details.

[6] Minimum daily pathogen LRVs achieved by UV/AOP occurred on 1/1-12/31/2019. See Appendix F for details.

[7] Minimum daily virus LRV credit of 4-log for underground retention time from 1/1-7/31/2019 and 9/1-12/31/2019. Minimum daily virus LRV credit of 5-log for underground retention time from 8/1-31/2019. See Appendix F for details.

[8] Total daily minimum LRV for all processes in 2019. Totals are not additive per footnote 2. See Appendix F for details

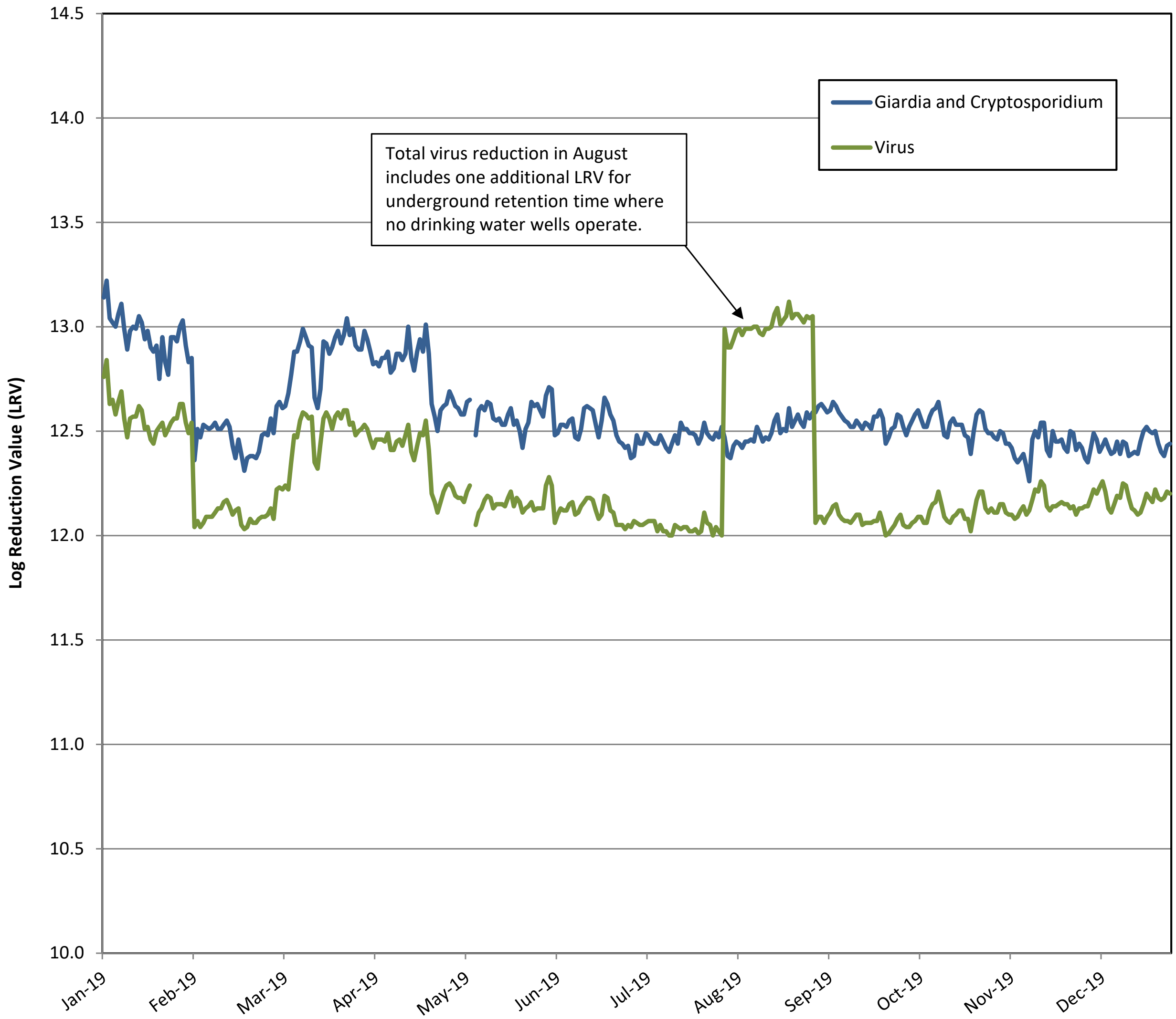


Figure 2-25. Summary of Minimum Daily GWRS Pathogen Log Reduction Credits Achieved in 2019

2.3.10 CEC Monitoring and Compliance with SWRCB Recycled Water Policy

OCWD continued its CEC and surrogate monitoring program during 2019 in compliance with the SWRCB amended Recycled Water Policy (SWRCB, 2013) per the GWRS monitoring and reporting requirements. The SWRCB adopted an updated Water Quality Control Policy for Recycled Water in 2018 (SWRCB, 2018). It is anticipated that the GWRS monitoring and reporting program will be modified to comply with the new SWRCB provisions in the future.

Table 2-11 summarizes the monitoring requirements for groundwater recharge projects and presents the results for GWRS. Monitoring of CECs and surrogates are 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;
- 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 2019. The emergency peak flow/rain event system was last tested on September 24, 2018, when 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 reached 99 to 100 MGD in six months of 2019 (January through April, November, and December).

Table 2-11. Summary of CEC and Surrogate Monitoring for GWRS in 2019

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	1	5.8	1	<2	na	na	4	<2	96.6%	96.6%	96.6%	N/A
Caffeine	Stimulant	✓	✓	50	3[4]	ng/L	3	1190	3	1.8	na	na	4	0.3	100.0%	100.0%	100.0%	>90%
NDMA	Disinfection byproduct	✓	✓	2	2	ng/L	55	37.5	56	12.3	52	0.3	56	1.9	94.9%	48.5%	99.7%	>80%
Triclosan	Antimicrobial	✓		50	1	ng/L	3	32.2	3	1.6	na	na	4	<1 - <5[5]	99.4%	96.1%	99.8%	N/A
DEET	Personal care product		✓	50	1	ng/L	3	300	3	<1	na	na	4	<1	100.0%	99.9%	100.0%	>90%
Sucralose	Food additive		✓	100	100	ng/L	3	45,067	3	<100	na	na	4	<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	53	1,712	53	36	2	38	364	96	94.4%	92.4%	96.3%	>90%
TOC[6]				N/A	0.05	mg/L	364	8	364	0.11	1	0.17	367	0.11	98.6%	82.3%	100.0%	>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 2019 data based on using 10% of the RDL for non-detectable readings unless noted otherwise.

[3] Compliance per GWRS monitoring and reporting program from the 2013 Recycled Water Policy 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). Changes to the GWRS monitoring and reporting program for the 2018 Water Quality Control Pollicy for Recycled Water (SWRCB, 2018) requirements are pending.

[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 Triclosan: OCWD's CEC Method with an RDL of 5 ng/L was used in April 2019. 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

Construction of the GWRS Final Expansion that will increase the AWPF purified recycled water production capacity from 100 to 130 MGD began in November 2019. The project schedule calls for construction of facilities to 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 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. Because the GWRS permit precludes flows from the SARI from being used as source water for the AWPF, 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. This flow will receive secondary treatment via the existing Plant No. 2 trickling filter-solids contact process. Plant No. 2 reclaimable secondary effluent will be flow-equalized and pumped to the expanded AWPF.

The GWRS Final Expansion consists 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 2019, 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:

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

3.1 Barrier Injection Facilities

Table 3-1 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 3-1. 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 3-2 illustrates these newer cluster-type well sites.

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 3-3.

3.2 Injection Water Sources

Three types of water were injected at the Talbert Barrier during 2019:

1. Purified recycled water produced by the AWPF;
2. Imported potable water from the MWD OC-44 turnout delivered via the City of Huntington Beach; and
3. Fountain Valley (FV) potable water comprised of a blend of groundwater and imported water.

The injection supply was predominately GWRS purified recycled water conveyed to the injection wells from the AWPF by the barrier pump station and pipeline. Negligible volumes of potable water were used periodically during AWPF shutdowns, which are described in Appendix D.

Table 3-1. Talbert Barrier Injection Well Design Criteria

<table>
<tr><th colspan="7">Aquifers and Perforated Intervals At Talbert Barrier</th></tr>
<tr><th rowspan="2">Injection Well No.</th><th rowspan="2">No. of Casings</th><th colspan="5">Aquifers and Perforated Interval Depth in feet below ground surface (ft bgs)</th></tr>
<tr><th>Talbert</th><th>Alpha</th><th>Beta</th><th>Lambda</th><th>Main</th></tr>
<tr><td>I1</td><td>4</td><td>65-100</td><td>150-200</td><td>235-350</td><td>365-400</td><td>---</td></tr>
<tr><td>I2</td><td>4</td><td>64-96</td><td>147-210</td><td>225-325</td><td>350-390</td><td>---</td></tr>
<tr><td>I3</td><td>4</td><td>65-96</td><td>145-200</td><td>225-325</td><td>340-380</td><td>---</td></tr>
<tr><td>I4</td><td>4</td><td>65-95</td><td>120-190</td><td>215-310</td><td>330-355</td><td>---</td></tr>
<tr><td>I5</td><td>4</td><td>70-90</td><td>115-180</td><td>210-265</td><td>320-245</td><td>---</td></tr>
<tr><td>I6</td><td>4</td><td>70-100</td><td>120-175</td><td>195-250</td><td>315-335</td><td>---</td></tr>
<tr><td>I7</td><td>4</td><td>70-95</td><td>110-150</td><td>165-250</td><td>315-336</td><td>---</td></tr>
<tr><td>I8</td><td>4</td><td>60-95</td><td>110-165</td><td>180-240</td><td>300-325</td><td>---</td></tr>
<tr><td>I9</td><td>4</td><td>65-90</td><td>110-150</td><td>175-235</td><td>300-330</td><td>---</td></tr>
<tr><td>I10</td><td>4</td><td>60-90</td><td>105-185</td><td>205-290</td><td>305-330</td><td>---</td></tr>
<tr><td>I11</td><td>3</td><td>65-95</td><td>115-180</td><td>200-225</td><td>---</td><td>---</td></tr>
<tr><td>I12</td><td>4</td><td>60-95</td><td>110-165</td><td>180-260</td><td>290-310</td><td>---</td></tr>
<tr><td>I13</td><td>4</td><td>77-100</td><td>120-160</td><td>175-250</td><td>280-305</td><td>---</td></tr>
<tr><td>I14</td><td>4</td><td>70-95</td><td>115-150</td><td>175-250</td><td>265-300</td><td>---</td></tr>
<tr><td>I15</td><td>4</td><td>70-93</td><td>115-145</td><td>70-235</td><td>262-285</td><td>---</td></tr>
<tr><td>I16</td><td>3</td><td>63-120</td><td>---</td><td>145-210</td><td>245-285</td><td>---</td></tr>
<tr><td>I17</td><td>3</td><td>62-130</td><td>---</td><td>150-215</td><td>250-275</td><td>---</td></tr>
<tr><td>I18</td><td>3</td><td>57-125</td><td>---</td><td>150-210</td><td>260-275</td><td>---</td></tr>
<tr><td>I19</td><td>3</td><td>57-127</td><td>---</td><td>145-200</td><td>235-270</td><td>---</td></tr>
<tr><td>I20</td><td>3</td><td>90-125</td><td>---</td><td>140-170</td><td>230-250</td><td>---</td></tr>
<tr><td>I21</td><td>3</td><td>55-125</td><td>---</td><td>150-170</td><td>230-250</td><td>---</td></tr>
<tr><td>I22</td><td>2</td><td>60-160</td><td>---</td><td>---</td><td>250-275</td><td>---</td></tr>
<tr><td>I23</td><td>2</td><td>70-155</td><td>---</td><td>---</td><td>215-252</td><td>---</td></tr>
<tr><td>I24</td><td>2</td><td>---</td><td colspan="3">120-330</td><td>420-605</td></tr>
<tr><td>I25</td><td>1</td><td>---</td><td colspan="3">120-320</td><td>---</td></tr>
<tr><td>I26</td><td>3</td><td colspan="2">56-195</td><td colspan="2">271-400</td><td>476-660</td></tr>
<tr><td>I27</td><td>3</td><td colspan="2">78-148</td><td colspan="2">210-260</td><td>355-420</td></tr>
<tr><td>I28</td><td>3</td><td colspan="2">80-140</td><td colspan="2">185-235</td><td>360-460</td></tr>
<tr><td>I29</td><td>3</td><td>---</td><td>90-120</td><td colspan="2">200-250</td><td>365-475</td></tr>
<tr><td>I30</td><td>3</td><td>---</td><td>95-160</td><td colspan="2">230-295</td><td>425-650</td></tr>
<tr><td>I31</td><td>3</td><td>---</td><td>90-165</td><td colspan="2">235-295</td><td>440-590</td></tr>
<tr><td>I32</td><td>3</td><td>---</td><td>90-155</td><td colspan="2">226-295</td><td>425-670</td></tr>
<tr><td>I33</td><td>1</td><td>61-156</td><td>---</td><td colspan="2">See Note 1</td><td>---</td></tr>
<tr><td>I34</td><td>1</td><td>60-135</td><td>---</td><td colspan="2">See Note 1</td><td>---</td></tr>
<tr><td>I35</td><td>1</td><td>60-115</td><td>---</td><td colspan="2">See Note 1</td><td>---</td></tr>
<tr><td>I36</td><td>1</td><td>60-110</td><td>---</td><td colspan="2">See Note 1</td><td>---</td></tr>
</table>

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

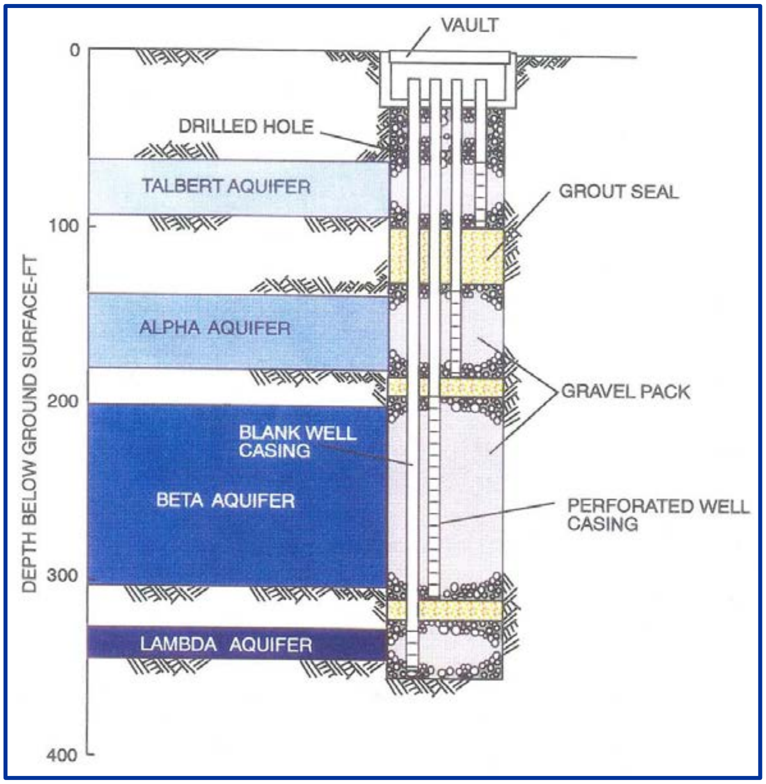


Figure 3-1. Typical Legacy Injection Well

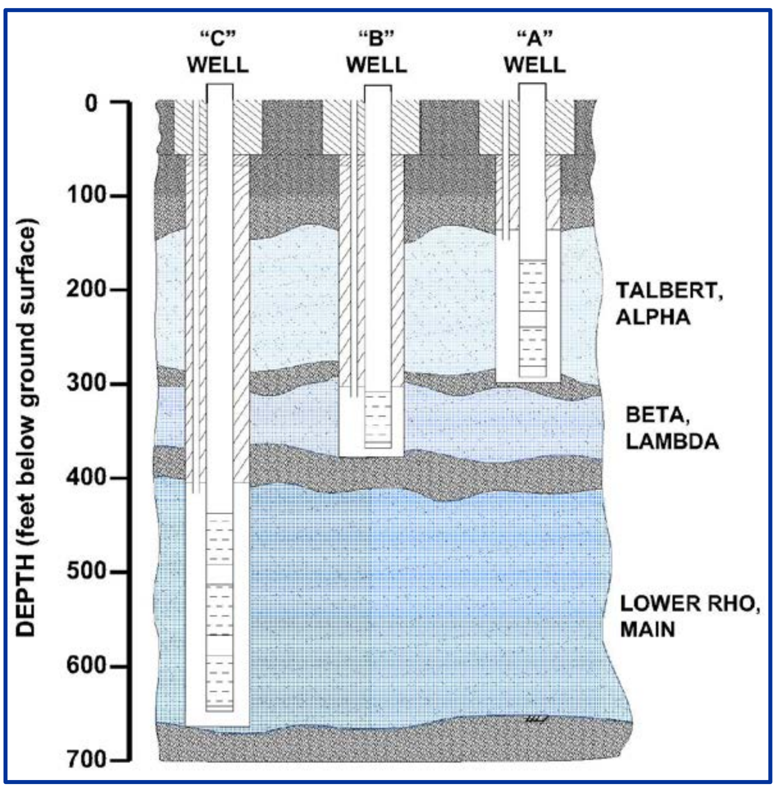


Figure 3-2. Typical Modern Cluster-Type Injection Well

Figure 3-3. Modern Injection Well Site I26

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. A limited volume of OC-44 potable water was used on eight days in 2019, primarily to keep the barrier pipeline pressurized and to maintain small injection flow into selected wells for operational purposes. OC-44 potable water was used as summarized below:

January	2 days	Process interruption and power outage
February	1 day	Power outage
March	1 day	Power outage
April	1 days	Process interruption
May	3 days	AWPF scheduled maintenance
June through December	0 days	

The highest daily usage of OC-44 potable water was 0.54 MG on May 7 when the AWPF was shut down for scheduled maintenance.

A limited volume of FV potable water was utilized to pressurize the barrier pipeline on two days in December 2019 when OC-44 potable water was unavailable during a brief AWPF shutdown. The FV potable water supply had not been used since 2016, and extensive testing in December 2019 revealed that corrective maintenance was required to use this supply. Repairs on the FV connection valve were made, replacing worn control parts and recalibrating with the AWPF control system. The highest daily usage of FV potable water was 0.11 MG on December 11.

3.3 Injection Water Volumes and Flow Rates

The volume of water injected at the Talbert Barrier in 2019 is presented below and compared with historical barrier injection.

3.3.1 2019 Injection Water Volumes and Flow Rates

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 2019 was 23.6 MGD. On a volumetric basis, a total volume of approximately 8,615 MG (26,438 AF) of purified recycled water, OC-44 potable water, and FV potable water was injected at the Talbert Barrier during 2019.

Figure 3-4 illustrates the volumes and average daily flow rates of each of the water sources injected at the Talbert Barrier during 2019. As noted above, essentially all of barrier injection, approximately 23.58 MGD on average (rounded to 8,613 MG or 26,432 AF), was GWRS purified recycled water. Less than 0.01 MGD on average (rounded to 1.8 MG or 5.6 AF) of OC-44 potable water was injected at the barrier during 2019. Less than 0.01 MGD on average (rounded to 0.1 MG or 0.4 AF) of FV potable water was injected at the barrier during 2019.

Table 3-2 summarizes the monthly average daily flow rates and quantities of purified recycled water and potable water injected at the barrier, and Figure 3-5 illustrates the monthly 2019 injection water supply volumes and average daily flow rates. 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.

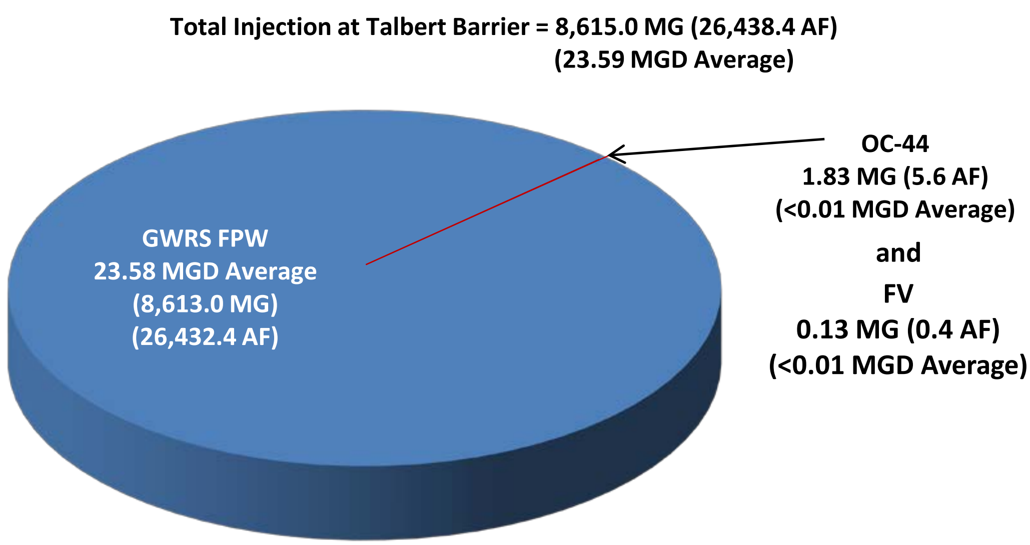


Figure 3-4. 2019 Talbert Barrier Injection Water Sources: Volumes and Flow Rates

Table 3-2. 2019 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	22.03	683.02	0.01	0.21	0.00	0.00	22.04	683.23	2,096.76	2,586,314
February	20.31	568.56	0.01	0.15	0.00	0.00	20.31	568.70	1,745.29	2,152,781
March	19.31	598.66	0.00	0.11	0.00	0.00	19.32	598.78	1,837.58	2,266,616
April	22.85	685.55	0.00	0.13	0.00	0.00	22.86	685.67	2,104.26	2,595,565
May	22.79	706.47	0.04	1.23	0.00	0.00	22.83	707.70	2,171.85	2,678,939
June	25.23	756.87	0.00	0.00	0.00	0.00	25.23	756.87	2,322.74	2,865,061
July	27.84	863.10	0.00	0.00	0.00	0.00	27.84	863.10	2,648.75	3,267,182
August	28.90	895.78	0.00	0.00	0.00	0.00	28.90	895.78	2,749.05	3,390,909
September	28.50	854.99	0.00	0.00	0.00	0.00	28.50	854.99	2,623.87	3,236,501
October	24.35	754.98	0.00	0.00	0.00	0.00	24.35	754.98	2,316.94	2,857,906
November	22.35	670.54	0.00	0.00	0.00	0.00	22.35	670.54	2,057.82	2,538,284
December	18.53	574.52	0.00	0.00	0.00	0.13	18.54	574.65	1,763.53	2,175,281
Total	**23.58**	**8,613.03**	**0.00**	**1.83**	**0.00**	**0.13**	**23.59**	**8,614.98**	**26,438.44**	**32,611,339**

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

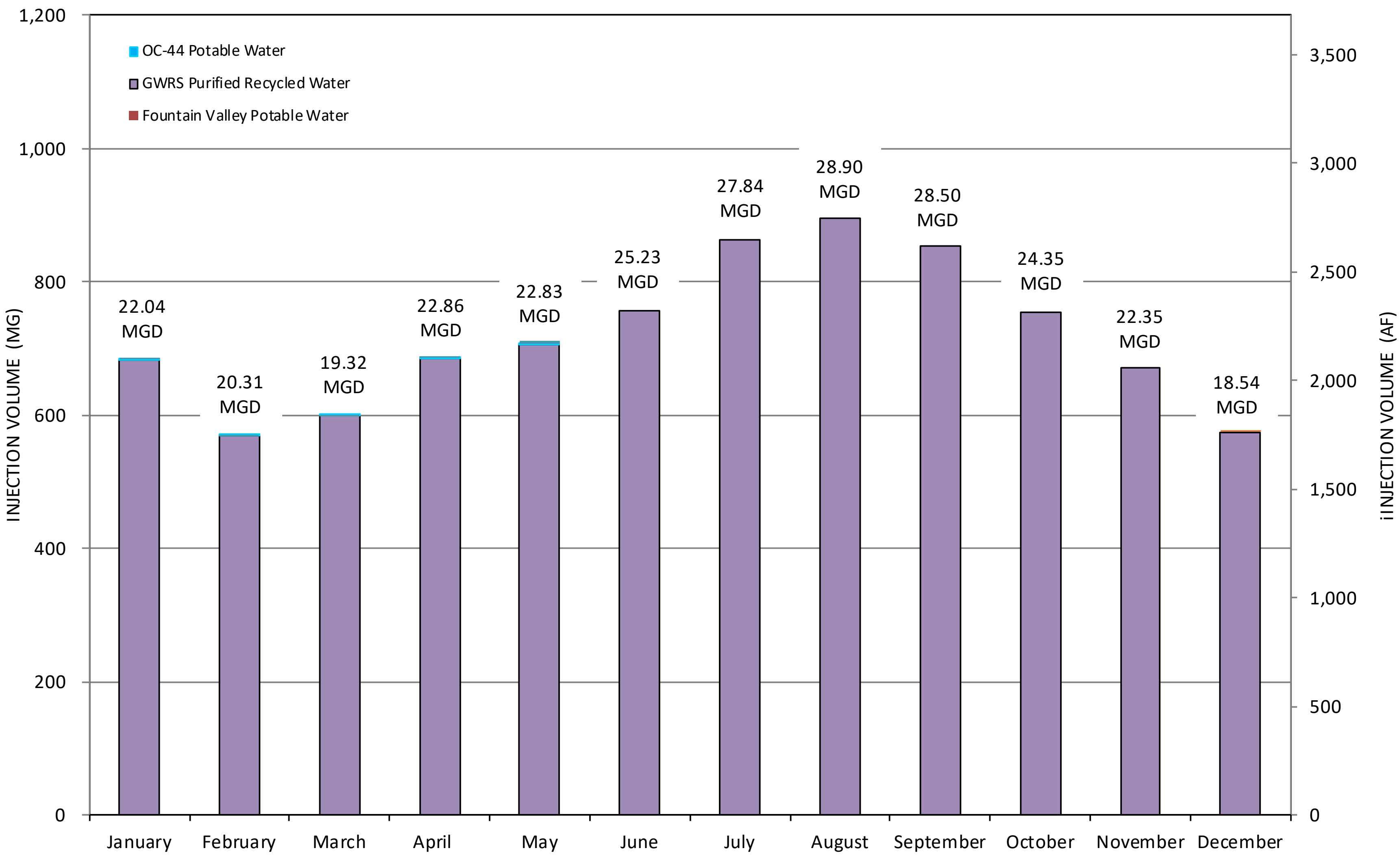


Figure 3-5. 2019 Monthly Injection Water Quantity at Talbert Barrier

3.3.2 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 3-3 and Figure 3-6 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 12 years since GWRS has been in operation, the average total injection at the Talbert Barrier has been approximately 30,137 AFY, with the annual total injection volumes ranging from a low of 24,489 AF in 2012 to a high of 38,394 AF in 2010. In comparison, the 26,438 AF of total injection in 2019 was below the 2008-2019 average annual volume (30,137 AFY). The maintenance of groundwater elevations protective 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 2019 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** – WF-21 recycled water consisting of secondary effluent treated by lime clarification, ammonia stripping (discontinued in 1987), recarbonation, filtration, GAC, and chlorination (all WF-21 treatment processes, except for ammonia stripping after 1987 and not including RO); AWT water produced by WF-21 was injected from 1976 to 2000.

2. **RO product water** – recycled water consisting of WF-21 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, ammonia stripping (1981-1987), recarbonation, chlorination, filtration, and RO. In 2001, a UV/AOP unit was added

Table 3-3. 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	na	na	5	53
2019			8,613.03		0.13	1.83	8,614.98	26,438.44	5	49	na	na	na	na	5	49
TOTALS	14,040.99	29,483.01	99,289.03	36,782.01	7,346.47	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.

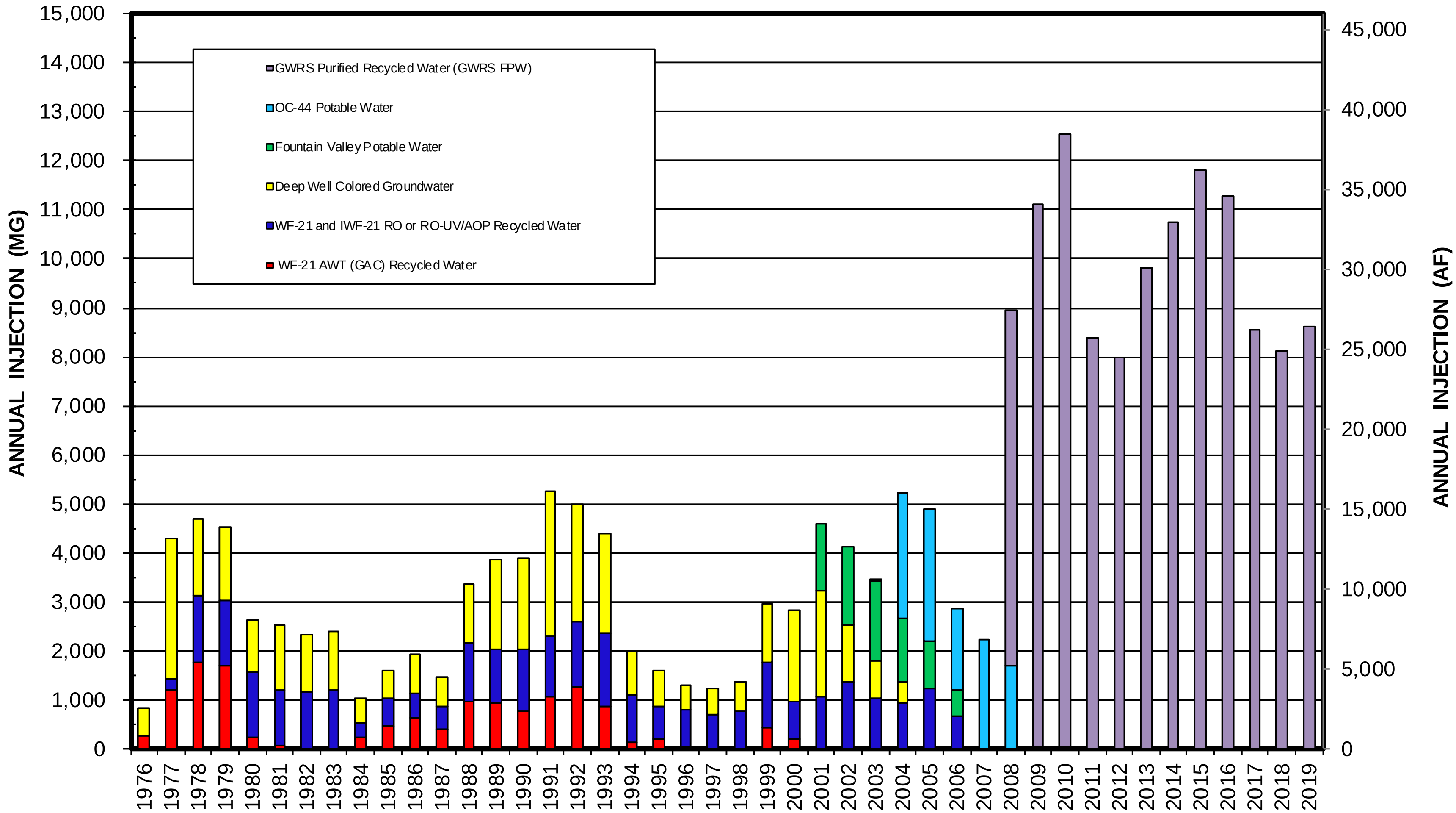


Figure 3-6. Historical Injection Water Quantity at Talbert Barrier

downstream of the RO process, replacing chlorination for disinfection and adding treatment for the removal 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. Negligible volumes of this water source were used during 2011, 2012, 2016, and 2019.

4. **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 2019. 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 nine years, primarily for maintaining pressure in the barrier pipeline during AWPF shutdowns. In general, this supplemental source has been preferred over the City of Fountain Valley potable connection.

3.4 Barrier Operations

Injection of purified recycled water produced by the AWPF began on January 10, 2008. During 2019, AWPF purified recycled water was the primary injection water source, comprising essentially 100% of the water injected. Potable imported water from the MWD OC-44 and FV connections 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 2019, the MWD OC-44 connection was used for brief periods on eight days and the FV connection was briefly used on two 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 12 years, minimal volumes of potable water have been used for filling and pressurizing the barrier pipeline, as shown by the small annual totals discussed in Section 3.3.2.

Since the GWRS came on-line in 2008, barrier injection was at its lowest in 2012 (Figure 3-6) 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 excessively high or above ground surface during that year. Annual barrier injection was steadily increased from 2012 through 2015 because of decreasing Basin groundwater level conditions (increasing accumulated overdraft) largely due to the extended drought during that period. Annual barrier injection decreased from 2016 through 2018 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 additional direct deliveries of MWD potable water in lieu of pumping groundwater, thereby increasing groundwater stored in the Basin.

Annual barrier injection in 2019 was 26,438 AF, representing a slight increase of 6.3% from the prior year primarily because of somewhat greater injection from January through April of 2019 as compared to those same months during 2018 when barrier injection was unusually low in response to the aforementioned basin-wide In-Lieu Program that ended in January 2018. Also, barrier injection was greater in September 2019 than in September 2018 when the AWPF experienced a one-week shutdown.

Although 2019 barrier injection was slightly greater than 2018, it was still relatively low in comparison to the last 12 years, due to continued high Basin storage conditions which led to relatively high groundwater elevations in the coastal area. From June 2018 to June 2019, groundwater storage increased by 41,000 AF throughout the Basin largely due to above-average rainfall during that period; the Basin accumulated overdraft was 236,000 AF as of June 30, 2019. Therefore, groundwater elevations were able to be maintained slightly above mean sea level seaward of the barrier throughout 2019 with a relatively lesser flow of injection required to protect against seawater intrusion, as discussed in more detail in Section 4.

Operation of the barrier was consistent and stable during 2019 due to a constant, reliable AWPF water supply and on-going rehabilitation and backwashing of the injection wells. As discussed in the previous section, an insignificant amount of potable water was used on 8 days from the MWD OC-44 connection and 2 days from the FV connection due to brief AWPF shutdowns. During 2019, there was only one AWPF shutdown that lasted longer than one day: a planned 3-day shutdown on May 6-8 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 other than minimal maintenance flows).

As shown in Table 3-2 and on Figure 3-5, monthly injection flow rates during 2019 ranged from a low daily average flow rate in March of 19.32 MGD to a high daily average flow rate in August of 28.90 MGD (annual high August volume of 895.78 MG or 2,749.05 AF). Volumetrically, February had slightly less injection than March due to being a shorter month (annual low February volume of 568.56 MG or 1,744.85 AF). Typically, the volume 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 again the case in 2019.

Operationally, injection was intermittently maintained at relatively high rates at most of the Talbert Barrier injection wells during 2019. Many of the injection wells were taken off-line and placed on stand-by for several months during 2019 because those wells were not needed to maintain protective elevations for seawater intrusion control and to prevent shallow groundwater issues in low-lying areas seaward of the barrier, including the Huntington Beach Central Park area west of the barrier where ground surface elevations are slightly below mean sea level. 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 2019, although some wells remained off-line all year since water levels did not decline as much as usual during the summer of 2019.

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 2019 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 as during 2019, 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.

3.4.1 Vertical Distribution of Injection

Figure 3-7 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. Most 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.

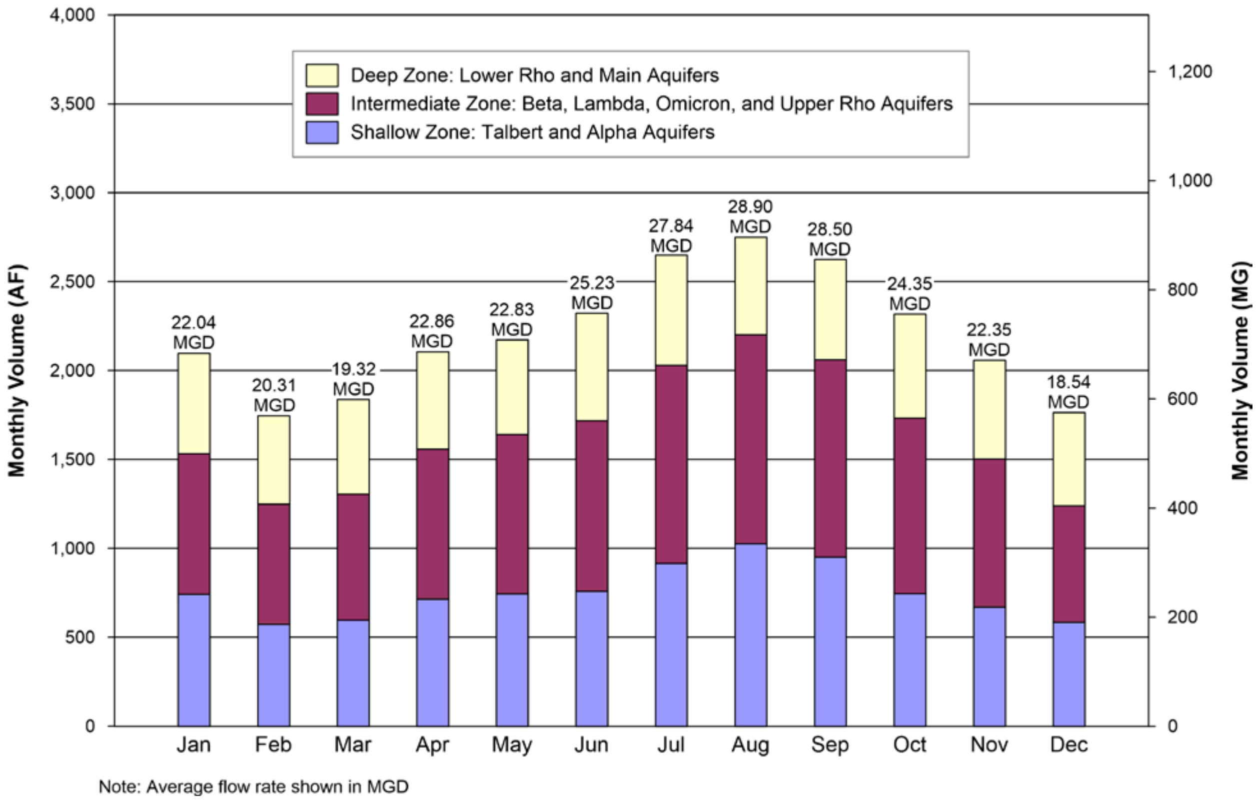


Figure 3-7. 2019 Talbert Barrier Monthly Injection Quantity by Aquifer Zone

As shown on Figure 3-7, 2019 monthly injection into the combined shallow and intermediate zones steadily increased from a winter low of approximately 400 MG (1,300 AF) in February to a summer high of approximately 700 MG (2,200 AF) in August, before steadily declining for the remainder of the year through the fall as the weather cooled and coastal area pumping declined. The lower injection volumes 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 and intermediate zone modern injection wells and legacy wells were 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 3-8, injection into the deep zone for Basin replenishment remained relatively constant from month to month during 2019, as ample pipeline capacity existed throughout the year 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.

During 2019, 34% of all injection was into the shallow zone, 41% into the intermediate zone, and 25% into the deep zone, as shown on Figure 3-8. Therefore, 75% of barrier injection during 2019 was collectively into the shallow and intermediate zones for the primary purpose of seawater intrusion control, similar to the 76% the prior year. Shallow zone injection was slightly less in 2019 than in 2018 because I27A, I28A, and southeast barrier wells I33, I34, and I35 were off-line on stand-by for more months in 2019. Intermediate zone injection was slightly more in 2019 than in 2018 because all six west-end modern injection wells screened in the intermediate zone (I27B, I28B, I29B, I30B, I31B, and I32B) were on-line throughout 2019, whereas in 2018 these six wells were off-line for the first half of the year.

Several shallow and intermediate zone injection wells were off-line on stand-by throughout much of 2019 due to the relatively high groundwater conditions, while all deep zone injection wells were on-line throughout 2019. 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.

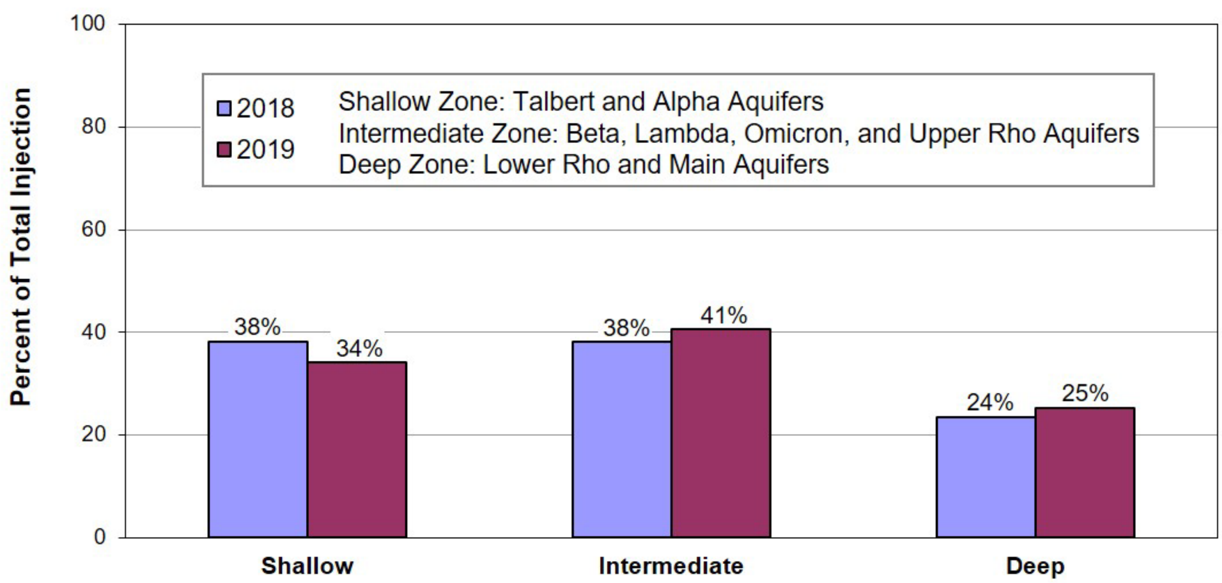


Figure 3-8. 2018 and 2019 Annual Average Injection Percentages for Each Depth Zone

3.4.2 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 3-4 shows the annual volume injected into each of the 36 injection well sites during 2019. Each well site consists of one to four discretely measured injection casings (installed at different depth zones). Table 3-4 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 3-4 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 3-2 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 3-4. For a given month, all well points were adjusted by the same factor. During 2019, the monthly adjustments ranged from approximately 1.5% to 2.0% 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.

Figure 3-9 graphically depicts the annual volume injected into each of the 36 injection well sites during 2019. The injection volumes are divided into the same three depth zones described above: shallow, intermediate, and deep. The 36 well sites on Figure 3-9 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 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 aided by the deep zone contribution at those sites, and east-side legacy wells I1, I4, and I7 were good performers with relatively high annual injection totals.

Table 3-4. 2019 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	1,172.35	476.75	1,027.32	2,676.42	872.11
	I31	867.58	670.55	1,161.90	2,700.02	879.80
	I30	1,133.12	611.47	1,194.12	2,938.71	957.58
	I29	159.42	888.13	551.49	1,599.04	521.05
	I23	0.00	0.00	–	0.00	0.00
	I28	13.64	641.29	979.51	1,634.44	532.58
	I27	121.99	779.77	769.28	1,671.04	544.51
	I22	0.00	0.00	–	0.00	0.00
	I21	–	107.87	–	107.87	35.15
	I20	59.91	88.28	–	148.20	48.29
	I19	–	0.01	–	0.01	0.00
	I18	0.00	1.11	–	1.11	0.36
	I17	140.09	174.45	–	314.54	102.49
	I16	0.00	0.00	–	0.00	0.00
	I15	20.20	21.83	–	42.03	13.69
	I14	597.38	88.36	–	685.74	223.45
	I13	388.99	421.48	–	810.47	264.09
	I12	407.14	245.49	–	652.63	212.66
	I11	122.02	39.34	–	161.36	52.58
	I10	0.00	0.00	–	0.00	0.00
	I9	0.00	0.00	–	0.00	0.00
	I8	0.00	0.00	–	0.00	0.00
	I7	965.45	308.48	–	1,273.93	415.11
	I6	0.00	0.15	–	0.15	0.05
	I5	158.90	377.73	–	536.63	174.86
	I25	–	1,194.26	–	1,194.26	389.15
	I24	–	1,181.26	328.85	1,510.11	492.07
	I4	664.52	930.30	–	1,594.82	519.67
	I3	0.00	0.00	–	0.00	0.00
	I2	0.00	219.05	–	219.05	71.38
	I1	499.99	618.72	–	1,118.71	364.53
East	I26	643.32	668.66	655.26	1,967.24	641.03
Southeast Barrier	I33	88.87	–	–	88.87	28.96
	I34	101.94	–	–	101.94	33.22
	I35	245.27	–	–	245.27	79.92
	I36	443.94	–	–	443.94	144.66
	Total:	9,016.02	10,754.79	6,667.72	26,438.53	8,615.01
	Percent:	34.10%	40.68%	25.22%		

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.

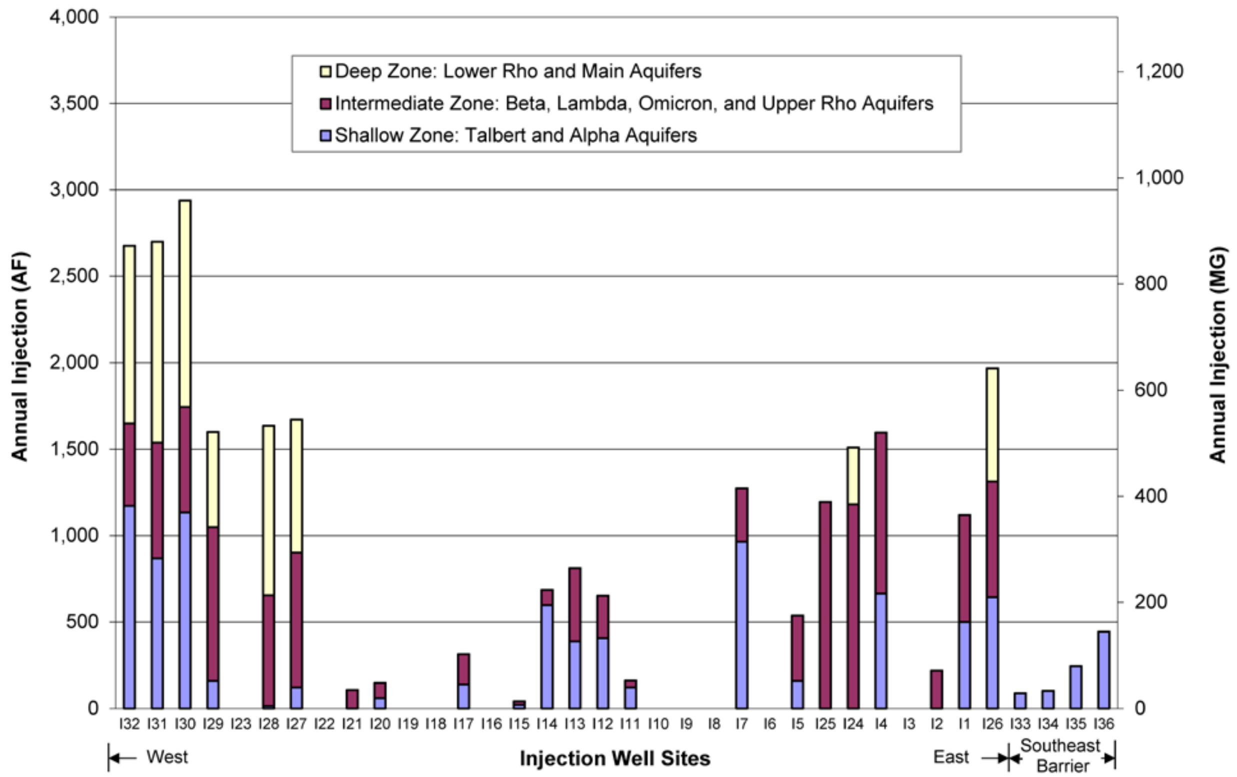


Figure 3-9. 2019 Talbert Barrier Injection Quantity at Each Well Site

As shown on Figure 3-9, three of the six west-end modern injection wells (I27, I28, and I29) had very low shallow zone annual injection during 2019 because I27A, I28A, and I29A were off-line on stand-by for most of 2019 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. Similarly, southeast barrier modern injection wells I33, I34, and I35 had low annual injection during 2019 because they were off-line on stand-by for most of the year except for one to two summer months to maintain protective elevations.

The older legacy well sites (I1 through I23) tend to have lower injection capacities than the modern wells. However, I1, I4, and I7 performed comparably with shallow and intermediate zone injection totals at the modern injection wells. Similar to the prior year, legacy well I4 was on-line throughout 2019 and was the top performing legacy well once again, with combined shallow and intermediate zone annual injection of nearly 1,600 AF (1.4 MGD daily average), slightly greater than the combined shallow and intermediate zone injection at nearby east-end modern injection well I26 which was also on-line all year (Figure 3-9). During 2019, many of the other legacy injection wells had relatively low combined shallow and intermediate zone annual injection volumes ranging from zero to approximately 800 AF, with the lower end of this range mostly due to legacy wells being off-line on stand-by for several months or for the entire year.

During 2019, legacy wells I2 and I21 had very low annual injection of approximately 100 to 200 AF even though they were on-line all year; these two wells, in addition to I3 which was off-line during 2019, are consistently poor performers and have lost capacity over the years due to leaky well seals and/or irreversible clogging. These three wells are planned to be replaced within the next few years. A total of ten legacy wells had no injection during 2019 (I3, I6, I8, I9, I10, I16, I18, I19, I22, and I23) because they were off-line on stand-by 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. Lastly, an additional four legacy wells (I11, I15, I17, and I20) had very low annual injection of approximately 300 AF or less (Figure 3-9) because they were off-line on stand-by for nine months or more during 2019 since they too were not needed to maintain protective elevations seaward of the barrier.

Table 3-5 shows which wells were off- or on-line on a weekly basis during 2019, 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 3-5 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 3-5 shows a separate status entry for each individual injection zone for these modern wells. As described above, many legacy injection wells were off-line for either all or a major portion of 2019 due to relatively high groundwater conditions. In fact, only seven legacy wells were on-line for the majority of 2019: I1, I2, I4, I12, I13, I14, and I21, as indicated in Table 3-5. Protective elevations were maintained throughout the year with the use of these seven legacy wells, intermittent use of other legacy wells, and most of the modern injection wells.

Due to the reduced injection into the shallow and intermediate zones during 2019, all deep zone modern injection wells were on-line throughout 2019 (Table 3-4). In years with lower groundwater levels and a higher injection requirement for seawater intrusion control in the shallow and intermediate zones, deep zone modern injection wells commonly need to be taken off-line during peak summer months due to 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.

Table 3-5. 2019 Injection Wells Operational Status

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

☐ Well in Operation: GWRS Recycled Water

☐ (cyan) Well in Operation: OC-44 Potable Water

☐ (yellow) Well in Operation: City Fountain Valley

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).

3.4.3 Injection Well Repairs and Redevelopment

The Talbert Seawater Intrusion Barrier consists of 100 individual injection well points arranged into 36 injection well sites. During 2019, only 26 of the 36 injection well sites were operated over the course of the year, with ten legacy well sites off-line on stand-by for the entire year since they were not needed to maintain protective elevations. In general, various injection wells are typically placed off-line for either brief or extended periods during the 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;
- Hydraulic restrictions on the barrier pipeline and appurtenances (bottlenecks); and
- OCWD and OCSD construction activities requiring localized dewatering in the vicinity of the injection barrier.

As shown in Table 3-5, only one injection well, I24/2, was off-line for an extended period due to maintenance repairs during 2019. On-site deep zone modern injection well I24/2 was off-line from mid-July through the end of the year due to an inoperable down-hole flow control valve. Replacement with a more reliable type of flow control valve used on most of the other modern injection wells is planned, along with upsizing the drop pipe within the well. This maintenance work is currently on hold due to access issues related to GWRS Final Expansion activities.

Four other modern injection wells were off-line for maintenance repairs for a brief period of one to two weeks during 2019: I29A, I31A, I31C, and I32B, as shown in Table 3-5. These maintenance repairs involved replacement of the flow tube on the flow sensor apparatus at each of the four wells, as the flow tube polypropylene lining wore out largely due to FPW aggressivity. The new flow tubes have a Teflon lining.

No legacy wells were redeveloped during 2019. 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. 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. Since many of the legacy injection wells were off-line for either all or a significant portion of 2019, no legacy redevelopment is planned for 2020.

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 airlift pumping and surging to remove accumulated fine material that causes well clogging near the formation interface with the gravel pack. Airlift pumping flows are discharged to the sewer after settling tanks sufficiently remove the fine-grained material. During the 2018 redevelopment, approximately 15 cubic yards of fine-grained material were removed from the 21 legacy wells, leading to an average injection capacity increase of 65% per well site.

None of the modern injection wells have required an extensive redevelopment to date. Modern injection well sites I24, I25, and I26 were constructed and placed on-line approximately 20 years ago in 1999-2000, while I27 and I28 went on-line in 2004, and finally I29 through I36 went on-line in 2008 with the commencement of GWRS. Sustained injection capacity over the life of these wells thus far has largely been attributed to regularly scheduled short duration backwash pumping of these injection wells, either by the airlift pumping method using a portable compressor (off-site wells) or backwash pumping with dedicated submersible pumps (on-site wells). Airlift pumped flows from the off-site modern injection wells are sufficiently desilted before being discharged to the storm drain under a "de minimis" permit from the RWQCB (RWQCB, 2015), whereas backwash pumping from the on-site modern injection wells (I24/1, I24/2, and I25/1) is discharged to the AWPF RO concentrate (brine) line.

The three on-site 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 one to two months. Backwash pumping is controlled 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 to better remove any particulate material that may have been introduced into the gravel pack or out into the formation. During 2019, the submersible backwash pumping rate for these three wells ranged from approximately 1,700 to 2,100 gpm.

The off-site modern injection wells (sites I26 through I36) are equipped with dedicated air lines and are regularly backwashed using the airlift 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 airlift backwash these modern wells lacking dedicated pumps.

The airlift 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 airlift 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 airlift backwashed require minimal 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 measurable amounts of sand found at the west-end pipeline terminus during maintenance blow-off activities and on in-line bypass filters. In fact, I32C located at this west-end terminus of the barrier pipeline is the first modern injection well showing initial signs of possibly requiring a more extensive redevelopment, since ongoing airlift pumping may not be removing all the injected fine-grained material from the lower portion of its screened interval.

To help limit potential pipeline erosion, historically the quality of the lime used during post-treatment operations has been improved and specific post-treatment stability targets have been adjusted. Barrier Operations and AWPF Operations staff continue to closely monitor the lime post-treatment process and operating parameters (e.g., pH) to help minimize the potential for well clogging.

There were no significant changes to the post-treatment process or the associated operating parameters during 2019. 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 recycling program as well as the assessment of the effectiveness of the barrier in preventing seawater intrusion. This section presents the following for 2019:

- 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 these mesas.

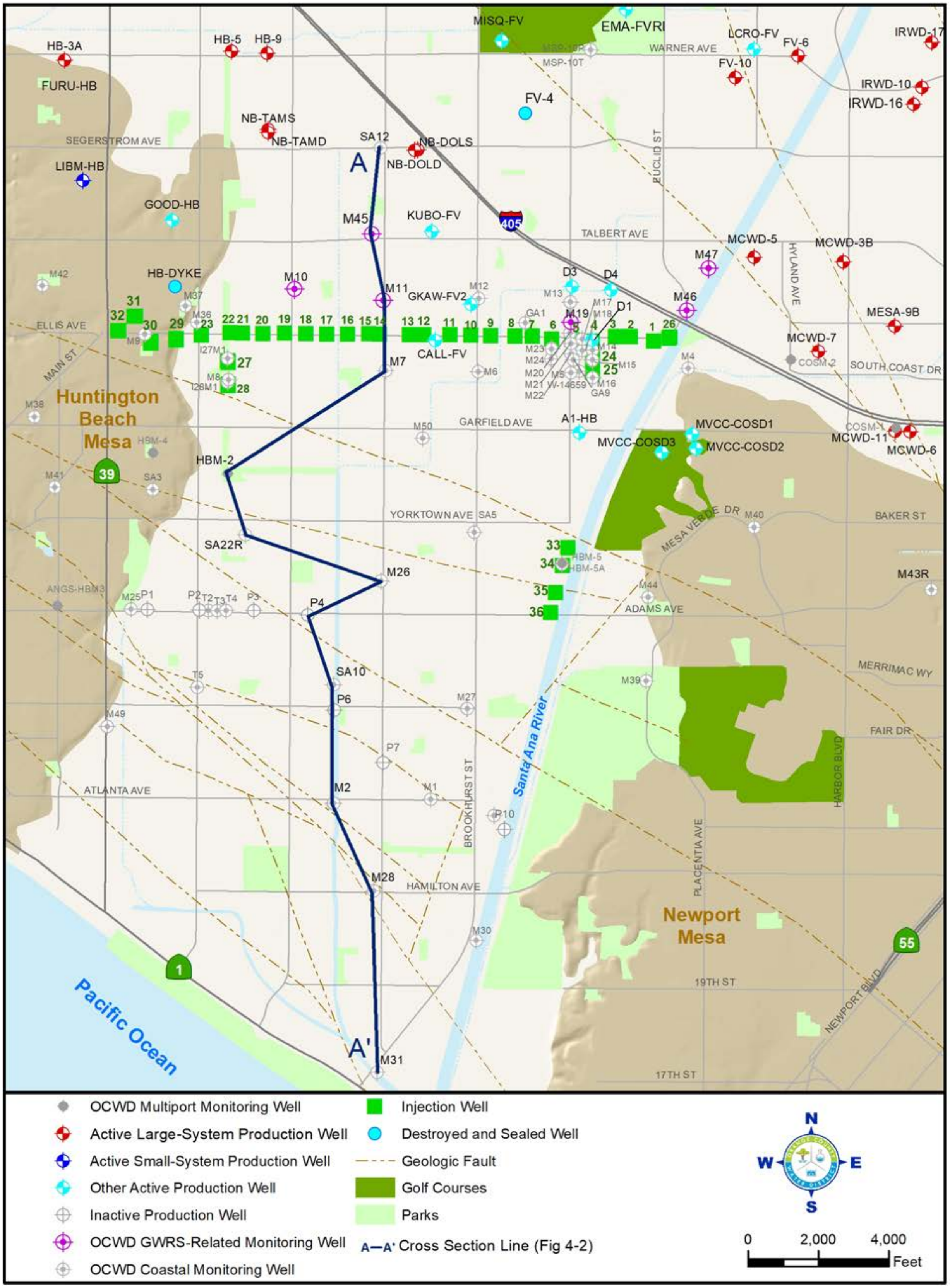


Figure 4-1. Talbert Gap Study Area and Well Location Map

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 horizontally or vertically adjacent (i.e., merged) 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).

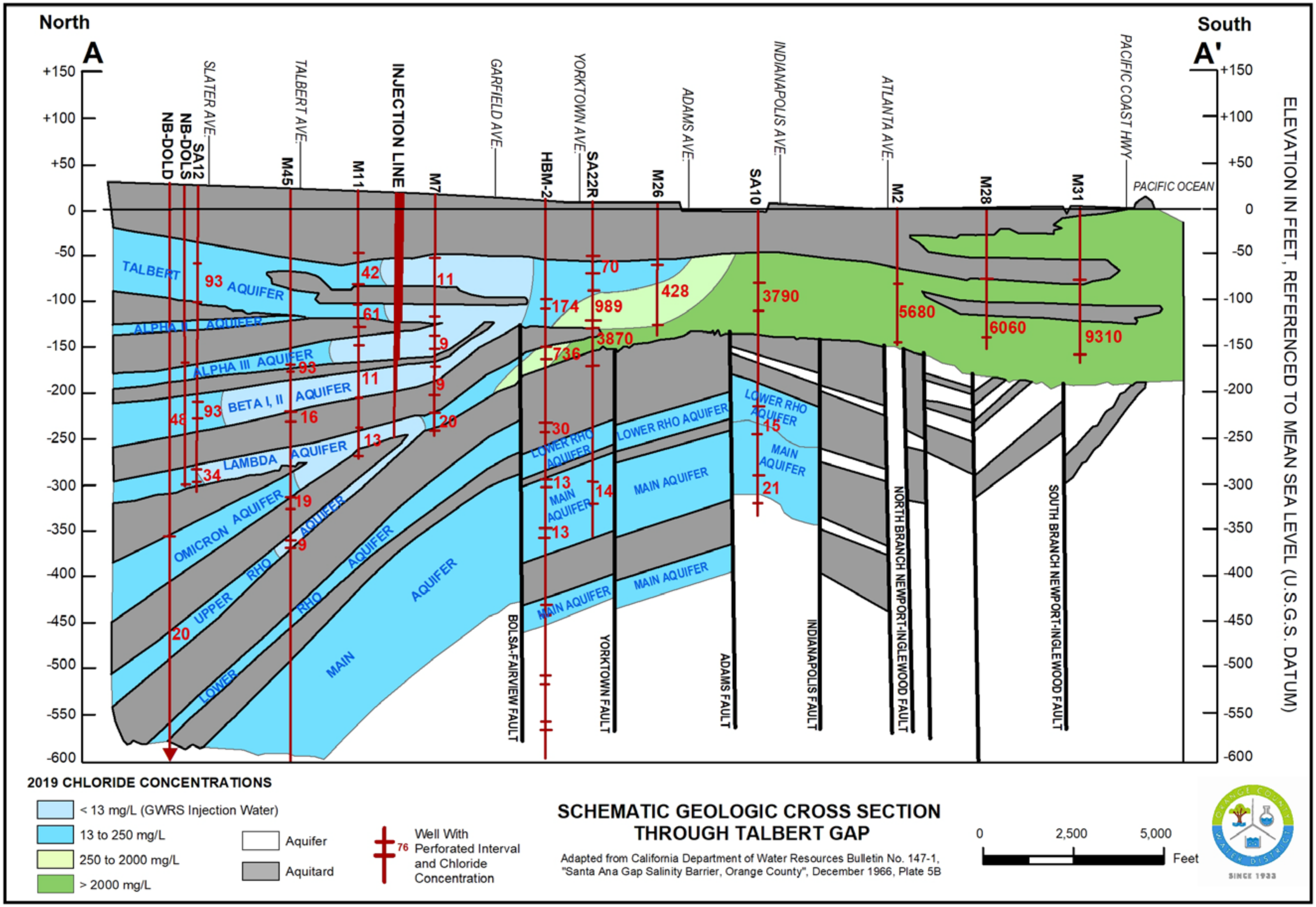


Figure 4-2. Schematic Geological Cross Section Through Talbert Gap

4.2 Groundwater Monitoring Program

As part of the groundwater monitoring program required by the current permit for the GWRS (RWQCB, 2004, 2008, 2014a,2016, and 2019), OCWD-owned monitoring wells and several municipal and private wells in the Talbert Barrier area were sampled in 2019. 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 2019, 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, 2019 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 lateral 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 drains transmitting water from the Talbert aquifer 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 at least 5 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 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 2019 time frame.

The Shallow aquifer groundwater elevations shown on Figure 4-3 for June 2019 were very similar to the prior year for June 2018, due to similar barrier injection and relatively high coastal groundwater conditions.

During both 2018 and 2019, 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). 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 2019. The inferred groundwater

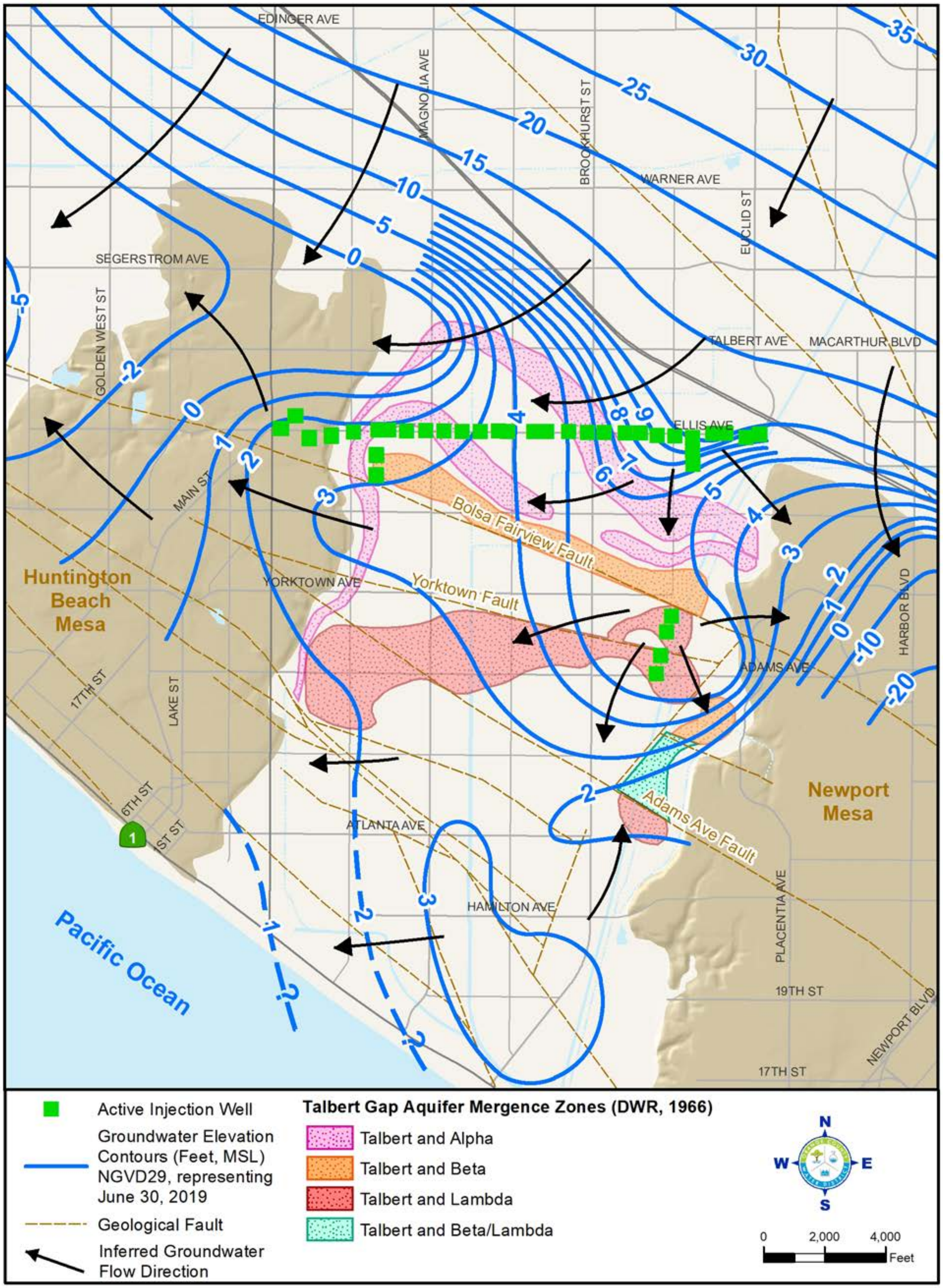


Figure 4-3. Shallow Aquifer Potentiometric Surface with Inferred Groundwater Flow Directions in the Talbert Gap Area During 2019

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 2019 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 of the Huntington Beach Mesa. Although not shown on Figure 4-3, the 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 2019 were very similar to those the prior year during June 2018 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 2019, 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 2019 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 displacing 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 accounts for 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 there would be net annual seaward movement of groundwater; 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 12 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 12 years because barrier injection supply was limited 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 rise over a two-year period to reach protective elevations by the beginning of 2010 (Figure 4-4). Since then, groundwater elevations at M26 have consistently been maintained at or above protective elevations except for brief periods related to AWPF shutdowns.

During 2019, groundwater elevations at M26 started the year at approximately 4 ft msl and remained relatively stable throughout the year, declining only about one foot during the summer months while still achieving protective elevations (Figure 4-4). As was discussed in Section 3, barrier injection was gradually increased during the late spring and summer months to keep pace with increased coastal production.

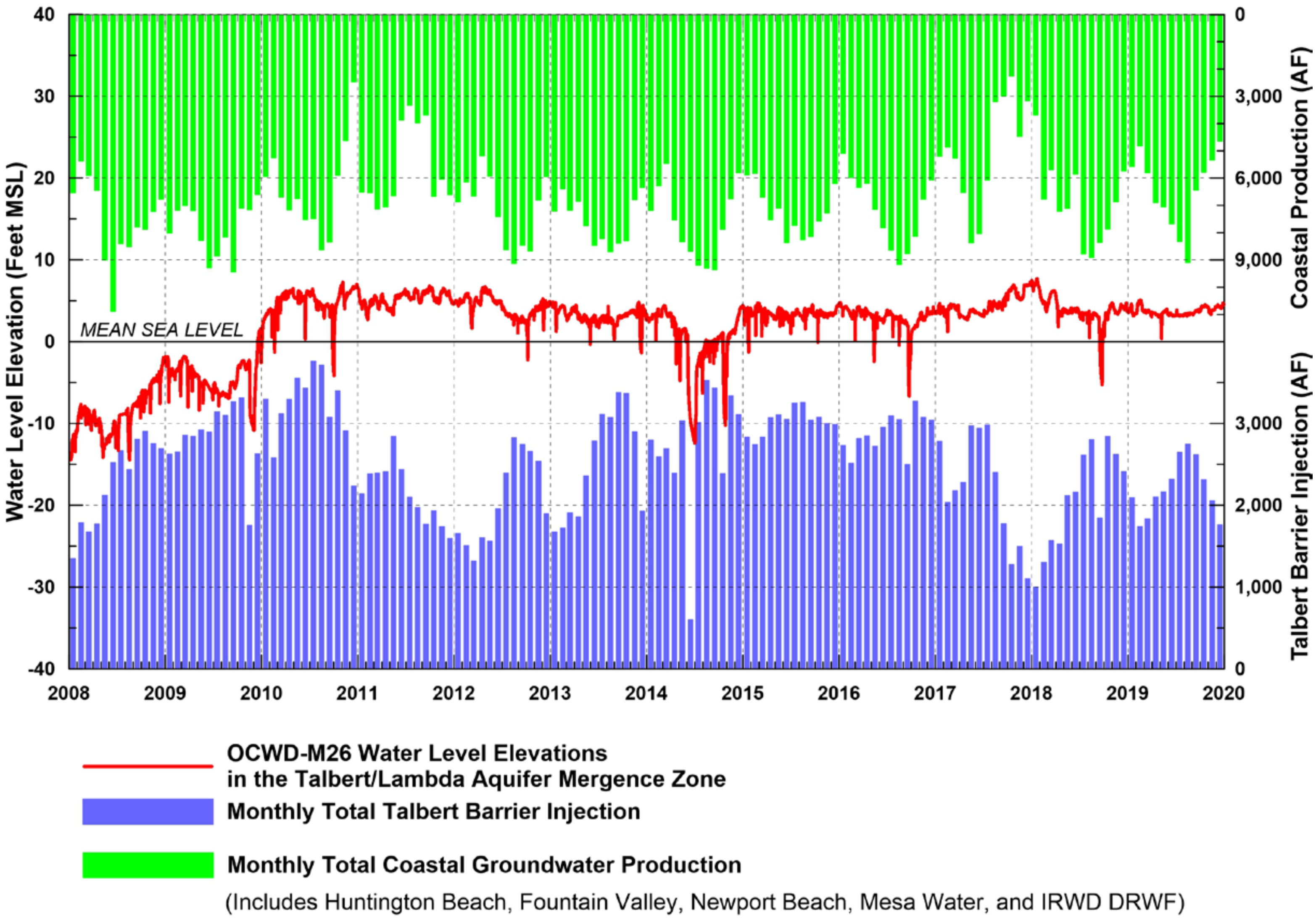


Figure 4-4. Talbert Barrier Injection, Coastal Production, and M26 Groundwater Levels

A brief AWPF and barrier shutdown May 6-8 caused groundwater elevations at M26 to briefly drop to just above mean sea level for two days but then recovered quickly back up to protective elevations and remained relatively stable during the second half of the year, increasing slightly back up to approximately 4 ft msl by the end of the year (Figure 4-4). Optimally, groundwater elevations at M26 are maintained between 3 and 6 ft msl for seawater intrusion control while avoiding shallow groundwater issues in low lying areas.

Operationally, whenever groundwater elevations at M26 rise above 6 ft msl, barrier injection is reduced 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 increased 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 2019 was low during the winter/spring months, higher during the summer months, and low again during the late fall months, as is typical based on seasonal water demands. Coastal production totaled 77,545 AF during 2019 (includes Huntington Beach, Fountain Valley, IRWD well field in Santa Ana, Mesa Water, and Newport Beach), representing a slight decrease of 6% from the prior year primarily because of reduced water demands stemming from the wet winter of 2018-2019.

In response, Figure 4-4 shows that barrier injection during the first three months of 2019 was relatively low but was incrementally increased in the late spring and summer to keep pace with increased coastal production during the high water demands of summer, with monthly maximum injection of over 2,700 AF in August (daily average of 28.9 MGD). As the weather cooled into the fall, barrier injection was reduced once again as coastal production also declined, completing the typical seasonal cycle. The annual barrier injection of 26,438 AF for 2019 was approximately 6% greater than the prior year but still relatively low compared to most other recent years due to relatively 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, 2019 during a typical on-line barrier condition. The June 2019 Lambda inferred flow directions shown on Figure 4-5 are very similar to those for June 2018 presented in the prior year's Annual Report.

The June 2019 Lambda groundwater elevations in Figure 4-5 are very similar to those from the prior June, except for the inland eastern portion of the study area near the Mesa Water wells and

IRWD Dyer Road Well Field (DRWF) in Santa Ana where it was approximately 20 ft lower. The lower Lambda groundwater elevations in this pumping area were likely caused by having 66% more pumping from the IRWD DRWF and Mesa Water wells in June 2019 than in June 2018, especially given that the groundwater elevations were measured at the end of June/beginning of July.

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 2019 (Figure 4-5) were nearly the same as in June 2018, due to typical sustained barrier injection and pumping conditions and continued high Basin storage conditions.

Revised geologic interpretations completed by OCWD Hydrogeology staff in 2018 of the aquifer stratigraphy were used to determine which wells were screened in the Lambda aquifer for constructing the June 2019 Lambda groundwater elevation contour maps, the same as was done the past two years for the June 2017 and June 2018 contour maps. The revised geologic interpretations primarily focused on the Bolsa-Sunset Gap area for groundwater modeling work but were extrapolated westward to the area inland of the Talbert Barrier. The geologic interpretations have the Lambda aquifer being penetrated by the upper portion of the screened intervals at the IRWD DRWF wells, whose groundwater elevations were thus interpreted for constructing the Lambda aquifer groundwater contours in that area for Figure 4-5.

When the barrier is on-line as in June 2019, there is typically a localized mound of raised groundwater elevations in the Lambda aquifer, albeit below sea level, in 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 3-9), 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 downward vertical flow lost 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.

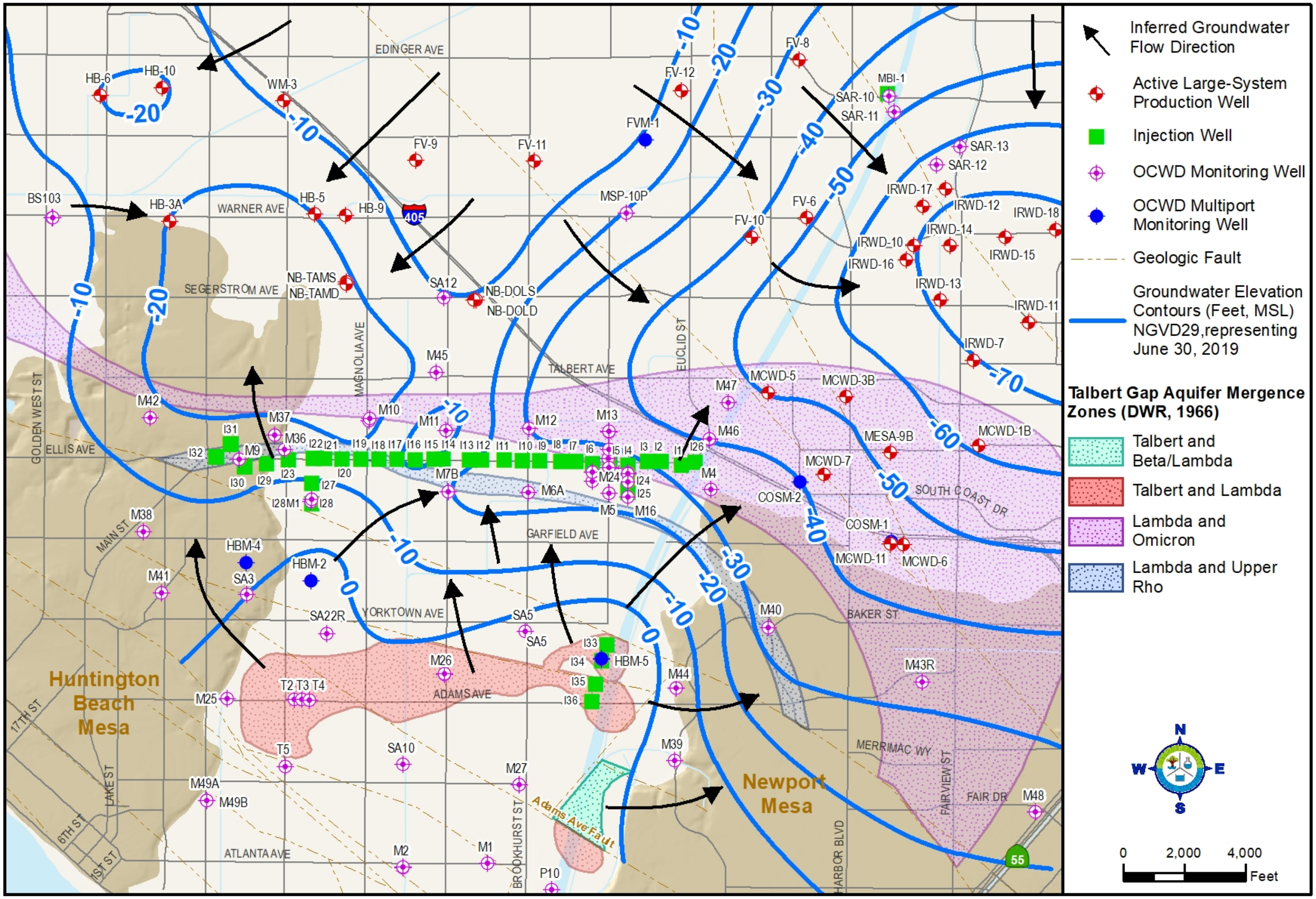


Figure 4-5. Lambda Aquifer Potentiometric Surface with Inferred Groundwater Flow Directions in the Talbert Gap Area

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. 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 northeast of the Talbert Barrier, at approximately -50 to -70 ft msl near the Mesa Water production wells and IRWD DRWF at the end of June 2019. Lambda groundwater elevations were approximately -10 to -20 ft msl to the north/northwest of the Talbert Barrier near Huntington Beach and Newport Beach production wells at the end of June 2019.

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, 2019. 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.

As in previous years, the June 2019 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 -70 to -80 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 to -50 ft msl. Compared to June of the prior year, these groundwater elevations in the Main aquifer for June 2019 were approximately 20 ft lower in the area of the Mesa Water production wells and IRWD DRWF and approximately 5 feet lower 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 at the west end of the Talbert Barrier. All six of the Talbert Barrier west-end deep injection wells were on-line throughout 2019. These June 2019 Main aquifer groundwater elevations were approximately the same as in June 2018 due to similarly sustained injection from the west-end deep injection wells throughout both 2018 and 2019.

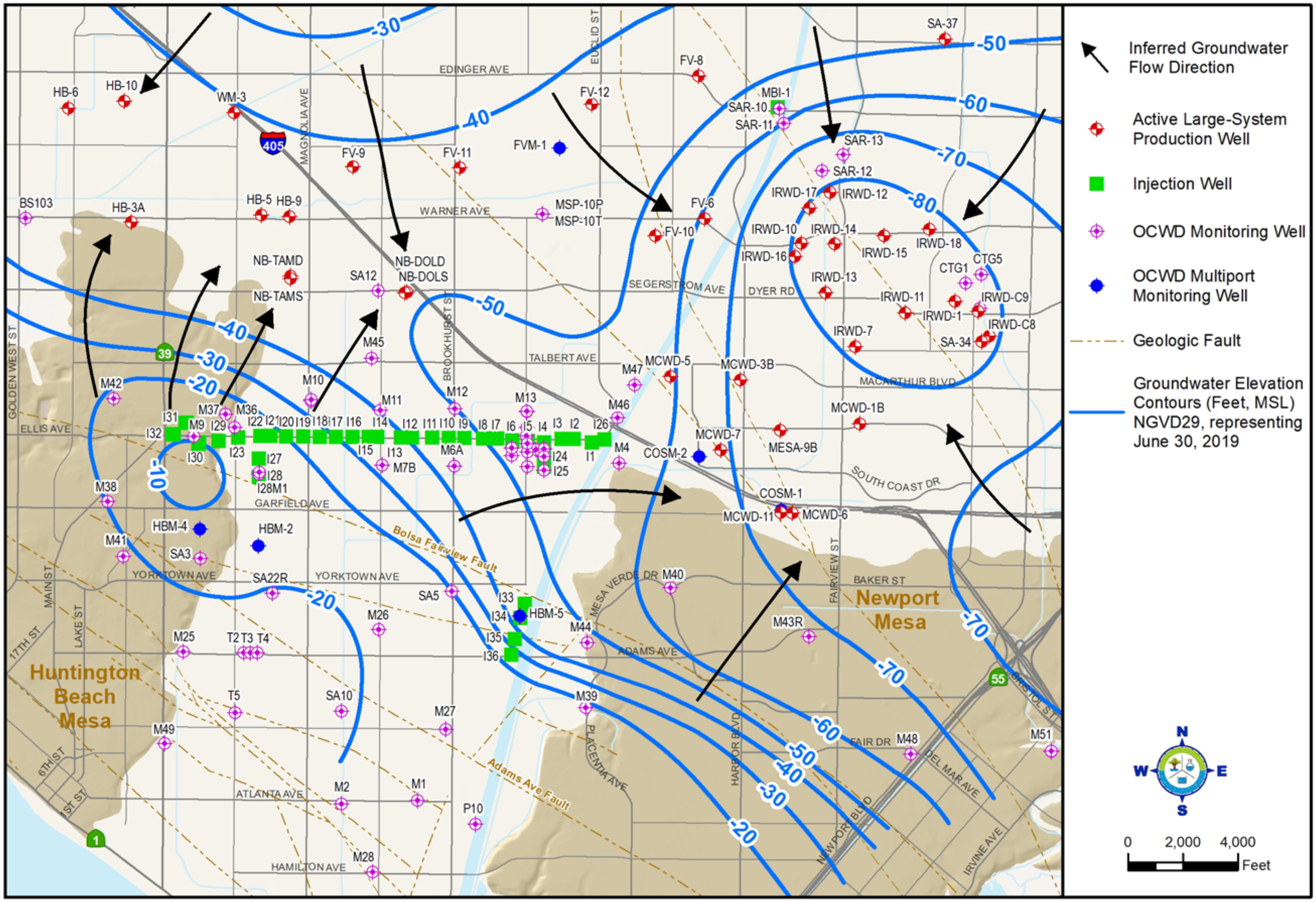


Figure 4-6. Principal Aquifer Potentiometric Surface with Inferred Groundwater Flow Directions in the Talbert Gap Area

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 the first half of 2019 through the end of June when groundwater levels were measured, 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, but I24/2 was off-line during the second half of 2019 for maintenance repairs. Although Main aquifer groundwater elevations shown on Figure 4-6 were well below 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. 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 2010-2019 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 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 2019 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.

Overall, groundwater levels in all barrier compliance monitoring wells in 2019 were very similar to their 2018 seasonal counterparts, except for not being as high at the beginning of 2019 as in January 2018 when groundwater levels were unusually high due to the Basin-wide In-Lieu Program that ended in January 2018.

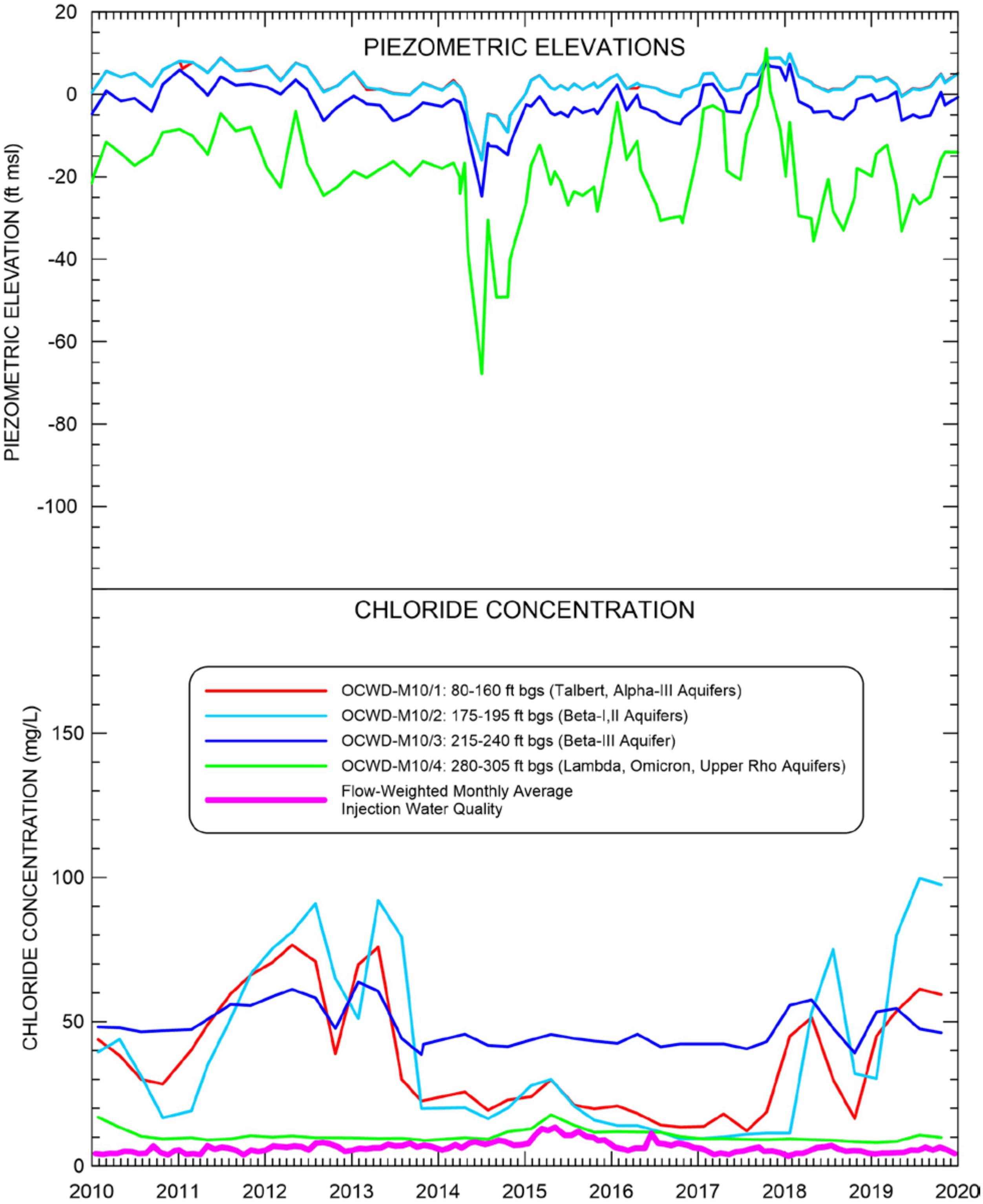


Figure 4-7. Monitoring Well OCWD-M10 Piezometric Elevations and Chloride Concentration

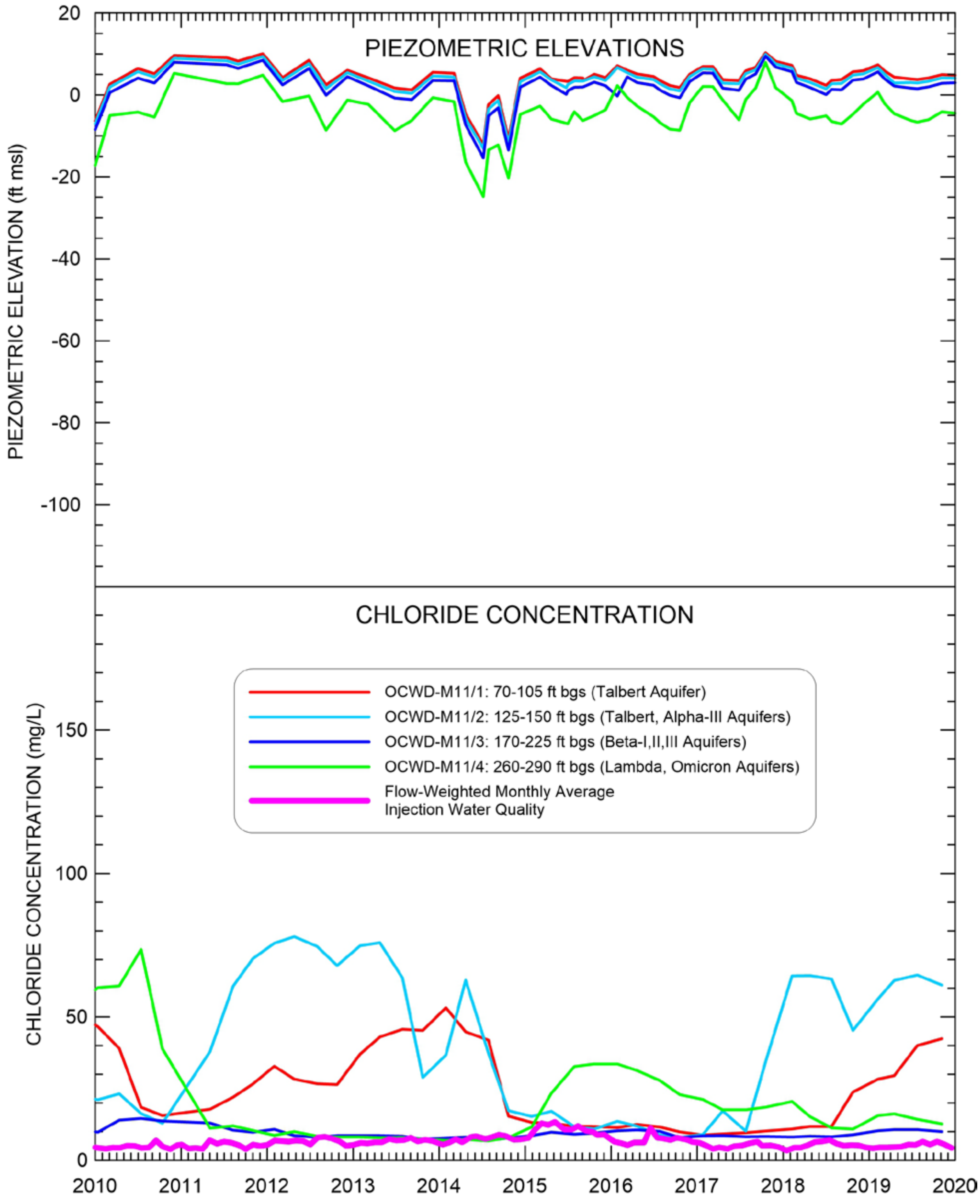


Figure 4-8. Monitoring Well OCWD-M11 Piezometric Elevations and Chloride Concentration

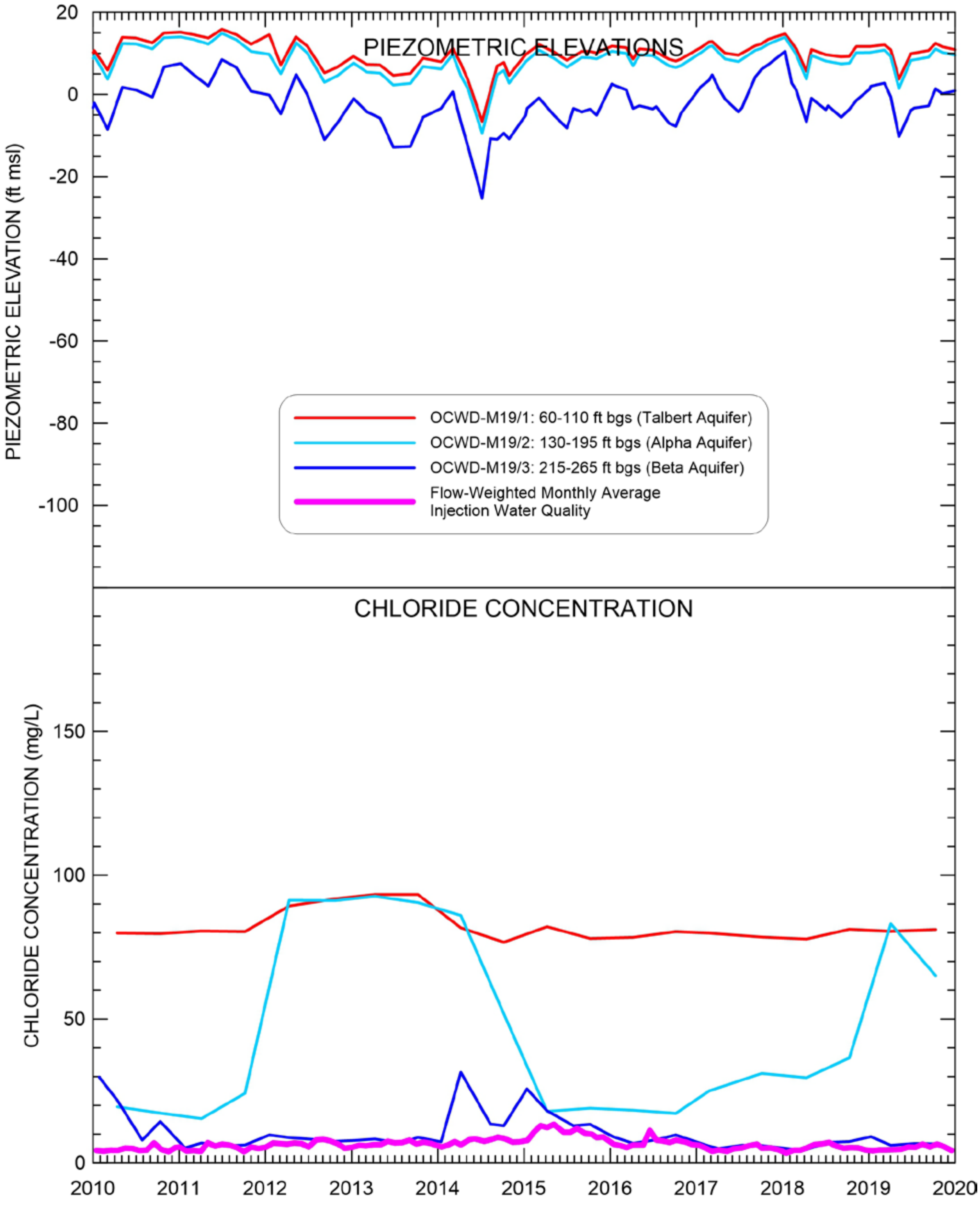


Figure 4-9. Monitoring Well OCWD-M19 Piezometric Elevations and Chloride Concentration

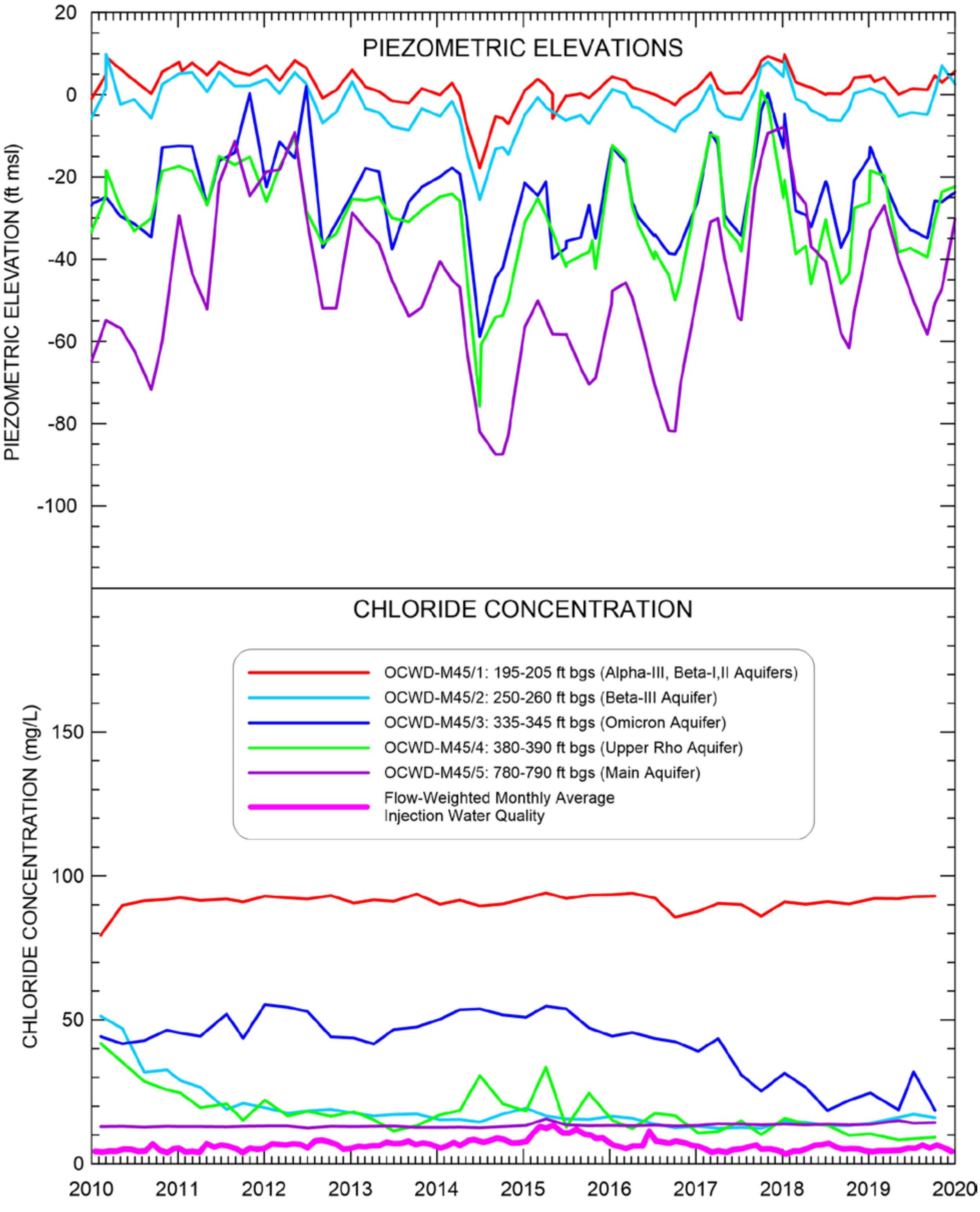


Figure 4-10. Monitoring Well OCWD-M45 Piezometric Elevations and Chloride Concentration

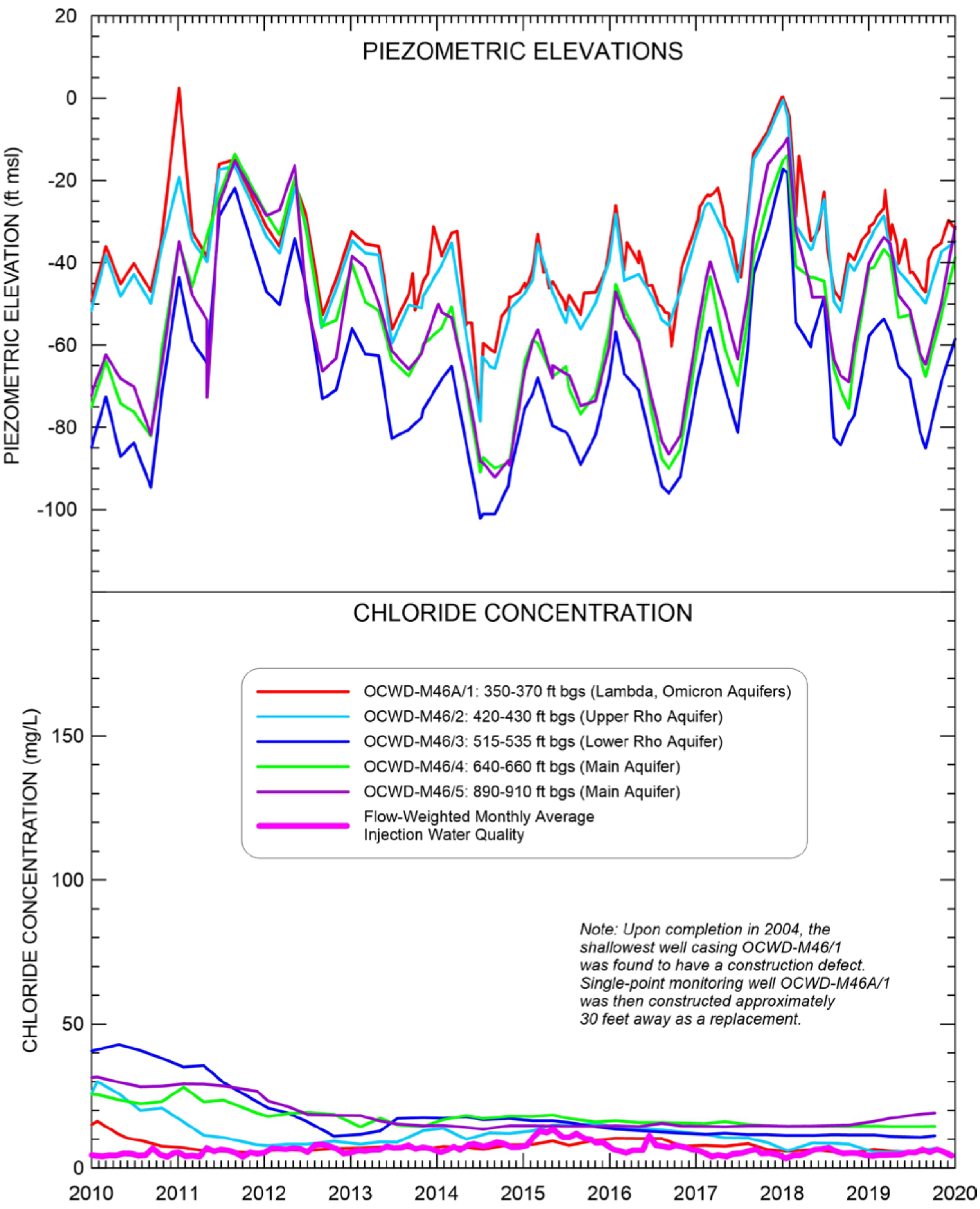


Figure 4-11. Monitoring Well OCWD-M46 and -M46A Piezometric Elevations and Chloride Concentration

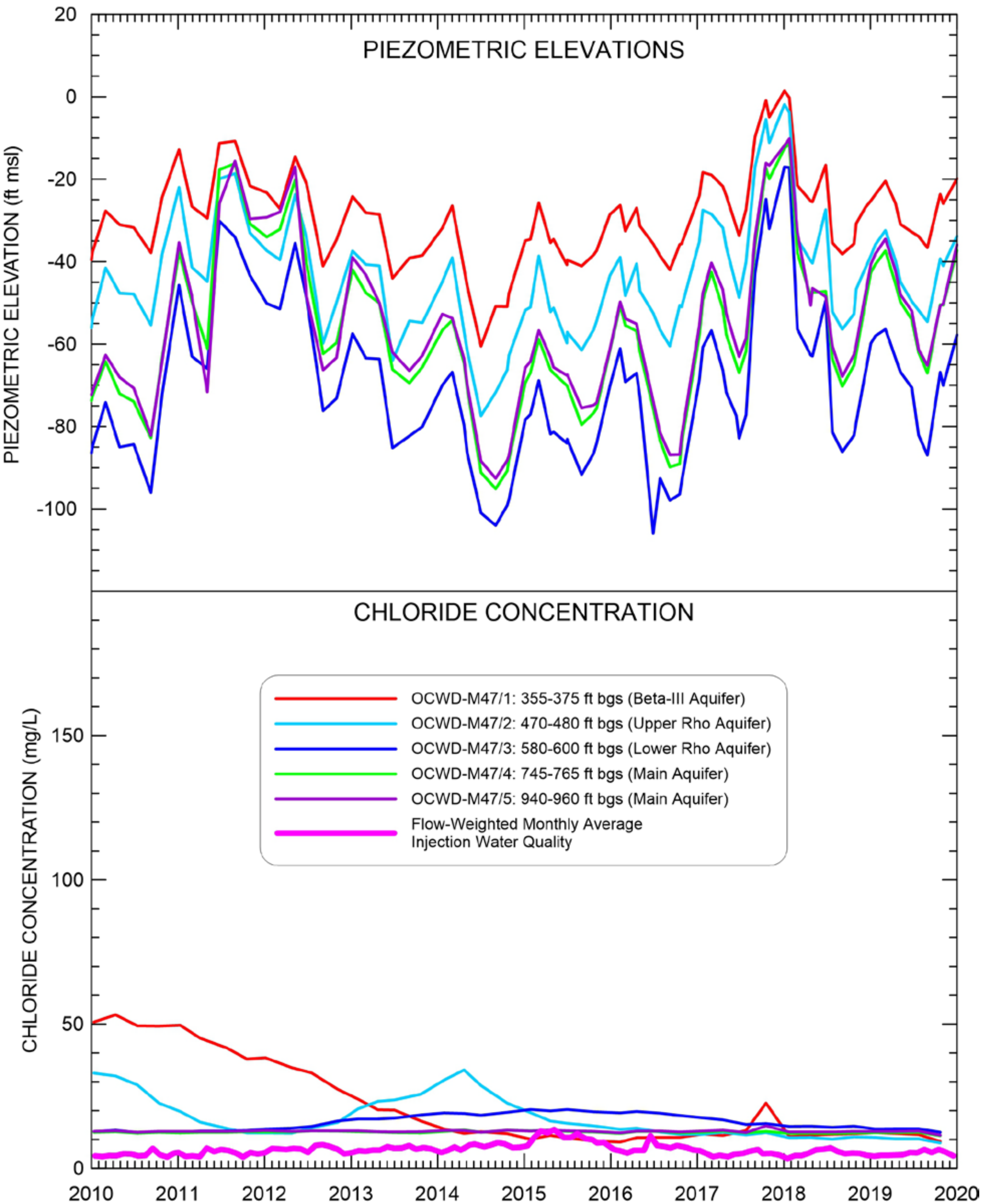


Figure 4-12. Monitoring Well OCWD-M47 Piezometric Elevations and Chloride Concentration

During the first quarter of 2019, groundwater levels in all barrier compliance wells rose slightly in January and February, but then declined somewhat in March for a net decline of 5 feet or less for the quarter in all aquifer zones. Although slight, this decline was somewhat atypical, as groundwater levels typically rise and reach a peak during the first quarter of most years.

During the second quarter of 2019, groundwater levels in the compliance wells experienced a slight decline of approximately 5 feet in the shallow Talbert and Alpha aquifers and a slightly larger decline of 10 to 15 feet in the intermediate and deeper zones as is typical for that time of year as coastal pumping increases.

During the third quarter of 2019, groundwater levels either remained stable or declined slightly during July and August but then experienced a moderate rise in September due to reduced coastal production that month. Because of this earlier than normal recovery in September, the summertime low occurred at the end of August at the compliance wells and was similar in magnitude to the summertime low the prior year. At the compliance wells, the seasonal amplitude in 2019 from the winter high in February to the summer low in August was only 5 to 10 feet in the shallow Talbert and Alpha aquifers as well as in the intermediate depth Beta aquifer, and approximately 15 to 30 feet in the other intermediate depth aquifers and deeper aquifers. Overall, these seasonal amplitudes were somewhat less than most years, likely resulting from the continued high Basin storage conditions.

During the fourth quarter of 2019, 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 10 ft in the intermediate aquifers, and 15 to 25 ft in the deeper aquifer zones. Groundwater levels at the compliance wells ended the year approximately the same (within 5 feet higher or lower) as at the beginning of the year in all aquifer zones.

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 largest summertime declines within the deeper Lower Rho and Main aquifers, declining more than 100 feet below mean sea level during the summers of 2014 and 2016 due to lower Basin conditions stemming from extended drought conditions during those years. During 2019, groundwater elevations in the Lower Rho and Main aquifers declined to a low of approximately 85 ft below mean sea level in August, similar to the prior year's summer low in September. Lower Rho and Main aquifer groundwater elevations at M46 and M47 ended the year approximately the same as 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 2019 are presented in Appendix G for the Talbert Barrier monitoring wells. General groundwater quality data for 2015-19 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 2019, groundwater quality at the compliance monitoring wells complied with all Federal and State Primary Drinking Water Standards. During the fourth quarter of 2018, arsenic was detected slightly above the Primary Maximum Contaminant Level (MCL) at barrier compliance monitoring well M47/1 (10.2 μg/L) but decreased to below the MCL during 2019 down to 7.7 μg/L by the end of the year. 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 2019. 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 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.

Some analyses revealed constituents above the EPA Secondary MCL in 2019 (color and odor), similar to past years and unrelated to purified recycled water injection. It is suspected that the elevated color and odor levels may be due to the presence of deep aquifer groundwater containing naturally occurring organic matter. Lastly, microbial detections are no longer a reporting requirement 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, DDW, and RWQCB (RWQCB, 2018 and DDW, 2018a).

Other changes in the GWRS groundwater monitoring program reduced the required frequency for some analytes from quarterly to annually based on a history of no detections (RWQCB 2011 and CDPH, 2010a; RWQCB 2018 and DDW, 2018a). The GWRS permit allows for review of the monitoring program every two years or sooner if necessary.

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 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 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 and 5 mg/L for the last three years, 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 as shown in 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 barrier monitoring wells M10, M11, M19, M45, M46, and M47 are shown on the lower graph of Figure 4-7 through Figure 4-12 for the 10-year period 2010-2019, respectively. For illustrative purposes, these graphs have been kept to a running 10-year history for each successive Annual Report. 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.

Since the 10-year period shown in Figure 4-7 through Figure 4-12 no longer includes the commencement of GWRS injection in 2008, the efficacy of tracking injection water by using chloride concentrations and first arrival of the low-chloride GWRS signal at many of these monitoring wells is more thoroughly described in Section 4.4.2 of prior years' Annual Reports, especially for wells with a discernable travel time of less than two years located relatively close to and downgradient from the barrier.

At M10/1 (Talbert and Alpha aquifers) and M10/2 (Beta-I and Beta-II aquifers), Figure 4-7 shows that chloride concentration trends have been very similar at these two wells over the last 10 years, with the chloride signal being lagged by a couple months at M10/2 as compared to M10/1, likely related to a slightly deeper, slower flow path at M10/2. During 2019, chloride concentrations rose sharply at both M10/1 and M10/2, peaking as high as 100 mg/L during the third quarter at M10/2. During the fourth quarter, chloride concentrations remained relatively stable and high at both M10/1 and M10/2. In both cases, the sharp chloride concentration increase was very similar to what occurred in 2012 and 2013 and slightly larger than occurred in 2018, all such events resulting from high groundwater conditions causing a temporary shift in the gradient direction or a complete gradient reversal from landward to seaward in which older injection water inland of M10/1 and M10/2 migrated back to these wells; this gradient reversal phenomenon has previously been observed during other high groundwater periods at other nearby monitoring wells and is also discussed in Section 4.4.3 with regards to temporary increases in 1,4-dioxane.

At M10/3 (Beta-III aquifer), Figure 4-7 shows that chloride concentration trends were similar to but much more dampened than at M10/1 and M10/2 over the entire period shown. From 2014-2017, 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 at M10/3 experienced a short-term subtle rise in the first half of 2018 and again in late 2018 into the first half of 2019, before decreasing slightly once again back down to 46 mg/L by the end of 2019, indicating two short-lived gradient reversals 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), a travel time of approximately 10 to 12 months was estimated for GWRS injection water to reach M10/4 based on the first arrival of the low-chloride GWRS signal at M10/4 during the last quarter of 2008, as shown in Figure 4-7 of prior years' Annual Reports. 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 2019, chloride concentrations at M10/4 experienced a very subtle increase but remained low, still indicating a predominance of GWRS water at this well.

At monitoring well site M11, arrival of GWRS water has occurred at various times in all four zones, with arrival being the fastest at M11/3 (Beta aquifer) with a previously 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 2019, chloride concentrations remained low and stable at approximately 10 mg/L at M11/3 (Figure 4-8), indicating nearly 100% GWRS purified recycled water at this well and indicating that the gradient remained predominantly landward in the Beta aquifer at this location.

At M11/4 (Lambda aquifer), chloride concentrations shown on Figure 4-8 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. During 2019, chloride concentrations at M11/4 experienced a subtle increase in the first half before gradually declining back down to 13 mg/L in the fourth quarter, likely indicating a subtle short-term shift in the gradient direction but then reverting back to a landward gradient and a predominance of GWRS water at this well.

At M11/1 (Talbert aquifer) and M11/2 (Talbert and Alpha aquifers), Figure 4-8 shows that chloride concentrations increased in both wells during 2019 to over 40 mg/L at M11/1 and over 60 mg/L at M11/2. At both wells, the chloride concentration increases likely indicated a seaward gradient reversal from late 2018 through 2019 in the Talbert and Alpha aquifers at this location.

At M19/3 (Beta aquifer), first arrival of the low-chloride GWRS signal in March/April 2008 indicated a three-month travel time to that well from the nearest injection well I5. Given a distance of 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. Figure 4-9 shows that chloride concentrations at M19/3 experienced a temporary increase from low GWRS levels in 2010, early 2014, and early 2015, indicating three seaward gradient reversal events, before eventually reverting back to a landward gradient that has persisted since 2017 with chloride concentrations at M19/3 remaining below 10 mg/L through 2019.

At M19/2 (Alpha aquifer), chloride concentrations also suggest gradient reversals (Figure 4-9). Relatively low chloride concentrations below 20 mg/L at M19/2 during 2010 and early 2011 indicated the sustained arrival of a large portion of GWRS water during that time due to a landward gradient, 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 during that time. 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 due to lower groundwater levels resulting from extended drought conditions during that time. Since 2017, chloride concentrations at M19/2 have increased and reached a peak of 83 mg/L in April 2019, again indicating a seaward gradient reversal and higher percentage of pre-GWRS injection water arriving at this well in the Alpha aquifer because of higher groundwater conditions over the last two to three years.

At M19/1 (Talbert aquifer), 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 on Figure 4-3.

The results from barrier compliance monitoring well sites M45, M46, and M47 were also consistent with OCWD's hydrogeological understanding of the area. Chloride concentration trends in many of these monitoring well zones also showed the influence of injection water, albeit in a somewhat slower and more dispersive fashion in some of the deeper zones.

At M45/1 (Alpha-III and Beta-I,II aquifers), Figure 4-10 shows that chloride concentrations have remained stable at historical background levels of approximately 80 to 100 mg/L, significantly higher than GWRS water and thus indicating that no GWRS water has ever reached M45/1, consistent with the observed seaward gradient at this location in the Alpha aquifer.

At M45/2 (Beta-III aquifer) and M45/4 (Upper Rho aquifer), Figure 4-10 shows that chloride concentrations declined noticeably during 2010 and 2011 and have since declined much more gradually and have largely stabilized at relatively low levels, indicating the sustained arrival of GWRS water in these two zones but reliable travel time estimates were not discernable due to the dampened trends. During 2019, chloride concentrations were low and stable in both wells, ranging from 8 to 17 mg/L and indicating a predominance of GWRS.

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 down to 19 mg/L by the second quarter of 2019 before a brief increase in the third quarter and then back down to 19 mg/L in the fourth quarter. 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-III, 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 2019 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.

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.

At M46A/1 (Lambda aquifer), the decline in chloride concentrations during the fourth quarter of 2008 indicated the first arrival of GWRS water at that well and indicated a travel time of approximately 10 months. Since 2011, chloride concentrations at M46A/1 have remained low and stable at GWRS levels (Figure 4-11), 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 have not been discerned for these deeper zones at the M46 site. At M46/2 (Upper Rho aquifer), chloride concentrations declined slightly down to GWRS levels in 2019 and indicated 100% GWRS water at this well. At the two deeper zones M46/3 (Lower Rho aquifer) and M46/4 (Main aquifer), chloride concentrations during 2019 remained low and stable ranging from 11 to 15 mg/L just slightly higher than GWRS water. Finally, at the deepest zone M46/5 (Main aquifer), chloride concentrations also remained relatively low but experienced a slight increase from 15 mg/L in 2018 to 19 mg/L in the second half of 2019, possibly indicating a very subtle shift in the gradient and a small percentage of pre-GWRS water arriving back to this well in this Main aquifer zone.

At M47/1 (Beta-III aquifer), Figure 4-12 shows that chloride concentrations began to gradually decline from background levels in 2011 and finally reached low GWRS levels in 2015. Due to the gradual dampened nature of this chloride decline, a GWRS arrival time has not been be calculated but is likely greater than three years. During 2019, chloride concentrations were low and stable at approximately 12 mg/L with a slight decrease to 9 mg/L in the fourth quarter, indicating nearly 100% GWRS water at this well.

At M47/2 (Upper Rho aquifer), 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 was faster than M47/1 but once again was not readily discernable due to the dampened nature of the chloride trends. During 2019, chloride concentrations at M47/2 were low and stable at 9 to 10 mg/L, indicating nearly 100% GWRS water at this well. 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 GWRS injection.

4.4.3 Monitoring Wells – 1,4-Dioxane and NDMA

In 2000-2001, 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 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.

Testing for NDMA and 1,4-dioxane at monitoring wells and production wells near the Talbert Barrier continued during 2019. Data from the monitoring wells are illustrated on Figure 4-14 through Figure 4-19 and are presented in Appendix H. During 2019, 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 two monitoring wells during 2019 at M46A/1 and M19/3, and both were 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.

At monitoring well site M10 (Figure 4-14), the 1,4-dioxane results in 2019 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 remained relatively stable during 2019 at 6.4 to 6.8 μg/L. The stable (rather than decreasing) 1,4-dioxane concentrations at M10/3 are consistent

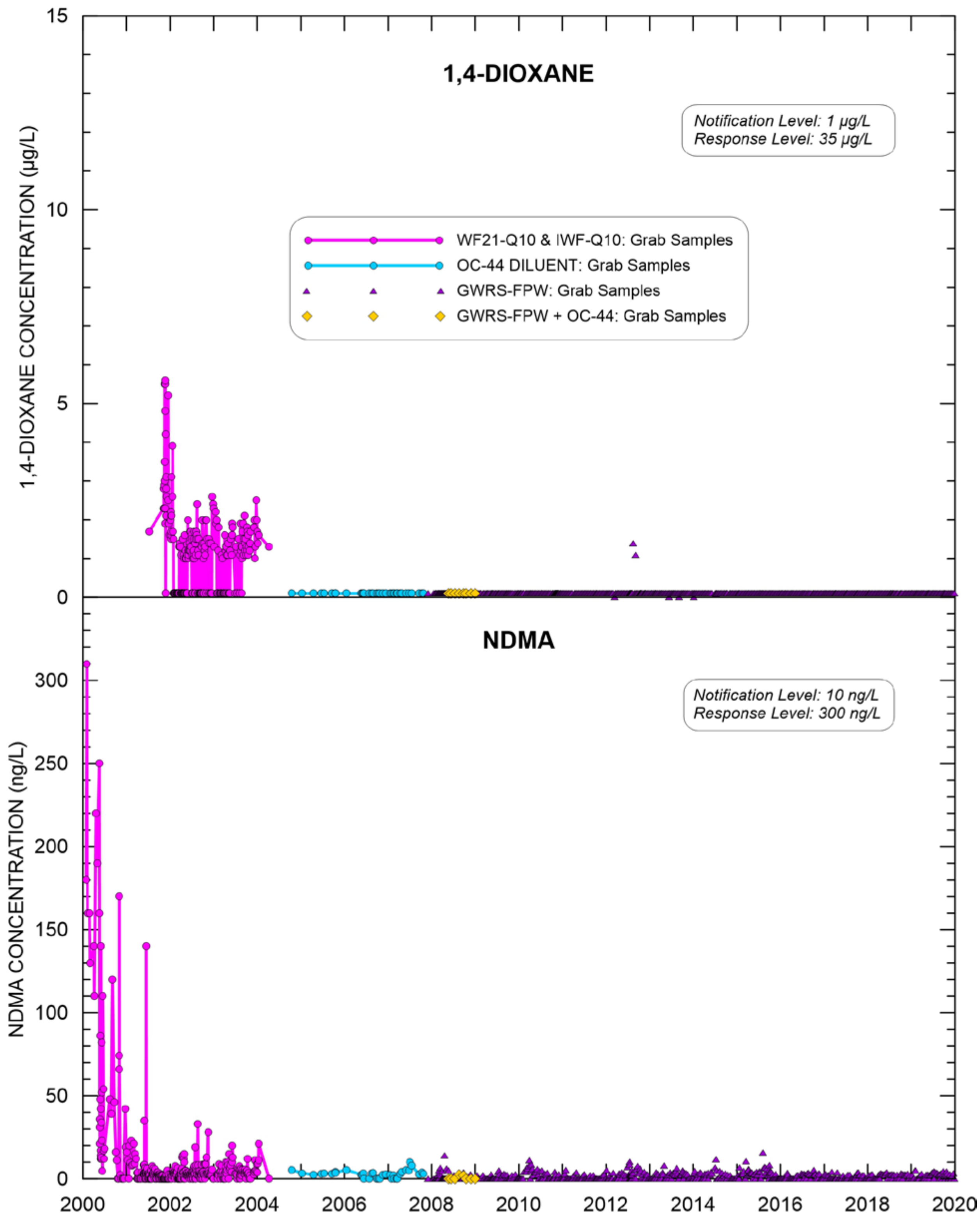


Figure 4-13. Talbert Barrier Injection Water 1,4-Dioxane and NDMA Concentrations

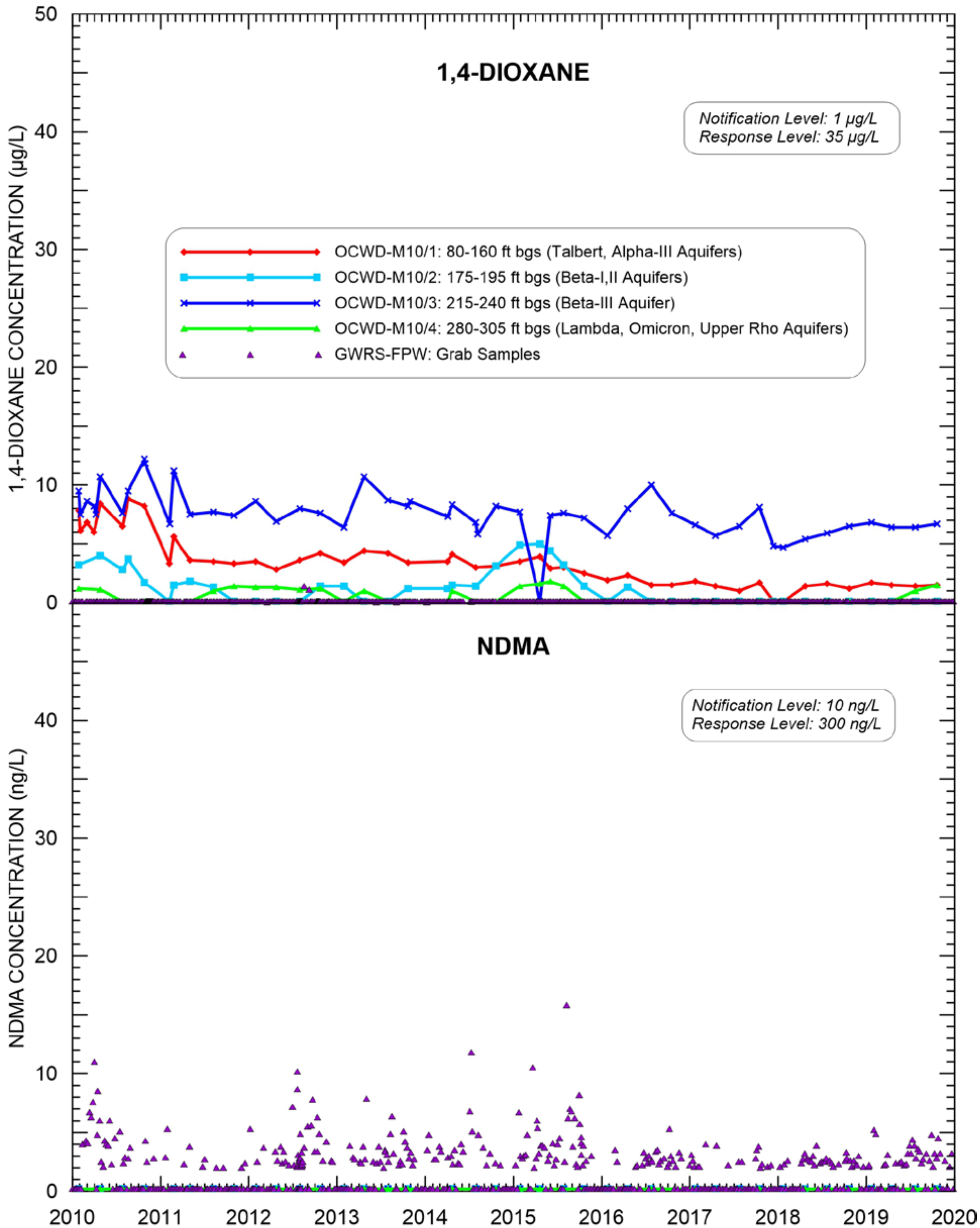


Figure 4-14. Monitoring Well OCWD-M10 1,4-Dioxane and NDMA Concentrations

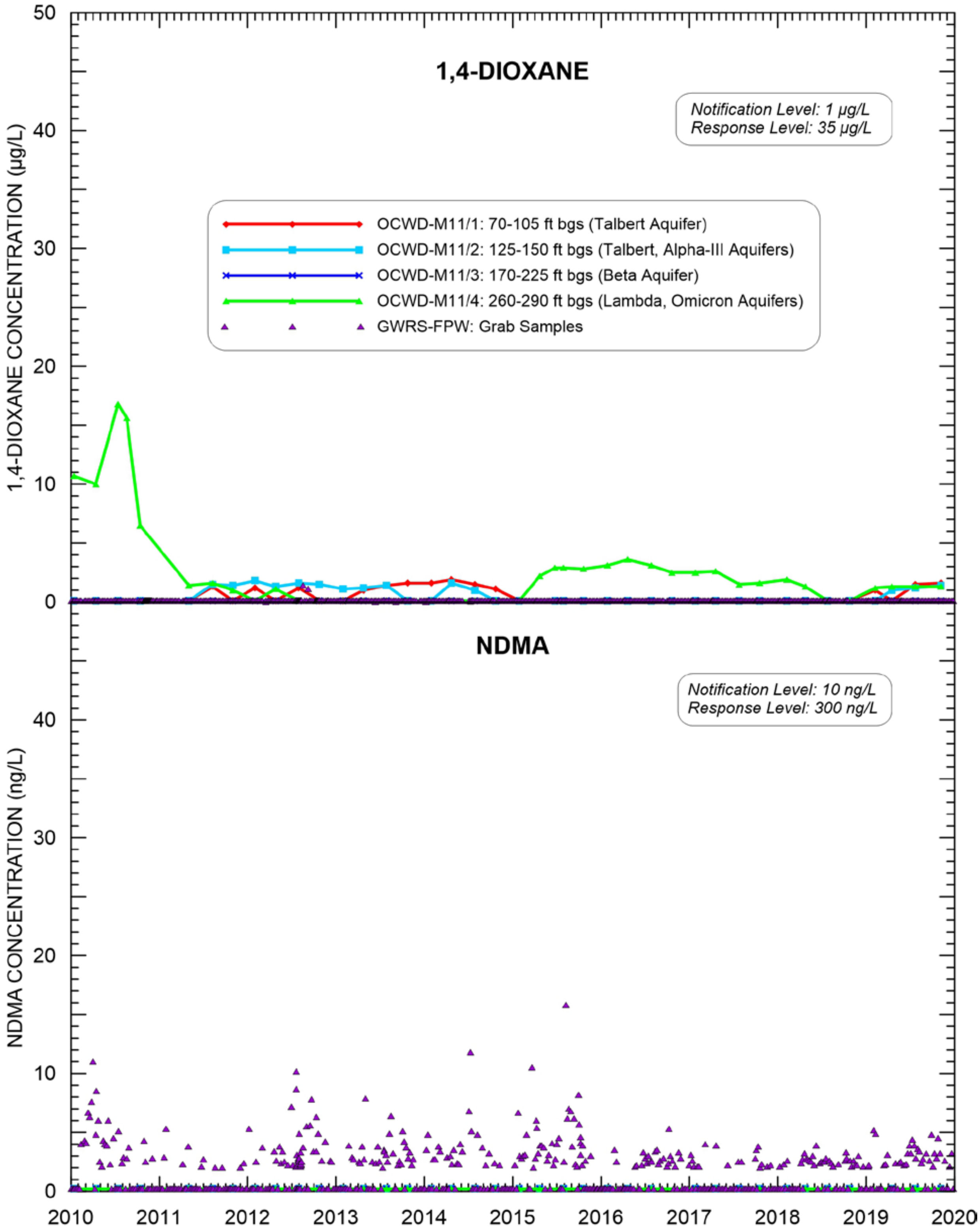


Figure 4-15. Monitoring Well OCWD-M11 1,4-Dioxane and NDMA Concentrations

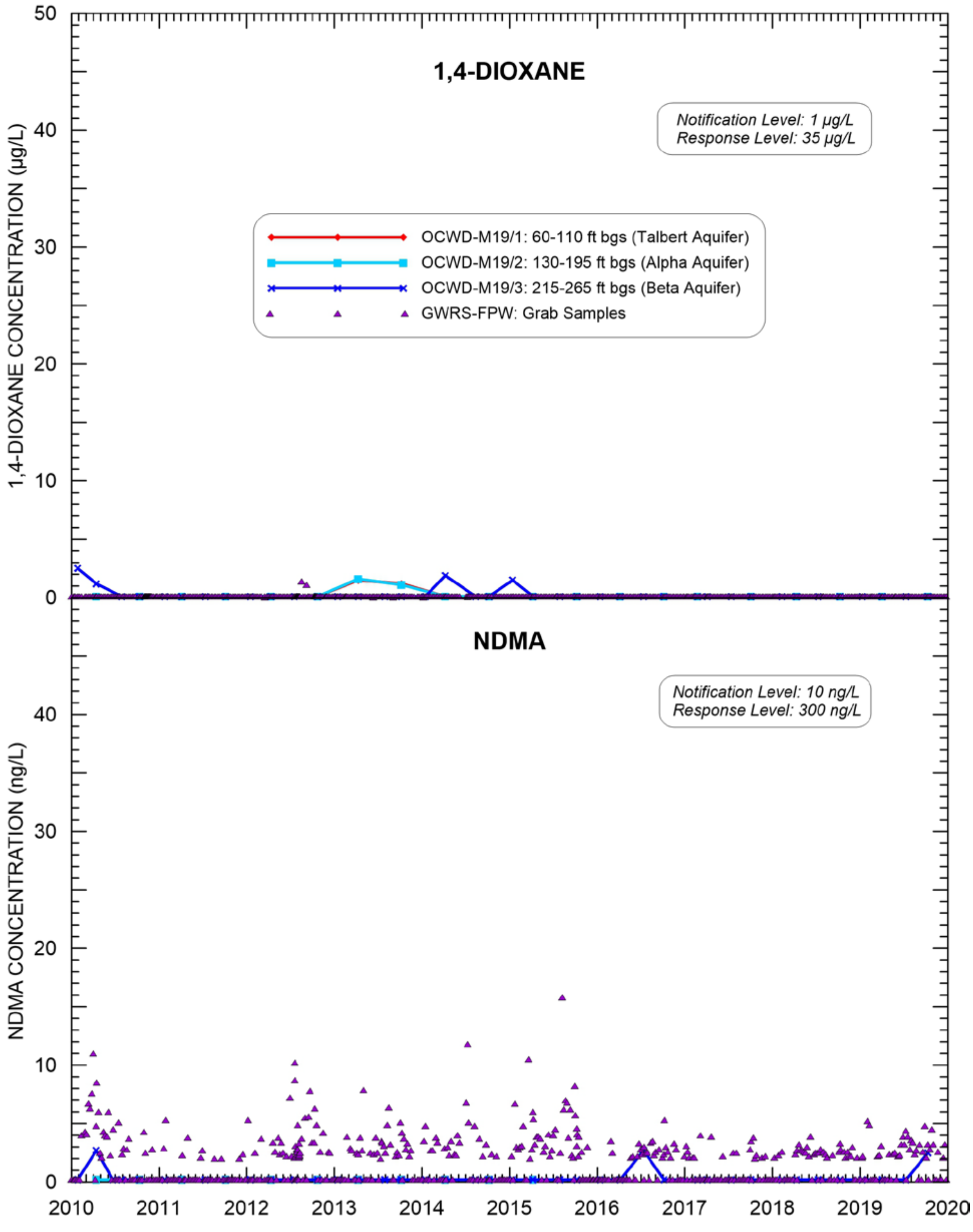


Figure 4-16. Monitoring Well OCWD-M19 1,4- Dioxane and NDMA Concentrations

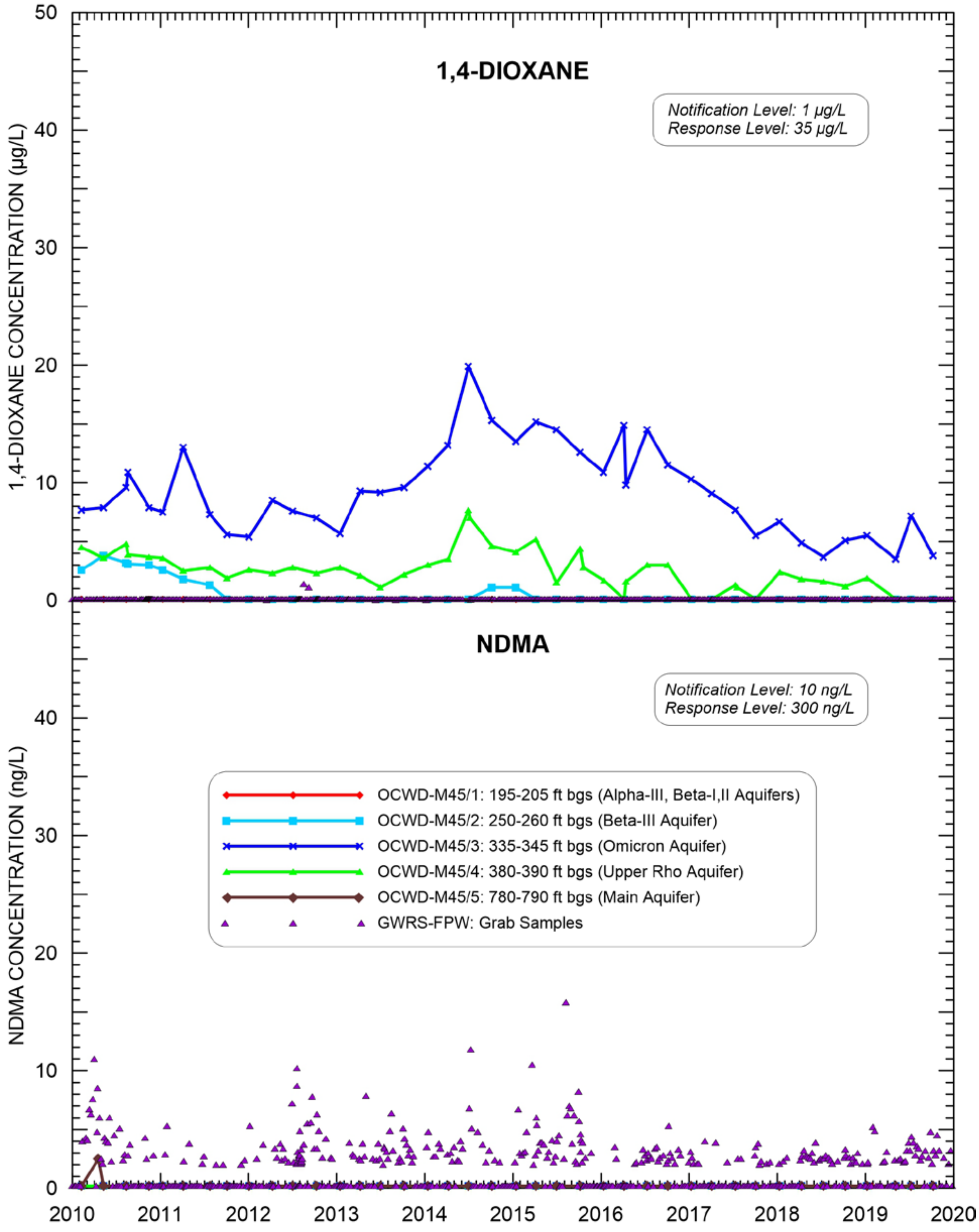


Figure 4-17. Monitoring Well OCWD-M45 1,4-Dioxane and NDMA Concentrations

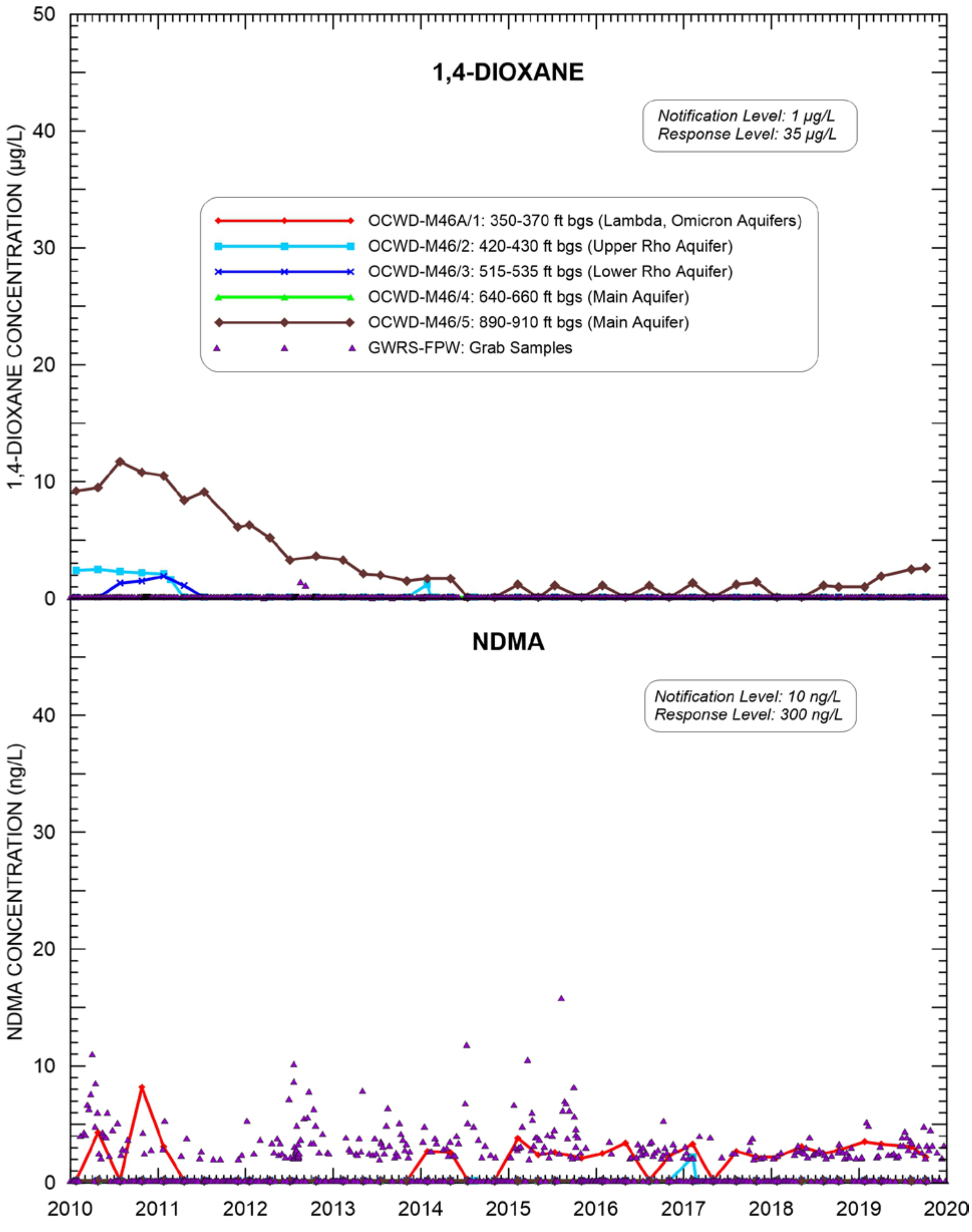


Figure 4-18. Monitoring Well OCWD-M46 1,4-Dioxane and NDMA Concentrations

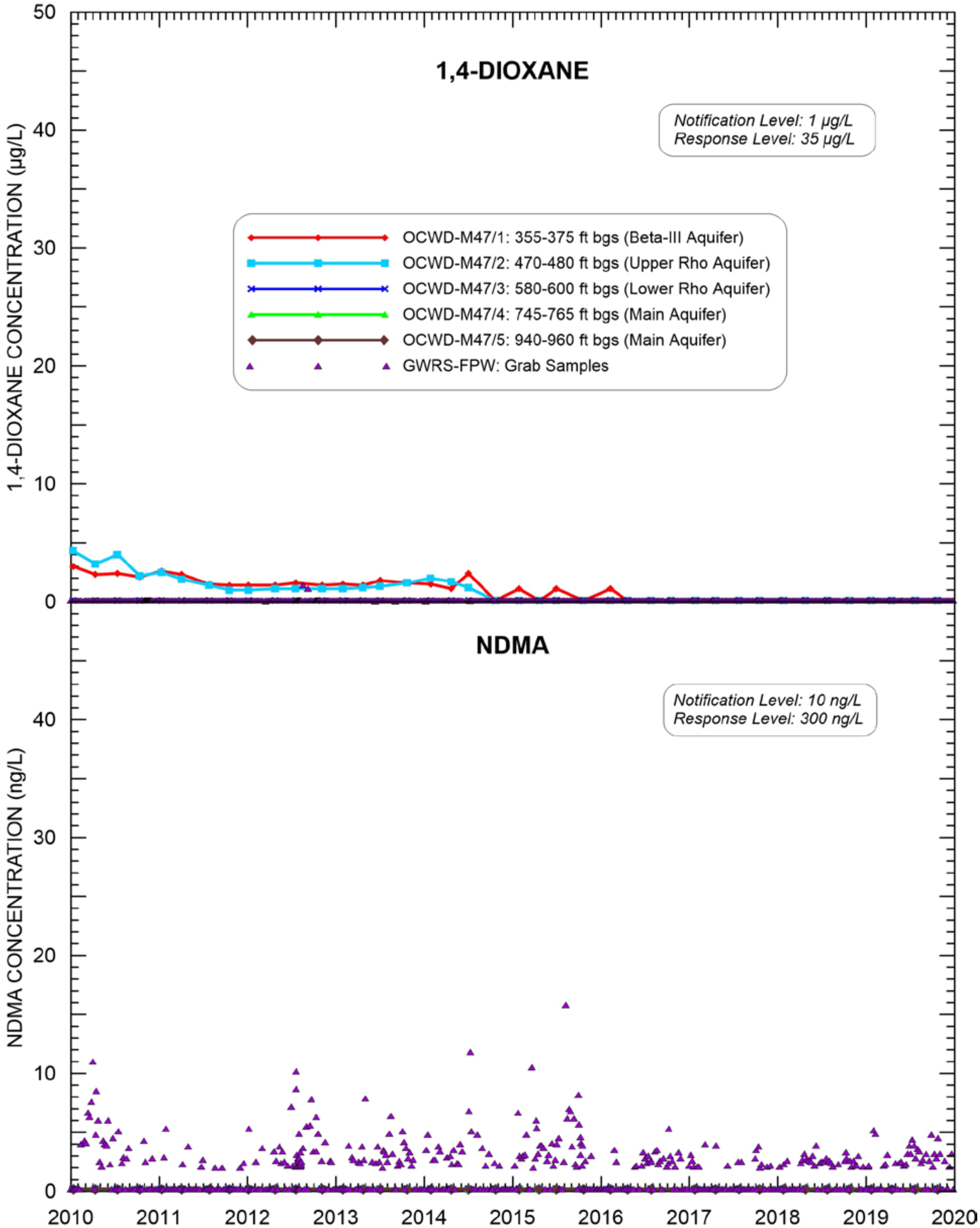


Figure 4-19. Monitoring Well OCWD-M47 1,4-Dioxane and NDMA Concentrations

with the somewhat higher chloride concentrations at this well during 2019 which indicated a continued seaward gradient shift, allowing a relatively high percentage of older (pre-GWRS) WF-21 injection water to remain or migrate back to this well. At M10/4 (Lambda, Omicron, and Upper Rho aquifers), concentrations of 1,4-dioxane increased slightly 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 through 2018 indicated the return of a more typical sustained landward gradient from the barrier to this well and a predominance of GWRS water. During 2019, concentrations of 1,4-dioxane at M10/4 experienced a slight increase from below the RDL to just above the RDL at 1.5 μg/L by the fourth quarter, once again consistent with a contemporaneous increase in chloride concentrations, indicating a slight shift in the gradient and return of a small portion of pre-GWRS injection water to this well in the Lambda aquifer.

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, 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 but was likely due to the barrier being off-line in June 2014 rather than from high groundwater conditions as is typically the case with these gradient reversals. Concentrations of 1,4-dioxane at M10/2 subsequently decreased back down to 1 μg/L by the end of 2015 and largely remained below the RDL through 2019 despite seaward gradient reversals during both 2018 and 2019 as indicated by chloride concentration increases during that time (Figure 4-7). The 2018 and 2019 seaward gradient reversals at M10/2 may have brought higher chloride native groundwater (devoid of 1,4-dioxane) rather than GWRS water back to this well.

At M10/1 (Talbert and Alpha aquifers), Figure 4-14 shows that concentrations of 1,4-dioxane remained low and relatively stable during 2019 at 1.4 to 1.7 μg/L just slightly above the RDL despite the sharp increase in chloride concentrations in this well during 2018 and 2019 (Figure 4-7). Like the explanation for M10/2 above, the lack of any increase in 1,4-dioxane concentrations at M10/1 despite the contemporaneous chloride increase may indicate that the seaward gradient reversals in 2018 and 2019 may have caused some native groundwater to migrate back to this well rather than pre-GWRS injection water.

NDMA concentrations at monitoring well site M10 (all zones) remained below the RDL of 2 ng/L throughout 2019.

At monitoring well site M11, Figure 4-15 shows that concentrations of 1,4-dioxane increased slightly from below the RDL in 2018 to just above the RDL at 1.3 to 1.6 μg/L during 2019 in all zones except M11/3 (Beta aquifer). At M11/3, 1,4-dioxane concentrations have been below the

RDL since 2008, indicating nearly 100% GWRS purified recycled water at this well for several years and confirmed by low chloride concentrations below 15 mg/L since 2010.

At M11/4 (Lambda and Omicron aquifers), concentrations of 1,4-dioxane increased slightly during 2015 and the first half of 2016 (Figure 4-15), consistent with the contemporaneous increase in chloride concentrations at this well (Figure 4-8) and signaling a gradient shift or reversal that likely brought a pulse of older pre-GWRS water back to this well. Similarly, the slight uptick in 1,4-dioxane concentrations to just above the RDL during 2019 at M11/4 likely signaled a subtle gradient reversal, consistent with the contemporaneous subtle chloride increase at this well.

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 contemporaneous high chloride concentrations. During 2019, the slight increase in 1,4-dioxane concentrations to just above the RDL at M11/1 and M11/2 were likely caused by a seaward gradient reversal that began in 2018 and continued through 2019 as evidenced by the high chloride concentrations during that time in these two wells (Figure 4-8).

NDMA concentrations at monitoring well site M11 (all zones) remained below the RDL of 2 ng/L throughout 2019.

At monitoring well site M19, Figure 4-16 shows that 1,4-dioxane concentrations were below the RDL in all three zones during 2019, albeit for different reasons. At M19/1 (Talbert aquifer), high chloride concentrations of approximately 80 mg/L during 2019 (Figure 4-9) indicated a continued seaward gradient with native groundwater (devoid of 1,4-dioxane) at this well. 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), the sharp increase in chloride concentrations during 2019 (Figure 4-9) likely indicated a gradient shift or reversal that may have brought a proportionally large blend of native groundwater (devoid of 1,4-dioxane) rather than pre-GWRS injection water back to this well.

NDMA concentrations at monitoring well site M19 remained below the RDL of 2 ng/L throughout 2019 in all zones except M19/3, which had one detection of 2.5 ng/L in October (Figure 4-16). Given that this well represents approximately 100% GWRS water with a relatively short travel time, this detection was likely due to the slight increase in NDMA concentrations in GWRS-FPW approximately 3 months earlier, like the one-time detections in 2010 and 2016 at this well.

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 2010-2019. 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 both pre-GWRS and GWRS injection water in these areas.

At M45/3 (Omicron aquifer), Figure 4-17 shows that 1,4-dioxane concentrations began to decline in 2017 and dropped to a low of 3.7 μg/L by the third quarter of 2018 due to the first evident arrival of GWRS water to this well and confirmed by a contemporaneous chloride decline (Figure 4-10), suggesting a travel time 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 an 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 suggest. Furthermore, any seasonal shifts in the gradient direction as well as vertical migration from the Lambda aquifer at the legacy injection wells down into the Omicron aquifer to reach M45/3 could lengthen the overall injection water travel path and thus equate to a higher groundwater velocity for the 9-year mean travel time. During 2019, concentrations of 1,4-dioxane increased slightly from 3.5 μg/L in the second quarter to 5.1 μg/L in the third quarter, and then back down to 3.8 μg/L in the fourth quarter. This short-term subtle increase was consistent with the contemporaneous subtle increase in chloride concentrations at this well (Figure 4-10) and likely indicated a slight shift in the gradient due to the relatively high groundwater conditions.

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 arrived at M45/4 during that time with an estimated travel time of approximately 3 to 4 years. This equates to an average groundwater velocity of approximately 2 to 3 feet per day if originating from the nearest injection wells 3,000 feet away. Since the nearest legacy injection wells are not screened in the Upper Rho aquifer, GWRS arrival at M45/4 required vertical migration from the Lambda aquifer down into the Upper Rho aquifer, likely from their zone of mergence in the vicinity of the central portion of the barrier (Figure 4-5). During 2019, concentrations of 1,4-dioxane at M45/4 decreased from 1.9 μg/L in the first quarter down to below the RDL for the remainder of the year, consistent with a contemporaneous subtle decrease in chloride concentrations down below 10 mg/L (Figure 4-10) and indicating a landward gradient with nearly 100% GWRS water at this well in the Upper Rho aquifer.

At M45/2 (Beta-III aquifer), Figure 4-17 shows that 1,4-dioxane concentrations remained below the RDL during 2019, consistent with contemporaneously low and stable 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 the shallow M45/1 (Alpha-III and Beta-I,II aquifers) and deep 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 2019.

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. At M46A/1 (Lambda aquifer) and M46/2 (Upper Rho aquifer), low chloride concentrations below 15 mg/L since 2012 and even lower at 5 to 7 mg/L during 2019 indicated the long-term sustained predominance of GWRS water in those two wells. At M46/3 (Lower Rho aquifer) and M46/4 (Main aquifer), relatively low chloride concentrations below 20 mg/L since 2013 but with more dampened trends indicated at least some proportion of GWRS water but with less certainty due to lower 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 a mean arrival time. From 2015-2018, concentrations of 1,4-dioxane have oscillated seasonally each year from non-detect to just above the RDL of 1 μg/L, possibly indicating subtle shifts in the seasonal gradient direction causing small pulses of older pre-GWRS water to temporarily migrate back and forth to this well without noticeably increasing chloride concentrations (Figure 4-11). During 2019, a gradual increase in 1,4-dioxane concentrations from the RDL of 1 μg/L in the first quarter to 2.6 μg/L in the fourth quarter likely indicated a more sustained gradient shift than the previous four years and was consistent with the contemporaneous subtle rise in chloride concentrations at M46/5 in the Main aquifer.

NDMA concentrations at monitoring well site M46 remained below the RDL of 2 ng/L throughout 2019 in all zones except M46A/1, where NDMA concentrations gradually decreased from 3.5 ng/L in the first quarter to 2.2 ng/L in the fourth quarter, remaining well below the NL of 10 ng/L all year. The detections of NDMA at M46A/1 during 2010, 2011, 2014, and 2015-19 all appear to correlate with NDMA concentrations in GWRS-FPW from several months prior, generally consistent with the 10-month mean travel time estimate to this well. Since M46A/1 is 900 feet from the nearest injection well (I26), the 10-month mean travel time equates to an average groundwater velocity of approximately 3 feet per day. The actual 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 monitoring well site M47, Figure 4-19 shows that 1,4-dioxane concentrations remained below the RDL in all zones during 2019, 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 remained below the RDL since early 2016. The decline in 1,4-dioxane concentrations was consistent with the contemporaneous decline in chloride concentrations down to nearly GWRS levels (Figure 4-12), indicating a 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 late 2014 but then remained below the RDL ever since then 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 and east end of the barrier. Also, the inferred groundwater flow direction at M47 in the Lower Rho and Main aquifers appears to consistently be to the east as shown on the Main aquifer groundwater elevation contours previously shown on Figure 4-6. Based on the Figure 4-6 contours, groundwater arriving at M47 in these deeper aquifers may either be 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 2019.

4.4.4 Production Wells

Groundwater quality data for water samples collected during 2019 from several potable and non-potable production wells in the vicinity of the Talbert Barrier are summarized in Table 4-1.

As discussed in Section 1, the GWRS 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.

Table 4-1. 2019 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	2.3 (2.2 - 2.3)	13.8 (12.4 - 14.8)	0.016 (ND - 0.038)	167 (142 - 182)	1.21 (1.19 - 1.22)	ND	0.126 (0.09 - 0.15)	ND	1.28 (1.2 - 1.3)
MCWD-7	793	363 - 753	4,200	1.2	51.6 (50 - 53.1)	0.165 (0.16 - 0.17)	314	0.71 (0.64 - 0.75)	ND	0.215 (0.18 - 0.25)	ND	2.35 (2.1 - 2.6)
NB-DOLD	739	399 - 729	5,300	2 (1.8 - 2.1)	19.6 (19.5 - 19.8)	0.019 (ND - 0.057)	209 (196 - 218)	0.18 (0.16 - 0.19)	ND	0.156 (0.08 - 0.23)	ND	2.67 (2.5 - 2.8)
NB-DOLS	366	201 - 356	5,300	ND	47.2 (45.1 - 48.7)	0.167 (0.16 - 0.173)	378 (360 - 394)	2.45 (2.03 - 2.61)	ND	0.18 (0.10 - 0.22)	ND	ND
MCWD-3B	592	242 - 572	5,400	1.8	29.5 (28.9 - 30.2)	0.064 (ND - 0.118)	266	1.06 (1.00 - 1.10)	0.001 (ND - 0.002)	0.16 (0.15 - 0.17)	ND	3.58 (3.3 - 4)
NB-TAMD	700	395 - 690	5,700	3.5 (3.1 - 3.9)	10.3 (9.2 - 10.9)	0.012 (ND - 0.022)	130 (112 - 154)	0.76 (0.66 - 0.89)	ND	0.112 (0.08 - 0.13)	ND	ND
NB-TAMS	370	170 - 360	5,800	1.3 (1.0 - 1.5)	57.9 (56.6 - 60.1)	0.233 (0.22 - 0.264)	468 (458 - 480)	2.34 (1.64 - 2.57)	0.002 (ND - 0.004)	0.278 (0.25 - 0.30)	ND	0.6 (ND - 1.1)
FV-10	990	460 - 980	7,600	ND	29.0	0.05 (ND - 0.09)	296	1.03 (1.02 - 1.03)	0.003 (ND - 0.006)	0.135 (0.12 - 0.15)	ND	1.88 (1.5 - 2.1)
HB-3A	660	370 - 640	7,600	1.5	45.7 (44.6 - 46.8)	0.24 (0.205 - 0.27)	232 (222 - 242)	0.22 (0.21 - 0.22)	ND	0.41 (0.39 - 0.43)	ND	ND
HB-5	820	223 - 800	8,000	2.4	26.2 (23.4 - 28.9)	0.06 (ND - 0.11)	300	1.40 (1.18 - 1.61)	0.004 (0.003 - 0.005)	0.15	ND	ND
HB-9	996	556 - 996	8,000	ND	15.8 (13.1 - 18.4)	ND	252	0.14 (0.12 - 0.15)	0.005 (ND - 0.009)	0.27	ND	ND
Small System and Private Wells												
GKAW-FV2	125	120 - 125	700	1.2	102 (100 - 104)	0.27 (0.22 - 0.32)	637 (626 - 648)	4.96 (4.71 - 5.21)	0.003 (ND - 0.005)	0.26 (0.24 - 0.27)	ND	5.85 (5.4 - 6.4)
KUBO-FV	133	122 - 132	2,900	1.4	78.7 (78.6 - 78.8)	0.23 (0.19 - 0.26)	598 (582 - 614)	3.83	ND	0.25	ND	ND
LIBM-HB		NA	4,100	0.8 (ND - 1.5)	63.4 (51.4 - 86.1)	0.18 (0.15 - 0.23)	287 (250 - 364)	3.45 (3.00 - 3.89)	ND	0.193 (0.14 - 0.23)	ND	ND
Private Irrigation Wells												
CALL-FV		NA	400	2.2	6.5 (5.5 - 7.5)	ND	119 (102 - 136)	1.64 (1.62 - 1.65)	0.003 (ND - 0.005)	0.115 (0.09 - 0.14)	ND	ND
A1-HB	305	188 - 300	1,800	1.7	35.4 (33.1 - 37.6)	0.12 (0.11 - 0.12)	326 (318 - 342)	1.72 (1.55 - 1.85)	0.008 (ND - 0.016)	0.187 (0.16 - 0.2)	ND	1.35 (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

The Talbert Barrier injection operation complies with the GWRS 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 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.

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 10-year period 2010-2019 are shown on Figure 4-20. NDMA concentrations at MCWD-5 decreased below the RDL in early 2010 and remained below the RDL through 2019. 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 increase 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 2019, concentrations of 1,4-dioxane were low and stable at 1.2 to 1.3 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 2019, 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 declined from 15 to 12 mg/L during 2019

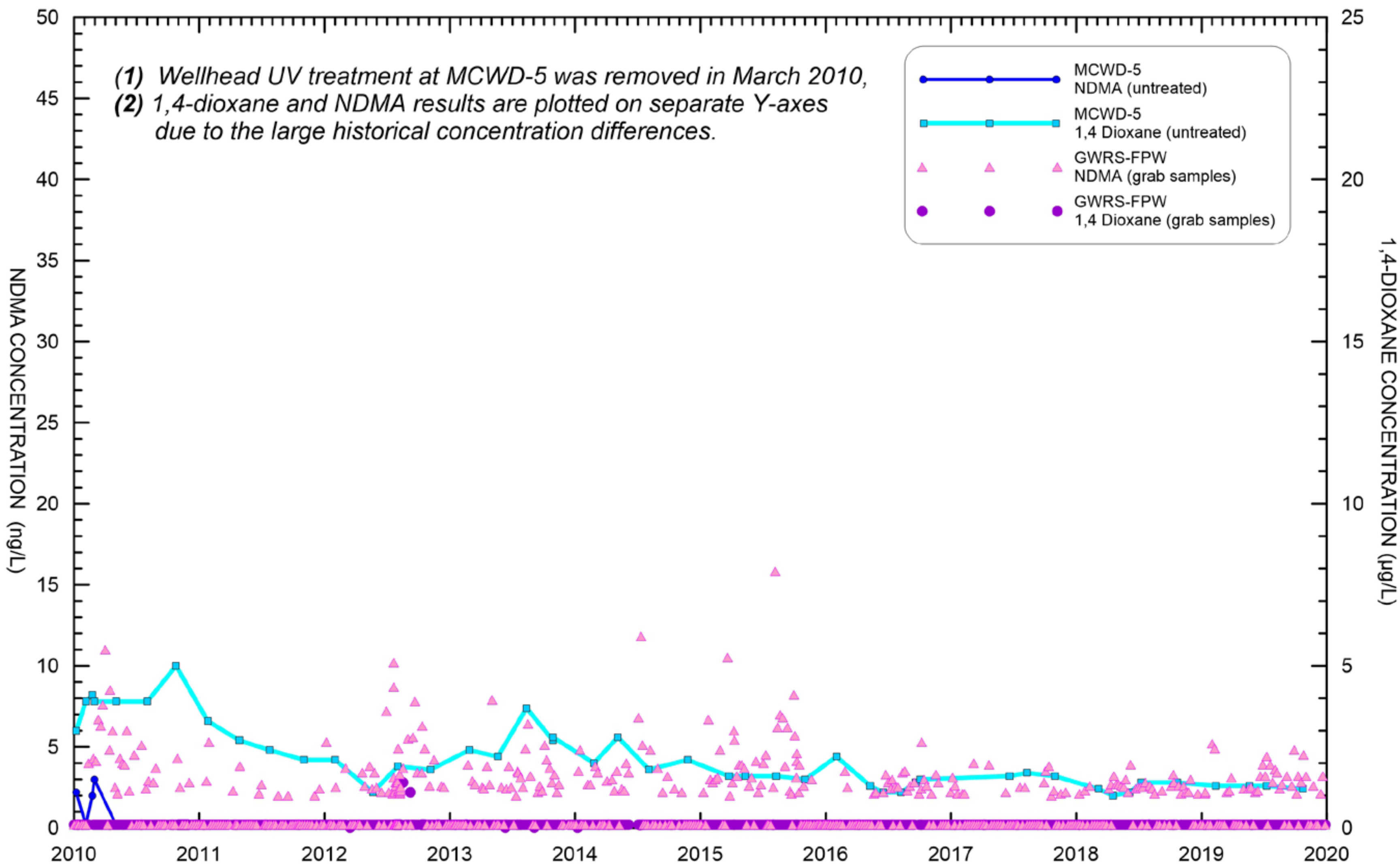


Figure 4-20. MCWD-5 Pre-Treatment and Injection Water 1,4-Dioxane and NDMA Concentrations

(Table 4-1), indicating the progressive arrival of greater proportions of GWRS water and consistent with the decline in 1,4-dioxane concentrations just slightly above the RDL.

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 20 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 lower 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 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 range of 23 to 29 mg/L in 2019 (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 chloride concentration during 2019 decreased from 18 mg/L in April down to 13 mg/L in November (Table 4-1), which is still within the lower end of the historical range for this well; continued decline of chloride concentrations below 10 mg/L at HB-9 could signal arrival of GWRS water. Neither NDMA or 1,4-dioxane were detected in either HB-5 or HB-9 during 2019.

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 GWRS purified recycled water 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. During 2019, chloride concentrations ranged from 100 to 104 mg/L while 1,4-dioxane concentrations ranged from 5.4 to 6.4 μg/L at GKAW-FV2/1 (Table 4-1), both indicative of pre-GWRS injection water and possibly some proportion of ambient groundwater. Since the inception of GWRS however, the groundwater flow direction in the Alpha aquifer at Well GKAW-FV2/1 is likely seaward towards the barrier. OCWD has contacted DDW and the RWQCB regarding Well GKAW-FV2/1.

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

During 2019 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 facilities;
- Spreading water sources;
- Spreading water volumes; and
- K-M-M-L Basins operations.

5.1 Spreading Facilities

Table 5-1 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 5-1. 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 5-1, GWRS purified recycled water recharge first began at Miller Basin on January 17, 2008.

Figure 5-1. 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 5-2, 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.

La Palma Basin is the newest spreading basin located south of Kraemer and Miraloma Basins along Carbon Canyon Diversion Channel as shown on Figure 5-3. 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 2019.

Figure 5-2. Miraloma Basin with GWRS Purified Recycled Water in 2012

Figure 5-3. La Palma Basin with GWRS Purified Recycled Water in 2016

5.2 Spreading Water Sources

Water from three sources was percolated at K-M-M-L Basins in 2019: (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 (Figure 1-6 and Figure 1-7). 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 formally recorded 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 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 2019. Since determination of the RWC is no longer required, the two non-GWRS sources are grouped together herein as “other water.”

5.3 Spreading Water Volumes and Flow Rates

Spreading water volumes recharged in the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins area in 2019 are presented below and compared with historical spreading amounts in this area.

5.3.1 2019 Spreading Water Quantities

Table 5-2 presents the monthly recharge volumes at each of the individual recharge basins in this area. A total volume of approximately 38,598 MG (118,454 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 2019.

Table 5-3 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 2019 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, GWRS Pipeline, flow measurement/metering inaccuracies, and unmeasured rainfall and local runoff to the basins. Based on AWPF flow meter records during 2019, the following volumes and average daily flow rates of GWRS purified recycled water were delivered to the Anaheim Forebay:

- Kraemer Basin received approximately 644 MG (1,978 AF), or 1.77 MGD on average;
- Miller Basin received none (not used);
- Miraloma Basin received approximately 4,935 MG (15,144 AF), or 13.52 MGD on average; and
- La Palma Basin received approximately 18,661 MG (57,269 AF), or 51.13 MGD on average.

The total volume of GWRS purified recycled water delivered to the K-M-M-L Basins during 2019 was 24,240 MG (74,391 AF). The annual average daily flow rate of GWRS purified recycled water spread in 2019 was 66.41 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.

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 2019, a total of approximately 14,318 MG (43,940 AF) of the two other (non-GWRS) sources was recharged in this area of the Anaheim Forebay. Kraemer and Miller Basins received primarily other water during 2019. Conversely, Miraloma and La Palma Basins received GWRS purified recycled water during 2019 (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.

Table 5-2. 2019 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	
	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]	(AF)	(MG)
Jan	0	648	178	470	0	1,150	135	1,015	1,955	0	22	1,933	4,714	0	1	4,713	2,704	67	0	10,902	3,552
Feb	0	1,209	-20	1,229	0	1,206	79	1,127	2,272	0	-18	2,289	4,305	0	47	4,258	2,542	159	189	11,793	3,843
Mar	0	889	-88	977	0	1,647	0	1,647	1,617	0	12	1,605	5,674	0	-1	5,675	2,599	154	357	13,014	4,241
Apr	0	0	-299	299	0	536	-214	750	1,253	0	-12	1,264	4,828	0	8	4,820	1,936	316	589	9,974	3,250
May	0	6	-141	147	0	13	4	9	224	0	-9	233	5,213	0	6	5,207	1,946	328	745	8,615	2,807
Jun	0	-456[3]	-466	10	0	440	1	439	422	0	2	420	5,421	0	6	5,415	459	46	342	7,131	2,324
Jul	362	0	24	338	0	138	-5	143	688	0	6	682	4,757	0	4	4,753	17	0	81	6,014	1,960
Aug	1,025	431	158	1,298	0	83	27	56	894	0	-2	896	3,830	0	-15	3,845	0	0	0	6,095	1,986
Sep	0	4,977	165	4,812	0	1,788	1	1,787	925	0	1	924	4,636	0	9	4,627	0	191	702	13,043	4,250
Oct	0	1,881	-112	1,993	0	1,222	-9	1,231	1,222	0	36	1,186	4,885	0	-2	4,887	1,433	314	579	11,623	3,787
Nov	0	2,646	117	2,529	0	0	-17	17	2,538	0	9	2,529	4,035	0	13	4,022	492	56	311	9,956	3,244
Dec	591	278	-129	998	0	1,147	143	1,004	1,137	0	60	1,076	4,971	0	162	4,809	2,083	189	135	10,294	3,354
TOTAL	**1,978**	**12,509**	**-613**	**15,100**	**0**	**9,370**	**145**	**9,225**	**15,144**	**0**	**107**	**15,037**	**57,269**	**0**	**238**	**57,031**	**16,211**	**1,820**	**4,030**	**118,454**	**38,598**

[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 value is 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 5-3. 2019 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	
	(Avg. MGD)	(AF)	(Avg. MGD)	(AF)	(Avg. MGD)	(AF)	(AF)	(AF)	(MG)
January	70.1	6,669	48.0	4,569	118.1	11,238	336	10,902	3,552
February	76.5	6,577	61.7	5,305	138.3	11,882	88	11,793	3,843
March	76.6	7,291	59.3	5,646	136.0	12,937	(77)	13,014	4,241
April	66.0	6,080	36.7	3,377	102.7	9,457	(517)	9,974	3,250
May	57.2	5,437	31.9	3,038	89.1	8,475	(140)	8,615	2,807
June	63.5	5,843	9.0	831	72.5	6,674	(457)	7,131	2,324
July	61.0	5,807	2.5	236	63.5	6,043	29	6,014	1,960
August	60.4	5,750	5.4	514	65.8	6,263	168	6,095	1,986
September	60.4	5,560	83.2	7,658	143.6	13,218	176	13,043	4,250
October	64.2	6,107	57.1	5,429	121.3	11,536	(87)	11,623	3,787
November	71.4	6,573	38.1	3,505	109.5	10,078	122	9,956	3,244
December	70.4	6,698	40.3	3,832	110.7	10,530	236	10,294	3,354
TOTAL	**66.4**	**74,391**	**39.2**	**43,940**	**105.6**	**118,331**	**(123)**	**118,454**	**38,598**

[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).

Figure 5-4 illustrates the total 2019 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 24,240 MG (74,391 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 97% of the GWRS purified recycled water pumped to the Anaheim Forebay was recharged at Miraloma and La Palma Basins during 2019.

Figure 5-4 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 2019, ranging from 5,437 AF in May to over 7,291 AF in March. The amounts of other water (SAR water and imported water) varied seasonally depending on availability. Other water monthly volumes ranged from approximately 200 to 7,600 AF. The monthly volume of GWRS purified recycled water exceeded the monthly volume of other water in 11 months during 2019: all except September.

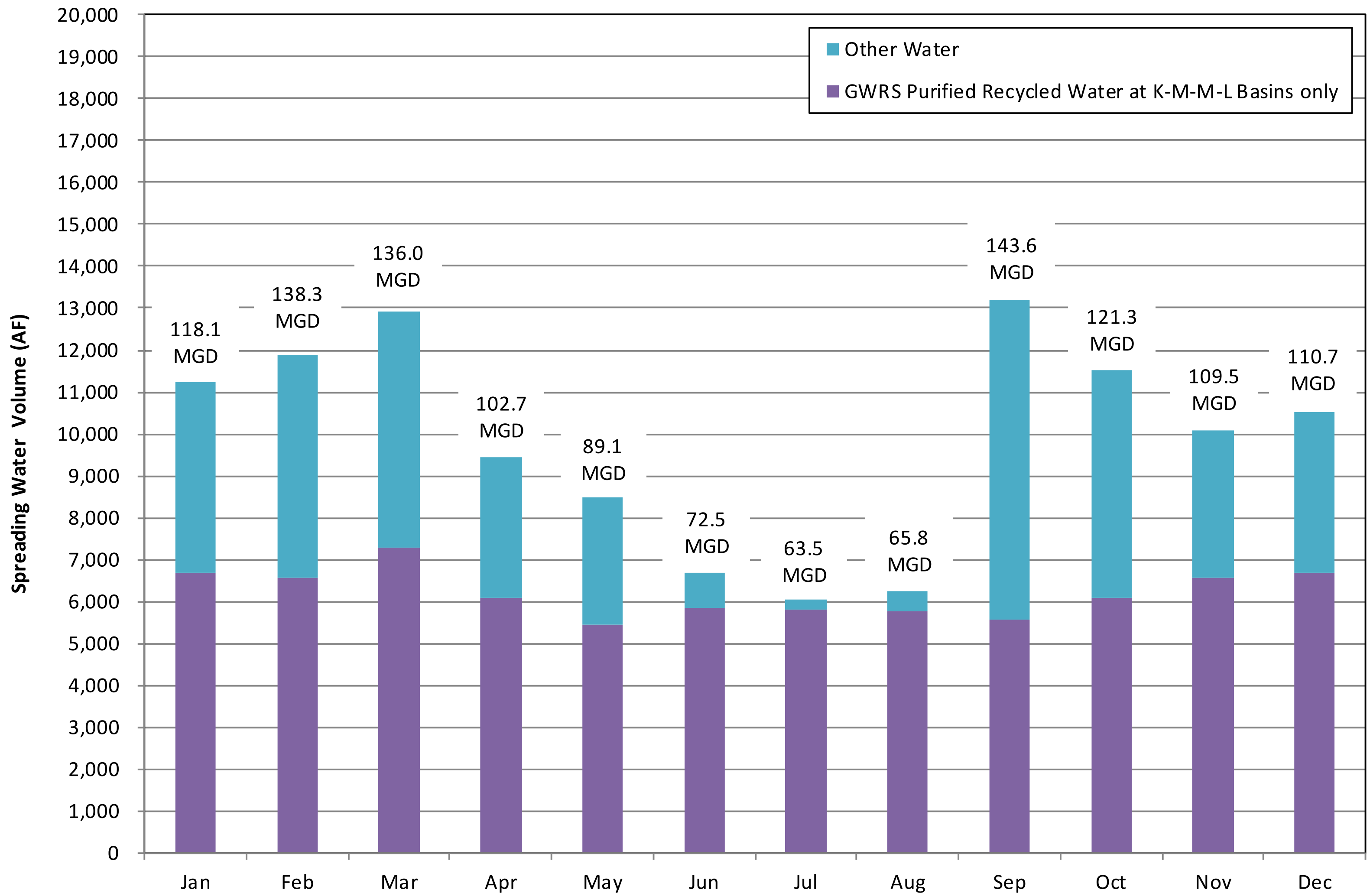
The average daily flow rate of GWRS purified recycled water recharged at K-M-M-L Basins was 66.4 MGD during 2019. The combined average daily flow rate of other water (SAR water and imported water) recharged at Anaheim Lake/Mini-Anaheim Lake/Kraemer-Miller/La Jolla Basins was approximately 39.2 MGD.

5.3.2 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 2019. Purified recycled water spreading began at Miller Basin in January 2008 and continued through 2017; while available, Miller Basin was not used for GWRS recharge in 2018 or 2019. Purified recycled water spreading began at Miraloma Basin in July 2012 and continued through2019. Purified recycled water spreading began at La Palma Basin when this basin first became operational in November 2016 and continued through 2019.

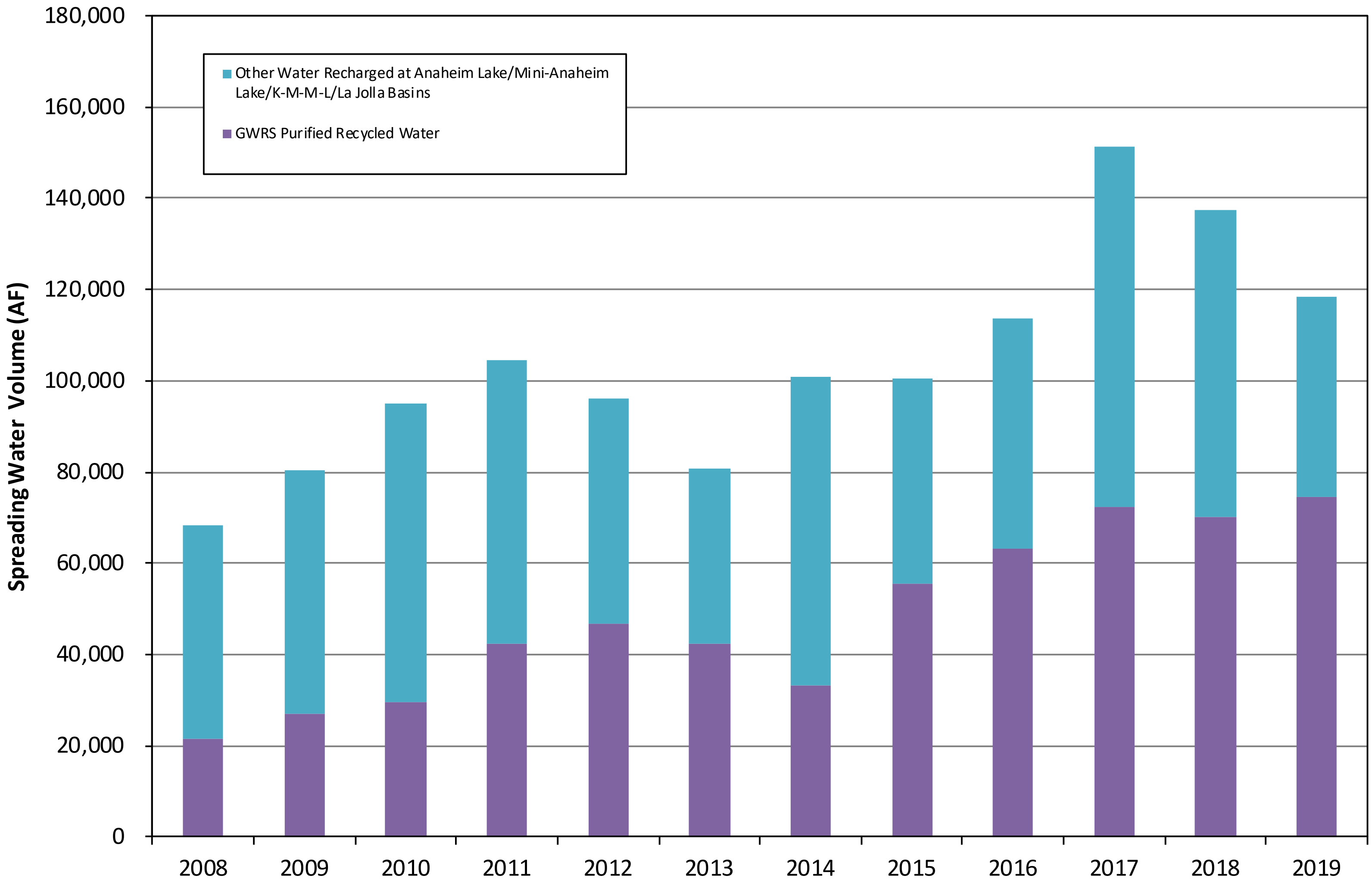
Figure 5-5 compares the volume of purified recycled water and other water recharged at K-M-M-L Basins in 2019 with historical recharge data since the GWRS began operation in January 2008. Since 2008, the highest purified recycled water volume that was delivered to K-M-M-L Basins occurred in 2019 (24,240 MG or 74,391 AF). The purified recycled water delivered to K-M-M-L Basins in 2019 was nearly 6% greater than the 2018 volume, which was limited by the GWRS Pipeline Rehabilitation Project that prevented deliveries to the Forebay for about six weeks.

Figure 5-5 also shows that the combined total of 118,454 AF (GWRS and other water) recharged at Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins during 2019 was approximately 13% lower than the 2018 volume. Less imported replenishment water was purchased and recharged during 2019 than 2018.



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

Figure 5-4. 2019 Spreading Water Sources and Volumes in Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins



Note: Other water consists of SAR water and imported water

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

Table 5-4 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. Regarding other water sources (SAR water and imported water), approximately 34% less non-GWRS water was recharged at the Anaheim Forebay in 2019 (43,940 AF) than in 2018 (67,017 AF) due to reduced purchases of imported water.

Table 5-4. 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)	(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
2019	43,940	74,391	118,454	38,598
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.

5.4 K-M-M-L Basins Operations

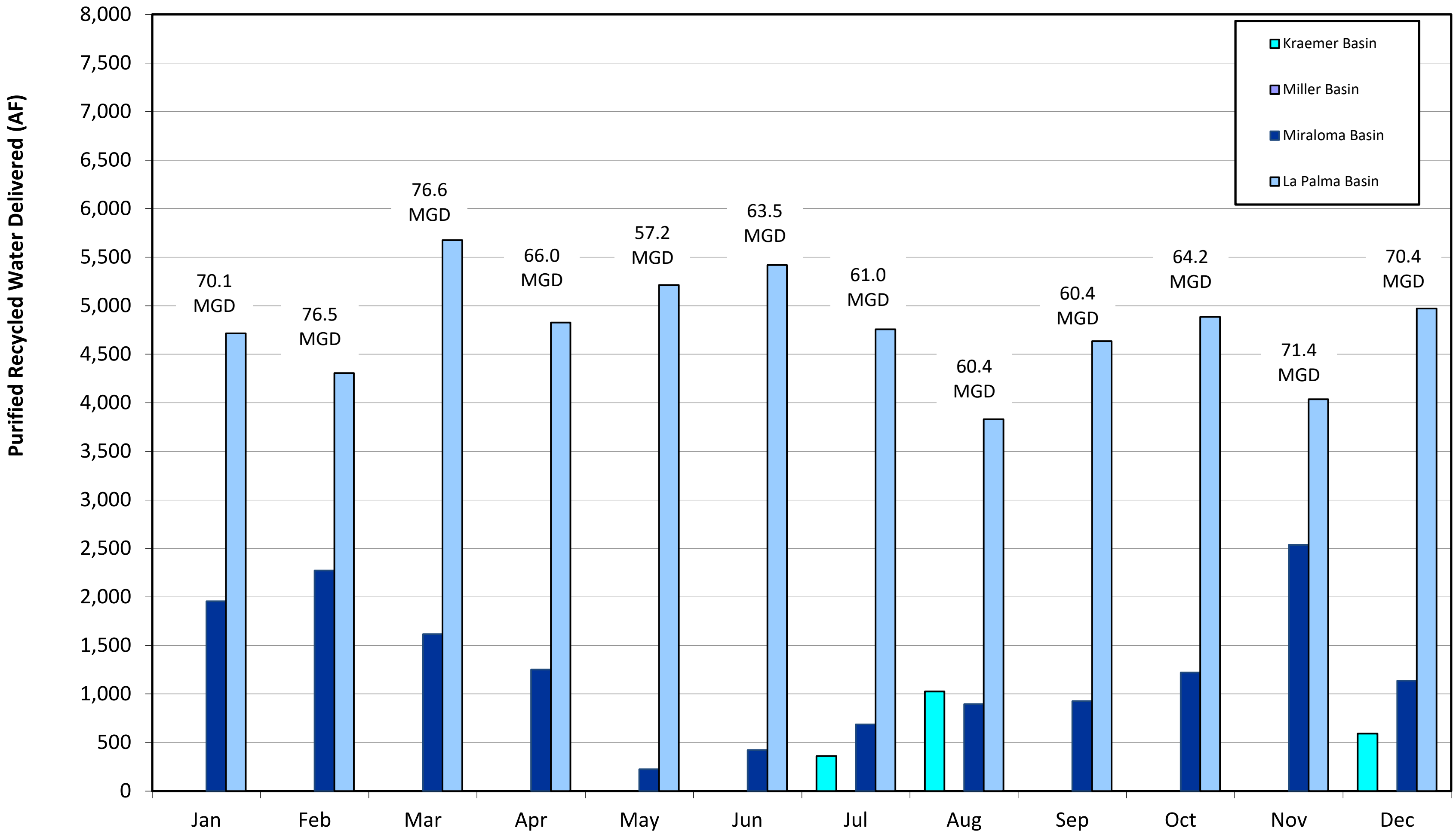
Purified recycled water produced by the AWPF was pumped to the Anaheim Forebay and spread at K-M-M-L Basins in 2019. Kraemer and Miller Basins have received purified recycled water since January 2008 (except that Miller Basin was not used in 2018-2019). Miraloma Basin has received purified recycled water 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 2019, as detailed in Table 5-5 and illustrated on Figure 5-6. La Palma Basin received almost four 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 2019. These latter two spreading basins were primarily utilized to recharge other water during 2019.

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 5-5. 2019 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	1,955	637	20.5	4,714	1,536	49.6	6,669	2,173	70.1
February	0	0	0.0	0	0	0.0	2,272	740	26.4	4,305	1,403	50.1	6,577	2,143	76.5
March	0	0	0.0	0	0	0.0	1,617	527	17.0	5,674	1,849	59.6	7,291	2,376	76.6
April	0	0	0.0	0	0	0.0	1,253	408	13.6	4,828	1,573	52.4	6,080	1,981	66.0
May	0	0	0.0	0	0	0.0	224	73	2.4	5,213	1,699	54.8	5,437	1,772	57.2
June	0	0	0.0	0	0	0.0	422	137	4.6	5,421	1,766	58.9	5,843	1,904	63.5
July	362	118	3.8	0	0	0.0	688	224	7.2	4,757	1,550	50.0	5,807	1,892	61.0
August	334	334	10.8	0	0	0.0	894	291	9.4	3,830	1,248	40.3	5,750	1,874	60.4
September	0	0	0.0	0	0	0.0	925	301	10.0	4,636	1,511	50.4	5,560	1,812	60.4
October	0	0	0.0	0	0	0.0	1,222	398	12.8	4,885	1,592	51.3	6,107	1,990	64.2
November	0	0	0.0	0	0	0.0	2,538	827	27.6	4,035	1,315	43.8	6,573	2,142	71.4
December	591	192	6.2	0	0	0.0	1,137	370	11.9	4,971	1,620	52.2	6,698	2,183	70.4
TOTAL	**1,287**	**645**	**1.8**	**0**	**0**	**0.0**	**15,144**	**4,935**	**13.5**	**57,269**	**18,661**	**51.1**	**74,391**	**24,240**	**66.4**



Note: Average Flow Rate in MGD to All Basins

Figure 5-6. 2019 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 initially 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 2019 marks 12 years of Forebay compliance monitoring at the well sites specified in the GWRS permit (RWQCB, 2004, 2008, 2014a,2016, and 2019). This section describes the following for calendar year 2019:

- 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 vast 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, 2018), 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, 2016, and 2019), the following OCWD monitoring well sites in the vicinity of K-M-M-L Basins were sampled in 2019: 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 2019 because of its 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

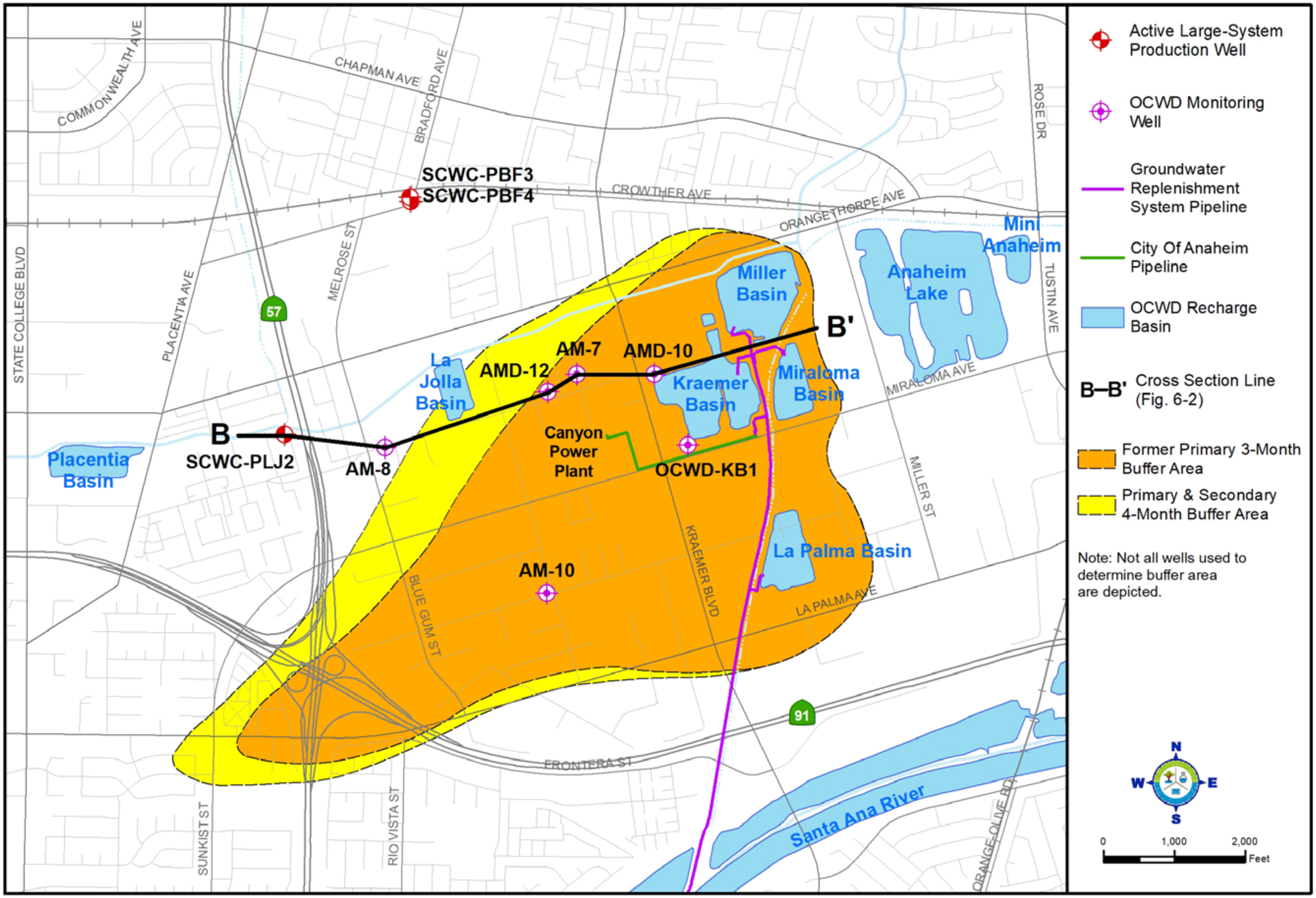


Figure 6-1. Selected Forebay Monitoring Well Locations and Buffer Areas

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, 2019. 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 2019 contour patterns are similar to those shown for June 2018 presented in last year's Annual Report. Due to the large volume of recharge into La Palma Basin during 2019, Figure 6-3 shows that the groundwater flow direction towards compliance monitoring well AM-10 likely originated from La Palma Basin in June 2019 for the third straight year since commencement of operations at that basin. Prior to recharge at La Palma Basin, the groundwater flow direction towards AM-10 typically originated 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.

The June 2019 Shallow aquifer groundwater elevations shown in Figure 6-3 were lower overall than in June 2018, by approximately 5 feet in the outlying Anaheim Forebay area downgradient of the recharge basins (e.g., at AM-8 and AM-10), by 10 feet surrounding La Palma Basin, and by as much as 25 feet lower immediately surrounding Miller 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 2019 were approximately 155 feet above mean sea level and formed an enclosed mound as in June 2018 due to the cumulative recharge of all these basins. However, in June 2019 the enclosed mound extended farther south and fully encompassed La Palma Basin which had much greater recharge compared to the other basins in June 2019 just prior to the measurement of groundwater levels at the end of June that were used for preparation of the contours shown in Figure 6-3. In June 2019, La Palma Basin recharge totaled 5,415 AF, while all the other basins combined totaled only 1,716 AF (Table 5-1).

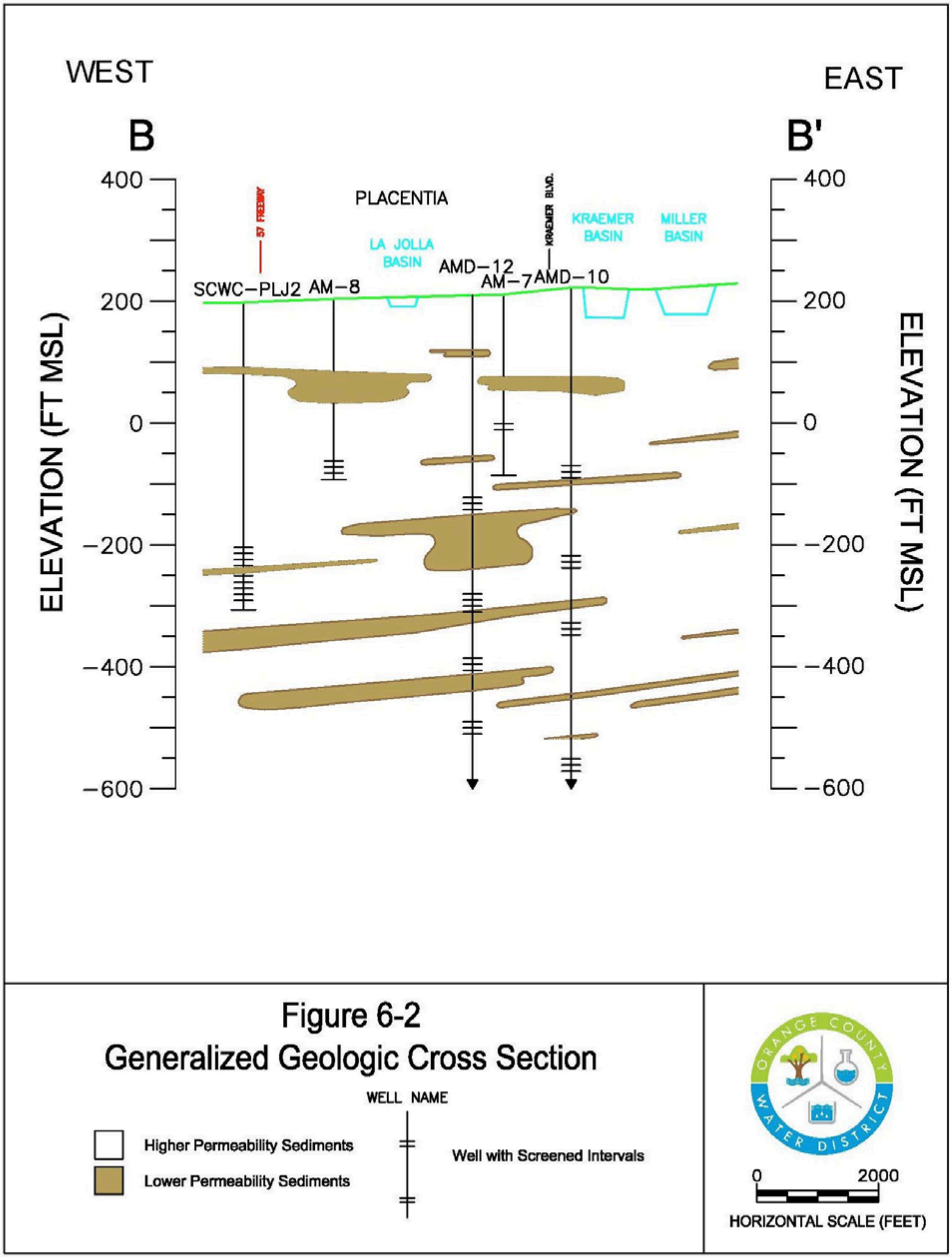


Figure 6-2. Generalized Geologic Cross Section in the Anaheim Forebay

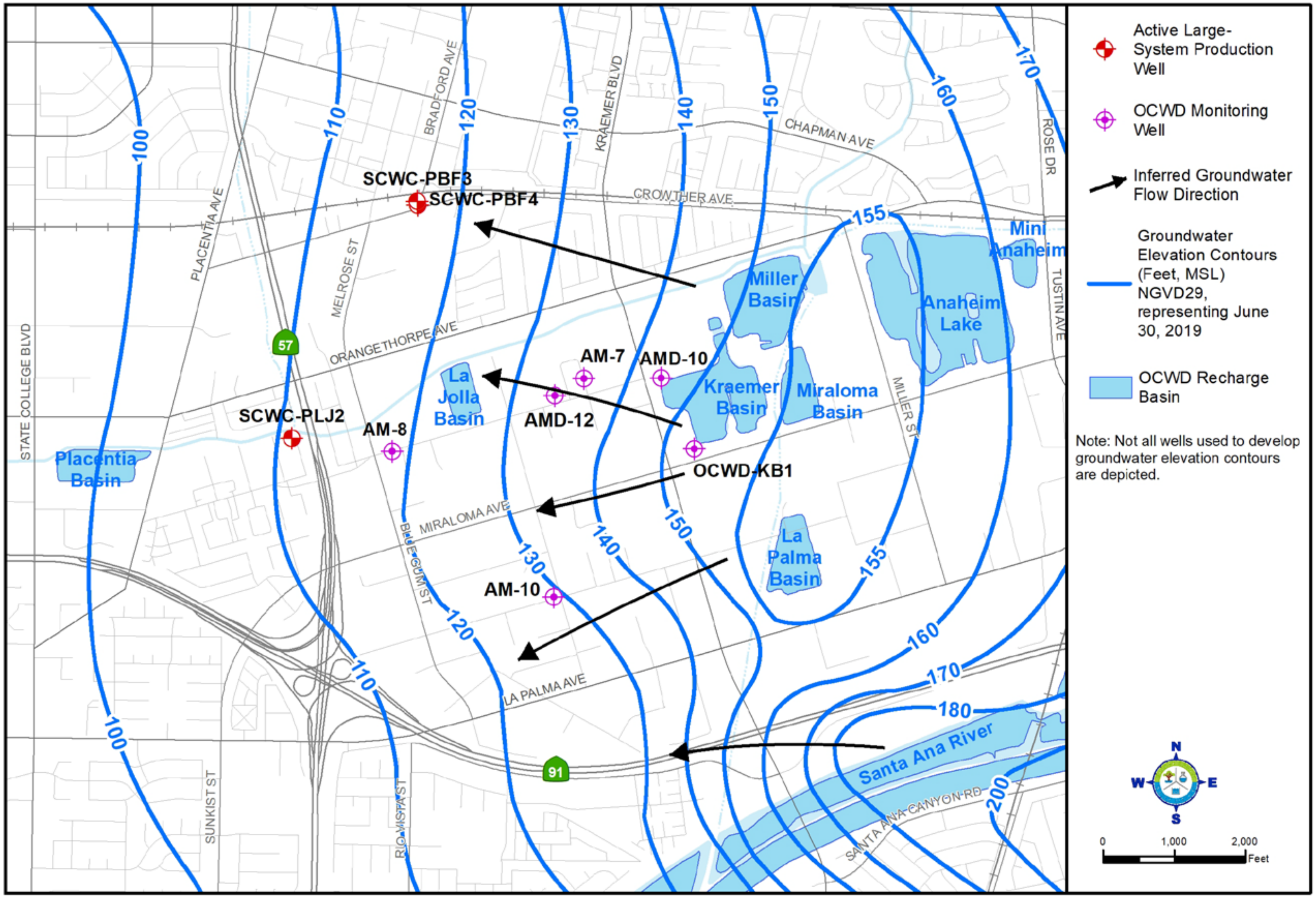


Figure 6-3. Shallow Aquifer Groundwater Elevation Contours and Inferred Groundwater Flow Directions in the Anaheim Forebay Area

Although groundwater storage conditions basin-wide were higher in June 2019 than in June 2018, groundwater levels were lower in June 2019 than in June 2018 in the vicinity of the OCWD spreading grounds in Anaheim (Figure 6-3) primarily because June 2019 recharge from the entire Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins complex was only about half of what it was in June 2018 due to the large volume of imported water recharged during the summer of 2018. In fact, due to the lesser amount of imported water purchased for direct replenishment, annual recharge from the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins complex was 13% lower in 2019 than in 2018 (Table 5-4 and Figure 5-5).

From June 2018 to June 2019, Shallow aquifer groundwater elevations dropped by approximately 13 feet near AMD-10 adjacent to Kraemer Basin and by approximately 5 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 25 feet in June 2019 (Figure 6-3) as compared to 33 feet in June 2018, indicating that the gradient in this area decreased. Farther south, the groundwater elevation difference from the northeast corner of La Palma Basin to downgradient compliance well AM-10 was approximately 28 feet in June 2019 (Figure 6-3) as compared to 38 feet in June 2018, indicating a slightly flatter gradient also along this southerly flow path.

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 2010-2019. 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 2019, groundwater level trends followed the typical seasonal pattern described above at all six monitoring wells. During the first quarter, groundwater levels rose slightly by 5 to 10 feet at all six wells and peaked at the end of March from increased recharge at the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins complex (Figure 6-1) due to SAR storm flows and reduced pumping demand stemming from above average rainfall that winter. During the second quarter, groundwater levels decreased slightly by 5 to 10 feet due to reduced SAR flows and increased pumping as the season warmed.

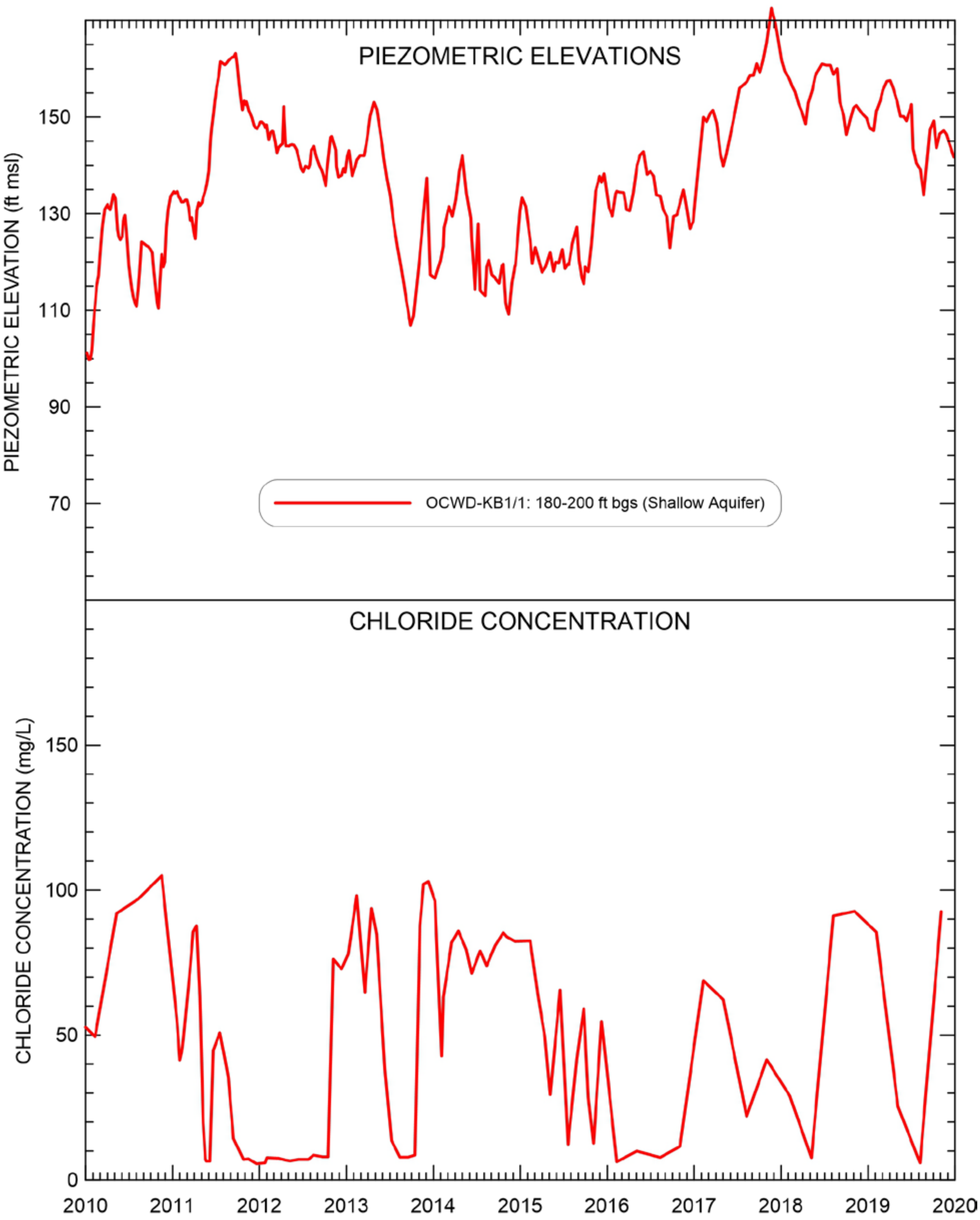


Figure 6-4. Monitoring Well OCWD-KB1 Piezometric Elevations and Chloride Concentration

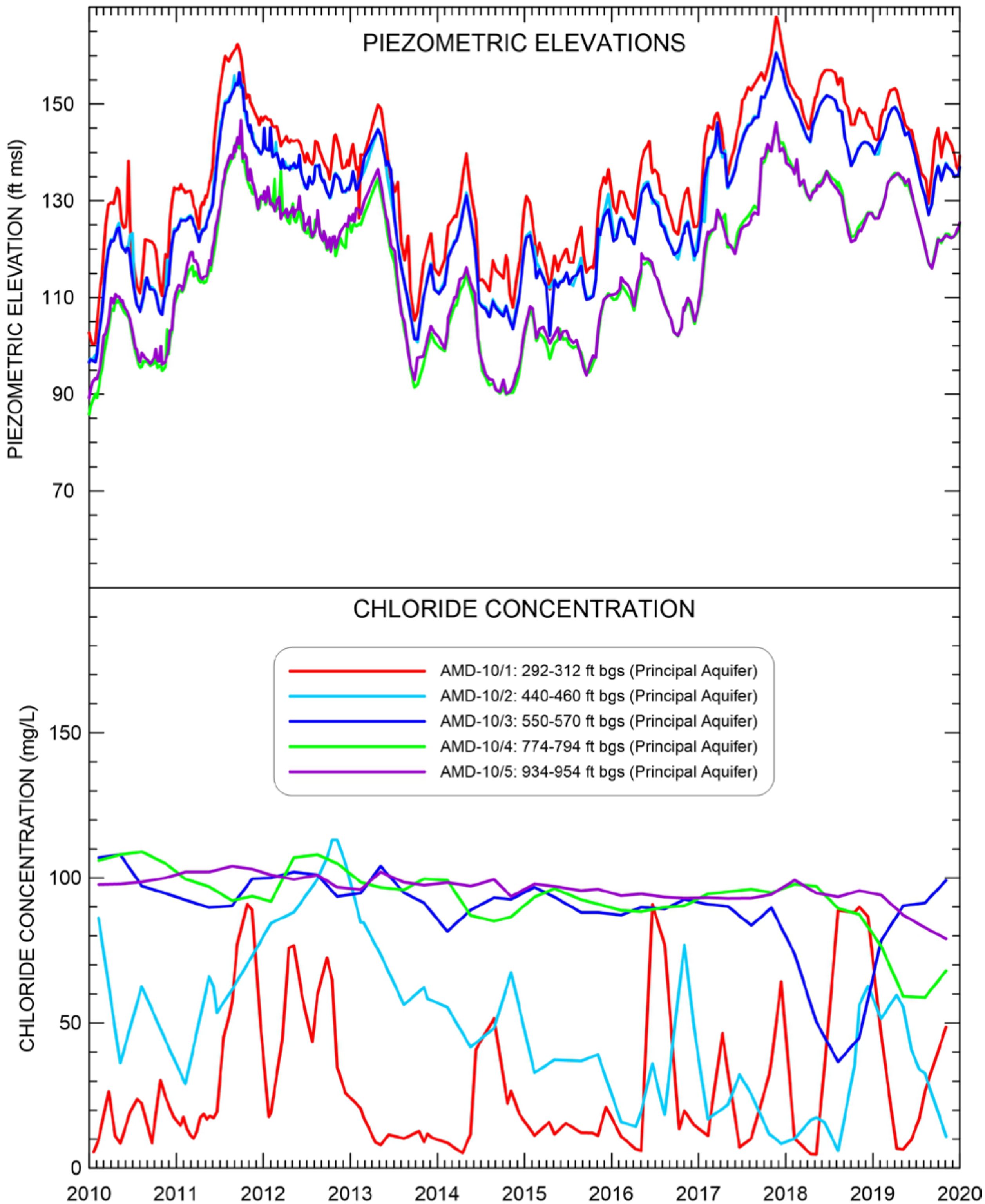


Figure 6-5. Monitoring Well AMD-10 Piezometric Elevations and Chloride Concentration

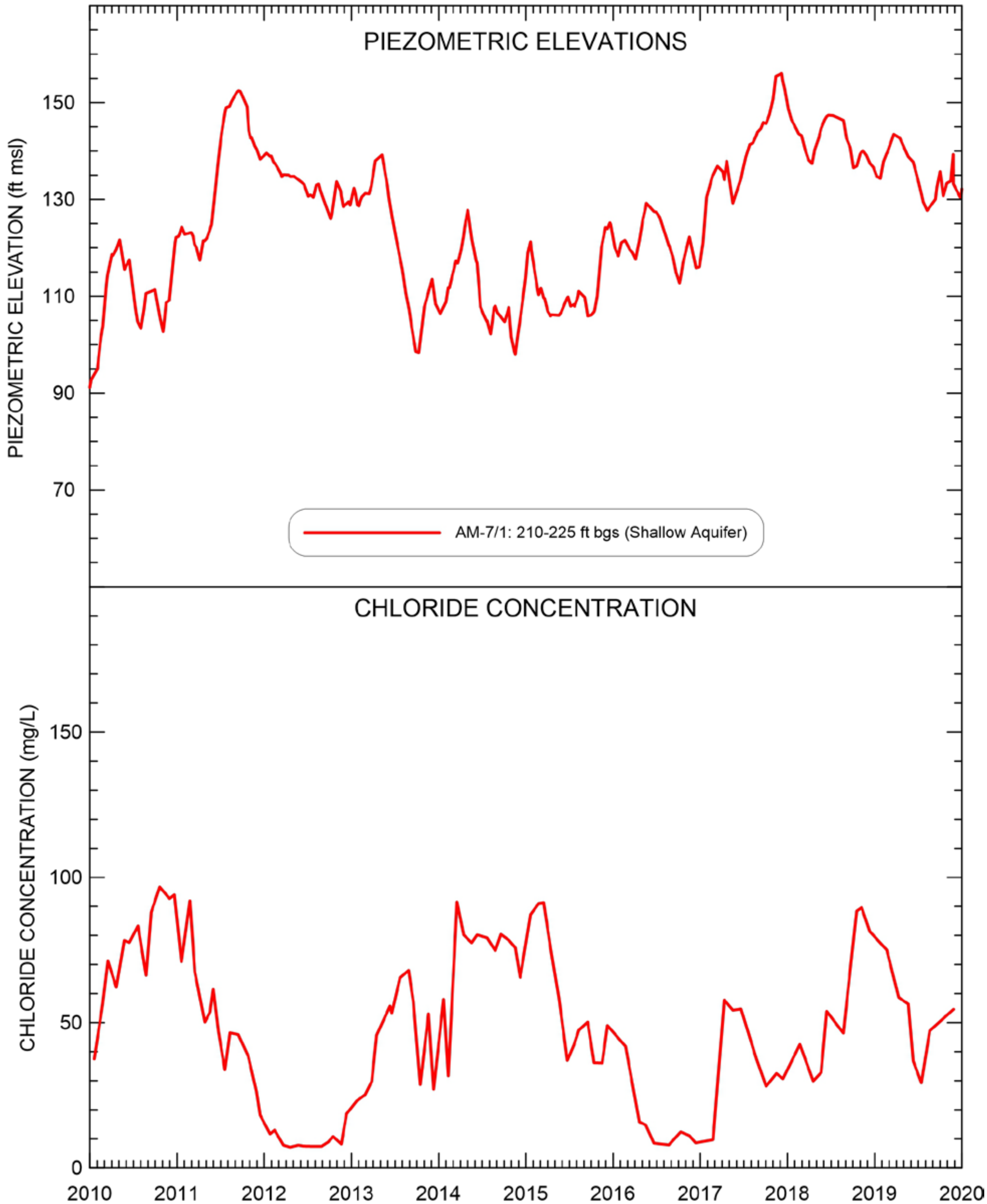


Figure 6-6. Monitoring Well AM-7 Piezometric Elevations and Chloride Concentration

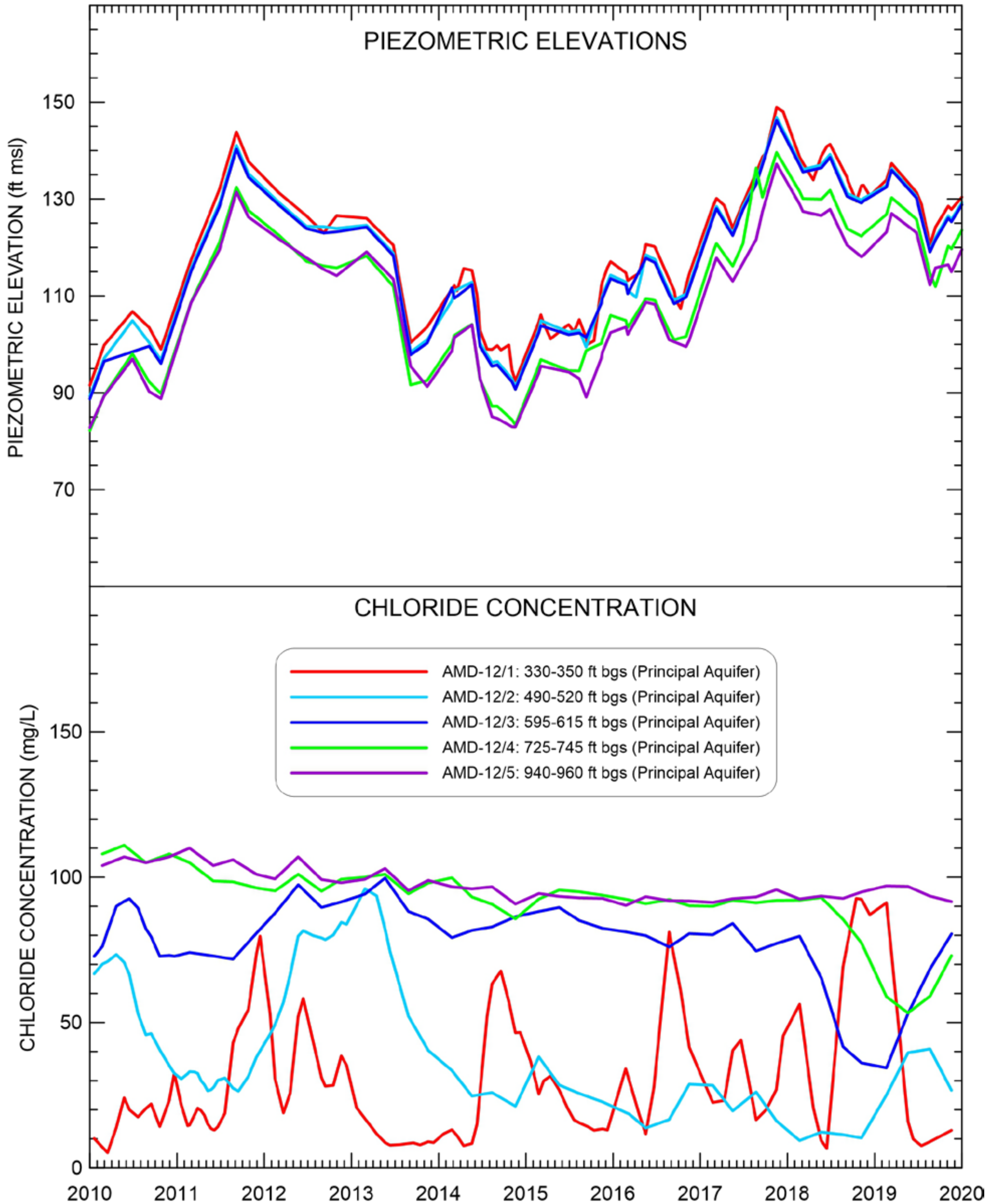


Figure 6-7. Monitoring Well AMD-12 Piezometric Elevations and Chloride Concentration

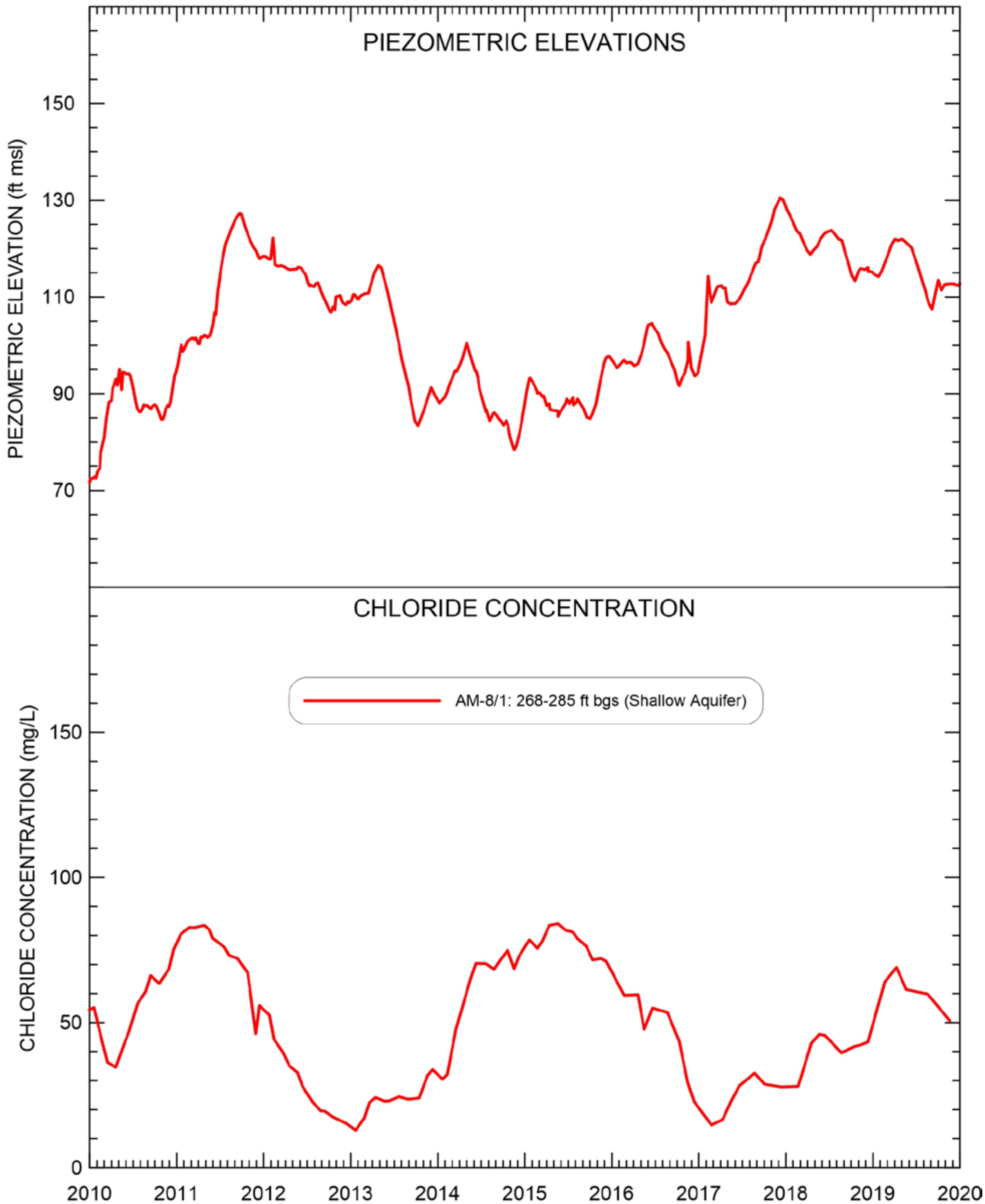


Figure 6-8. Monitoring Well AM-8 Piezometric Elevations and Chloride Concentration

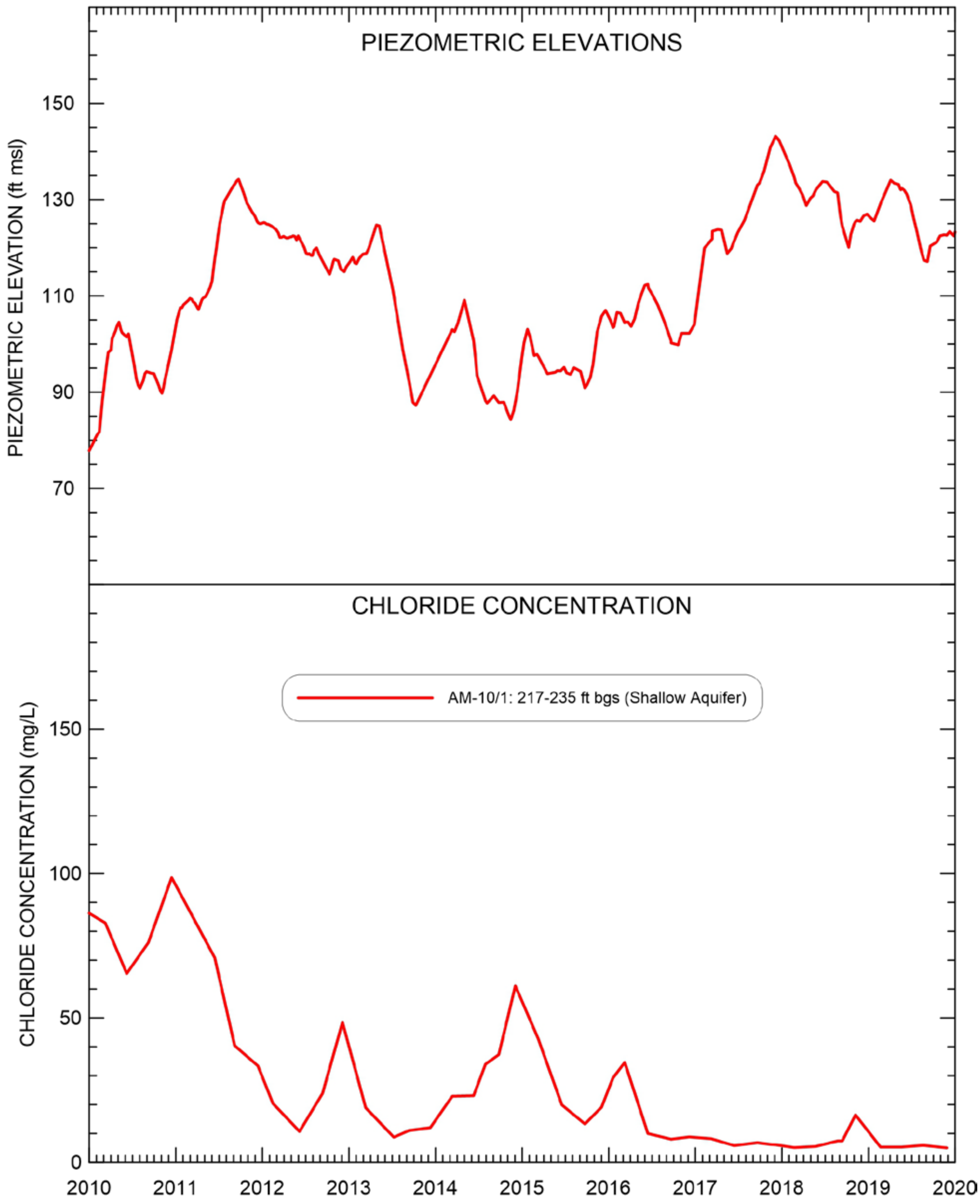


Figure 6-9. Monitoring Well AM-10 Piezometric Elevations and Chloride Concentration

During the third quarter, groundwater levels continued to decline slightly by an additional 5 to 10 feet down to an annual low by the end of August resulting from increased summer pumping and low monthly recharge from the Anaheim Lake/Mini-Anaheim Lake/K-M-M-L/La Jolla Basins complex due to limited SAR flows and no imported MWD replenishment water. The relatively mild decline would have been more significant if not for the continued recharge of relatively large volumes of GWRS water in La Palma Basin. Groundwater levels rebounded in September, rising by 5 to 15 feet as recharge more than doubled in September from the low amount in August due to purchases of MWD imported replenishment water.

During the fourth quarter, groundwater levels remained relatively stable, experiencing a slight downturn of 5 feet or less, except at nested monitoring wells AMD-10 and AMD-12 screened in the Principal aquifer that experienced a slight increase of less than 5 feet. The relatively stable groundwater levels during the fourth quarter indicated that moderate monthly recharge from continued MWD replenishment water purchases along with early season rainfall helped to offset groundwater production.

At all six monitoring wells, groundwater levels at the end of 2019 were approximately 1 to 7 feet lower than at the beginning of the year and approximately 25 to 30 feet lower than the historical high experienced in late 2017. At OCWD-KB1, the historically high 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 2019, groundwater levels at OCWD-KB1 were over 80 feet below ground surface or more than 30 feet below the bottom of Kraemer Basin, indicating the likely presence of an unsaturated zone beneath the basin more conducive for recharge operations as the Kraemer Basin recharge volume in December 2019 was relatively low at approximately 1,000 AF.

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 as evidenced by water quality trends in the next section.

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 2019 are presented in Appendix J. General groundwater quality data for 2015-2019 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 2019, 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 2019. During 2019, 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 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. The particulate iron from the corroding well casings may cause increased levels of color, odor, and manganese at these two monitoring well sites. All the other Secondary MCL exceedances at AM-8 and AMD-10 during 2019 were consistent with the prior monitoring data collected from 2008-2019 and were not associated with the presence of GWRS purified recycled water. Lastly, microbial detections are no longer a reporting requirement 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). In 2018 the groundwater monitoring program was revised to monitor annually in lieu of quarterly for total nitrogen, thiobencarb, and foaming agents and eliminate total coliform monitoring (RWQCB, 2018 and DDW, 2018a).

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 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 2010-2019 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. Since the running 10-year period shown in these figures begins in 2010, the first arrival of the low-chloride GWRS signal at many of these monitoring wells is not shown in these figures and is discussed more thoroughly in Section 6.4.2 of prior years' Annual Reports, especially for wells found to have a discernable travel time of less than two years originating from recharge of GWRS water beginning in January 2008 at Kraemer-Miller Basins.

Prior to GWRS start-up in January 2008, chloride concentrations in all six 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 were 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 was 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. 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 annual average chloride concentration of GWRS water has ranged from 4 to 11 mg/L since 2008 and has been 5 mg/L the last three years and is largely dependent on OCSD feed water quality and the collective performance and age of the AWPF RO membranes.

Comparing Table 5-2, Table 5-3, and Figure 5-4 presented 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 2019. These factors influence the strength of the GWRS low chloride signal, as well as where and when it is 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 sustained low chloride concentrations of 10 mg/L or less at OCWD-KB1/1 in 2016 indicated the sustained arrival of GWRS water from 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 volume of non-GWRS recharge in Kraemer Basin beginning one month prior in January 2017, thus confirming the one-month travel time from Kraemer Basin. Similarly, high chloride concentrations over 90 mg/L at OCWD-KB1/1 during the second half of 2018 indicated the sustained arrival of non-GWRS water from adjacent Kraemer Basin.

During 2019, Figure 6-4 shows that chloride concentrations at OCWD-KB1/1 decreased sharply from May down to a low of 6 mg/L by early August, but this time indicating the arrival of GWRS water from the large volumes recharged in Miraloma Basin four months prior in January through April while Kraemer Basin was contemporaneously being recharged with low volumes of non-GWRS water averaging less than 1,000 AF per month. This indicates a travel time of approximately four months for Miraloma Basin recharge to arrive at OCWD-KB1/1 in the Shallow aquifer when Kraemer Basin is either off-line or being operated at relatively low monthly recharge volumes of approximately 1,000 AF or less. Chloride concentrations at OCWD-KB1/1 subsequently climbed back up above 90 mg/L by early November, once again indicating the shorter one-month arrival time of non-GWRS water recharged in large volumes at adjacent Kraemer Basin from September through November.

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 three years in part from the newer La Palma Basin as well as continued high Basin storage conditions. During 2019, Figure 6-5 shows that chloride concentrations at AMD-10/1 decreased sharply from February down to low GWRS levels by June, 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 from December 2018 through April 2019. Chloride concentrations at AMD-10/1 subsequently increased to nearly 50 mg/L during the second half of 2019, similar to the contemporaneous trend at OCWD-KB1/1 and likely indicating arrival of non-GWRS water from the large volumes recharged at Kraemer Basin from September through November of 2019.

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 from 2017-2019 (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 when Kraemer Basin is fully operational, 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 deeper 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 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, Figure 6-6 shows the sustained arrival of GWRS water at AM-7/1 during the second half of 2016 based on low chloride concentrations remaining at or near GWRS levels during that time, nearly identical to the chloride trend at OCWD-KB1/1 (Figure 6-4) but lagged by 2 to 3 months. During 2019, 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 2019 did not get as low as GWRS concentrations 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 2019 reached 55 mg/L, similar to but more dampened than at OCWD-KB1/1.

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, Figure 6-7 shows that chloride concentration trends at AMD-12/1 during 2019 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. During 2019, chloride concentrations at AMD-12/1 decreased sharply from May down to low GWRS levels through August, correlative with a similar chloride decline to GWRS levels at AMD-10/1 (Figure 6-5) three months prior. Chloride concentrations at AMD-12/1 subsequently began to rise in the fourth quarter of 2019, consistent with the same trend at AMD-10/1 but once again lagged by approximately 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 concentration trends are consistent with those at AM-7/1 but lagged by about 2 months and slightly more dampened due to dispersive transport along this more distant flow path. For example, Figure 6-8 shows that chloride concentrations at AM-8/1 declined during late 2016 to a low of 15 mg/L by early 2017, indicating a relatively large proportion of GWRS water but less than 100% and exhibiting a weaker GWRS signal that did not appear to be sustained for as long as the corresponding event at AM-

7/1 approximately 2 months prior. 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 2019, chloride concentrations at AM-8/1 rose to 69 mg/L by April, before decreasing slightly during the second half of the year to 51 mg/L in November, once again similar to but more dampened than the chloride response at AM-7/1 approximately two months prior. Based on the estimated travel time of 3 to 4 months at AM-7/1 and 5 to 6 months at AM-8/1, the analogous chloride response at both wells during 2019 was consistent with the large volumes of non-GWRS recharge at Kraemer Basin from August through November of 2018 and low volumes from December 2018 through June 2019, the latter of which allowed GWRS recharge at Miraloma Basin to remain in the Shallow aquifer and migrate laterally downgradient to these two wells.

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 experienced a short-term increase 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 recharge at La Palma Basin two months prior during September 2018 (when there were no GWRS flows to K-M-M-L Basins). Previous tracer tests indicated that the travel time from Kraemer Basin to AM-10/1 (prior to La Palma Basin being on-line) was approximately 2 months for first arrival and nearly 5 months for peak arrival. A two-month first arrival time from either Kraemer Basin or La Palma Basin to AM-10/1 represents a groundwater velocity of 50 feet per day along these two flow paths.

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 compared to the shallowest zone at these two well sites due to 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 2014-2019 but were somewhat dampened and lagged by approximately 3 to 4 months (Figure 6-5). Chloride concentrations at AMD-10/2 decreased to just below 10 mg/L for the first time in December 2017, signifying the first arrival of near-100% GWRS water at this well; chloride concentrations then decreased further down to GWRS concentrations of 6 mg/L in August 2018. Chloride concentrations at AMD-10/2 increased to over 60 mg/L during the fourth quarter of 2018 and remained relatively high above 50 mg/L through May 2019, consistent with but dampened from the sharp chloride increase at AMD-10/1 approximately 3 to 4 months prior. During the second half of 2019, chloride concentrations at AMD-10/2 subsequently declined down to near-GWRS levels of 11 mg/L by November, once again consistent with the chloride decline to GWRS levels at AMD-10/1 about 3 to 4 months prior.

At AMD-10/3 (screened from 550 to 570 ft bgs), Figure 6-5 shows that 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 high groundwater conditions of 2017 and 2018 (upper graph on Figure 6-5) possibly aided by the addition of La Palma Basin in late 2016, GWRS recharge at Miraloma Basin may vertically migrate deeper than previously, 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. During 2019, chloride concentrations at AMD-10/3 subsequently increased all year and reached nearly 100 mg/L in November back up to background levels. The possible cause of GWRS water no longer reaching this deeper Principal aquifer zone at AMD-10/3 may be related to the unusually low recharge volumes in Miraloma Basin from May through September of 2019 weakening the GWRS pulse and/or the somewhat lower groundwater levels during 2019 reducing the mounding effects in the shallower zones and thus allowing lateral (instead of vertical) transport to be the path of least resistance once again as in the years prior to 2017.

At AMD-12/2 (screened from 490 to 520 ft bgs), Figure 6-7 shows that chloride concentration trends in this somewhat deeper Principal aquifer zone appeared to correlate with the shallower AMD-12/1 from 2014-2019 but were significantly dampened and delayed by approximately 5 to 6 months. 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 water at this well as 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 but then increased during the first three quarters of 2019 up to 41 mg/L in August, before declining slightly in the fourth quarter. Once again, this dampened chloride increase was consistent with the larger chloride increase at AMD-12/1 approximately 5 to 6 months prior.

At AMD-12/3 (screened from 595 to 615 ft bgs), Figure 6-7 shows that 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 signaling arrival of the largest percentage of GWRS water to have historically arrived at this well. As was discussed above for AMD-10/3, this appears to support that GWRS recharge at Miraloma Basin vertically migrated into successively deeper Principal aquifer zones during 2017-2018 when groundwater levels were unusually high in the vicinity of the Anaheim Forebay spreading grounds and possibly aided by the addition of large recharge volumes into La Palma Basin since November 2016. The higher groundwater levels may have caused mounding in the shallower aquifer zones, allowing vertical migration into the deeper Principal aquifer zones to become the path of least resistance. During 2019, chloride concentrations at AMD-12/3 increased all year and reached 80 mg/L in November back up to near-background levels once again, suggesting little or no GWRS water arriving at this well during 2019. This increasing chloride trend was once again similar to the trend that occurred at the analogous AMD-10/3 approximately three months prior.

At the deep monitoring wells AMD-10/4 (screened from 774 to 794) and AMD-12/4 (screened from 725 to 745), Figure 6-5 and Figure 6-7, respectively, show that chloride concentrations were relatively stable and remained at high background levels for several years ranging from approximately 90 to 110 mg/L until the second half of 2018 when chloride concentrations began to finally decrease enough to signal the arrival of some percentage of GWRS water. At both wells, chloride concentrations decreased significantly down to below 60 mg/L from mid-2018 to mid-2019, before beginning to rise again during the second half of 2019. This chloride decline and subsequent rise at both AMD-10/4 and AMD-12/4 are similar to but more dampened than the trend at their shallower counterparts AMD-10/3 and AMD-12/3 and are lagged by 3 to 6 months, likely indicating arrival of the same GWRS pulse in these deep zones. Assuming this represents the first notable percentage of GWRS water at both AMD-10/4 and AMD-12/4 leads to an upper-end maximum arrival time of approximately 6 years if originating from Miraloma Basin (which came on-line in July 2012). Based on the flow path discussions above for the somewhat shallower Principal aquifer zones at AMD-10/3 and AMD-12/3, a low-end minimum arrival time could be as fast as 2 years if this deeper vertical flow path from Miraloma Basin did not begin until La Palma Basin came on-line in late 2016, causing hydraulic interference in the shallower aquifer zones and thus driving Miraloma Basin recharge down to these greater depths at AMD-10/4 and AMD-12/4.

At the deepest monitoring wells AMD-10/5 (screened from 934 to 954 ft bgs) and AMD-12/5 (screened from 940 to 960 ft bgs), chloride concentrations were also relatively stable and remained at high background levels for several years. At AMD-10/5, Figure 6-5 shows that chloride concentrations exhibited their first notable decrease during the last three quarters of 2019 down to 79 mg/L by November, likely related to but more dampened and lagged than at the slightly shallower AMD-10/4 and also likely indicating arrival of a small percentage of GWRS water. At AMD-12/5, Figure 6-7 shows a slight downturn in chloride concentrations during the second half of 2019, which on its own would be too subtle to confidently signal the first arrival of any GWRS water, but from inference of the more definitive arrival at AMD-10/5 and the other deep zones at AMD-10 and AMD-12 discussed above, arrival of a small percentage of GWRS water also seems likely at AMD-12/5. This would lead to an arrival time range of approximately 3 to 7 years to AMD-10/5 and AMD-12/5 assuming a similar flow path from Miraloma Basin but lagged by approximately one year from their slightly shallower counterparts at AMD-10/4 and AMD-12/4 discussed above. Independent groundwater age estimates developed for this deeper (greater than 900 ft bgs) aquifer zone using tritium/helium age dating indicated average groundwater ages on the order of 10 years or greater (LLNL, 2004). However, these ages were based on the historical recharge operations of that time and thus did not include Miraloma or La Palma Basins, which appear to have reduced the vertical travel time in this area by causing mounding or hydraulic resistance in the shallower aquifer zones and thereby making vertical transport the path of least resistance.

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-10/1; (2) multi-depth nested monitoring well site AMD-10; and (3) multi-depth nested monitoring well site AMD-12, respectively. During 2019, either non-detect, low stable concentrations, or decreases in total arsenic were generally observed in all these monitoring wells, with the following exceptions:

- AM-7/1 – increased slightly from a near-historic low of 1.8 μg/L in the first quarter of 2019 to 3.0 μg/L in the third quarter, before decreasing slightly to 2.5 μg/L in the fourth quarter;
- AMD-10/1 – increased to 1.3 μg/L and 5.9 μg/L in the first and second quarters of 2019, respectively, then decreased the second half of 2019 to 1.6 μg/L in the fourth quarter;
- AMD-10/2 – increased gradually from a 7-year low of 1.6 μg/L in the second quarter of 2019 to 3.7 μg/L in the fourth quarter;
- AMD-12/1 – increased from a historical low of 1.2 μg/L in the first quarter of 2019 to a five-year high of 7.9 μg/L in the third quarter, before decreasing slightly to 6.0 μg/L in the fourth quarter;

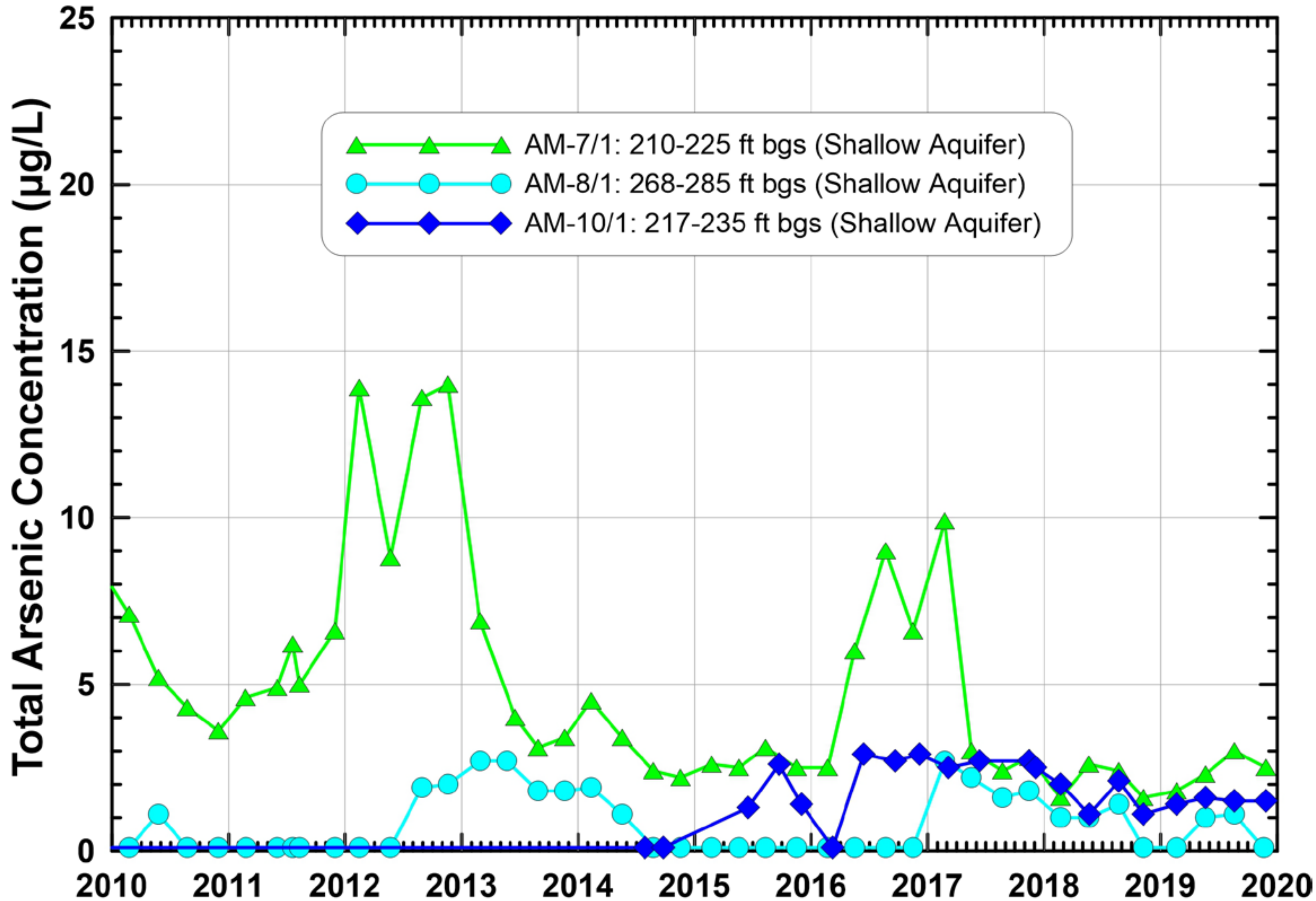


Figure 6-10. Monitoring Wells AM-7 and AM-8 Total Arsenic Concentrations

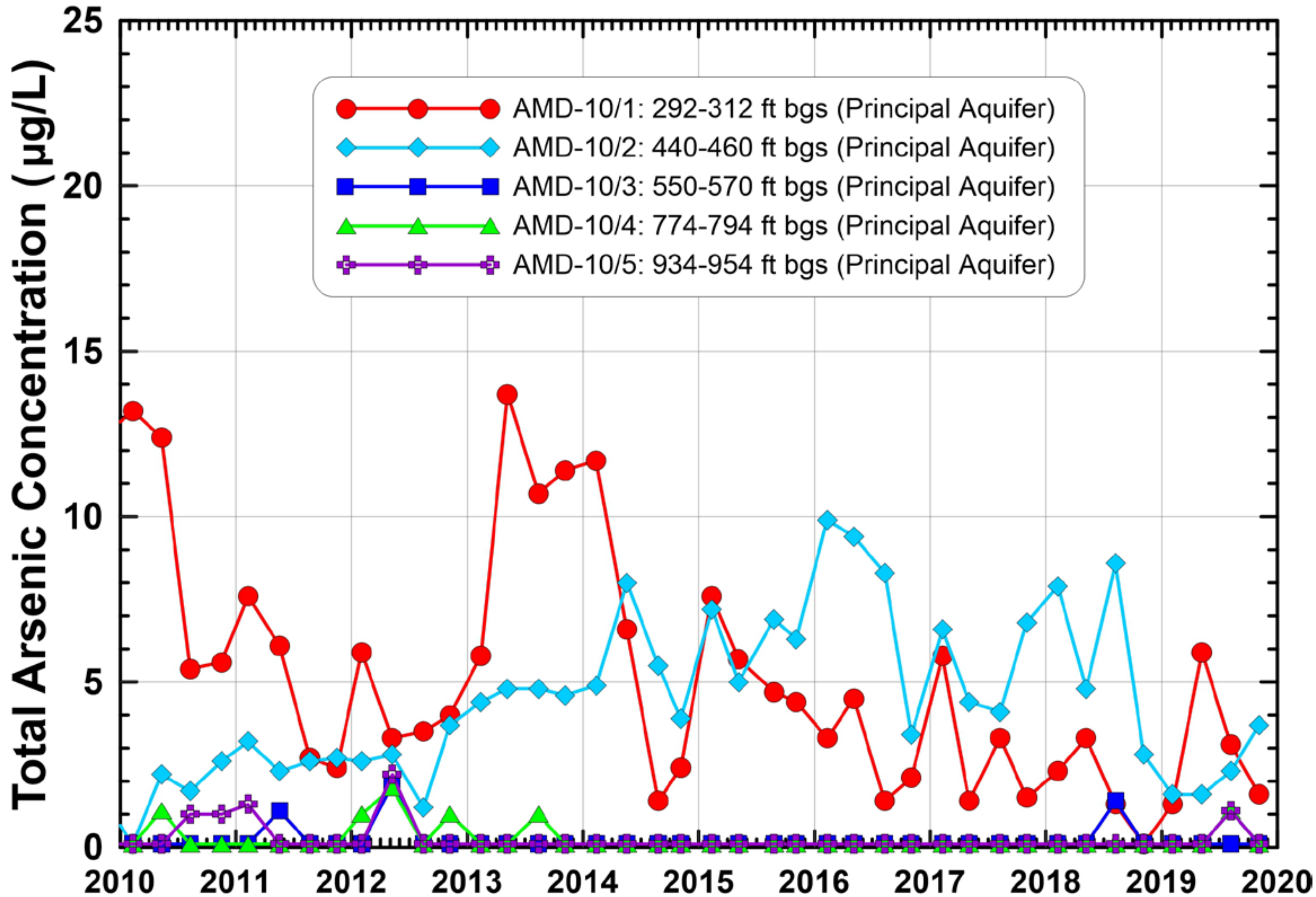


Figure 6-11. Monitoring Well AMD-10 Total Arsenic Concentrations

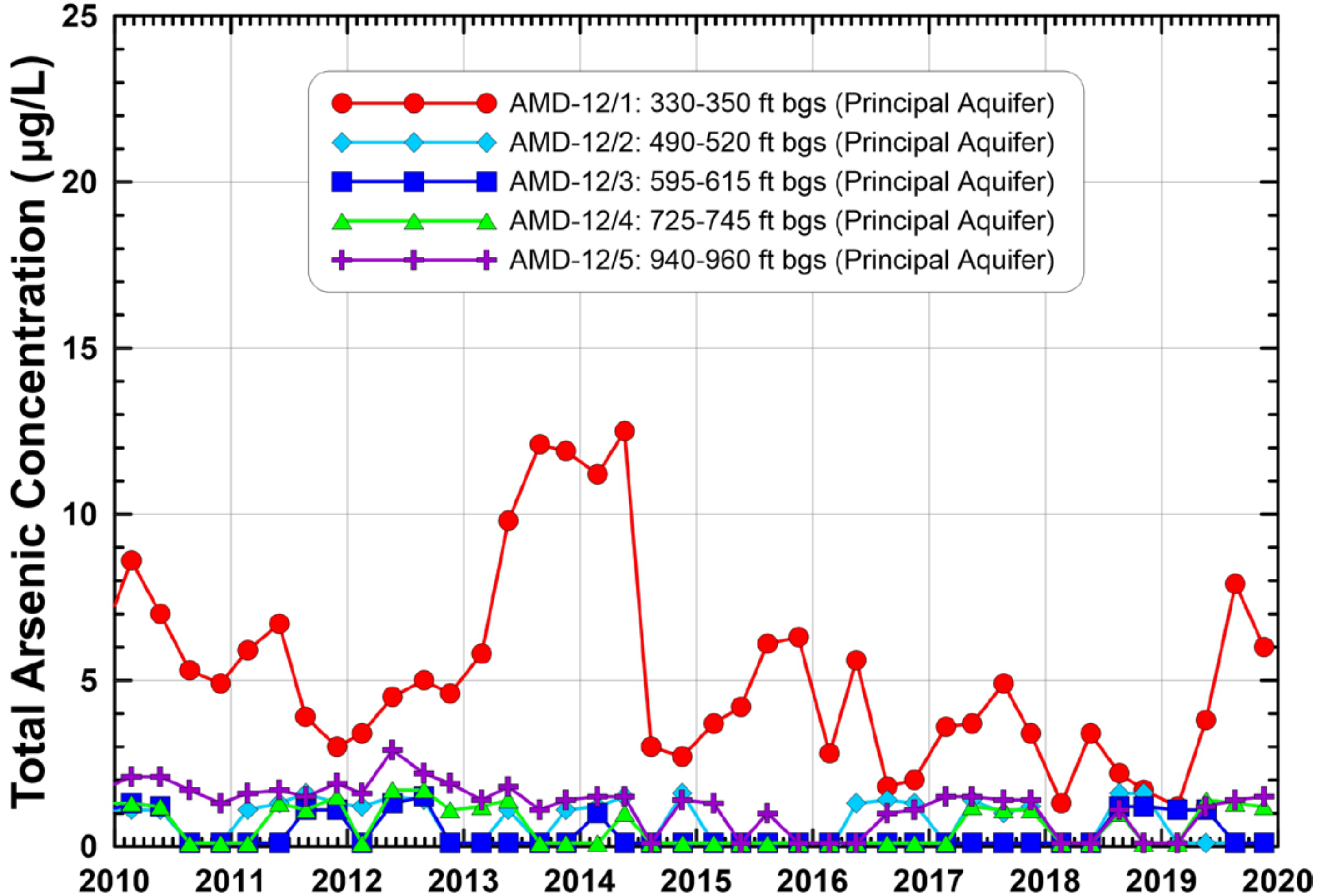


Figure 6-12. Monitoring Well AMD-12 Total Arsenic Concentrations

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. 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 are clearly 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 due to the arrival of other recharge sources (SAR storm flows 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 water and arsenic concentration in groundwater, after a minimum threshold percentage of GWRS water reached the monitoring well. The threshold percentage of GWRS 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 downgradient 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 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. More recent 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 within an alluvial aquifer matrix (Bowell, 1994).

The higher initial pH or lower ionic strength of GWRS 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 have resulted in diminishing arsenic peaks with each subsequent sufficiently sustained event due primarily to arsenic mass removal from the aquifer matrix. 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

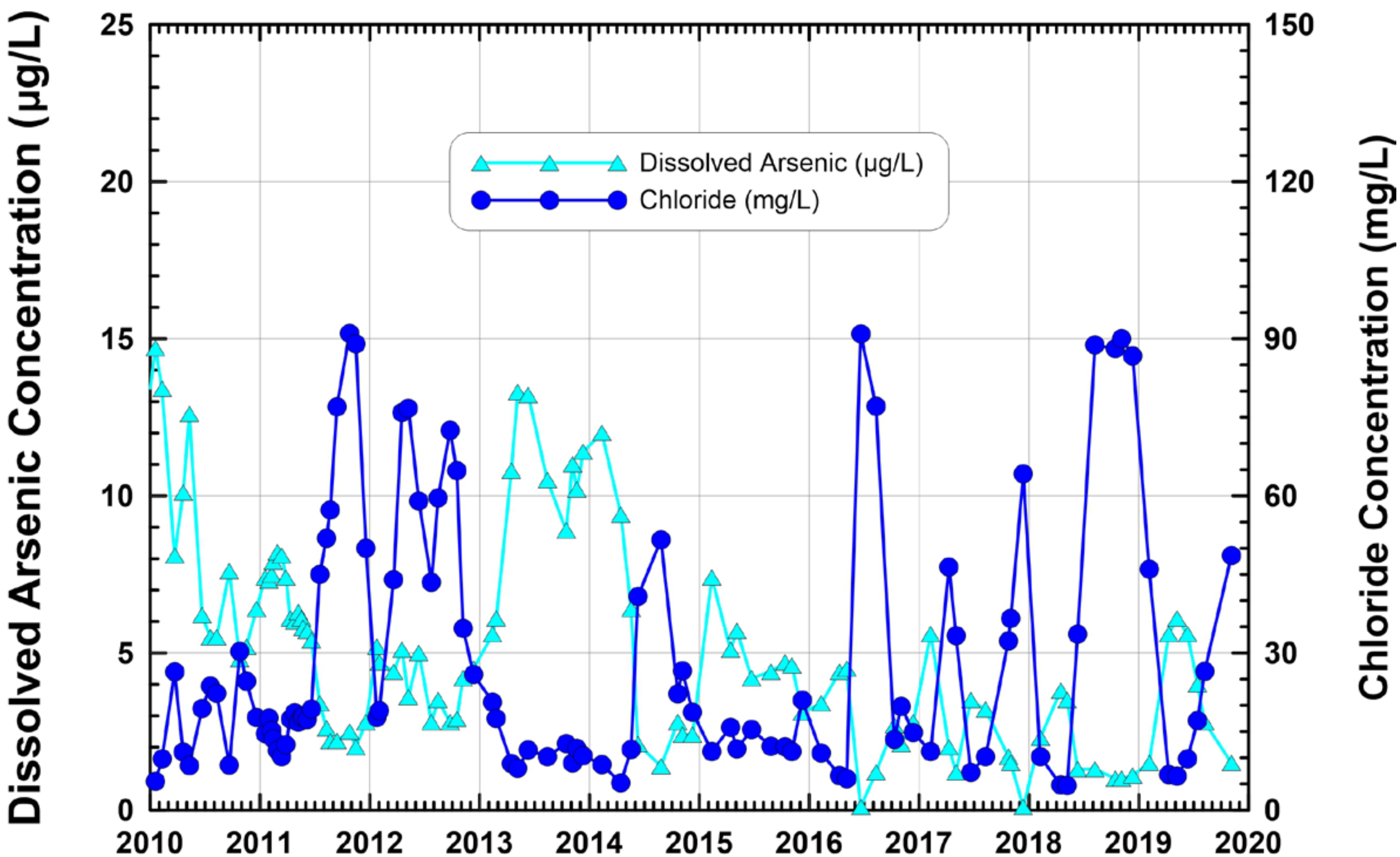


Figure 6-13. Monitoring Well AMD-10/1 Chloride and Dissolved Arsenic Concentrations

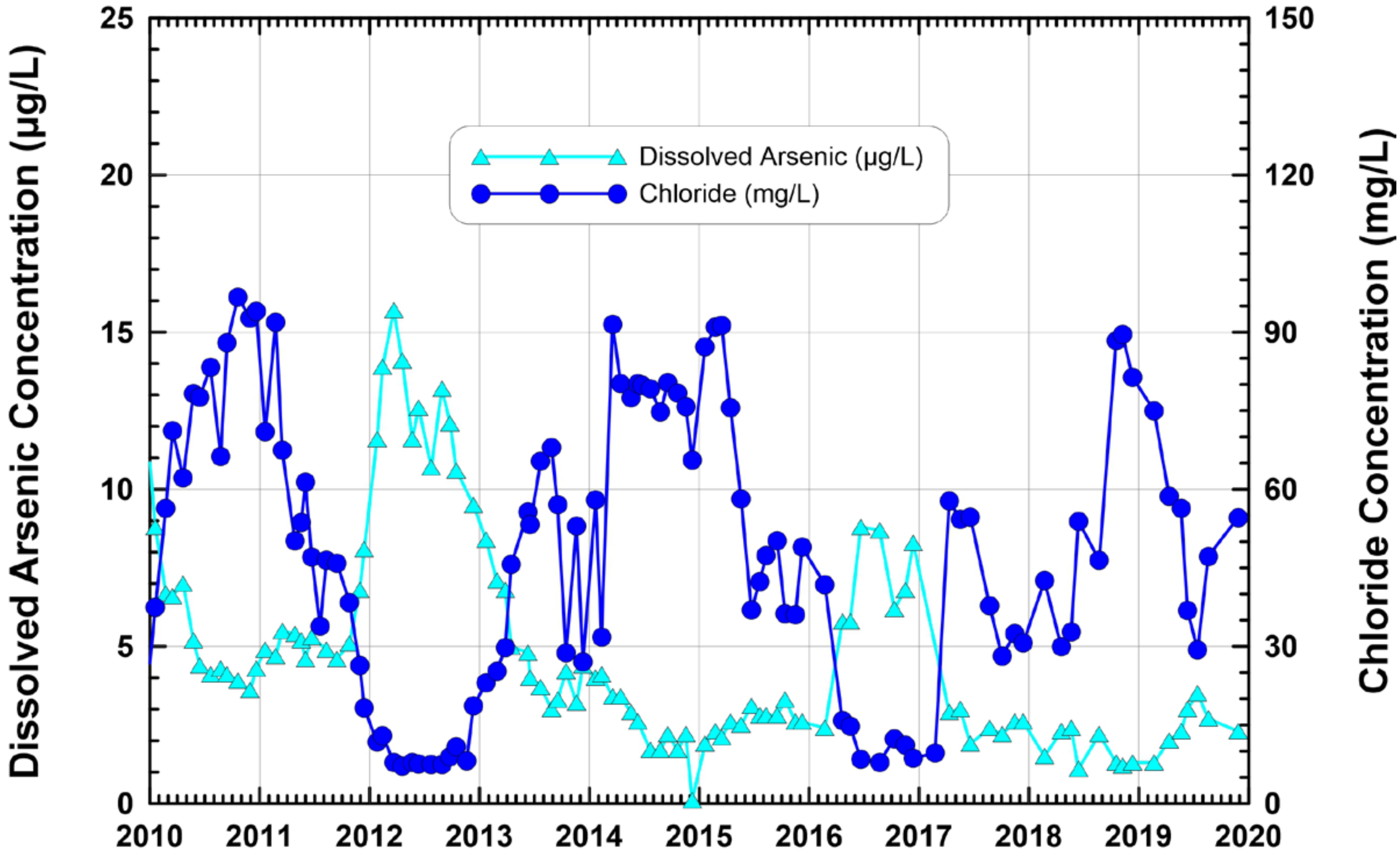


Figure 6-14. Monitoring Well AM-7 Chloride and Dissolved Arsenic Concentrations

to arsenic mass removal during the prior 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 2010, 2013, and 2015 to early 2016. Dissolved arsenic concentrations at AMD-10/1 declined below the RDL again in December 2017 after a fourth GWRS water arrival cycle, and finally declined to just slightly above the RDL in late-2018 and late-2019 after a fifth and sixth shorter duration GWRS arrival cycle.

The decline in dissolved arsenic concentrations at AMD-10/1 to below or just above the RDL in mid-2016, late-2017, late-2018, and late-2019 likely coincided with the arrival of other recharge sources as indicated by the contemporaneous chloride increase in all four cases (Figure 6-13). 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 having higher chloride concentrations following the sustained 100% GWRS event at this well during 2012. These other recharge sources typically have dissolved arsenic concentrations slightly higher than these low reported concentrations below or just above the RDL, but due to arsenic desorption during the preceding GWRS sustained arrival events, arsenic in these other recharge sources is likely being adsorbed onto the previously cleaned aquifer matrix surfaces, only to be desorbed again (albeit at much lower peak concentrations) with subsequent GWRS arrival events.

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 gradually decreased further 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. Dissolved arsenic concentrations at AM-7/1 increased slightly during the first half of 2019 and peaked at 3.5 µg/L in mid-2019, consistent with a contemporaneous chloride concentration decrease at that well but not down to GWRS levels, indicating the arrival of some percentage of GWRS water but much less than 100%. Therefore, the mid-2019 dissolved arsenic peak at AM-7/1 was much lower than the previous peak in 2016 likely because the 2019 GWRS arrival event was not sustained for long enough and never reached 100% GWRS water rather than being solely due to arsenic mass removal from the prior 2016 GWRS arrival event.

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 first arrival of newly mobilized arsenic from aquifer sediments directly beneath Miraloma Basin once this basin was first put into operation in July 2012. Prior arsenic peaks at these two wells were likely due to GWRS arrival events from a flow path originating from Kraemer-Miller Basins. As previously discussed in Section 6.4.2, the long duration 100% GWRS recharge event that arrived at AMD-10/1 and AMD-12/1 in 2013 through early 2014 (Figure 6-5 and Figure 6-7, respectively) was likely due to the consistent GWRS recharge from new Miraloma Basin migrating directly down into the uppermost Principal aquifer before laterally migrating downgradient to these two wells because of hydraulic interference from concurrent Kraemer Basin recharge into the Shallow aquifer. In summary, 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 smaller arsenic peaks that subsequently occurred in 2015, early 2016, 2017, 2018, and 2019 at both AMD-10/1 and AMD-12/1 were significantly reduced from the prior 2013-2014 peaks. These arsenic peak reductions were likely not only due to arsenic mass removal from the prior sustained 100% GWRS water arrival event in 2013-14, but were also due to these GWRS arrival events not being sustained for a sufficiently long period for full arsenic desorption and/or never reaching 100% GWRS water at both of these wells.

In the case of the most recent arsenic peak that occurred in 2019 at AMD-10/1 (Figure 6-11) and AMD-12/1 (Figure 6-12), low chloride concentrations down at GWRS levels at AMD-10/1 for two to three months (Figure 6-5) and sustained for three to five months at AMD-12/1 (Figure 6-7) indicated approximately 100% GWRS arrival at those two wells for those sustained periods. At AMD-12/1, arsenic concentrations peaked at 7.9 µg/L in the third quarter of 2019, noticeably higher than the prior peaks during the 2015 to 2018 period at this well and also slightly higher than the analogous peak of 5.9 µg/L in the second quarter of 2019 at AMD-10/1. Although the duration of the 2019 GWRS arrival event at both of these wells was much shorter than the 2013-2014 event, it is likely that the slightly longer duration at AMD-12/1 (3 to 5 months) as compared to AMD-10/1 (2 to 3 months) led to the higher arsenic peak at AMD-12/1, despite its slightly farther distance downgradient along the same flow path.

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 2016-2019, 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 aiming 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. 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 thought that cation bridging within finer-grained portions of the aquifer is the mechanism controlling 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 2019 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 2019.

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 cycled within a range of 20 to 75 mg/L. Like the upgradient monitoring wells discussed previously, the proportion of GWRS water at this well fluctuates with recharge operations and supplies.

As shown in Table 6-2, there were no detections of arsenic at SCWC-PLJ2 during 2019; arsenic has not been detected at this well since 2014. Previously, arsenic concentrations at SCWC-PLJ2 were low since the inception of GWRS recharge at Kraemer-Miller Basins in 2008, ranging from below the RDL of 1 µg/L to a one-time maximum of 2 µg/L. During 2019, there were also no detections of either NDMA or 1,4-dioxane at SCWC-PLJ2 (Table 6-2).

Table 6-2. 2019 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	63.0 (41.3 - 76.2)	0.015 (ND - 0.053)	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 was intended to provide 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 larger follow-on Mid-Basin Injection (MBI) Centennial Park Project 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. With operations commencing in 2020, 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 full-scale 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 GWRS Pipeline at the Santa Ana River and Edinger Avenue (Figure 1-8). 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. All water produced during backwash pumping of MBI-1 is discharged directly to the SAR channel under RWQCB and County of Orange Flood Control permits.

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.

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 7-1.

Operation of the demonstration facilities is presented in this section:

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

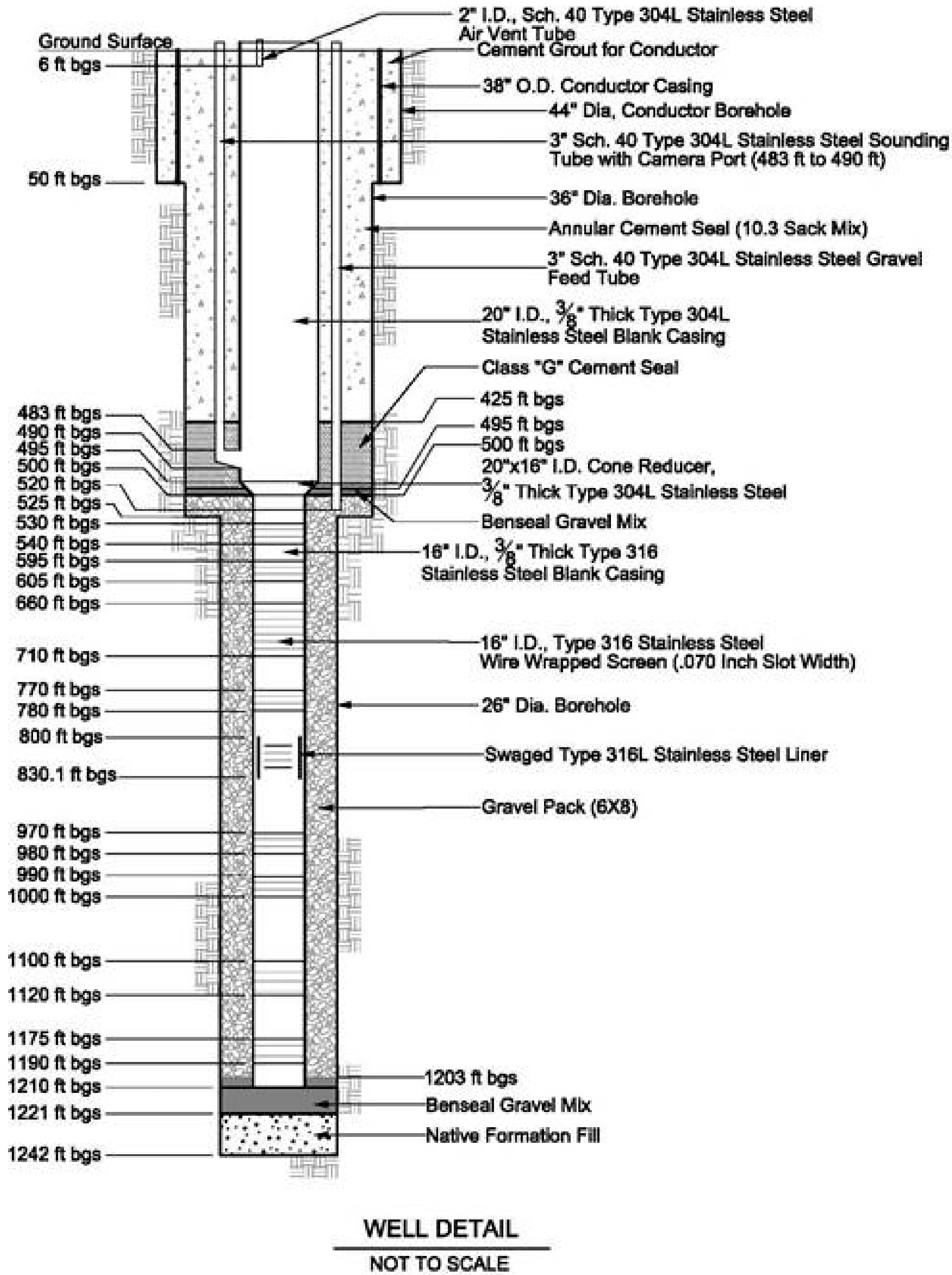


Figure 7-1. Injection Well MBI-1 As-Built Construction Diagram

7.1 DMBI Injection Water Source

Only one type of water was injected at MBI-1 during 2019: purified recycled water produced by the GWRS AWPF and delivered via the GWRS Pipeline. Both DDW (CDPH, 2010b) and the RWQCB (RWQCB, 2010) indicated support for the DMBI Project and injection of 100% purified recycled water; permitting of its long-term operations was included the RWQCB permit amendment covering the larger MBI Centennial Park Project (RWQCB, 2019).

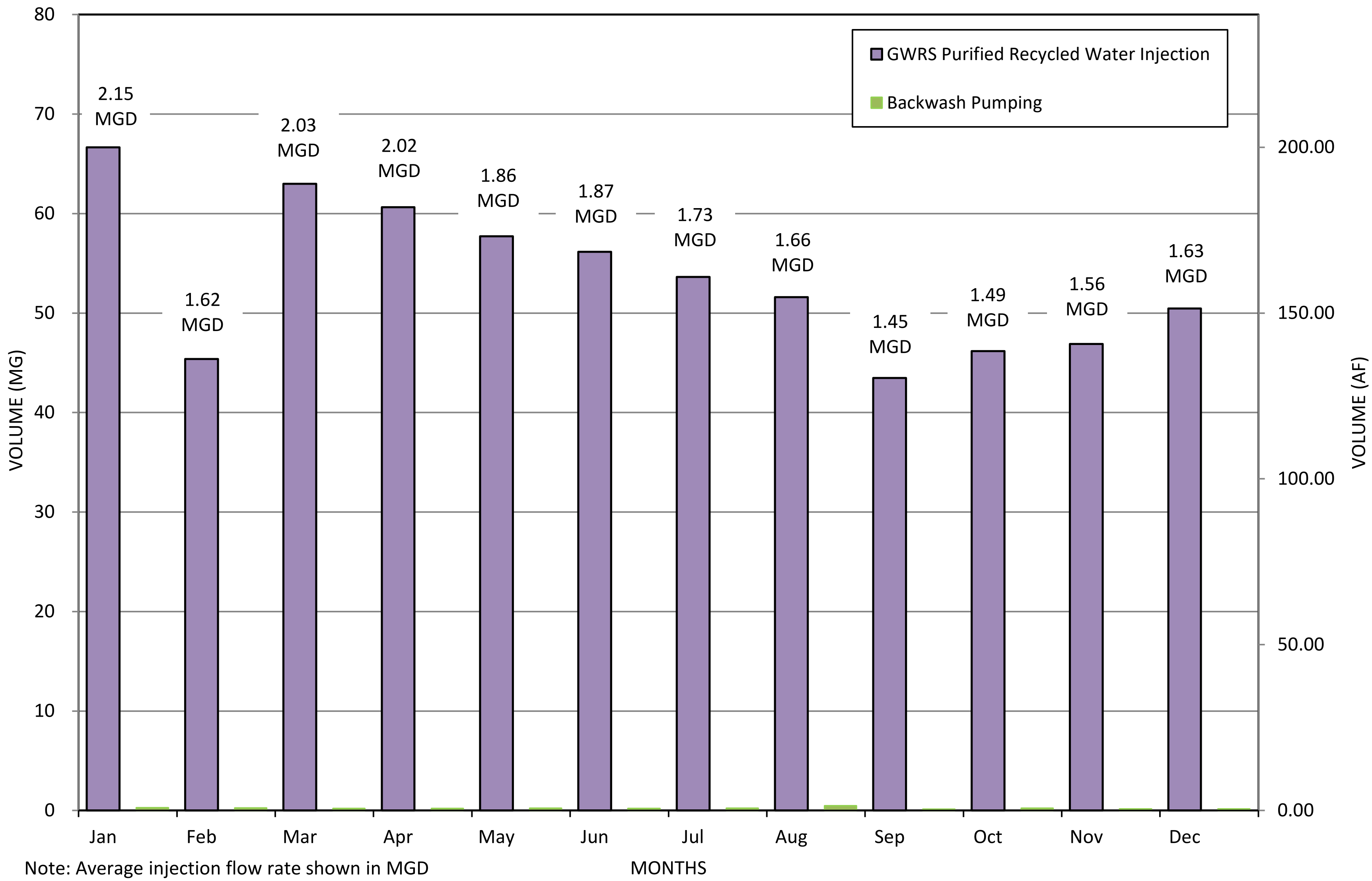
7.2 Injection Water Volumes and Flow Rates

A total volume of approximately 642 MG (1,970 AF) of purified recycled water was injected at MBI-1 during 2019. A minor volume of approximately 8 MG (26 AF) was pumped from MBI-1 during 2019 during 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 2019 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 7-2.

As shown in Table 7-1, the 2019 monthly injection volume at MBI-1varied slightly with the average daily injection rate ranging from 1.45 MGD in September to 2.15 MGD in January. These variations were not seasonal in nature but rather were primarily due to operational changes in the MBI-1 injection rate for testing/optimization purposes, as well as intermittent and brief AWPF shutdowns. The longest AWPF shutdown during 2019 was May 6-8; all others were one day or less.

Table 7-1. 2019 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	2.15	66.65	204.55	0.86	2.64
February	1.62	45.38	139.26	0.74	2.27
March	2.03	63.00	193.34	0.64	1.96
April	2.02	60.63	186.08	0.64	1.95
May	1.86	57.71	177.11	0.72	2.22
June	1.87	56.16	172.34	0.63	1.94
July	1.73	53.62	164.55	0.67	2.05
August	1.66	51.61	158.37	1.47	4.51
September	1.45	43.48	133.44	0.41	1.25
October	1.49	46.18	141.72	0.70	2.15
November	1.56	46.90	143.92	0.50	1.54
December	1.63	50.45	154.82	0.51	1.56
Totals	**1.76**	**641.77**	**1,969.50**	**8.48**	**26.04**



Note: Average injection flow rate shown in MGD

Figure 7-2. 2019 Monthly Injection and Backwash Quantities at DMBI Project

7.3 DMBI Project Operations

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 GWRS Pipeline. No other back-up injection supply is provided at the injection well site. Therefore, during AWPF and/or GWRS Pipeline shutdowns, MBI-1 is off-line.

7.3.1 Injection Rates and Yields

Figure 7-3 shows MBI-1 injection rates during 2019. The year began with injection rates in the historical high range of approximately 1,770 gpm (2.5 MGD) as injection capacity testing of MBI-1 after rehabilitation of the GWRS Pipeline continued from the previous year. As the injection yield began to decline, the MBI-1 injection rate was sequentially reduced to approximately 1,440 gpm (2.1 MGD) in mid-January and then down to 1,040 gpm (1.5 MGD) at the end of the month. The injection rate was then subsequently increased to 1,440 gpm (2.1 MGD) in late February and maintained until early June, when it was decreased to approximately 1,230 gpm (1.8 MGD) due to declining injection yields. Injection remained at this rate for the remainder of the year, except for a brief period beginning in late August when it was reduced to approximately 710 gpm (1.0 MGD) and run continuously for two weeks without a backwash as a performance test.

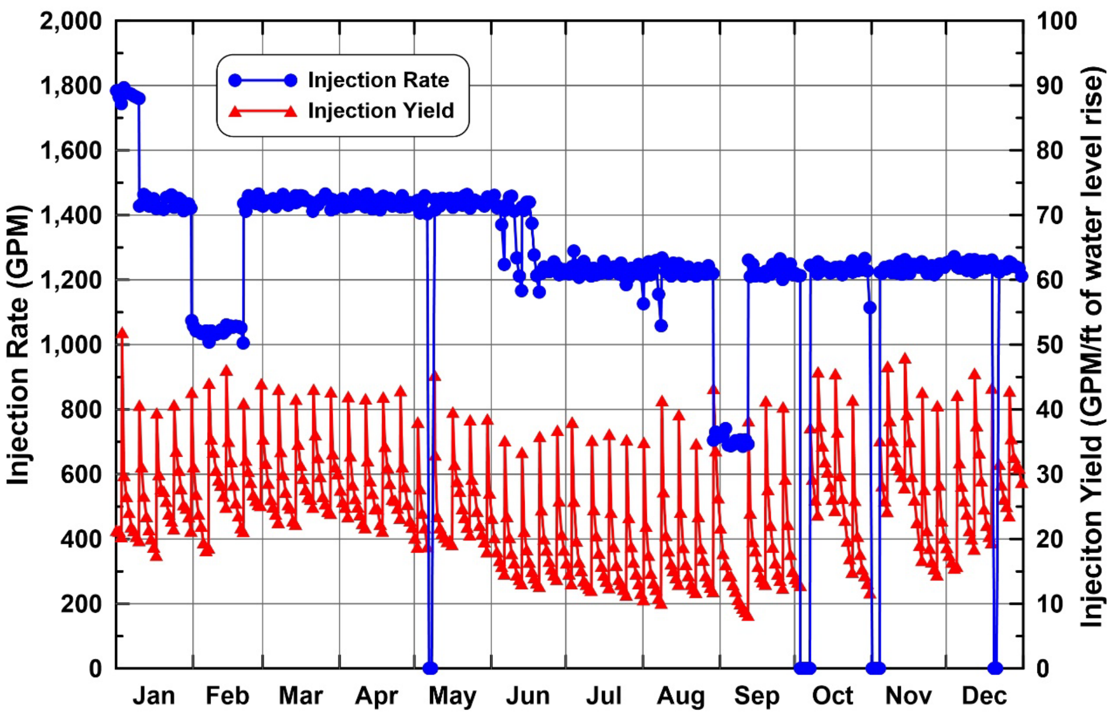


Figure 7-3. 2019 MBI-1 Injection Performance

The average daily injection at MBI-1 during 2019 was 1,222 gpm (1.76 MGD), an increase of over 14% from the prior year due to increased injection rates after rehabilitation of the GWRS Pipeline. As shown on Figure 7-3, injection operations at MBI-1 were continuous throughout 2019 except for a few brief periods: (1) AWPF shutdown on May 6-8, (2) MBI-1 turned off for 3 days in early October and again in early November as an operational test to determine if air entrainment over sustained periods of injection was contributing to reduced injection yields, and (3) one day in December for repair of a 78-inch coupling on the GWRS Pipeline.

Figure 7-3 also shows the variation of injection yield at MBI-1 during 2019. 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. During 2019, backwash pumping at MBI-1 typically occurred for approximately 40 minutes for each backwash event with a weekly frequency, except for the biweekly test cycle in early September. 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.

The injection yield ranged from 8 to 52 gpm/ft during 2019. 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.

Figure 7-3 shows that during 2019, the injection yields at MBI-1 were relatively high in the first quarter of the year, which is likely attributable to the recency of the GWRS Pipeline rehabilitation. As was described in last year's Annual Report, the higher injection yields observed immediately after the pipeline rehabilitation were likely because of 1) a reduction in particulate matter that had previously originated from the interior cement mortar lining of the pipeline, 2) continued weekly backwashing during the six-week shutdown associated with the GWRS Pipeline rehabilitation in September-October 2018, and 3) at least initially, lower local water levels prior to the full buildup of a sustained injection mound. In the spring of 2019, MBI-1 injection yields ranged from approximately 22 to 42 gpm/ft until May, when the low end of injection yields (just prior to the weekly backwash) decreased to around 19 gpm/ft, likely due to accumulation of particulate matter or possibly air entrainment from sustained injection. In response to the reduced injection yield, the MBI-1 injection rate was reduced to approximately 1.7 MGD in June as the low end of each injection yield cycle decreased further to approximately 11 gpm/ft by mid-June. The weekly cycle of injection yields subsequently remained stable at 11 to 36 gpm/ft throughout the summer until late August. Although lower than the prior spring months, the low ends of the injection yield cycles during the summer of 2019 were slightly higher than the analogous summer months in 2018 prior to the GWRS Pipeline relining, despite a higher sustained injection rate during the summer of 2019.

During early September 2019, injection was decreased to approximately 1 MGD and run continuously for a two-week period without a backwash as an operational test (Figure 7-3). At the end of the two-week test, injection yield fell to an annual low of approximately 8 gpm/ft, indicating that biweekly backwashing was not optimal, even under a reduced injection rate of 1 MGD. Injection rates were subsequently increased back up to approximately 1.7 MGD for the remainder of 2019.

Figure 7-3 shows that injection yields responded favorably to each of the entrained air tests in early October and early November immediately following MBI-1 being off-line for 3 days, with a much lesser decline for the first two post-test backflush cycles. Although these results indicate that brief shutdowns may at least temporarily increase injection yields by allowing off-gassing of entrained air in the formation and/or lowering of mounded groundwater levels, the relatively short period of benefit does not overcome the injection volume lost during the three-day shutdown. Finally, in December with injection rates sustained at approximately 1,200 gpm with weekly backwashing, the injection yield increased steadily up to approximately 23 to 44 gpm/ft by the end of the year. The increased injection yield during the last two injection cycles of the year may be due to the one-day shutdown on December 20 lowering the localized mound effects and off-gassing of entrained air in the formation similar to the operational tests in October and November. Study of the operational testing conducted during 2019 indicates that an optimal and sustainable condition for MBI-1 is an injection rate ranging from approximately 1,200 to 1,400 gpm (1.7 to 2.0 MGD) with a backwash frequency of one week.

As can be seen on Figure 7-3 for each weekly or biweekly injection cycle during 2019, 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 2019 was 25 gpm/ft, slightly closer to the low end of the 8 to 52 gpm/ft range. Figure 7-3 shows that the peak injection yield values (immediately following a backwash event) were highest in early January nearest the GWRS Pipeline rehabilitation, as well as in October and November during the two cycles following each of the entrained-air test shutdowns.

7.3.2 Backflush Pumping Rates and Yields

Figure 7-4 shows the MBI-1 pumping rate for all backwash events during 2019. The average pumping rate of all backwash events during 2019 was approximately 3,555 gpm. The backwash pumping rate is largely controlled by the groundwater level and any manual discharge valve throttling because the pump does not have a variable frequency drive to automatically adjust the backwash rate. From January through April, the backwash pumping rate was consistently high at around 3,600 gpm. The pumping rate decreased starting in early May and reached an annual low of 3,410 GPM in late June and remained below 3,500 gpm through August. In September, the rate increased again, reached an annual peak of 3,660 gpm in early October then remained high until mid-November before steadily falling to just below 3,500 gpm at the end of the year.

The high backwash pumping rates in January through May likely resulted from high groundwater levels and increased Basin storage conditions during that time, resultant of an above-average rainfall year. In early May Basin pumping increased and groundwater levels dropped, causing the

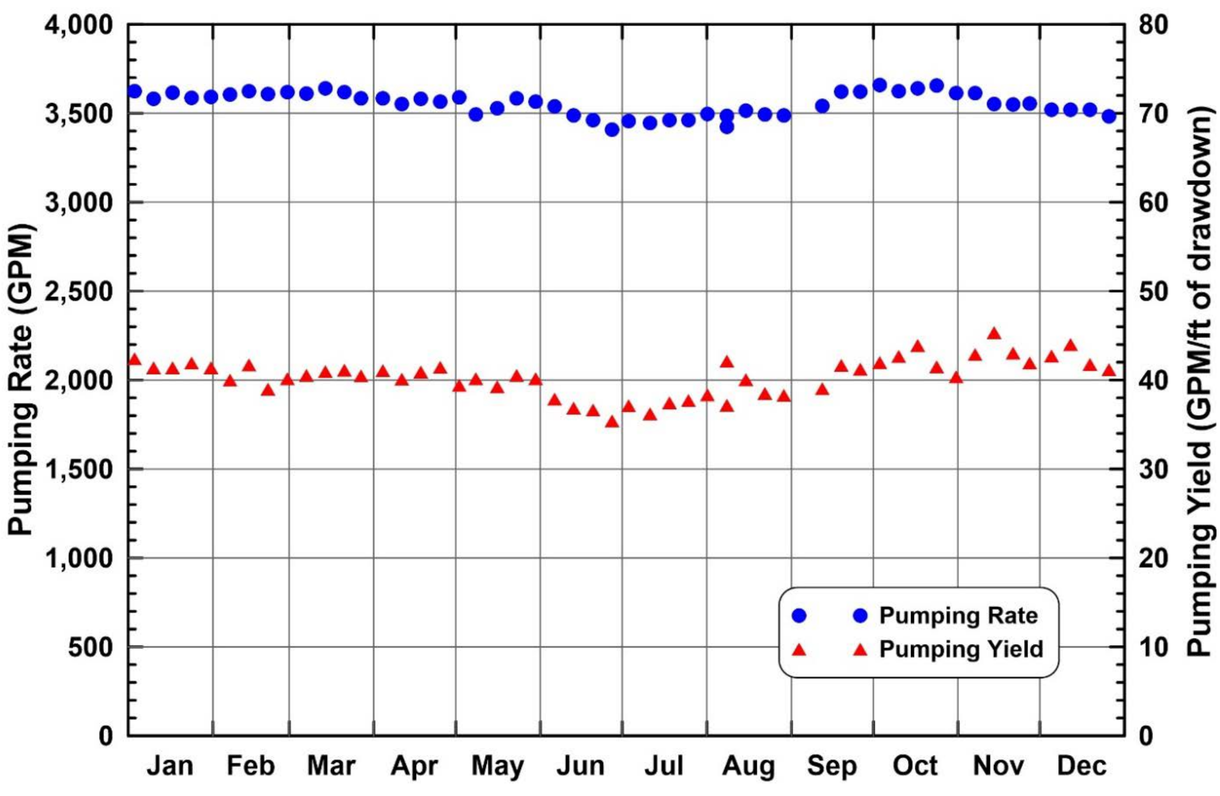


Figure 7-4. 2019 MBI-1 Pumping Performance

MBI-1 pumping rate to automatically decline at the given valve setting because of the increased pumping lift. The slightly lower backwash pumping rates from May through August (due to lower groundwater levels) were likely the reason for the contemporaneous decline in injection yields observed during that period (Figure 7-3). The increase in the MBI-1 pumping rate in September is attributed to a significant increase in water levels caused by decreased Basin pumping, as well as a 2% increase in valve setting. From mid-November to the end of the year the pumping rate decreased as remote operation of the backwash process was implemented with a target pumping rate set at 3,500 gpm.

Figure 7-4 also shows the MBI-1 pumping yield or specific capacity for all backwash events during 2019, ranging from 35 to 45 gpm/ft of drawdown in the well. The resulting average backwash pumping yield during 2019 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 followed a similar trend as the pumping rate throughout 2019 and given the consistent frequency and nature of backwashing, appears to be controlled by the same factors, namely Basin conditions and the pump discharge valve setting. The pumping yield was steady above 40 gpm/ft from January through April, decreased in May and June, and remained low through the summer months. As regional groundwater levels and MBI-1 backwash pumping rates increased in the final four months of 2019, so too did the MBI-1 pumping yields, remaining above 40 gpm/ft until year's end. The highest pumping yields of the year were observed in November and December, concurrent with the implementation of remotely operated backwashes. This pumping yield increase may be artificial however as the pumping yield calculation is likely more accurate under remote operation due to the PCS maintaining an extremely stable pumping rate over the course of the 40-minute backwash event as compared to the typical manual valve setting mode in which the pumping rate decreases slightly as drawdown increases and the lower pumping rate from the last five minutes of pumping is what is used to calculate the pumping yield. In other words, a manual mode backwash event would have a greater volume of pumped groundwater over the course of the 40-minute backwash (and thus slightly greater drawdown) than a remotely operated backwash at the same recorded pumping rate. 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 pre-pipeline rehabilitation 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) had resulted in a more acceptable weekly backwash frequency. Post-rehabilitation of the GWRS Pipeline, MBI-1 operational data in 2018 and 2019 suggest a higher sustainable injection rate of 1.7 to 2 MGD with a backwash frequency of one week. However, it still appears that MBI-1 backwash frequency needs 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 3.4, the GWRS purified recycled water has been shown to cause some erosion (breakdown or shedding) of the inner lining of certain reaches of the Talbert Barrier pipeline as well as the interior cement mortar lining of the large 13-mile GWRS Pipeline to the Forebay, which also supplies MBI-1. As such, Reach I of the GWRS Pipeline (from the AWPF product water pump station to the MBI-1 turnout) was rehabilitated during the summer of 2018 by epoxy coating the interior mortar lining to reduce the particulate loading to MBI-1 and eventually to the four new MBI wells in Centennial Park.

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 GWRS Pipeline as discussed above, an injection rate averaging approximately 1.7 to 2 MGD with a backwash frequency of one week appears to be optimal and sustainable.

7.4 MBI Centennial Park Project

As shown in Figure 7-5, the MBI Centennial Park Project is 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. In December 2018 OCWD completed drilling and construction of four additional injection wells, designated as MBI-2, MBI-3, MBI-4, and MBI-5, that are strategically located to help raise depressed groundwater levels in the Principal aquifer. OCWD has recently completed construction of the wellhead facilities, appurtenances, and associated pipelines within Centennial Park and after extensive startup testing and commissioning, placed the four new MBI wells on-line in March 2020. Well construction, testing, and operational data for the four new injection wells will be included in Section 7 of next year's Annual Report.

The Centennial Park injection wells were constructed similar to MBI-1 (Figure 7-1) but without the uppermost two screens and the lowermost screen. 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 will be presented in Section 7 of next year's Annual Report.

MBI-3 and MBI-5 were constructed using glass beads as the filter pack 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 in 2020, 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.

Two new nested monitoring wells, designated as SAR-12 and SAR-13, were constructed in December and October of 2017, respectively, as part of the MBI Centennial Park Project. These two monitoring wells are strategically located downgradient south of Centennial Park to comply with requirements (RWQCB, 2019) track the injected GWRS water as it migrates toward the nearest downgradient drinking water production wells IRWD-12 and IRWD-17 (Figure 7-5). Groundwater level and quality data at these two new monitoring wells will be presented in Section 8 of next year's Annual Report.

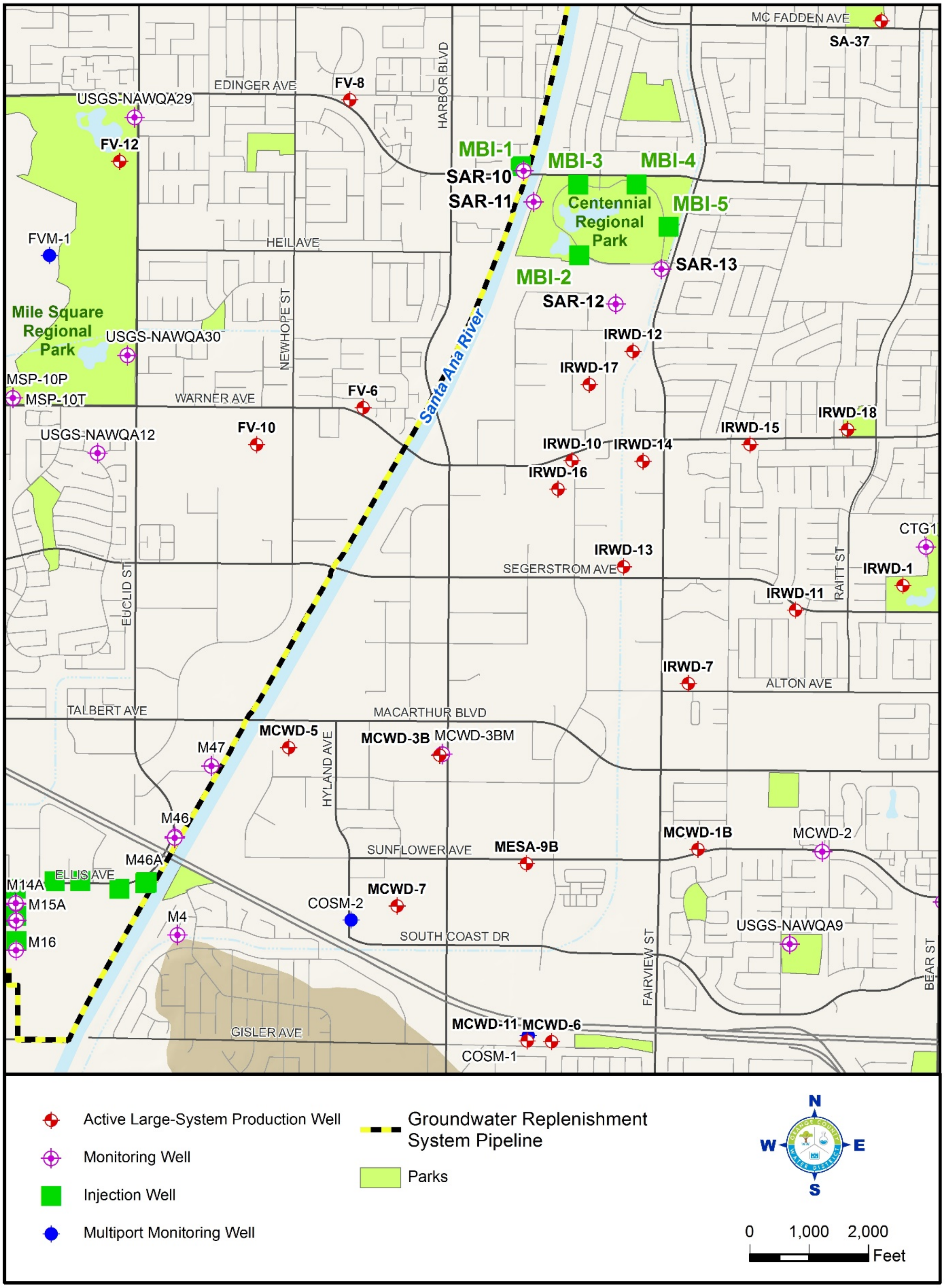


Figure 7-5. DMBI Project and MBI Centennial Park Project Location Map

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 organic, inorganic, and microbiological constituents at OCWD monitoring wells and potable drinking water wells.

In the DMBI Project area, OCWD began groundwater monitoring activities in 2012 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 GWRS Pipeline at the Santa Ana River and Edinger Avenue in the city of Santa Ana.

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 part of the MBI Centennial Park Project. 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, 2018; RWQCB, 2019) 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 were recently placed on-line in March 2020.

This section presents the following for calendar year 2019:

- 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

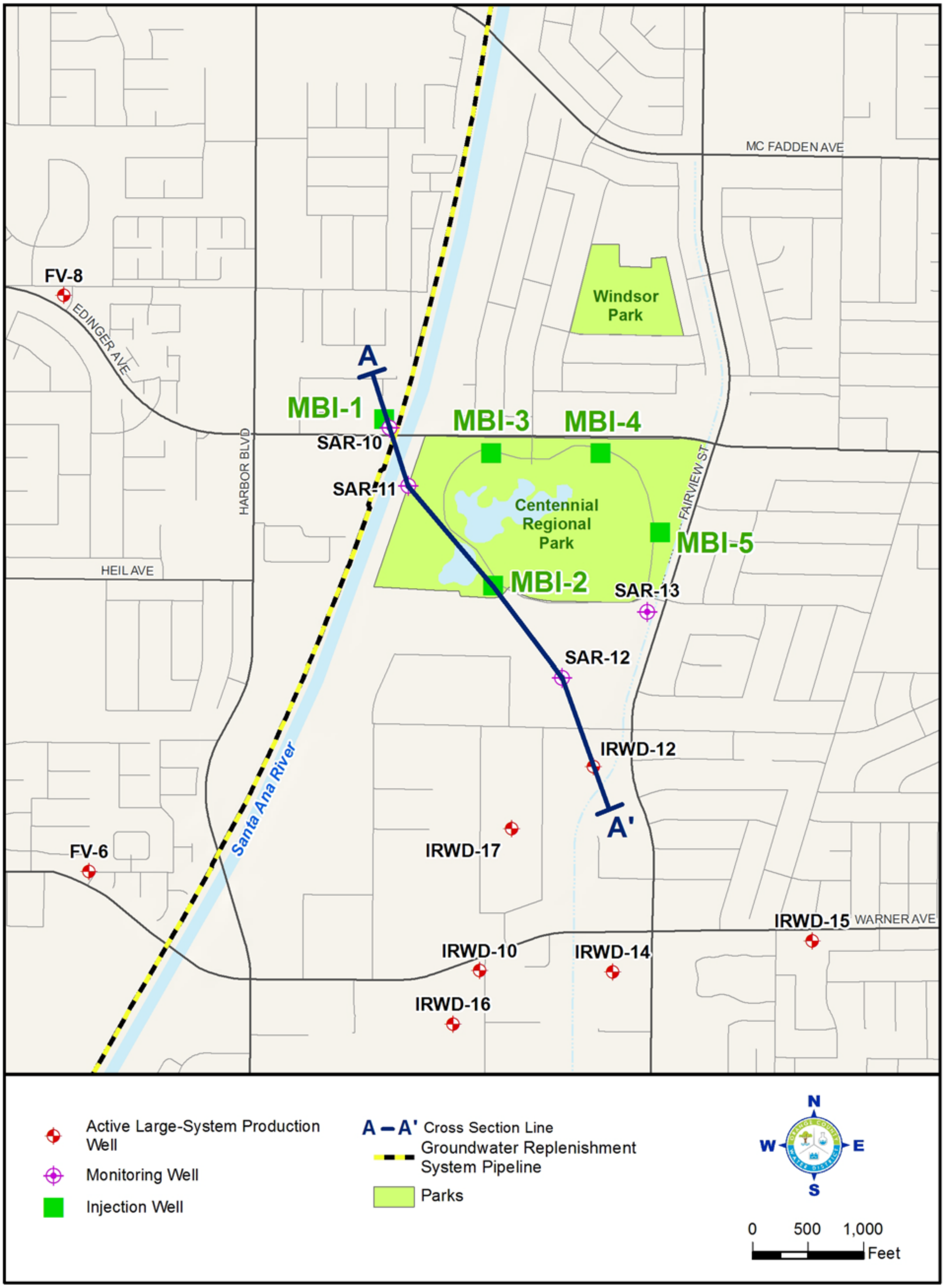


Figure 8-1. DMBI Project Area and Well Location Map

characterized by coarse-grained high permeability sediments (e.g., sands and gravels) and 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.

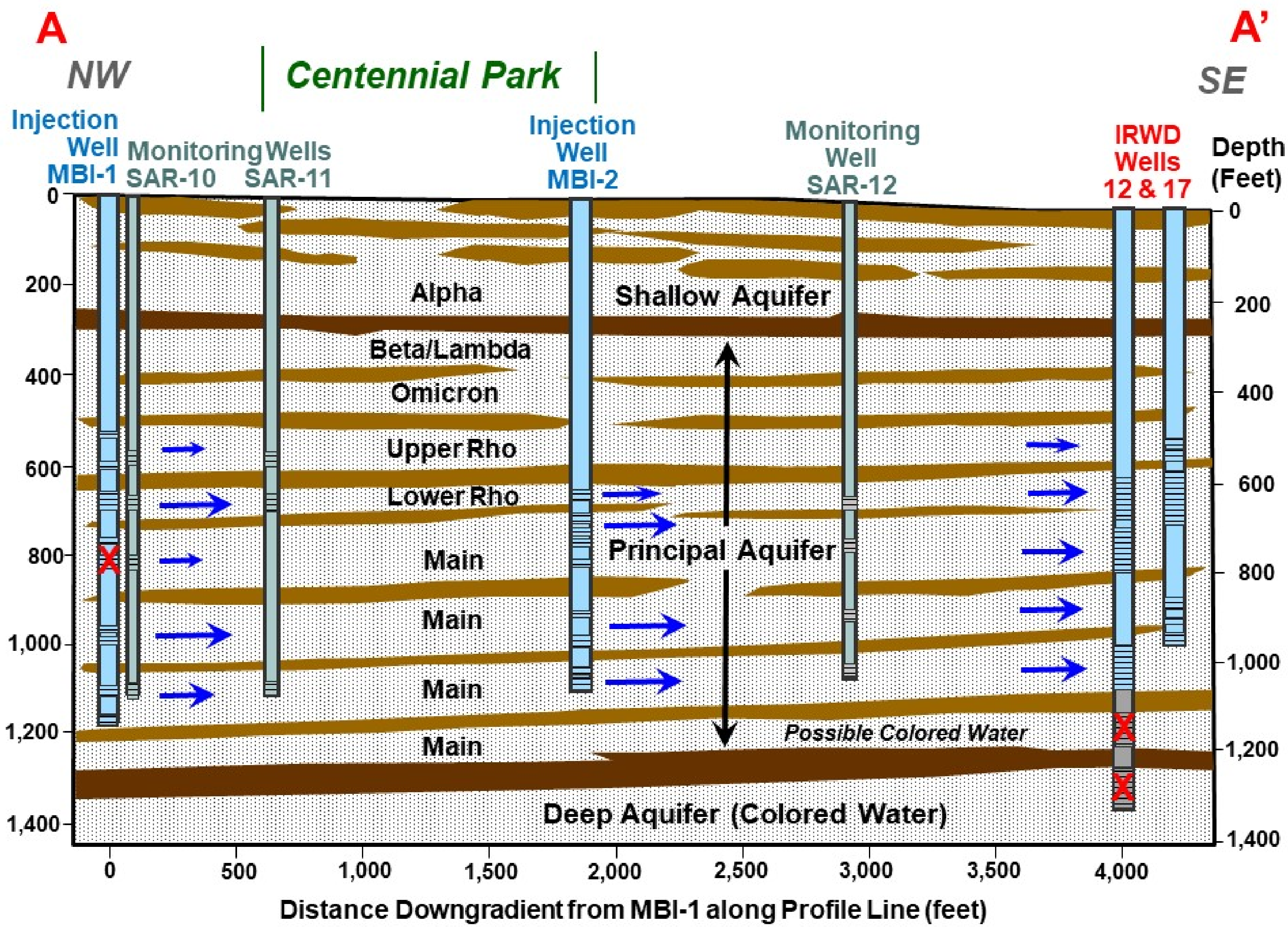


Figure 8-2. Schematic Geological Cross Section Through the DMBI Project Area

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 OCWD staff's 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.

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 volume 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 pumping often drives groundwater levels to as low as 100 feet below mean sea level in the summer 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 groundwater monitoring program similar to those of 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 2019, 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 2019. 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 have been 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 injection well MBI-1 is screened in this aquifer zone, as are the nearest downgradient production wells (IRWD-12 and IRWD-17) that will 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, 2019. 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 54 feet below mean sea level at SAR-10 and 61 feet below mean sea level at SAR-11 at the end of June 2019, approximately 8 feet lower at SAR-10 and 13 feet lower at SAR-11 than in June 2018. 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 active large-system 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 2019 were approximately 81 feet below mean sea level, approximately 20 feet lower than in June 2018. The June 2019 groundwater elevations at IRWD-12 were approximately 27 feet lower than at SAR-10 adjacent to the MBI-1 site, as compared to 15 feet lower than SAR-10 in June 2018, resulting in a steeper gradient in June 2019 and thus likely a somewhat faster groundwater velocity. As the hydraulic gradient in this area is strongly influenced by variations in the timing and amount of nearby pumping, the steeper gradient during June 2019 was likely due to 1,500 AF more groundwater pumping from the IRWD Dyer Road Well Field in June 2019 than in June 2018, representing an increase of nearly 80%. Based on analysis of groundwater levels before and after MBI-1 injection began, injection operations during both 2018 and 2019 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.

Finally, it should be noted that although Figure 8-3 shows new injection wells MBI-2, MBI-3, MBI-4, and MBI-5, they were not yet active in 2019 but were recently commissioned and placed on-line in March 2020. Their effect on Principal aquifer groundwater elevations, including the magnitude and direction of the hydraulic gradient, will be presented in this section of next year's Annual Report.

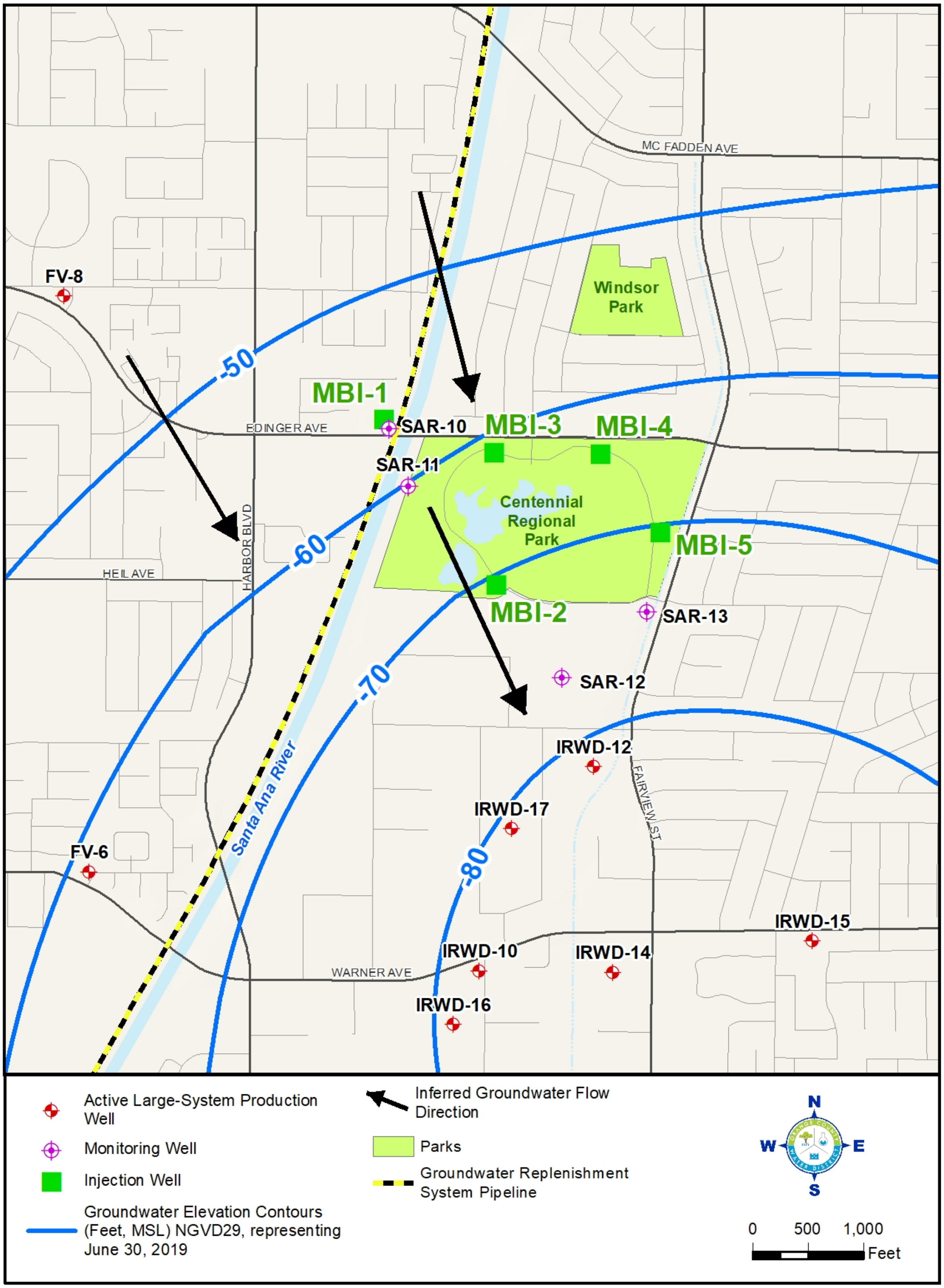


Figure 8-3. Principal Aquifer Potentiometric Surface with Inferred Groundwater Flow Directions in the DMBI Area

8.3.2 Compliance Monitoring Well Trends

Groundwater level hydrographs for DMBI Project monitoring wells SAR-10 and SAR-11 are shown in 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 show groundwater level and chloride data from 2014 through 2019, a timeframe showing over one year of ambient background data before MBI-1 came on-line in April 2015. 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 2014-2019 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 and/or remaining high 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.

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.

During 2019, Principal aquifer groundwater levels at SAR-10 (Figure 8-4) and SAR-11 (Figure 8-5) were similar to one another and followed the typical seasonal pattern described above, albeit slightly dampened in range relative to previous years. During the first quarter, Principal aquifer groundwater levels at both monitoring wells remained relatively high and stable, rising just slightly during the winter and early spring months, and peaking in early March. During the second quarter, Principal aquifer groundwater levels gradually declined overall, as is typical, except for a brief rise in May likely due to decreased Basin pumping in response to significant late season rainfall. During the third quarter, Principal aquifer groundwater levels continued their typical

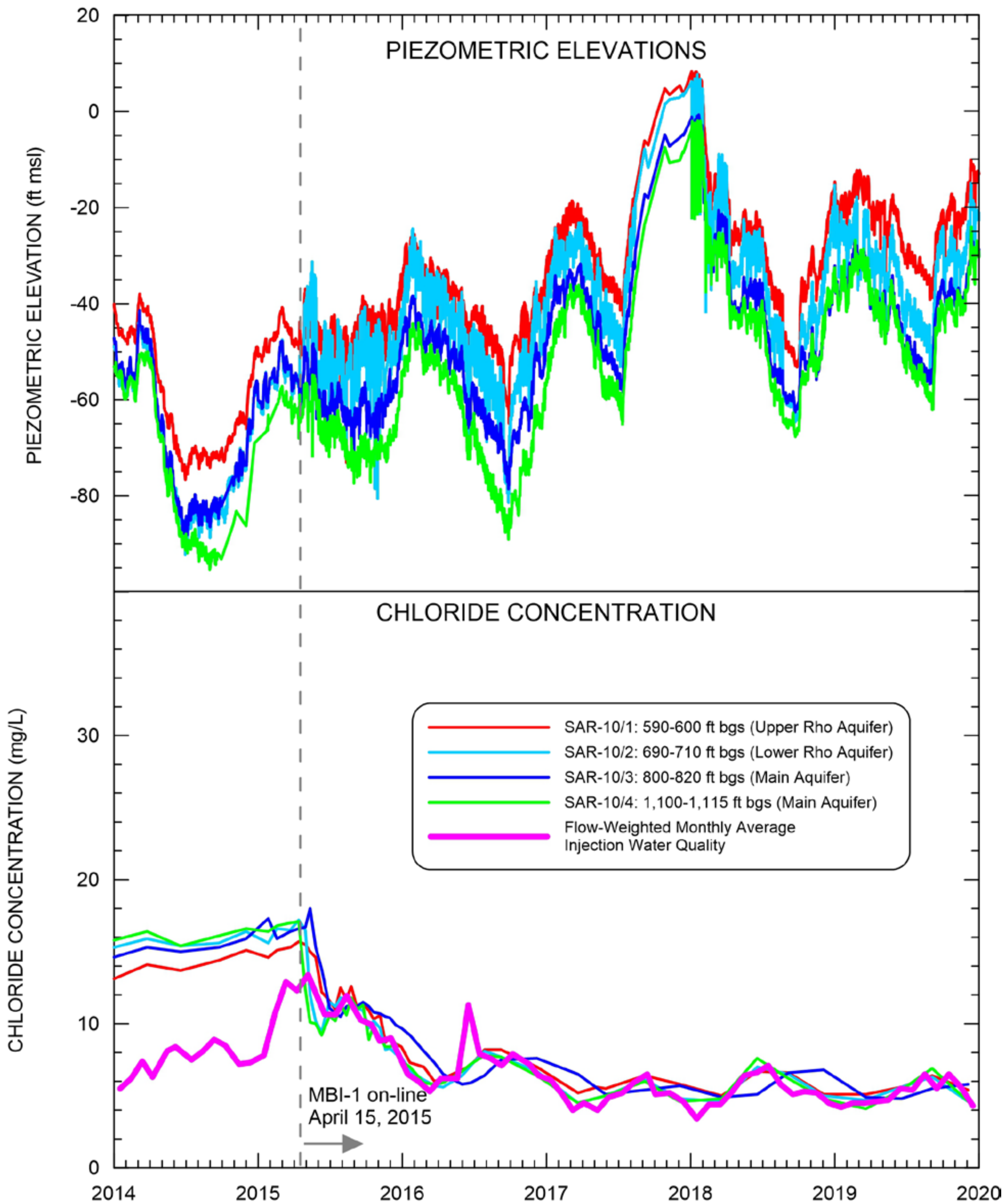


Figure 8-4. Monitoring Well SAR-10 Piezometric Elevations and Chloride Concentration

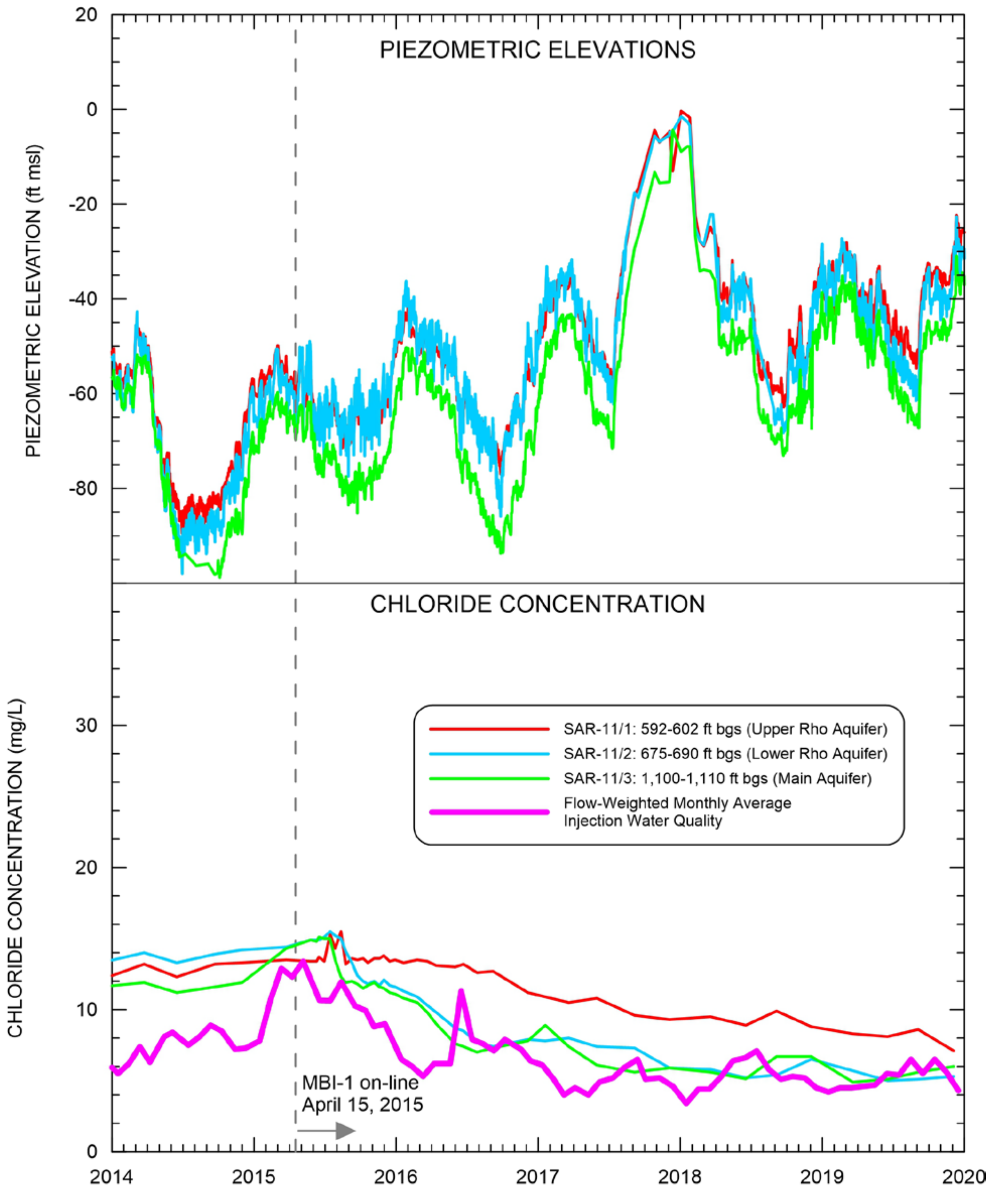


Figure 8-5. Monitoring Well SAR-11 Piezometric Elevations and Chloride Concentration

decline due to increased summertime pumping and dropped to an annual low in early September that was approximately 6 feet higher than the summer low the prior year. During the fourth quarter, Principal aquifer groundwater levels at both wells rose by an amount slightly greater in magnitude than the 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 2019 approximately 5 feet higher than at the beginning of the year and higher than the end of all years shown on Figure 8-4 and Figure 8-5, with the exception of the late 2017 peak that was directly related to a basin-wide In-Lieu Program. In fact, Principal aquifer groundwater levels at both wells show an overall rising long-term average trend for the six-year period 2014-2019.

8.4 Groundwater Quality

Quarterly compliance sampling continued at monitoring wells SAR-10 and SAR-11 during 2019, following periods of more frequent voluntary monitoring in 2015 and 2016 around the startup of MBI-1 operations. Groundwater quality data for 2019 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 2019 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.

This section describes monitoring well groundwater quality for general constituents used as intrinsic tracers, 1,4-dioxane, NDMA, 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 2019 ranged from approximately 4 to 7 mg/L, with an annual average of approximately 5 mg/L for the third consecutive year and slightly less than the 7 to 11 mg/L average in 2015-2016 due to replacement of RO membranes at the AWPF. Since commencement of MBI-1 operations in April 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 more proximal 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. From the chloride data only, a precise initial arrival time was difficult to discern, possibly due to limited injection into this interval.

Chloride concentrations at SAR-11/1 have gradually declined during 2016-2019 and reached a low of approximately 7 mg/L in December 2019, still slightly higher than but approaching 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). During 2019, chloride concentrations at both SAR-11/2 and SAR-11/3 (Figure 8-5) remained low and stable at GWRS levels, indicating approximately 100% GWRS water in these two zones.

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 than chloride 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 but with more definitive breakthrough curves.

Figure 8-6 and Figure 8-7 show chloride and sulfate concentrations during 2015-2019 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 readily apparent with 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 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.

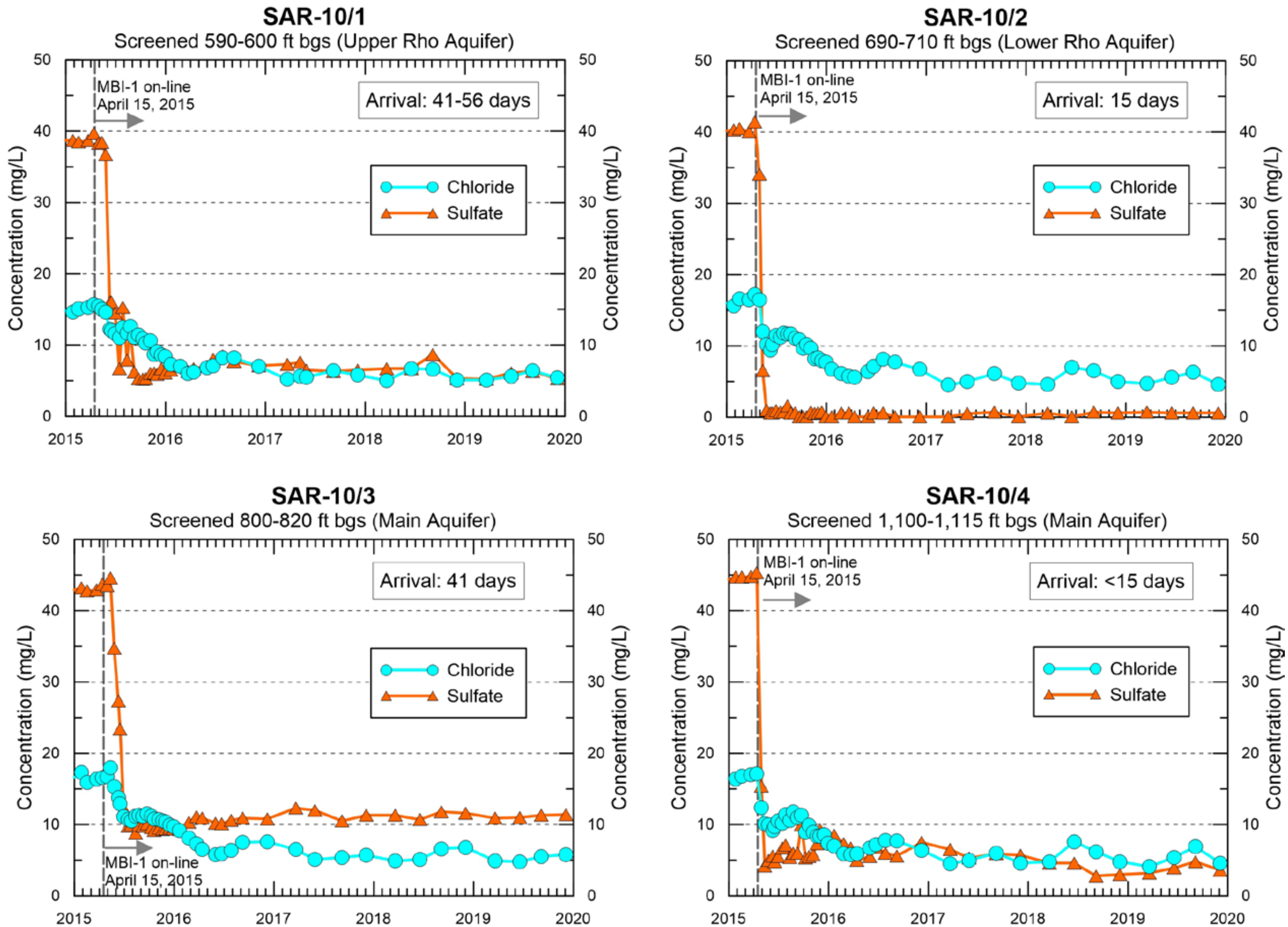


Figure 8-6. Monitoring Well SAR-10 Chloride and Sulfate Concentrations

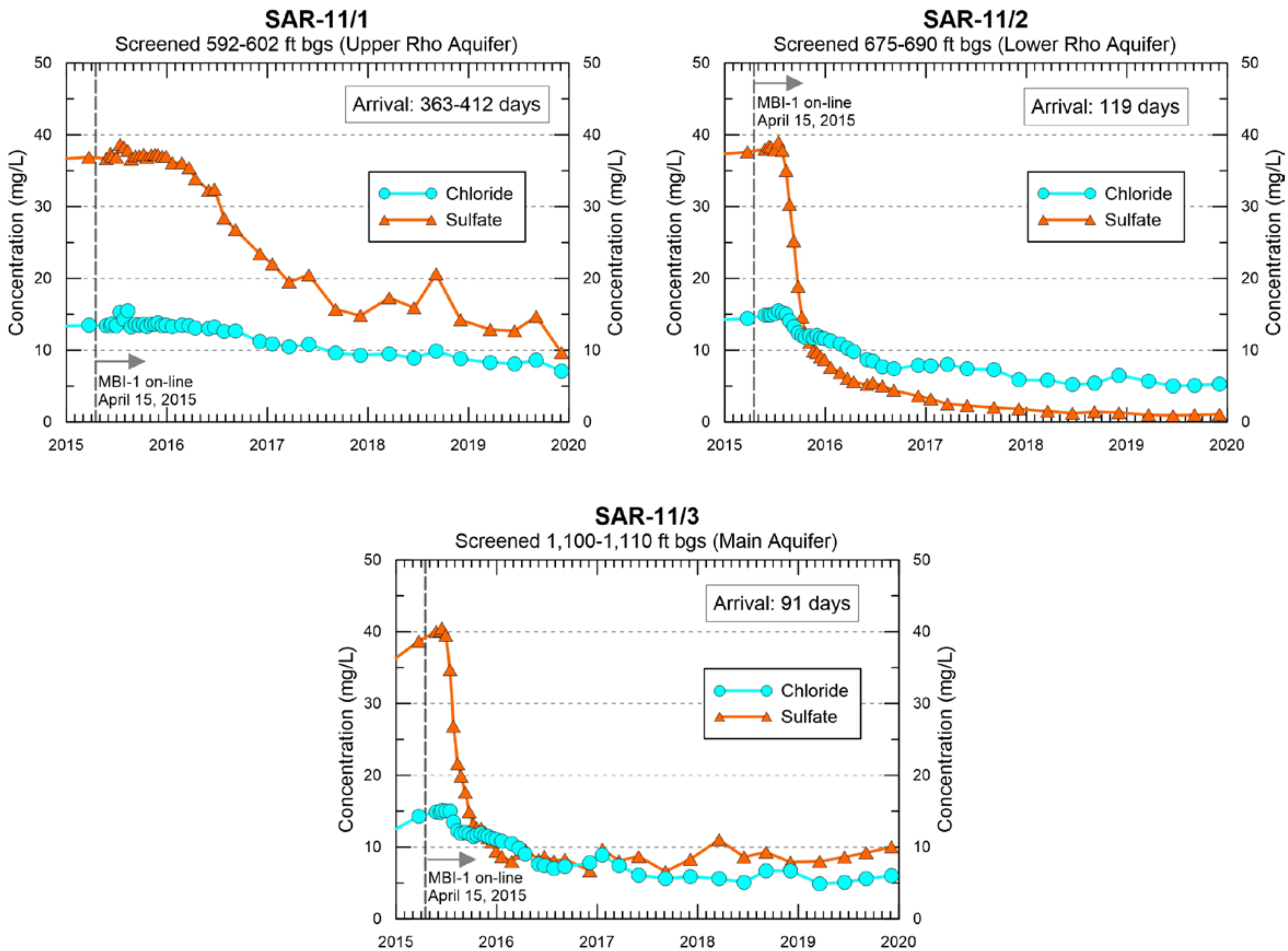


Figure 8-7. Monitoring Well SAR-11 Chloride and Sulfate Concentrations

During 2019, only SAR-10/2 (Figure 8-6) and SAR-11/2 (Figure 8-7) showed sulfate concentrations as low as GWRS water, thereby indicating approximately 100% sustained GWRS water at these two wells, which are both screened in the Lower Rho aquifer which was shown to receive the largest proportion of MBI-1 injection. During 2019, sulfate concentrations at SAR-11/1 continued the steadily decreasing trend that began in 2016, similar to the contemporaneous chloride concentration decline discussed previously and indicating an increasing proportion of GWRS water but still less than 100%. At SAR-10/1, SAR-10/3, SAR-10/4, and SAR-11/3, sulfate concentrations have remained relatively low and stable since 2016 after arrival of GWRS water but have never completely declined to GWRS levels like for chloride, likely due to the oxidation of iron sulfide minerals generating sulfate in these aquifers zones.

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).

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). From 2014 to late 2015, NDMA concentrations in GWRS-FPW were high relative to more recent years, with an average of approximately 3 ng/L and three detections above the NL of 10 ng/L with the highest being 15.8 ng/L. In late 2015, a lower pH target of 8.5 was implemented in the post-treatment process and the replacement of RO membranes began. RO membrane replacement occurred continuously and is thought to be effective in further reducing the amount of precursor passing through to the downstream processes, thus helping to limit NDMA reformation (OCWD, 2015c). From late 2015 to early 2018 the average NDMA concentration in GWRS-FPW was reduced to approximately 1 ng/L, with only one detection exceeding 5 ng/L. During the second half of 2019 however, NDMA concentrations in GWRS-FPW were slightly higher, frequently in the 2 to 4 ng/L range, with a maximum detection of 5.2 ng/L (well below the NL of 10 ng/L).

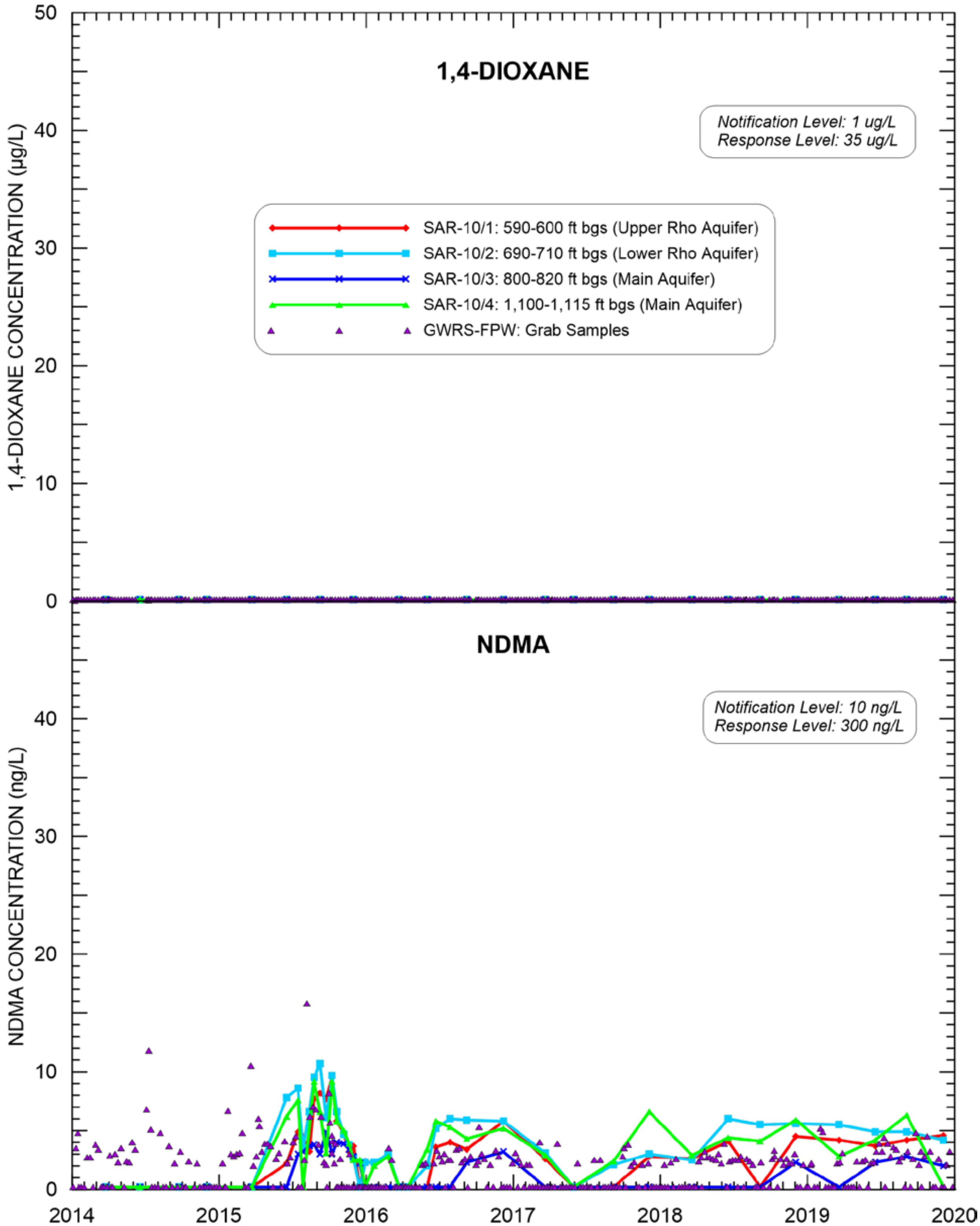


Figure 8-8. Monitoring Well SAR-10 1,4-Dioxane and NDMA Concentrations

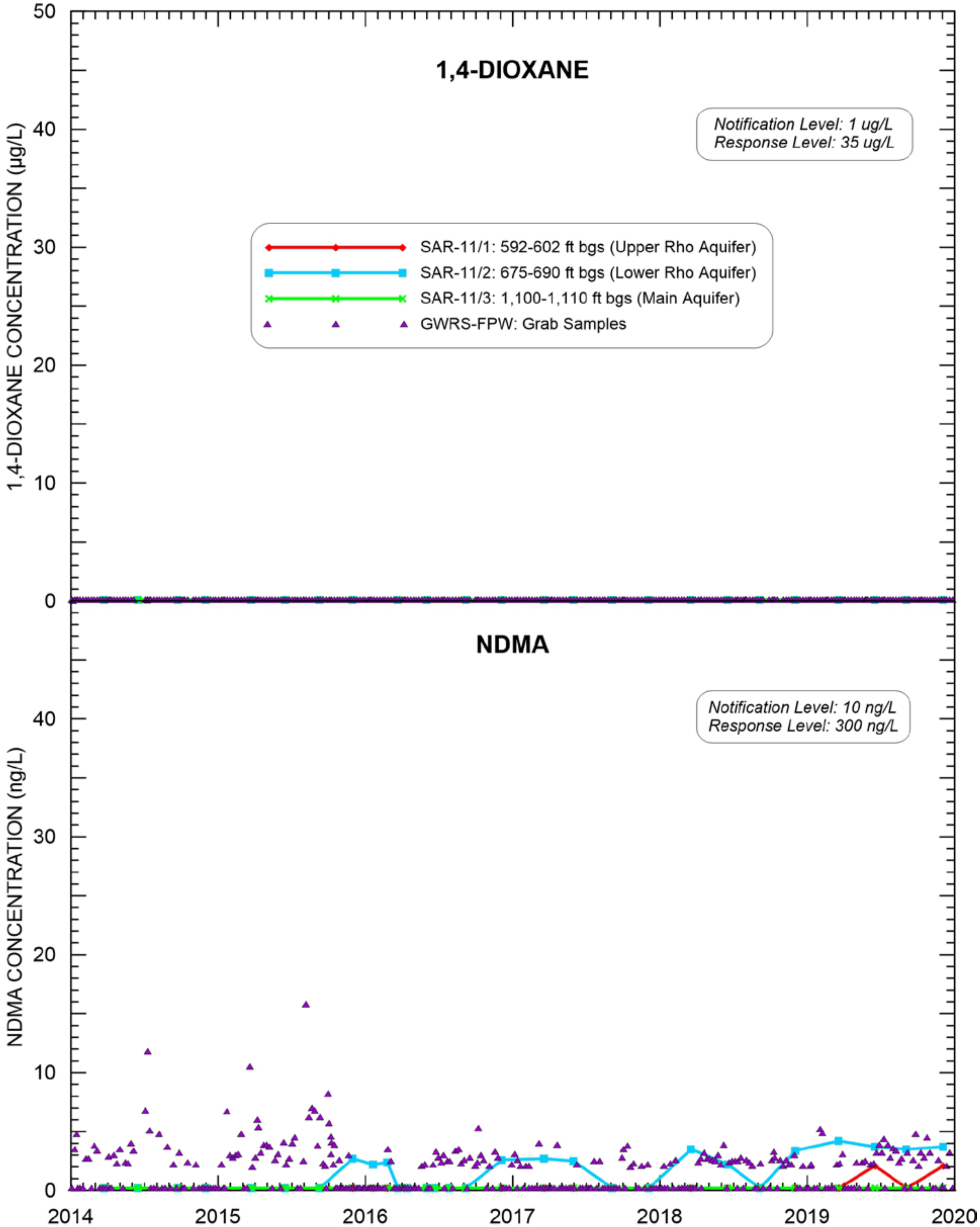


Figure 8-9. Monitoring Well SAR-11 1,4-Dioxane and NDMA Concentrations

NDMA concentrations at SAR-10 for 2014-2019 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 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 2019, NDMA concentrations in all four zones at SAR-10 ranged from below the RDL to 6.3 ng/L (Figure 8-8). At SAR-10/1 and SAR-10/3, NDMA concentrations were lower than the other wells at the SAR-10 site and were consistently within the range of NDMA concentrations of GWRS-FPW during 2019. At SAR-10/2, NDMA concentrations were consistently the highest of the SAR-10 wells throughout 2019, gradually declining from a high of 6 ng/L in mid-2018 down to 4.2 ng/L in the fourth quarter of 2019. This range in NDMA concentrations at SAR-10/2 is slightly higher than the contemporaneous NDMA concentrations in GWRS-FPW and was likely caused by older GWRS water injected during the 2015-2017 period arriving at this well due to a shift in the local hydraulic gradient from well development activities and pump testing of the new MBI wells in Centennial Park during the second half of 2018. At SAR-10/4, NDMA concentrations during 2019 were the most variable of the SAR-10 wells, registering the highest and lowest detections of the group, which may be attributable to the extremely short arrival time at SAR-10/4 indicating primarily advective transport with little to no mixing or dispersion.

NDMA concentrations at SAR-11 for 2014-2019 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 start of MBI-1 injection, SAR-11/3 has consistently been non-detect. Prior to 2019, SAR-11/1 had also consistently been non-detect for NDMA but was measured at 2.1 ng/L in June and again in December of 2019. The NDMA concentrations at SAR-11/1 in 2019 are within the lower range of those measured in GWRS-FPW throughout the year. At SAR-11/2, NDMA concentrations were detected in the 2 to 4 ng/L range intermittently during 2015-2018 and remained slightly higher and more stable at 3.5 to 4.2 ng/L throughout 2019, which was generally consistent with concurrent NDMA concentrations in GWRS-FPW but could have also been affected by the gradient shift discussed above for the analogous SAR-10/2. Overall, the NDMA concentrations were 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

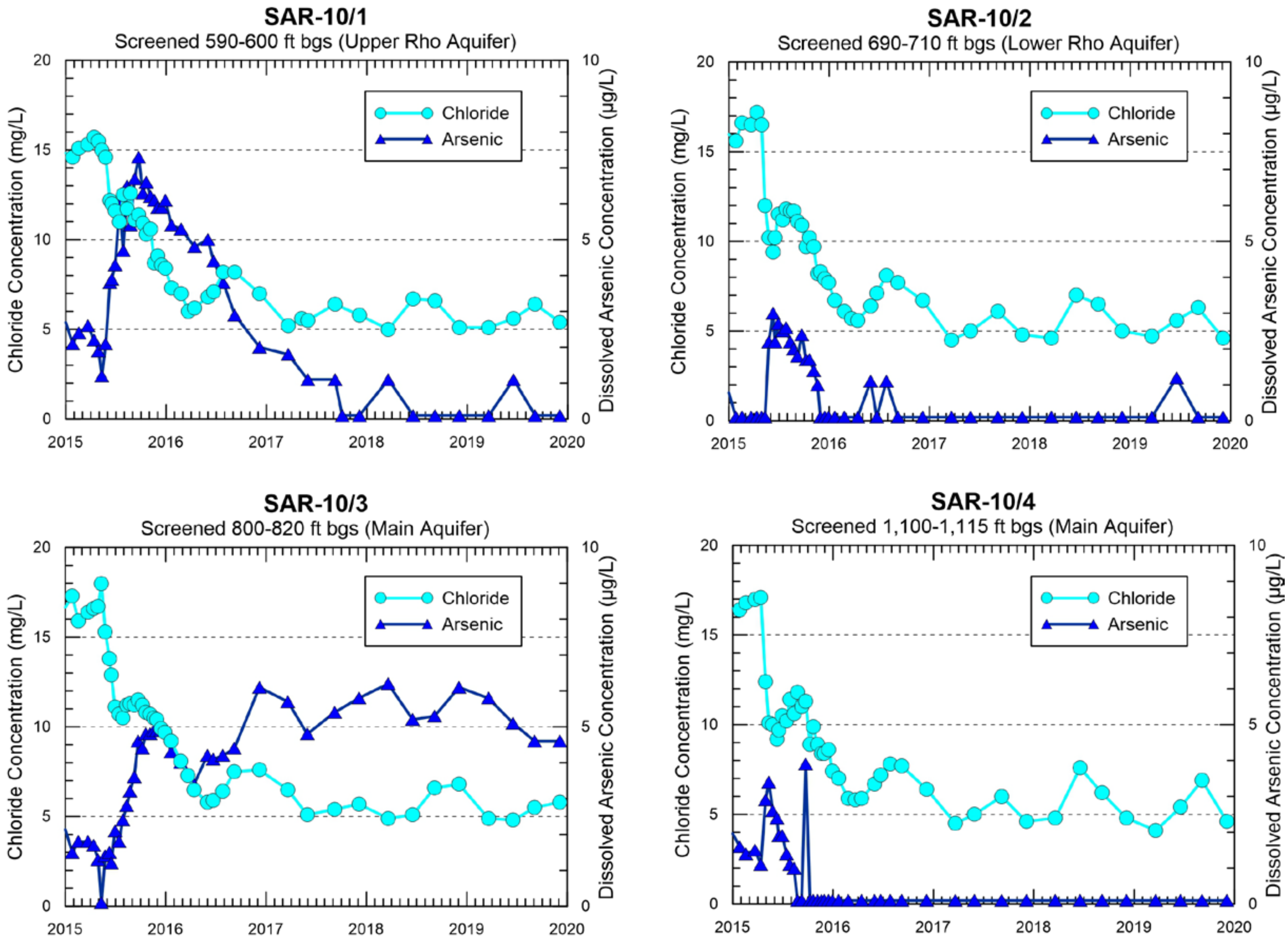


Figure 8-10. Monitoring Well SAR-10 Chloride and Dissolved Arsenic Concentrations

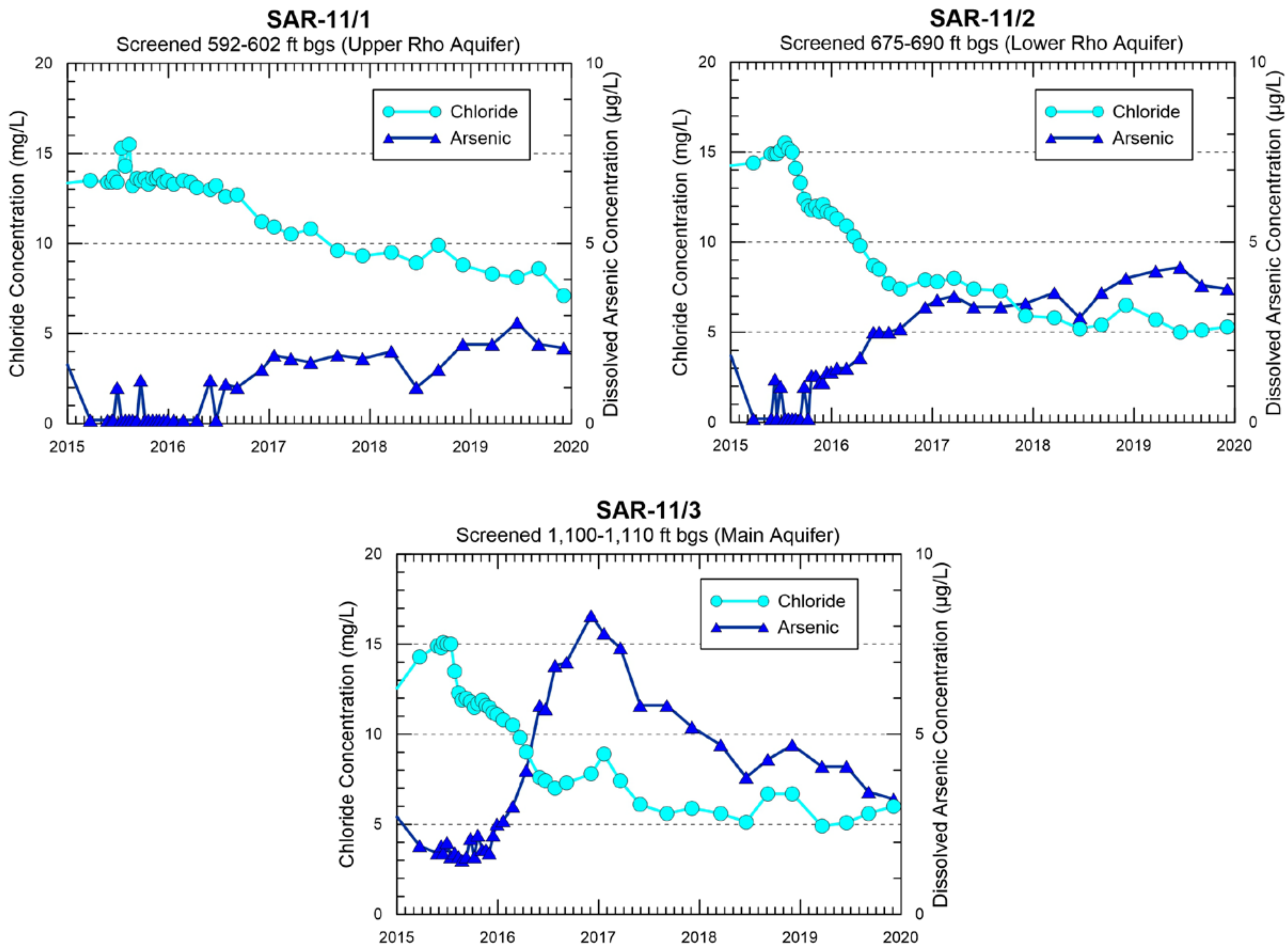


Figure 8-11. Monitoring Well SAR-11 Chloride and Dissolved Arsenic Concentrations

dissolved arsenic and chloride concentrations during 2015-2019 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; and then 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.

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 to below the RDL at SAR-10/2 by late 2016 and at 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, SAR-10/2, and SAR-10/4 gradually declined below pre-injection ambient levels due to arsenic mass removal from the sustained presence of 100% GWRS water and remained below the RDL of 1 µg/L during 2019, except for minor detections in June of 1.1 and 1.2 µg/L at SAR-10/1 and SAR-10/2, respectively (Figure 8-10). These minor detections in June 2019 may have been related to the aforementioned gradient shift in this localized area during the second half of 2018.

Small variations in the chloride concentrations observed at all SAR-10 zones during 2016-19 (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.

At SAR-10/3, arsenic concentrations increased after the first arrival of GWRS water in 2015 and continue to remain elevated beyond pre-injection ambient background levels through 2019. Concentrations reached temporary peaks of approximately 6 µg/L in December 2016, March 2018, and December 2018, all slightly higher than the initial peak of approximately 5 µg/L in late 2015 (Figure 8-10). As was discussed in the previous section for SAR-10/3, although chloride concentrations were down at GWRS levels, sulfate concentrations of approximately 10 to 12 mg/L during 2016-2019 (Figure 8-6) were higher than those in GWRS-FPW and may indicate the oxidation of iron sulfide minerals; this may indicate a somewhat different geochemical environment for mobilization compared to other zones at SAR-10.

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 coupled with an increase in arsenic concentrations from non-detect to approximately 2 µg/L during the second half of 2016 and were just slightly higher at 2.1 to 2.8 µg/L during 2019. At SAR-11/2 and SAR-11/3, the initial arsenic increase resulting from the first arrival of GWRS water began in late 2015 but 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, after the initial arrival of GWRS water in 2015, arsenic concentrations continued to rise at both SAR-11/2 and SAR-11/3. At SAR-11/2, arsenic concentrations continued to gradually rise since 2016 and peaked at 4.3 µg/L in June 2019 before declining slightly to 3.7 µg/L in December. At SAR-11/3, arsenic concentrations rose more sharply and peaked at 8.3 µg/L in December 2016 before steadily declining to 3.5 µg/L by December 2019 (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. This geochemistry may also help to explain sulfate concentrations in some of the zones at SAR-10 and SAR-11 never declining as low as GWRS-FPW levels despite more conservative chloride concentrations indicative of 100% GWRS water.

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 2015-2019 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 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.

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 of 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. Since peaking in mid-2016, vanadium concentrations at SAR-10/1 have gradually declined and ranged from 3.6 to 4.1 µg/L during 2019, just slightly less 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 and 2019. As was

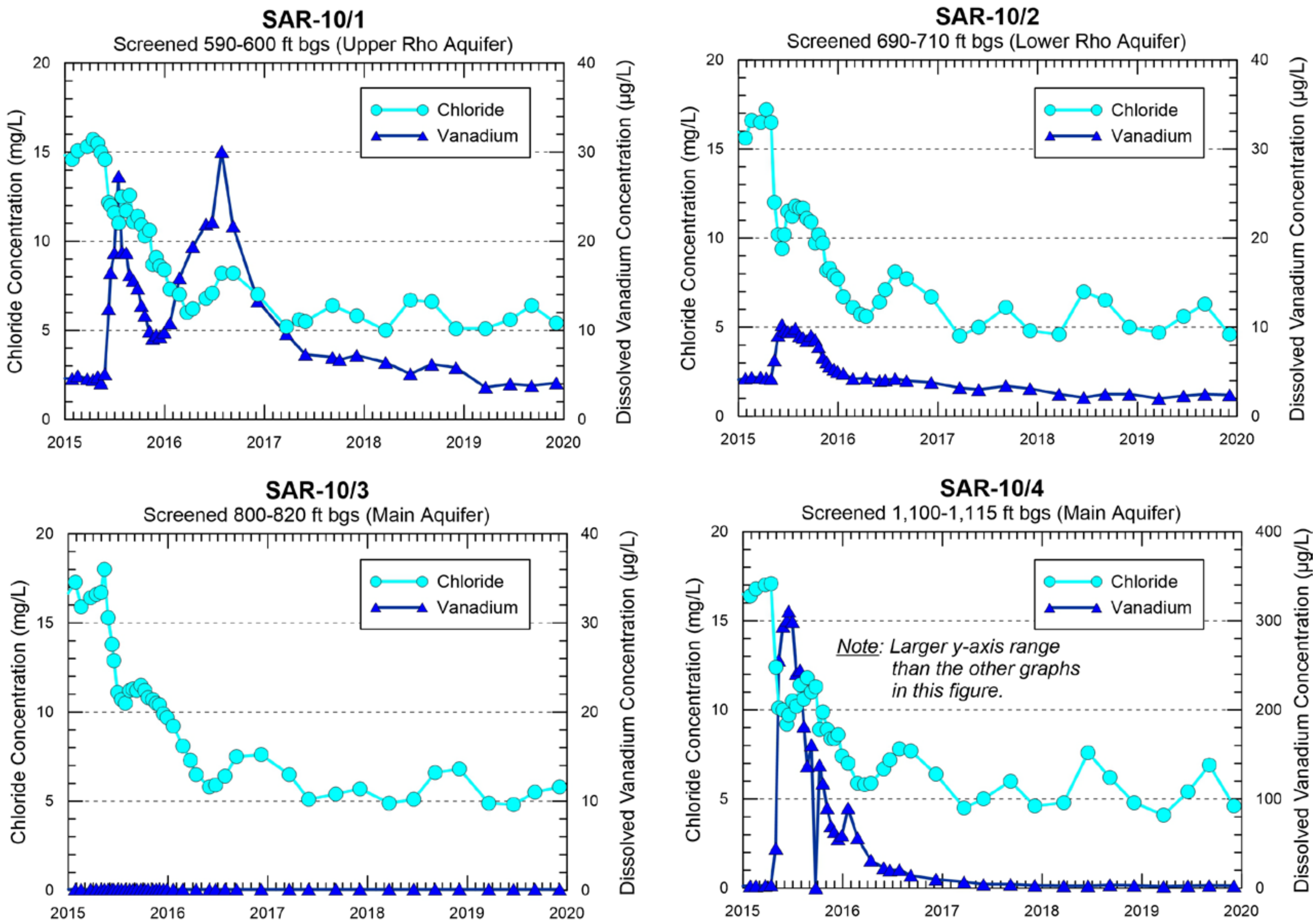


Figure 8-12. Monitoring Well SAR-10 Chloride and Dissolved Vanadium Concentrations

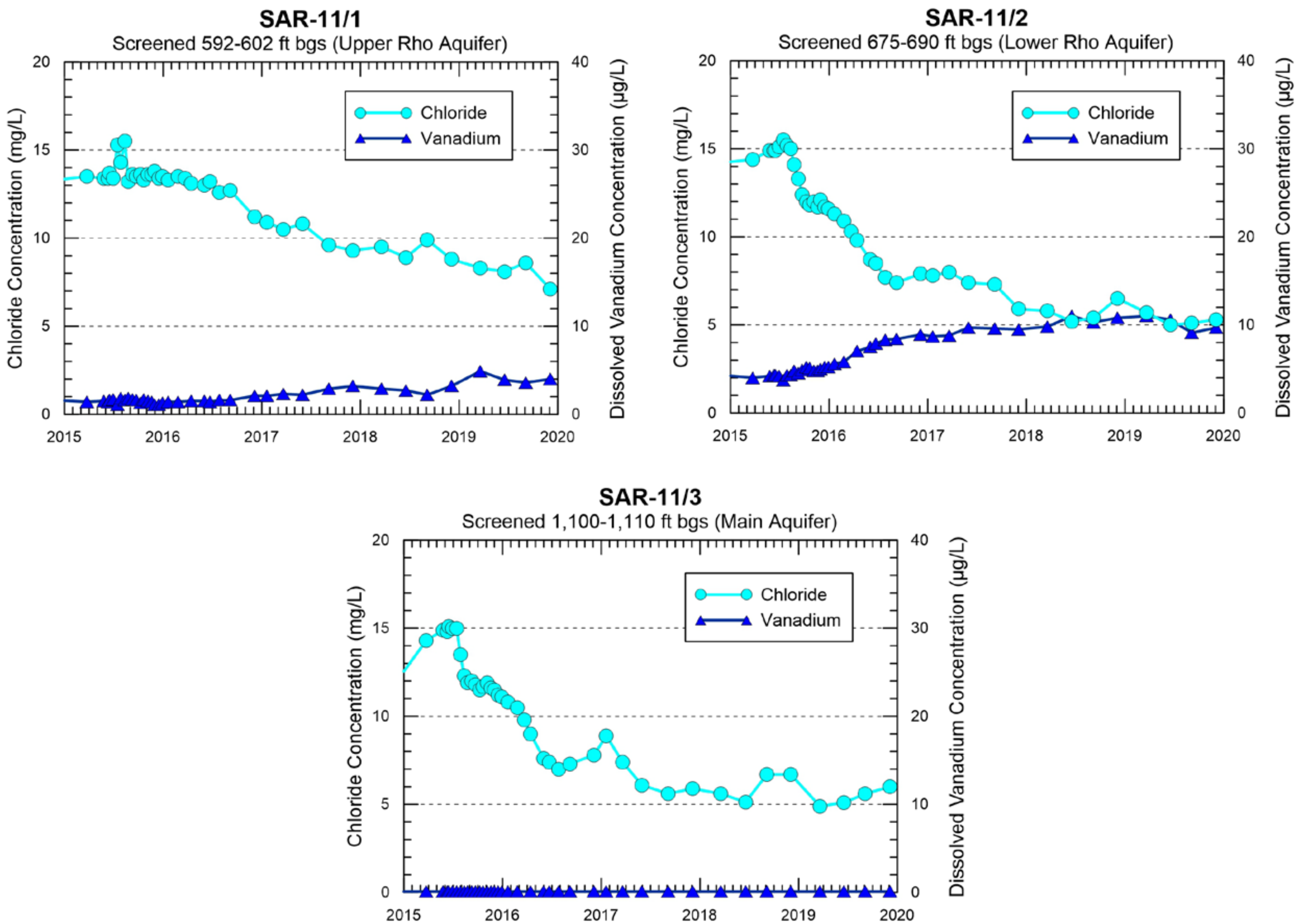


Figure 8-13. Monitoring Well SAR-11 Chloride and Dissolved Vanadium Concentrations

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 2.1 to 3 µg/L during 2019, 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-11/1 (Figure 8-13), the previously documented arrival of less than 100% GWRS water at this well in mid-2016 was not discernable as vanadium concentrations remained at low ambient levels below 2 µg/L but began to rise ever so slightly from 2.1 µg/L in December 2016 to a mild peak of 4.9 µg/L in the first quarter of 2019 before decreasing slightly to just below 4 µg/L for the remainder of the year.

At SAR-11/2 (Figure 8-13), vanadium concentrations began to rise during 2016 from ambient background concentrations of 4 to 5 µg/L to 11 µg/L by June 2018 as GWRS arrival likely reached 100% during this time based on contemporaneous chloride and sulfate concentrations declining to approximately GWRS levels. During 2019, vanadium concentrations at SAR-11/2 remained at 11 µg/L in the first quarter before decreasing slightly to under 10 µg/L during the second half of the year, as 100% GWRS water was sustained at the well. 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 a California primary and secondary MCL 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 2019, total aluminum concentrations at SAR-10/1 were below the Secondary MCL all year, remaining within ambient levels except for a slight increase to 139 µg/L during the fourth quarter.

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 a California and Federal Secondary MCL, both set at 300 µg/L. Total iron concentrations at SAR-10/1 have 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 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).

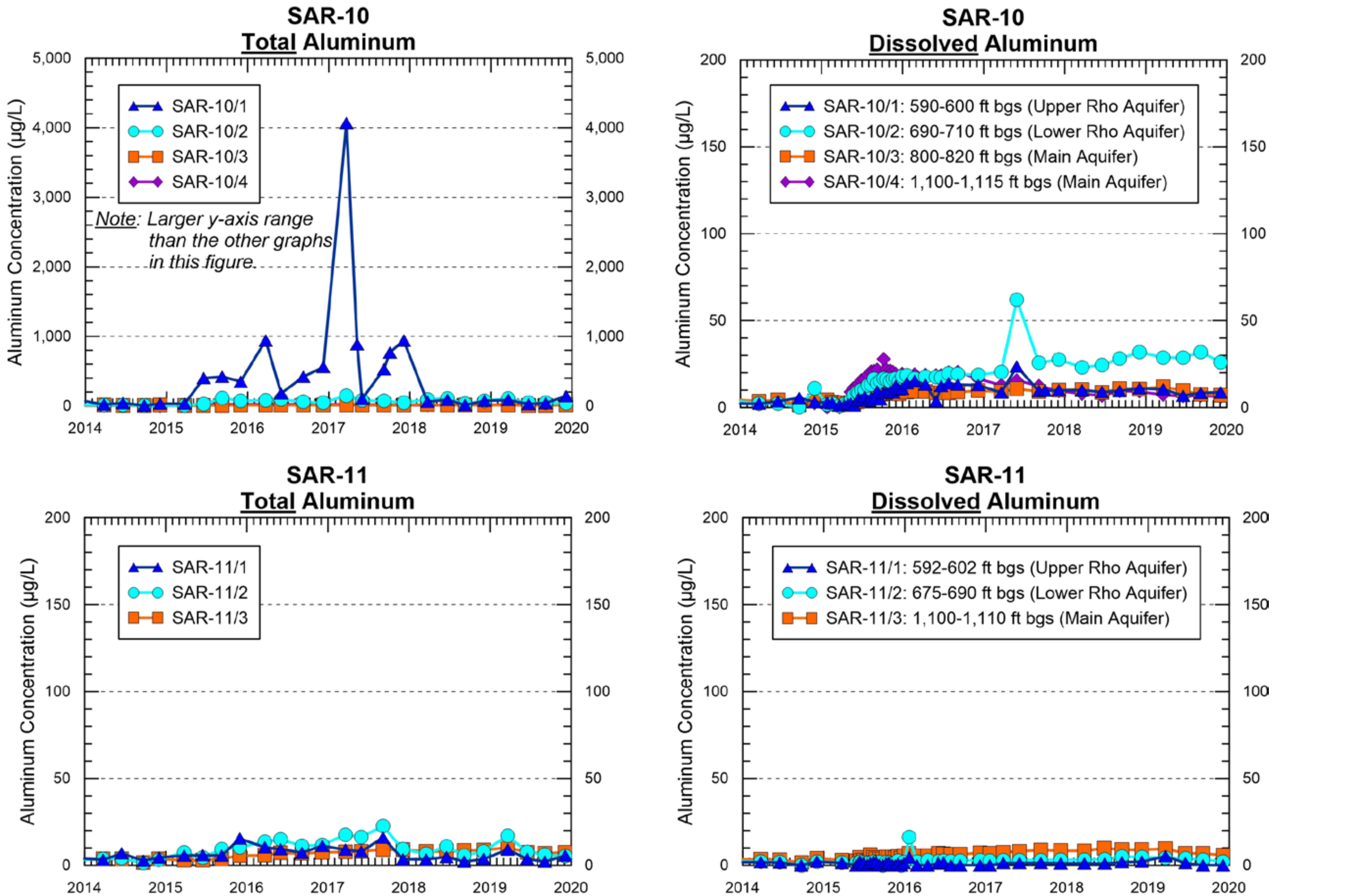


Figure 8-14. Monitoring Wells SAR-10 and SAR-11 Total and Dissolved Aluminum Concentrations

Table 8-3. 2019 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	0.64 (ND - 1.5)	28.7 (27.9 - 31.0)	61.1 (60.2 - 62.4)	330 (302 - 358)	1.328 (1.14 - 1.47)	ND	0.097 (ND - 0.13)	ND	ND
IRWD-12	1,335	580 - 1,040	3,655	0.38 (ND - 1.2)	15.9 (15.5 - 17.2)	38.4 (37.7 - 39.9)	236 (212 - 266)	0.346 (0.30 - 0.39)	0.001 (ND - 0.002)	0.050 (ND - 0.10)	ND	ND
IRWD-17	980	504 - 960	3,864	0.35 (ND - 1.1)	21.3 (19.6 - 23.4)	46.8 (44.3 - 49.8)	260 (232 - 278)	0.336 (0.27 - 0.40)	0.001 (ND - 0.002)	0.102 (0.07 - 0.14)	ND	0.60 (ND - 1.1)
FV-6	1,120	370 - 1,110	4,867	0.43 (ND - 1.4)	36.5 (34.1 - 40.1)	66.8 (64.0 - 71.9)	293 (246 - 332)	0.865 (0.80 - 0.96)	0.001 (ND - 0.004)	0.152 (0.08 - 0.18)	ND	1.96 (1.7 - 2.5)

[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

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, 2018); 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 2019 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 chloride concentrations during 2019, experiencing a slight increase from 15 to 17 mg/L at IRWD-12 and 20 to 23 mg/L at IRWD-17. Sulfate concentrations during 2019 at IRWD-12 and IRWD-17 also experienced a slight increase from 38 to 40 mg/L and 44 to 50 mg/L, respectively. These 2019 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 have shown 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 system and migrating slowly south to the IRWD Dyer Road Well Field area. At IRWD-12 and IRWD-17, both chloride and sulfate concentrations continue the long-term slight gradual increase and remain in the native range, forming a clear indication that in 2019 GWRS water from MBI-1 has not arrived at either of these downgradient production wells.

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 system 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

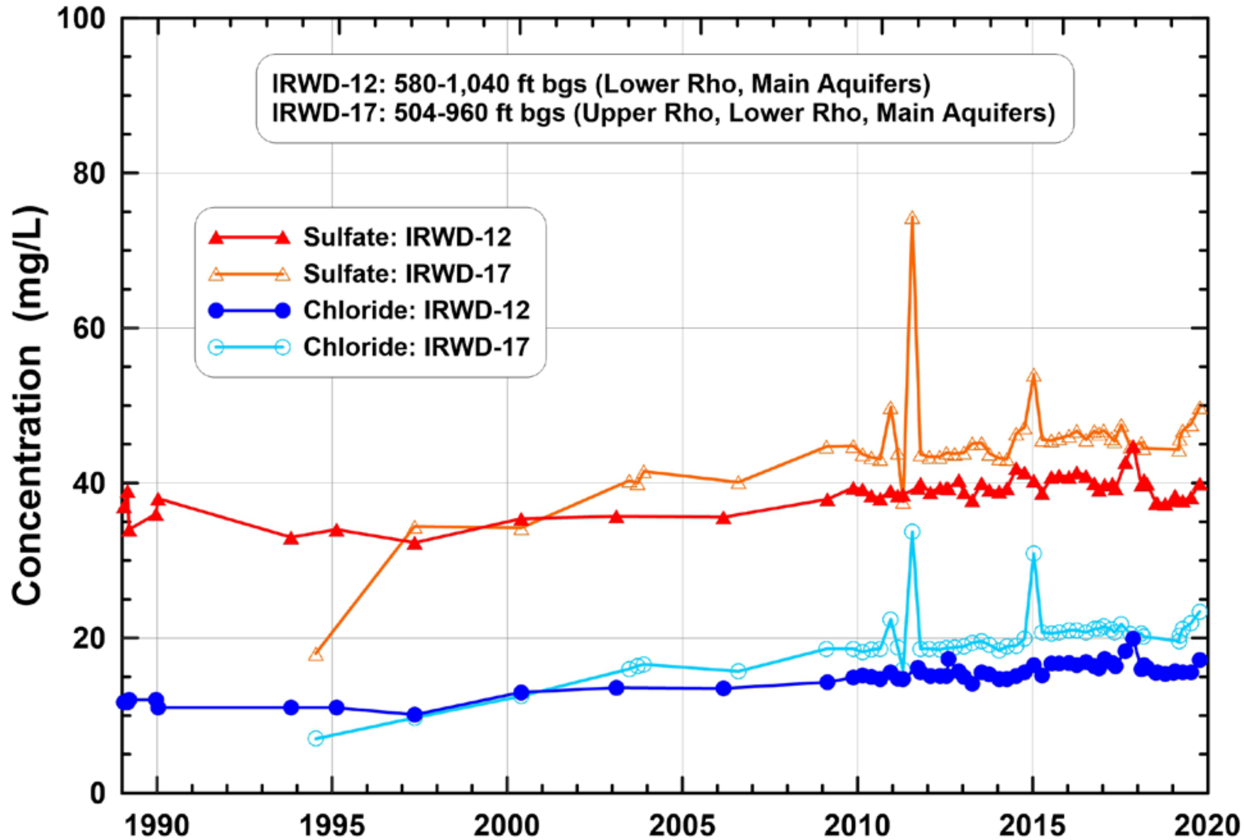


Figure 8-15. Wells IRWD-12 and IRWD-17 Chloride and Sulfate Concentrations

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 2019, IRWD-12 had only one minor detection of 1.2 µg/L based on quarterly samples. At IRWD-17, arsenic concentrations ranged historically from below the RDL to 2.4 µg/L, and during 2019 IRWD-17 had one minor detection of 1.1 µg/L based on quarterly samples. During 2019, vanadium concentrations at both IRWD-12 and IRWD-17 remained within the historical range of 2.4 to 5.9 µg/L and remaining well below the NL of 50 µg/L.

IRWD-12 and IRWD-17 historically have had no detections of NDMA or 1,4-dioxane. However, IRWD-17 had a minor detection of 1,4-dioxane at a concentration of 1.1 µg/L just above the RDL for the first time in July 2019 and subsequently confirmed with a resample at the same concentration in August 2019, before dropping back down below the RDL in October. This may indicate a small percentage of historical (pre-GWRS) injection water finally arriving at IRWD-17 from the Talbert Barrier approximately 2 miles away.

In closing, since injection operations at MBI-1 began in April 2015, GWRS water from MBI-1 has not arrived at IRWD-12 or IRWD-17. Based on the observed arrival times discussed above and the groundwater modeling result, GWRS water from MBI-1 is expected to arrive at one or both of these production wells in 2020 or later. 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 new MBI wells in Centennial Park were placed on-line March 2020 and the additional injection will likely strengthen the GWRS signal and steepen the gradient within the Principal aquifer and reduce anticipated travel times.

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)
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
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Appendix A

Water Quality Requirements for

Groundwater Replenishment System

and

Final Product Water Quality Data

January 1 through December 31, 2019

Advanced Water Treatment Facility

Orange County Water District
Groundwater Replenishment System
2019 Annual Report

WATER QUALITY -- GWRS SYSTEM PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1]) AVERAGES FOR ALL AVAILABLE DATA FOR 2019[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 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	96.92	87.76	90.72	92.01				≤ 100
REQUIRED REVERSE OSMOSIS PRODUCT MONITORING[5]											
Ultraviolet Transmittance (UV%/T) at 254	Plant Monitoring	0.10%	%	97.4%	97.8%	97.9%	97.7%				>90%
Turbidity	Plant Monitoring	N/A	NTU	0.06	0.06	0.07	0.07		5		<0.2/0.5[6]
BIOLOGICAL											
E. Coli (Colilert - MPN/100mL) (ECOLIQ)	9223B	1	MPN	ND	ND	ND	ND				N/A
Total Coliform (Colilert - MPN/100mL) (TCOLIQ)	9223B	1	MPN	ND	ND	ND	ND				2.2
INORGANIC											
Aggressive Index (AI)	UNKWQAN		A.I.	11.6	11.8	11.7	11.7				>11.0
Alkalinity-Phenolphthalein (ALKPHE)	2320B	1	mg/L	ND	ND	ND	ND				N/A
Aluminum (Al)	X200.8	1	ug/L	ND	1.9	ND	1.7	1,000	200		200[7]
Ammonia Nitrogen (NH3-N)	350.1	0.1	mg/L	0.14	0.12	0.08	0.11				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	38.74	38.67	38.11	36.7				N/A
Bicarbonate (as HCO3) (HCO3)	UNKWQAN	1.2	mg/L	47.22	47.15	46.46	44.74				N/A
Boron (B)	X200.7	0.1	mg/L	0.21	0.24	0.24	0.25			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	0.01	0.011	0.012	0.011				N/A
Cadmium (Cd)	X200.8	1	ug/L	ND	ND	ND	ND	5			5
Calcium (Ca)	X200.7	0.5	mg/L	13.99	14.37	13.32	13.21				N/A
Calcium Hardness (CaHRD)	X200.7	0.25	mg/L	34.95	35.88	33.22	32.98				N/A
Carbonate (as CaCO3) (CO3Ca)	2320B	1	mg/L	ND	ND	ND	ND				N/A
Cation-Anion meq balance (CATANI)	UNKWQAN		RATIO	-8.80	-0.99	1.18	-6.18				N/A
Chlorate (CLO3)	300.1B	10	ug/L	ND	ND	11.3	ND			800	N/A
Chloride (Cl)	X1-300.0	0.5	mg/L	4.4	4.93	5.8	5.47		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
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.	-0.84	-0.86	-0.91	-0.99				N/A
Cyanide (CN)	X1-335.4	5	ug/L	ND	ND	ND	ND	150			150
Electrical Conductivity (EC)	2510B	1	um/cm	92.72	96.93	100.09	95.84		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

WATER QUALITY -- GWRS SYSTEM PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1]) AVERAGES FOR ALL AVAILABLE DATA FOR 2019[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Free Res. Chlorine - Amperometric Method (FRCL2A)	4500CLD	0.1	mg/L	ND	ND	ND	ND				N/A
Gadolinium (Gd)	X200.8	10	ng/L	ND	ND	ND	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	2.25	2.05	2.09	2.09				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
Nickel (Ni)	X200.8	1	ug/L	ND	ND	ND	ND	100			100
Nitrate (NO3)	4500NO3F / UNKWQAN	0.4	mg/L	2.45	2.72	3.61	3.16	45			45
Nitrate + Nitrite Nitrogen (NO3NO2-N)	4500NO3F	0.1	mg/L	0.59	0.65	0.85	0.75	10			10[12]
Nitrate Nitrogen (NO3-N)	4500NO3F	0.1	mg/L	0.55	0.61	0.81	0.71	10			3[12]
Nitrite (NO2)	UNKWQAN	0.007	mg/L	0.117	0.105	0.101	0.116				N/A
Nitrite Nitrogen (NO2-N)	4500NO3F	0.002	mg/L	0.036	0.032	0.031	0.035	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	0.055	ND	ND	ND				N/A
Perchlorate (CLO4)	332.0	2.5	ug/L	ND	ND	ND	ND	6			6
pH (pH)	4500H+B	1	UNITS	7.84	7.82	7.85	7.76				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	ND	0.2	ND				N/A
Selenium (Se)	X200.8	1	ug/L	ND	ND	ND	ND	50			50
Silica (SIO2)	4500SIOC	1	mg/L	ND	1	ND	ND				N/A
Silver (Ag)	X200.8	1	ug/L	ND	ND	ND	ND		100		100
Sodium (Na)	X200.7	0.5	mg/L	4.833	5.5	6.6	5.8				45[13]
Sulfate (SO4)	X1-300.0	0.5	mg/L	0.6	0.38	0.35	0.73		250		100[14]
Surfactants (MBAS)	5540C	0.02	mg/L	ND	ND	ND	ND		0.5		0.5
Temperature (Laboratory) (TEMP)	4500H+B	1	C	21.32	21.19	20.79	20.62				
Thallium (Tl)	X200.8	1	ug/L	ND	ND	ND	ND	2			2
Threshold Odor Number (Median) (ODOR)	2150B	0	TON	ND	ND	ND	ND		3		3
Title 22 Cation-Anion Balance (T22CAB)	UNKWQAN		meq/L	-8.59	-0.77	1.50	-5.88				N/A
Title 22 Total Anions (T22ANI)	UNKWQAN		meq/L	0.923	0.916	0.926	1.015				N/A
Title 22 Total Cations (T22CAT)	UNKWQAN		meq/L	0.887	0.934	0.968	0.894				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	38.738	38.669	38.108	36.7				N/A
Total Anions (TOTANI)	UNKWQAN		meq/L	0.93	0.92	0.93	1.02				N/A
Total Cations (TOTCAT)	UNKWQAN		meq/L	0.85	0.91	0.94	0.96				N/A

WATER QUALITY -- GWRS SYSTEM PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1])
AVERAGES FOR ALL AVAILABLE DATA FOR 2019[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Total Chlorine (TOTCL2)	4500CLF	0.1	mg/L	0.9	0.9	0.9	1				N/A
Total Dissolved Solids (TDS)	2540C	1 - 2.5	mg/L	47.27	48.12	52.65	48.86		500		500[15]
Total Hardness (as CaCO3) (TOTHRD)	X200.7	1	mg/L	34.1	35.13	34.1	32.27				240[16]
Total Kjeldahl Nitrogen (TKN)	X1-351.2	0.2	mg/L	0.122	0.058	0.03	0.03				N/A
Total Nitrogen (TOT-N)	X1-351.2	0.3	mg/L	0.757	0.733	0.934	0.803				5
Total Organic Carbon (Unfiltered) (TOC)	5310C	0.05	mg/L	0.083	0.112	0.142	0.1				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	ND		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-Trichloro-2-propanone (TCPONE)	551.1	0.5	ug/L	NR	NR	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	NR	NR				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 - 0.5	ug/L	ND	0.1	ND	ND				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 - 9.9	ug/L	0.12	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 - 9.9	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
1,2-Diphenylhydrazine (12DPH)	625	20	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 - 9.9	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 - 9.9	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 - 10	ng/L	ND	ND	ND	ND				N/A
17b-Estradiol (bESTRA)	CEC	2	ng/L	ND	ND	ND	ND				N/A

WATER QUALITY -- GWRS SYSTEM PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1])
AVERAGES FOR ALL AVAILABLE DATA FOR 2019[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
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	4.8	pg/L	ND	ND	ND	ND	30			30
2,4,5-Trichlorophenol (245TCP)	625	20	ug/L	ND	ND	ND	ND				N/A
2,4,6-Trichlorophenol (246TCP)	625	20	ug/L	ND	ND	ND	ND				N/A
2,4-Dichlorophenol (24DCPH)	625	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
2,4-Dimethylphenol (24DMP)	625	20	ug/L	ND	ND	ND	ND			100	N/A
2,4-Dinitrophenol (24DNP)	625	39 - 40	ug/L	ND	ND	ND	ND				N/A
2,4-Dinitrotoluene (24DNT)	525.2 / 625	0.1 - 9.9	ug/L	ND	ND	ND	ND				N/A
2,6-Dinitrotoluene (26DNT)	525.2 / 625	0.1 - 9.9	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	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
2-Chlorophenol (2ClPNL)	625	9.8 - 9.9	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	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
2-Methyl-4,6-Dinitrophenol (2MDNP)	625	20	ug/L	ND	ND	ND	ND				N/A
2-Methylphenol (oCRESL)	625	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
2-Nitroaniline (oNTANL)	625	20	ug/L	ND	ND	ND	ND				N/A
2-Nitrophenol (2NPNL)	625	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
3- & 4-Methylphenol (mpCRESL)	625	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
3,3'-Dichlorobenzidine (DCBZDE)	625	20	ug/L	ND	ND	ND	ND				N/A
3-Nitroaniline (mNTANL)	625	20	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	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
4-Chloro-3-methylphenol (43CMP)[22]	625	20	ug/L	ND	ND	ND	ND				N/A
4-Chloroaniline (pCIANL)	625	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
4-Chlorophenyl phenyl ether (4ClPPE)	625	9.8 - 9.9	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	ug/L	ND	ND	ND	ND				N/A
4-Nitrophenol (4NPNL)	625	20	ug/L	ND	ND	ND	ND				N/A
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	4	ND	1.17				N/A
Acetone (ACETNE)	524.2	10	ug/L	1.79	2.38	1.83	1.76				N/A
Aniline (ANLN)	625	9.8 - 9.9	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	39 - 40	ug/L	ND	ND	ND	ND				N/A

WATER QUALITY -- GWRS SYSTEM PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1]) AVERAGES FOR ALL AVAILABLE DATA FOR 2019[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Benzoic Acid (BNZACD)	625	20	ug/L	ND	ND	ND	ND				N/A
Benzyl Alcohol (BNZALC)	625	20	ug/L	ND	ND	ND	ND				N/A
bis (2-chloroethoxy) methane (B2CEM)	625	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
bis (2-chloroethyl) ether (B2CLEE)	524.2 / 625	5 - 9.9	ug/L	ND	ND	ND	ND				N/A
bis (2-chloroisopropyl) ether (B2CIPE)	625	9.8 - 9.9	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 - 0.5	ug/L	0.2	0.4	0.84	0.64				N/A
Bromochloromethane (CH2BrC)	524.2	0.5	ug/L	ND	ND	ND	0.11				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	0.55	1.07	2.08	1.64				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	1.22	1.85	2.96	2.59				N/A
Chloromethane (CH3Cl)[26]	524.2	0.5	ug/L	ND	ND	ND	ND				N/A
Chloropicrin (ClPICR)	551.1	0.1 - 0.5	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
Decanal (DECNAL)	556	2	ug/L	ND	ND	ND	ND				N/A
Dibenzofuran (DBFUR)	625	9.8 - 9.9	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 - 0.5	ug/L	ND	ND	ND	ND				N/A
Dibromochloromethane (CHBr2C)[29]	524.2 / 551.1	0.1 - 0.5	ug/L	0.05	0.08	0.27	0.12				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 - 3	ug/L	0.4	0.6	ND	0.71				N/A
Dichlorodifluoromethane (CCl2F2)	524.2	0.5	ug/L	ND	ND	ND	ND			1,000	N/A
Diclofenac (DICLFN)	CEC	5 - 10	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

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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 - 10	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	ng/L	ND	ND	ND	ND				N/A
Formaldehyde (FORALD)	556	2	ug/L	9.3	9.6	14	11			100	N/A
Freon 123a (FR123A)	524.2	0.5 - 2	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	ug/L	ND	ND	ND	ND				N/A
Hexachlorobutadiene (HClBut)	524.2 / 625	0.5 - 9.9	ug/L	ND	ND	ND	ND				N/A
Hexachloroethane (HCE)	625	9.8 - 9.9	ug/L	ND	ND	ND	ND				N/A
Hexafluoropropylene oxide dimer acid (GenX) (HFPODA)	537	4	ng/L	ND	NR	NR	NR				N/A
Hexanal (HEXNAL)	556	2	ug/L	ND	ND	ND	ND				N/A
Iohexol (IOHEXL)	CEC	20 - 40	ng/L	ND	ND	ND	ND				N/A
Iopromide (IOPRMD)	CEC	10 - 20	ng/L	ND	ND	ND	ND				N/A
Isophorone (IPHOR)	525.2 / 625	0.1 - 9.9	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)	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
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	0.15	0.19	0.15	0.08	5			5
Methylglyoxal (MGLYOX)	556	2	ug/L	ND	ND	ND	ND				N/A
Methylisothiocyanate (MITC)	14DIOX	0.1	ug/L	ND	ND	ND	0.04			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 - 9.9	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

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Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Nitrobenzene (NBENZ)	625	20	ug/L	ND	ND	ND	ND				N/A
N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
N-Nitrosodiethylamine (NDEA)	NDMA-LOW	2	ng/L	ND	ND	ND	ND			10	N/A
n-Nitrosodimethylamine (NDMA)	NDMA-LOW	2	ng/L	1.67	1.45	2.69	1.78			10	N/A
n-Nitroso-di-n-propylamine (NDPA)	625 / NDMA-LOW	2 - 9,900	ng/L	ND	ND	ND	ND			10	N/A
n-Nitrosodiphenylamine (NDPhA)	625	9,800 - 9,900	ng/L	ND	ND	ND	ND				N/A
N-Nitrosomorpholine (NMOR)	NDMA-LOW	2	ng/L	ND	ND	ND	ND				N/A
Nonanal (NONNAL)	556	2	ug/L	ND	ND	ND	1.13				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	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1221 (PCB21)[33]	508	0.1	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1232 (PCB32)[33]	508	0.1	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1242 (PCB42)[33]	508	0.1	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1248 (PCB48)[33]	508	0.1	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1254 (PCB54)[33]	508	0.1	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCB-1260 (PCB60)[33]	508	0.1	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
PCBs, Total (TOTPCB)[33]	508	0.5	ug/L	ND	ND	ND	ND	0.5[33]			0.5[33]
Perfluoro butane sulfonic acid (PFBS)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Perfluoro heptanoic acid (PFHpA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Perfluoro hexane sulfonic acid (PFHxS)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Perfluoro nonanoic acid (PFNA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Perfluoro octane sulfonic acid (PFOS)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND			6.5	N/A
Perfluoro octanoic acid (PFOA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND			5.1	N/A
Perfluorodecanoic acid (PFDA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Perfluorododecanoic acid (PFDoA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Perfluorohexanoic acid (PFHxA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Perfluorotetradecanoic acid (PFTA)	537 / 537RV1.1	4 - 10	ng/L	ND	ND	ND	ND				N/A
Perfluorotridecanoic acid (PFTrDA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
Perfluoroundecanoic acid (PFUnA)	537 / 537RV1.1	4	ng/L	ND	ND	ND	ND				N/A
PFOA + PFOS (PFOAOS)	537RV1.1 / UNKWQAN	4	ng/L	ND	ND	ND	ND				N/A
Phenol (PHENOL)	625	9.8 - 9.9	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

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Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
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	ND	ND	ND	ND				N/A
Sum of Six Brominated Haloacetic Acids (HAA6Br)	UNKWQAN	1	ug/L	ND	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	1.69	2.77	5.35	4.22	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 - 0.5	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	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	ND	ND	1.64	15			15
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 - 0.391	pCi/L	ND	ND	ND	ND				N/A
Radium 226 + Radium 228 (Ra6Ra8)	UNKWQAN	DLR[40], 1 pCi/L	pCi/L	ND	ND	0.20	ND	5			5
Radium 226 + Radium 228 Counting Error (Ra68CE)	UNKWQAN	0.384 - 0.506	pCi/L	ND	ND	0.64	ND				N/A
Total Alpha (TOTa)	7110C	1.11 - 1.39	pCi/L	ND	ND	ND	1.64				N/A
Total Alpha Counting Error (TOTaCE)	7110C	1.11 - 1.39	pCi/L	ND	ND	ND	1.22				N/A
Total Beta (TOTb)	900.0	DLR[40], 4 pCi/L	pCi/L	ND	0.82	4.1	2.39	50			50
Total Beta Counting Error (TOTbCE)	900.0	0.623 - 1.27	pCi/L	ND	0.76	1.49	1.06				N/A
Total Radium 226 (TRa226)	903.0	0.274 - 0.47	pCi/L	ND	ND	ND	ND				N/A
Total Radium 226 Counting Error (TRa6CE)	903.0	0.274 - 0.47	pCi/L	ND	ND	ND	ND				N/A
Total Radium 228 (TRa228)	RA-05	0.384 - 0.506	pCi/L	ND	ND	0.20	ND				N/A
Total Radium 228 Counting Error (TRa8CE)	RA-05	0.384 - 0.506	pCi/L	ND	ND	0.64	ND				N/A

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Total Strontium-90 (TS90)	905.0	DLR[40], 2 pCi/L	pCi/L	0.04	0.39	0.11	ND	8			8
Total Strontium-90 Counting Error (TS90CE)	905.0	0.546	pCi/L	0.24	0.29	0.22	ND				N/A
Total Tritium (TTr)	906.0	DLR[40], 1,000 pCi/L	pCi/L	42.67	35.53	234.58	104.88	20,000			20,000
Total Tritium Counting Error (TTrCE)	906.0	434	pCi/L	271.33	270.5	270.25	269.25				N/A
SEMI-ORGANIC											
1-Naphthol (NPTHOL)	531	5	ug/L	ND	ND	ND	ND				N/A
2,4,5-T (245T)	515.3 / 515.4	0.2	ug/L	ND	ND	ND	ND				N/A
2,4,5-TP (Silvex) (245TP)	515.3 / 515.4	0.2	ug/L	ND	ND	ND	ND	50			50
2,4,6-Trinitrotoluene (246TNT)	8330A	0.099 - 0.1	ug/L	ND	ND	ND	ND			1	N/A
2,4-DB (24DB)	515.3 / 515.4	2	ug/L	ND	ND	ND	ND				N/A
2,4-Dichlorophenoxyacetic Acid (24D)	515.3 / 515.4	0.4	ug/L	ND	ND	ND	ND	70			70
3,5-Dichlorobenzoic Acid (35DBA)	515.3 / 515.4	1	ug/L	ND	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 - 9.9	ug/L	ND	ND	ND	ND				N/A
Acenaphthylene (ACENAP)	525.2 / 625	0.1 - 9.9	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	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
Anthracene (ANTHRA)	525.2 / 625	0.1 - 9.9	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 - 100	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	2	ug/L	ND	ND	ND	ND	18			18
Benzo(a)anthracene (BaANTH)	525.2 / 625	0.1 - 9.9	ug/L	ND	ND	ND	ND				N/A
Benzo(a)pyrene (BaPYRE)	525.2 / 625	0.1 - 9.9	ug/L	ND	ND	ND	ND	0.2			0.2
Benzo(b)fluoranthene (BbFLUR)	525.2 / 625	0.1 - 9.9	ug/L	ND	ND	ND	ND				N/A
Benzo(g,h,i)perylene (BghiPR)	525.2 / 625	0.1 - 9.9	ug/L	ND	ND	ND	ND				N/A
Benzo[k]fluoranthene (BkFLUR)	525.2 / 625	0.1 - 9.9	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 - 20	ug/L	ND	ND	ND	ND	4			4
Bromacil (BROMAC)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A

WATER QUALITY -- GWRS SYSTEM PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1])
AVERAGES FOR ALL AVAILABLE DATA FOR 2019[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
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 - 20	ug/L	ND	ND	ND	ND				N/A
Caffeine (CAFFEI)	525.2 / CEC	3 - 100	ng/L	ND	ND	ND	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)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Chlordane-gamma (CLDG)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Chlorobenzilate (CLBZLA)	525.2	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 - 9.9	ug/L	ND	ND	ND	ND				N/A
Dalapon (DALAPN)	515.3 / 515.4 / 552.2	0.4 - 1	ug/L	ND	ND	ND	ND	200			200
DCPA-Dacthal (DCPA)	515.3 / 515.4 / 525.2	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 - 20	ug/L	ND	ND	ND	ND				N/A
Dicamba (DICAMB)	515.3 / 515.4	0.6	ug/L	ND	ND	ND	ND				N/A
Dichlorprop (24DP)	515.3 / 515.4	0.3	ug/L	ND	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
Diethyl phthalate (DEP)	525.2 / 625	2 - 9.9	ug/L	ND	ND	ND	ND				N/A
Diethylene Glycol (DEGLYCOL)	8015B	10,000	ug/L	NR	ND	NR	NR				
Dimethoate (DMTH)	525.2	1	ug/L	ND	ND	ND	ND			1	N/A
Dimethyl phthalate (DMP)	525.2 / 625	2 - 9.9	ug/L	ND	ND	ND	ND				N/A
Di-n-butylphthalate (DnBP)	525.2 / 625	2 - 20	ug/L	ND	ND	ND	ND				N/A
Di-n-octyl phthalate (DnOP)	525.2 / 625	2 - 20	ug/L	ND	ND	ND	ND				N/A
Dinoseb (DINOSB)	515.3 / 515.4	0.4	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

WATER QUALITY -- GWRS SYSTEM PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1])
AVERAGES FOR ALL AVAILABLE DATA FOR 2019[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
Endrin Aldehyde (ENDR-A)	508 / 525.2	0.01 - 0.1	ug/L	ND	ND	ND	ND				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
Ethylene Glycol (GLYCOL)	8015B	10,000	ug/L	ND	ND	ND	ND				
Etridiazole (ETRDZL)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Fluoranthene (FLANTH)	525.2 / 625	0.1 - 9.9	ug/L	ND	ND	ND	ND				N/A
Fluorene (FLUOR)	525.2 / 625	0.1 - 9.9	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 / 525.2 / 625	0.05 - 9.9	ug/L	ND	ND	ND	ND	1			1
Hexachlorocyclopentadiene (HClCPD)	508 / 525.2 / 625	0.05 - 20	ug/L	ND	ND	ND	ND	50			50
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330A	0.099 - 0.1	ug/L	ND	ND	ND	ND				
Hexazinone (HEXZON)	525.2	0.1	ug/L	ND	ND	ND	ND				N/A
Ibuprofen (IBPRFN)	CEC	1 - 5	ng/L	ND	ND	ND	ND				N/A
Indeno(1,2,3-cd)pyrene (INDPYR)	525.2 / 625	0.1 - 20	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
N,N-diethyl-m-toluamide (DEET)	CEC	1	ng/L	ND	ND	ND	ND				N/A
Norflurazon (NORFLR)	525.2	1	ug/L	ND	ND	ND	ND				N/A
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330A	0.099 - 0.1	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 / 515.4 / 525.2 / 625 / CEC	0.2 - 20	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 - 9.9	ug/L	ND	ND	ND	ND				N/A
Picloram (PICLOR)	515.3 / 515.4	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

WATER QUALITY -- GWRS SYSTEM PURIFIED RECYCLED WATER (FINISHED PRODUCT WATER, EXCEPT AS NOTED[1])
AVERAGES FOR ALL AVAILABLE DATA FOR 2019[2]

Parameters[3]	Methods	Reportable Detection Limit	Units	2019 Quarter 1	2019 Quarter 2	2019 Quarter 3	2019 Quarter 4	Primary MCL[4]	Secondary MCL[4]	Action or Notification Level[4]	Permit Requirement
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
Propylene Glycol (PRGLYCOL)	8015B	10,000	ug/L	NR	ND	NR	NR				N/A
Pyrene (PYRENE)	525.2 / 625	0.1 - 9.9	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 - 5	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 and R8-2016-0051

[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 2019 Quarterly Sampling Dates
OCWD Water Quality Department
GWRS FINAL PRODUCT WATER (FPW)

Monitoring Well	Qtr 1	Qtr 2	Qtr 3	Qtr 4
GWRS-FPW	01/09/2019	04/03/2019	07/10/2019	10/09/2019

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 2019 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 2019 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	ND	1.9	ND	1.7
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND	ND	ND	ND
Asbestos (ASBESTOS), MFL	Eurofins / EurofCEI	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	0.28 - 0.65	0.42 - 0.74	0.7 - 0.91	0.6 - 0.87
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.022 - 0.044	ND - 0.045	0.021 - 0.054	0.026 - 0.067
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	EuroTSac / EutalKnx / TalSac	30	ND	ND	ND	ND
Primary Drinking Water Standards - Radioactivity						
Gross Alpha Excluding Uranium (TOTa-U), pCi/L	FGL	15	ND	ND	ND	1.64
Other Radionuclides	FGL	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	1 - 2.4	ND - 5.5	3.6 - 7.8	3 - 6.6
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	2.2	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	N/A	72 - 111	89 - 111	90 - 108	87 - 110
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	41.5 - 57	40.5 - 54.5	47 - 60.5	25.5 - 66
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	0.24	0.24	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	ND	ND	ND
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD / EurfTIrv / TestAmer	N/A	ND	ND	ND	ND
2,6-Dinitrotoluene (26DNT), ug/L		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
DCPA-Dacthal (DCPA), 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	EurfTIrv / 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 2019 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	ND	ND < MCL
1613B	2,3,7,8-Tetrachlorodibenzo-p-dioxin	EuroTSac / EuTalKnx / TalSac	ND	ND	ND	ND
504.1	EDB, DBCP & 123TCP	OCWD / Weck	ND	ND	ND	ND
508	Chlorinated Pesticides	Weck	ND	ND	ND	ND
515.3 & 515.4	Chlorinated Acids	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 & 537RV1.1	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 / Weck	ND < MCL	ND < MCL	ND - Detections	ND - Detections
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	EurfTIrv / TestAmer	ND	ND	ND	ND
8015B	Nonhalogenated Organics	EurofBuf / EuroTNsh / TalNshv	ND	ND	ND	ND
8330A	Nitroaromatics and Nitramines	EuroTSac / TalSac	ND	ND	ND	ND
CEC	Chemicals of Emerging Concern	OCWD	ND	ND	ND	ND
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < NL

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date &	*Time*	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
1/4/2019	8:00	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
1/4/2019	8:00	Chloroform (CHCl3)	1.1	ug/L	0.5
1/4/2019	8:00	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5
1/9/2019	10:00	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
1/9/2019	10:00	Chloroform (CHCl3)	1.3	ug/L	0.5
1/9/2019	10:00	Total Trihalomethanes (TTHMs)	1.9	ug/L	0.5
1/11/2019	7:50	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
1/11/2019	7:50	Chloroform (CHCl3)	1.2	ug/L	0.5
1/11/2019	7:50	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5
1/18/2019	7:55	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
1/18/2019	7:55	Chloroform (CHCl3)	1.4	ug/L	0.5
1/18/2019	7:55	Total Trihalomethanes (TTHMs)	2.4	ug/L	0.5
1/25/2019	8:15	1,2,4-Trichlorobenzene (124TCB)	TR	ug/L	0.5
1/25/2019	8:15	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
1/25/2019	8:15	Chloroform (CHCl3)	1.0	ug/L	0.5
1/25/2019	8:15	Methylene Chloride (CH2Cl2)	1.4	ug/L	0.5
1/25/2019	8:15	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5
2/1/2019	8:15	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
2/1/2019	8:15	Chloroform (CHCl3)	1.1	ug/L	0.5
2/1/2019	8:15	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
2/1/2019	8:15	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5
2/8/2019	8:15	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
2/8/2019	8:15	Chloroform (CHCl3)	1.0	ug/L	0.5
2/8/2019	8:15	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5
2/15/2019	8:25	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
2/15/2019	8:25	Chloroform (CHCl3)	1.2	ug/L	0.5
2/15/2019	8:25	Total Trihalomethanes (TTHMs)	2.1	ug/L	0.5
2/22/2019	8:15	Acetone (ACETNE)	13.6	ug/L	10
2/22/2019	8:15	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
2/22/2019	8:15	Chloroform (CHCl3)	1.4	ug/L	0.5
2/22/2019	8:15	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.5
3/1/2019	8:20	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.5
3/1/2019	8:20	Chloroform (CHCl3)	1.2	ug/L	0.5
3/1/2019	8:20	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5
3/8/2019	8:10	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
3/8/2019	8:10	Chloroform (CHCl3)	1.4	ug/L	0.5
3/8/2019	8:10	Total Trihalomethanes (TTHMs)	2.1	ug/L	0.5
3/12/2019	11:05	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
3/12/2019	11:05	Chloroform (CHCl3)	1.4	ug/L	0.5

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/12/2019	11:05	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5
3/12/2019	11:15	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
3/12/2019	11:15	Chloroform (CHCl3)	1.4	ug/L	0.5
3/12/2019	11:15	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5
3/15/2019	8:50	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
3/15/2019	8:50	Chloroform (CHCl3)	1.0	ug/L	0.5
3/15/2019	8:50	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5
3/22/2019	8:10	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
3/22/2019	8:10	Chloroform (CHCl3)	1.1	ug/L	0.5
3/22/2019	8:10	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5
3/29/2019	8:00	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
3/29/2019	8:00	Chloroform (CHCl3)	1.5	ug/L	0.5
3/29/2019	8:00	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/9/2019	10:00	Bromochloroacetonitrile (BCAN)	0.2	ug/L	0.1
1/9/2019	10:00	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.1
1/9/2019	10:00	Chloroform (CHCl3)	1.1	ug/L	0.1
1/9/2019	10:00	Dibromochloromethane (CHBr2C)	0.1	ug/L	0.1
1/9/2019	10:00	Dichloroacetonitrile (DCAN)	0.4	ug/L	0.1
1/9/2019	10:00	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.1

METHOD: 556

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/9/2019	10:00	Formaldehyde (FORALD)	9.3	ug/L	2

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/9/2019	10:00	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2
1/11/2019	7:50	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2
2/1/2019	8:15	n-Nitrosodimethylamine (NDMA)	5.2	ng/L	2
2/8/2019	8:15	n-Nitrosodimethylamine (NDMA)	4.9	ng/L	2
3/15/2019	8:50	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2
3/22/2019	8:10	n-Nitrosodimethylamine (NDMA)	2.3	ng/L	2
3/29/2019	8:00	n-Nitrosodimethylamine (NDMA)	3.1	ng/L	2

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 1

METHOD: ***NDMA-LOW***

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit

Year 2019, Quarter 2

METHOD: ***524.2***

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/3/2019	11:30	Bromodichloromethane (CHBrCl)	1.5	ug/L	0.5
4/3/2019	11:30	Chloroform (CHCl3)	2.1	ug/L	0.5
4/3/2019	11:30	Total Trihalomethanes (TTHMs)	3.6	ug/L	0.5
4/5/2019	8:00	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
4/5/2019	8:00	Chloroform (CHCl3)	1.6	ug/L	0.5
4/5/2019	8:00	Total Trihalomethanes (TTHMs)	2.4	ug/L	0.5
4/12/2019	7:35	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
4/12/2019	7:35	Chloroform (CHCl3)	1.8	ug/L	0.5
4/12/2019	7:35	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5
4/25/2019	8:55	Acetone (ACETNE)	10.8	ug/L	10
4/25/2019	8:55	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.5
4/25/2019	8:55	Chloroform (CHCl3)	1.8	ug/L	0.5
4/25/2019	8:55	Total Trihalomethanes (TTHMs)	2.7	ug/L	0.5
4/26/2019	12:00	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
4/26/2019	12:00	Chloroform (CHCl3)	1.6	ug/L	0.5
5/3/2019	7:30	Chloroform (CHCl3)	0.8	ug/L	0.5
5/3/2019	7:30	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
5/10/2019	8:35	Bromodichloromethane (CHBrCl)	2.3	ug/L	0.5
5/10/2019	8:35	Chloroform (CHCl3)	3.2	ug/L	0.5
5/10/2019	8:35	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
5/10/2019	8:35	Methylene Chloride (CH2Cl2)	1.0	ug/L	0.5
5/10/2019	8:35	Total Trihalomethanes (TTHMs)	5.5	ug/L	0.5
5/17/2019	8:00	Bromodichloromethane (CHBrCl)	1.1	ug/L	0.5
5/17/2019	8:00	Chloroform (CHCl3)	2.2	ug/L	0.5
5/17/2019	8:00	Total Trihalomethanes (TTHMs)	3.4	ug/L	0.5
5/24/2019	8:35	Acetone (ACETNE)	13.2	ug/L	10
5/24/2019	8:35	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
5/24/2019	8:35	Chloroform (CHCl3)	1.6	ug/L	0.5
5/24/2019	8:35	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5
5/26/2019	9:00	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
5/26/2019	9:00	Chloroform (CHCl3)	1.5	ug/L	0.5
5/26/2019	9:00	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 2

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
5/26/2019	9:00	Total Trihalomethanes (TTHMs)	2.5	ug/L	0.5
5/28/2019	9:00	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.5
5/28/2019	9:00	Chloroform (CHCl3)	1.5	ug/L	0.5
5/28/2019	9:00	Total Trihalomethanes (TTHMs)	2.4	ug/L	0.5
5/31/2019	8:00	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
5/31/2019	8:00	Chloroform (CHCl3)	1.9	ug/L	0.5
5/31/2019	8:00	Methylene Chloride (CH2Cl2)	0.9	ug/L	0.5
5/31/2019	8:00	Total Trihalomethanes (TTHMs)	2.6	ug/L	0.5
6/7/2019	7:45	Bromodichloromethane (CHBrCl)	1.7	ug/L	0.5
6/7/2019	7:45	Chloroform (CHCl3)	2.9	ug/L	0.5
6/7/2019	7:45	Total Trihalomethanes (TTHMs)	4.6	ug/L	0.5
6/14/2019	8:30	Bromodichloromethane (CHBrCl)	1.2	ug/L	0.5
6/14/2019	8:30	Chloroform (CHCl3)	2.0	ug/L	0.5
6/14/2019	8:30	Total Trihalomethanes (TTHMs)	3.2	ug/L	0.5
6/21/2019	8:15	Bromodichloromethane (CHBrCl)	1.2	ug/L	0.5
6/21/2019	8:15	Chloroform (CHCl3)	1.8	ug/L	0.5
6/21/2019	8:15	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
6/21/2019	8:15	Total Trihalomethanes (TTHMs)	3.0	ug/L	0.5
6/28/2019	8:00	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
6/28/2019	8:00	Chloroform (CHCl3)	1.6	ug/L	0.5
6/28/2019	8:00	Total Trihalomethanes (TTHMs)	2.6	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/3/2019	11:30	1,1-Dichloro-2-propanone (11DC2P)	0.1	ug/L	0.1
4/3/2019	11:30	Bromochloroacetonitrile (BCAN)	0.4	ug/L	0.1
4/3/2019	11:30	Bromodichloromethane (CHBrCl)	1.3	ug/L	0.1
4/3/2019	11:30	Chloroform (CHCl3)	1.6	ug/L	0.2
4/3/2019	11:30	Dibromochloromethane (CHBr2C)	0.2	ug/L	0.1
4/3/2019	11:30	Dichloroacetonitrile (DCAN)	0.6	ug/L	0.1
4/3/2019	11:30	Total Trihalomethanes (TTHMs)	3.4	ug/L	0.1

METHOD: 556

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/3/2019	11:30	Acetaldehyde (ACEALD)	4.0	ug/L	2
4/3/2019	11:30	Formaldehyde (FORALD)	9.6	ug/L	2

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 2

METHOD: NDMA-LOW

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
5/3/2019	7:30	n-Nitrosodimethylamine (NDMA)	2.4	ng/L	2
5/17/2019	8:00	n-Nitrosodimethylamine (NDMA)	2.4	ng/L	2
5/24/2019	8:35	n-Nitrosodimethylamine (NDMA)	2.5	ng/L	2
6/7/2019	7:45	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2
6/14/2019	8:30	n-Nitrosodimethylamine (NDMA)	2.3	ng/L	2
6/21/2019	8:15	n-Nitrosodimethylamine (NDMA)	3.2	ng/L	2
6/28/2019	8:00	n-Nitrosodimethylamine (NDMA)	3.9	ng/L	2

Year 2019, Quarter 3

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/5/2019	9:45	Bromodichloromethane (CHBrCl)	1.8	ug/L	0.5
7/5/2019	9:45	Chloroform (CHCl3)	2.2	ug/L	0.5
7/5/2019	9:45	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
7/5/2019	9:45	Total Trihalomethanes (TTHMs)	7.8	ug/L	0.5
7/10/2019	10:30	Acetone (ACETNE)	13.5	ug/L	10
7/10/2019	10:30	Bromodichloromethane (CHBrCl)	2.5	ug/L	0.5
7/10/2019	10:30	Chloroform (CHCl3)	2.8	ug/L	0.5
7/10/2019	10:30	Dibromochloromethane (CHBr2C)	0.5	ug/L	0.5
7/10/2019	10:30	Total Trihalomethanes (TTHMs)	5.8	ug/L	0.5
7/12/2019	8:40	Bromodichloromethane (CHBrCl)	2.3	ug/L	0.5
7/12/2019	8:40	Chloroform (CHCl3)	3.1	ug/L	0.5
7/12/2019	8:40	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
7/12/2019	8:40	Total Trihalomethanes (TTHMs)	5.3	ug/L	0.5
7/19/2019	8:55	Bromodichloromethane (CHBrCl)	1.8	ug/L	0.5
7/19/2019	8:55	Chloroform (CHCl3)	2.6	ug/L	0.5
7/19/2019	8:55	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
7/19/2019	8:55	Methylene Chloride (CH2Cl2)	0.6	ug/L	0.5
7/19/2019	8:55	Total Trihalomethanes (TTHMs)	4.4	ug/L	0.5
7/23/2019	6:35	Bromodichloromethane (CHBrCl)	1.2	ug/L	0.5
7/23/2019	6:35	Chloroform (CHCl3)	2.4	ug/L	0.5
7/23/2019	6:35	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
7/23/2019	6:35	Total Trihalomethanes (TTHMs)	3.6	ug/L	0.5
7/26/2019	8:45	Bromodichloromethane (CHBrCl)	2.3	ug/L	0.5
7/26/2019	8:45	Chloroform (CHCl3)	3.4	ug/L	0.5
7/26/2019	8:45	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 3

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/26/2019	8:45	Total Trihalomethanes (TTHMs)	5.7	ug/L	0.5
8/2/2019	8:30	Bromodichloromethane (CHBrCl)	1.9	ug/L	0.5
8/2/2019	8:30	Chloroform (CHCl3)	2.7	ug/L	0.5
8/2/2019	8:30	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
8/2/2019	8:30	Total Trihalomethanes (TTHMs)	4.6	ug/L	0.5
8/9/2019	8:15	Bromodichloromethane (CHBrCl)	1.7	ug/L	0.5
8/9/2019	8:15	Chloroform (CHCl3)	2.6	ug/L	0.5
8/9/2019	8:15	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
8/9/2019	8:15	Total Trihalomethanes (TTHMs)	4.3	ug/L	0.5
8/16/2019	8:15	Bromodichloromethane (CHBrCl)	2.4	ug/L	0.5
8/16/2019	8:15	Chloroform (CHCl3)	3.4	ug/L	0.5
8/16/2019	8:15	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
8/16/2019	8:15	Total Trihalomethanes (TTHMs)	5.8	ug/L	0.5
8/23/2019	8:25	Bromodichloromethane (CHBrCl)	2.5	ug/L	0.5
8/23/2019	8:25	Chloroform (CHCl3)	3.5	ug/L	0.5
8/23/2019	8:25	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
8/23/2019	8:25	Total Trihalomethanes (TTHMs)	5.9	ug/L	0.5
8/30/2019	8:00	Bromodichloromethane (CHBrCl)	3.1	ug/L	0.5
8/30/2019	8:00	Chloroform (CHCl3)	3.9	ug/L	0.5
8/30/2019	8:00	Dibromochloromethane (CHBr2C)	0.5	ug/L	0.5
8/30/2019	8:00	Total Trihalomethanes (TTHMs)	7.5	ug/L	0.5
9/6/2019	8:20	Bromodichloromethane (CHBrCl)	1.4	ug/L	0.5
9/6/2019	8:20	Chloroform (CHCl3)	2.4	ug/L	0.5
9/6/2019	8:20	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
9/6/2019	8:20	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
9/6/2019	8:20	Total Trihalomethanes (TTHMs)	3.8	ug/L	0.5
9/13/2019	7:50	Bromodichloromethane (CHBrCl)	1.7	ug/L	0.5
9/13/2019	7:50	Chloroform (CHCl3)	2.6	ug/L	0.5
9/13/2019	7:50	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
9/13/2019	7:50	Methylene Chloride (CH2Cl2)	0.6	ug/L	0.5
9/13/2019	7:50	Total Trihalomethanes (TTHMs)	4.3	ug/L	0.5
9/20/2019	7:50	Bromodichloromethane (CHBrCl)	2.3	ug/L	0.5
9/20/2019	7:50	Chloroform (CHCl3)	2.8	ug/L	0.5
9/20/2019	7:50	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
9/20/2019	7:50	Total Trihalomethanes (TTHMs)	5.1	ug/L	0.5
9/27/2019	8:00	Bromodichloromethane (CHBrCl)	2.3	ug/L	0.5
9/27/2019	8:00	Chloroform (CHCl3)	4.0	ug/L	0.5
9/27/2019	8:00	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
9/27/2019	8:00	Total Trihalomethanes (TTHMs)	6.3	ug/L	0.5

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 3

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/10/2019	10:30	Bromochloroacetonitrile (BCAN)	0.84	ug/L	0.5

METHOD: 556

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/10/2019	10:30	Formaldehyde (FORALD)	14	ug/L	2

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/5/2019	9:45	n-Nitrosodimethylamine (NDMA)	3.2	ng/L	2
7/10/2019	10:30	n-Nitrosodimethylamine (NDMA)	4.4	ng/L	2
7/19/2019	8:55	n-Nitrosodimethylamine (NDMA)	3.9	ng/L	2
7/26/2019	8:45	n-Nitrosodimethylamine (NDMA)	2.8	ng/L	2
8/2/2019	8:30	n-Nitrosodimethylamine (NDMA)	3.6	ng/L	2
8/9/2019	8:15	n-Nitrosodimethylamine (NDMA)	3.4	ng/L	2
8/16/2019	8:15	n-Nitrosodimethylamine (NDMA)	2.4	ng/L	2
8/23/2019	8:25	n-Nitrosodimethylamine (NDMA)	2.7	ng/L	2
9/6/2019	8:20	n-Nitrosodimethylamine (NDMA)	3.2	ng/L	2
9/20/2019	7:50	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2
9/27/2019	8:00	n-Nitrosodimethylamine (NDMA)	4.8	ng/L	2

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/4/2019	8:10	Methylisothiocyanate (MITC)	0.43	ug/L	0.1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/4/2019	8:10	Bromodichloromethane (CHBrCl)	2.8	ug/L	0.5
10/4/2019	8:10	Chloroform (CHCl3)	3.9	ug/L	0.5
10/4/2019	8:10	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
10/4/2019	8:10	Total Trihalomethanes (TTHMs)	6.6	ug/L	0.5
10/9/2019	10:30	Bromodichloromethane (CHBrCl)	1.8	ug/L	0.5

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date &	*Time*	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
10/9/2019	10:30	Chloroform (CHCl3)	2.3	ug/L	0.5
10/9/2019	10:30	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
10/9/2019	10:30	Total Trihalomethanes (TTHMs)	4.1	ug/L	0.5
10/11/2019	7:50	Bromodichloromethane (CHBrCl)	1.6	ug/L	0.5
10/11/2019	7:50	Chloroform (CHCl3)	2.5	ug/L	0.5
10/11/2019	7:50	Total Trihalomethanes (TTHMs)	4.1	ug/L	0.5
10/18/2019	8:25	Acetone (ACETNE)	11.7	ug/L	10
10/18/2019	8:25	Bromodichloromethane (CHBrCl)	1.5	ug/L	0.5
10/18/2019	8:25	Chloroform (CHCl3)	2.8	ug/L	0.5
10/18/2019	8:25	Total Trihalomethanes (TTHMs)	4.3	ug/L	0.5
10/25/2019	7:45	Bromodichloromethane (CHBrCl)	1.4	ug/L	0.5
10/25/2019	7:45	Chloroform (CHCl3)	2.1	ug/L	0.5
10/25/2019	7:45	Total Trihalomethanes (TTHMs)	3.5	ug/L	0.5
11/1/2019	8:35	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
11/1/2019	8:35	Chloroform (CHCl3)	2.1	ug/L	0.5
11/1/2019	8:35	Total Trihalomethanes (TTHMs)	3.1	ug/L	0.5
11/8/2019	8:30	Bromodichloromethane (CHBrCl)	1.6	ug/L	0.5
11/8/2019	8:30	Chloroform (CHCl3)	2.4	ug/L	0.5
11/8/2019	8:30	Total Trihalomethanes (TTHMs)	4.0	ug/L	0.5
11/15/2019	8:15	Bromochloromethane (CH2BrC)	TR	ug/L	0.5
11/15/2019	8:15	Bromodichloromethane (CHBrCl)	1.3	ug/L	0.5
11/15/2019	8:15	Chloroform (CHCl3)	2.0	ug/L	0.5
11/15/2019	8:15	Total Trihalomethanes (TTHMs)	3.3	ug/L	0.5
11/22/2019	7:50	Bromodichloromethane (CHBrCl)	1.1	ug/L	0.5
11/22/2019	7:50	Chloroform (CHCl3)	1.9	ug/L	0.5
11/22/2019	7:50	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
11/22/2019	7:50	Total Trihalomethanes (TTHMs)	3.0	ug/L	0.5
11/29/2019	8:10	Bromodichloromethane (CHBrCl)	1.9	ug/L	0.5
11/29/2019	8:10	Chloroform (CHCl3)	2.6	ug/L	0.5
11/29/2019	8:10	Total Trihalomethanes (TTHMs)	4.6	ug/L	0.5
12/6/2019	8:30	Bromochloromethane (CH2BrC)	0.7	ug/L	0.5
12/6/2019	8:30	Bromodichloromethane (CHBrCl)	2.1	ug/L	0.5
12/6/2019	8:30	Chloroform (CHCl3)	3.4	ug/L	0.5
12/6/2019	8:30	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
12/6/2019	8:30	Total Trihalomethanes (TTHMs)	5.5	ug/L	0.5
12/13/2019	8:10	Bromodichloromethane (CHBrCl)	1.7	ug/L	0.5
12/13/2019	8:10	Chloroform (CHCl3)	2.5	ug/L	0.5
12/13/2019	8:10	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
12/13/2019	8:10	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

GWRS-FPW
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
12/13/2019	8:10	Total Trihalomethanes (TTHMs)	4.2	ug/L	0.5
12/20/2019	8:35	Bromodichloromethane (CHBrCl)	1.4	ug/L	0.5
12/20/2019	8:35	Chloroform (CHCl3)	3.1	ug/L	0.5
12/20/2019	8:35	Total Trihalomethanes (TTHMs)	4.5	ug/L	0.5
12/27/2019	8:25	Bromodichloromethane (CHBrCl)	1.7	ug/L	0.5
12/27/2019	8:25	Chloroform (CHCl3)	2.6	ug/L	0.5
12/27/2019	8:25	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
12/27/2019	8:25	Total Trihalomethanes (TTHMs)	4.3	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2019	10:30	Bromochloroacetonitrile (BCAN)	0.64	ug/L	0.5
10/9/2019	10:30	Dichloroacetonitrile (DCAN)	0.71	ug/L	0.5

METHOD: 556

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/9/2019	10:30	Acetaldehyde (ACEALD)	3.1	ug/L	2
10/9/2019	10:30	Formaldehyde (FORALD)	12	ug/L	2
10/9/2019	10:30	Nonanal (NONNAL)	3.0	ug/L	2
12/4/2019	8:40	Formaldehyde (FORALD)	10	ug/L	2
12/4/2019	8:55	Formaldehyde (FORALD)	11	ug/L	2

METHOD: NDMA-LOW

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/4/2019	8:10	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2
10/9/2019	10:30	n-Nitrosodimethylamine (NDMA)	3.2	ng/L	2
10/18/2019	8:25	n-Nitrosodimethylamine (NDMA)	2.8	ng/L	2
10/25/2019	7:45	n-Nitrosodimethylamine (NDMA)	4.5	ng/L	2
11/1/2019	8:35	n-Nitrosodimethylamine (NDMA)	3.2	ng/L	2
11/22/2019	7:50	n-Nitrosodimethylamine (NDMA)	2.6	ng/L	2
12/13/2019	8:10	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2
12/20/2019	8:35	n-Nitrosodimethylamine (NDMA)	3.2	ng/L	2

Appendix B

Laboratory Methods of Analysis

Orange County Water District
Groundwater Replenishment System
2019 Annual Report

Laboratory Method: 100.2

Laboratory: EUROFINS CEI, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Asbestos (ASBESTOS)	0.18	MFL

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: 1613B

Laboratory: EUROFINS TESTAMERICA, KNOXVILLE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	4.7 - 5	pg/L

Laboratory Method: 1613B

Laboratory: EUROFINS TESTAMERICA, SACRAMENTO

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	4.8 - 5	pg/L

Laboratory: TESTAMERICA SACRAMENTO

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	4.8 - 4.9	pg/L

Laboratory Method: 2120B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Apparent Color (unfiltered) (APCOLR)	3 - 9	UNITS
True Color (filtered) (TRCOLR)	3 - 9	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 - 5	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)	2.5	mg/L

ORANGE COUNTY WATER DISTRICT
LABORATORY METHODS OF ANALYSES

Laboratory Method: 2540D

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Suspended Solids (SUSSOL)	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 - 0.5	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 - 0.13	mg/L
Tot. Res. Chlorine -- Amperometric Method (TOTCLA)	0.1 - 0.4	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 - 0.2	mg/L

Laboratory Method: 4500H+B

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
pH (pH)	1	UNITS
Temperature (Laboratory) (TEMP)	1	C

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 - 0.2	mg/L
Nitrate Nitrogen (NO3-N)	0.1 - 0.8	mg/L
Nitrite Nitrogen (NO2-N)	0.002 - 0.008	mg/L

Laboratory Method: 4500SIOC

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Silica (SIO2)	1 - 2	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: WECK LABORATORIES, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
1,2-Dibromo-3-chloropropane (DBCP)	0.01	ug/L
1,2-Dibromoethane (EDB)	0.02	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

Laboratory Method: 508

Laboratory: WECK LABORATORIES, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
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
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: 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
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: 5210B

Laboratory: EUROFINS TESTAMERICA, IRVINE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Biochemical Oxygen Demand (BOD)	4 - 6	mg/L

Laboratory: TESTAMERICA IRVINE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Biochemical Oxygen Demand (BOD)	8.6	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

Laboratory Method: 524.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
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	ug/L
1,2,3-Trichloropropane (123TCP)	0.5	ug/L
1,2,4-Trichlorobenzene (124TCB)	0.5	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	ug/L
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 - 5	ug/L

Laboratory Method: 524.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
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 - 2	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	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
Tert-amyl methyl ether (TAME)	1	ug/L
tert-butyl alcohol (TBA)	2	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

Laboratory Method: 524.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
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	ug/L
2,6-Dinitrotoluene (26DNT)	0.1	ug/L
4,4'-DDD (DDD)	0.1	ug/L
4,4'-DDE (DDE)	0.1	ug/L
4,4'-DDT (DDT)	0.1	ug/L
Acenaphthene (ACNAPE)	0.1	ug/L
Acenaphthylene (ACENAP)	0.1	ug/L
Acetochlor (ACETOC)	0.1	ug/L
Alachlor (ALACHL)	0.1	ug/L
Aldrin (ALDRIN)	0.1	ug/L
Ametryn (AMERYN)	0.1	ug/L
Anthracene (ANTHRA)	0.1	ug/L
Atrazine (ATRAZ)	0.1	ug/L
Benzo(a)anthracene (BaANTH)	0.1	ug/L
Benzo(a)pyrene (BaPYRE)	0.1	ug/L

Laboratory Method: 525.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Benzo(b)fluoranthene (BbFLUR)	0.1	ug/L
Benzo(g,h,i)perylene (BghiPR)	0.1	ug/L
Benzo[k]fluoranthene (BkFLUR)	0.1	ug/L
bis (2-ethylhexyl) adipate (DEHA)	2	ug/L
bis (2-ethylhexyl) phthalate (DEHP)	2	ug/L
Bromacil (BROMAC)	0.1	ug/L
Butachlor (BUTACL)	0.1	ug/L
Butylate (BTYATE)	0.1	ug/L
Butylbenzyl phthalate (BBP)	2	ug/L
Caffeine (CAFFEI)	100	ng/L
Captan (CAPTAN)	0.1	ug/L
Chlordane-alpha (CLDA)	0.1	ug/L
Chlordane-gamma (CLDG)	0.1	ug/L
Chlorobenzilate (CLBZLA)	0.1	ug/L
Chloroneb (CLNEB)	0.1	ug/L
Chloropropham (CPRPHM)	0.1	ug/L
Chlorothalonil (CLTNIL)	0.1	ug/L
Chlorpyrifos (ClPYRI)	0.1	ug/L
Chrysene (CHRYS)	0.1	ug/L
DCPA-Dacthal (DCPA)	0.1	ug/L
Diazinon (DIAZI)	0.1	ug/L
Dibenzo(a,h)anthracene (DBahAN)	0.1	ug/L
Dichlorvos (DCLVOS)	0.1	ug/L
Dieldrin (DIELDR)	0.1	ug/L
Diethyl phthalate (DEP)	2	ug/L
Dimethoate (DMTH)	1	ug/L
Dimethyl phthalate (DMP)	2	ug/L
Di-n-butylphthalate (DnBP)	2	ug/L
Di-n-octyl phthalate (DnOP)	2	ug/L
Diphenamid (DPHNMD)	0.1	ug/L
Endosulfan I (ENDOI)	0.1	ug/L
Endosulfan II (ENDOII)	0.1	ug/L
Endosulfan sulfate (ENDOSL)	0.1	ug/L
Endrin (ENDRIN)	0.1	ug/L

Laboratory Method: 525.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Endrin Aldehyde (ENDR-A)	0.1	ug/L
EPTC (EPTC)	0.1	ug/L
Ethion (ETHION)	0.1	ug/L
Ethoprop (ETHPRP)	0.1	ug/L
Etridiazole (ETRDZL)	0.1	ug/L
Fluoranthene (FLANTH)	0.1	ug/L
Fluorene (FLUOR)	0.1	ug/L
HCH-alpha (Alpha-BHC) (BHCa)	0.1	ug/L
HCH-beta (Beta-BHC) (BHCb)	0.1	ug/L
HCH-delta (Delta-BHC) (BHCd)	0.1	ug/L
HCH-gamma (Lindane) (LINDNE)	0.1	ug/L
Heptachlor (HEPTA)	0.1	ug/L
Heptachlor epoxide (HEPEPX)	0.1	ug/L
Hexachlorobenzene (HEXCLB)	0.1	ug/L
Hexachlorocyclopentadiene (HClCPD)	0.1	ug/L
Hexazinone (HEXZON)	0.1	ug/L
Indeno(1,2,3-cd)pyrene (INDPYR)	0.1	ug/L
Isophorone (IPHOR)	0.1	ug/L
Malathion (MALATH)	2	ug/L
Methoxychlor (METHOX)	0.1	ug/L
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
Naphthalene (NAP)	0.1	ug/L
Norflurazon (NORFLR)	0.1 - 1	ug/L
Parathion (PARA)	0.5	ug/L
Pentachlorophenol (PCP) (PCP)	1	ug/L
Permethrin-(total of cis/trans) (PMTHRN)	0.1	ug/L
Phenanthrene (PHENAN)	0.1	ug/L
Prometryn (PROMET)	0.1	ug/L
Pronamide (PROAMD)	0.1	ug/L
Propachlor (PROPCL)	0.1	ug/L
Propazine (PROPAZ)	0.1	ug/L

Laboratory Method: 525.2

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Pyrene (PYRENE)	0.1	ug/L
Simazine (SIMAZ)	0.1	ug/L
Tebuthiuron (TBTURN)	2	ug/L
Terbacil (TRBACL)	0.1	ug/L
Terbufos Sulfone (TERSUL)	0.1	ug/L
Thiobencarb (THIO)	0.1	ug/L
Trifluralin (TRFLRN)	0.1	ug/L
Trithion (TRTION)	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
Hexafluoropropylene oxide dimer acid (GenX) (HFPODA)	4	ng/L
N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSA)	4	ng/L
N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSA)	4	ng/L
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
Perfluorodecanoic acid (PFDA)	4	ng/L
Perfluorododecanoic acid (PFDoA)	4	ng/L
Perfluorohexanoic acid (PFHxA)	4	ng/L
Perfluorotetradecanoic acid (PFTA)	4 - 10	ng/L
Perfluorotridecanoic acid (PFTrDA)	4	ng/L
Perfluoroundecanoic acid (PFUnA)	4	ng/L

Laboratory Method: 537.1

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
11-chloroeicosafluoro-3-oxaundecane-1sulfonic acid (11CLPF)	2	ng/L
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	2	ng/L
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9CLPF3)	2	ng/L
Hexafluoropropylene oxide dimer acid (GenX) (HFPODA)	2	ng/L
N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSA)	2	ng/L
N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSA)	2	ng/L
Perfluoro butane sulfonic acid (PFBS)	2	ng/L
Perfluoro heptanoic acid (PFHpA)	2	ng/L
Perfluoro hexane sulfonic acid (PFHxS)	2	ng/L
Perfluoro nonanoic acid (PFNA)	2	ng/L
Perfluoro octane sulfonic acid (PFOS)	2	ng/L
Perfluoro octanoic acid (PFOA)	2	ng/L
Perfluorodecanoic acid (PFDA)	2	ng/L

Laboratory Method: 537.1

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Perfluorododecanoic acid (PFDoA)	2	ng/L
Perfluorohexanoic acid (PFHxA)	2	ng/L
Perfluorotetradecanoic acid (PFTA)	2	ng/L
Perfluorotridecanoic acid (PFTrDA)	2	ng/L
Perfluoroundecanoic acid (PFUnA)	2	ng/L

Laboratory Method: 537RV1.1

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSA)	4	ng/L
N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSA)	4	ng/L
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
Perfluorodecanoic acid (PFDA)	4	ng/L
Perfluorododecanoic acid (PFDoA)	4	ng/L
Perfluorohexanoic acid (PFHxA)	4 - 8	ng/L
Perfluorotetradecanoic acid (PFTA)	4	ng/L
Perfluorotridecanoic acid (PFTrDA)	4	ng/L
Perfluoroundecanoic acid (PFUnA)	4	ng/L
PFOA + PFOS (PFOAOS)	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 - 0.2	ug/L
1,1,1-Trichloropropanone (111TCP)	0.1 - 0.2	ug/L
1,1,2-Trichloroethane (112TCA)	0.1 - 0.2	ug/L
1,1-Dichloro-2-propanone (11DC2P)	0.1 - 0.2	ug/L
1,2,3-Trichloropropane (123TCP)	0.1 - 0.2	ug/L
1,2-Dibromo-3-chloropropane (DBCP)	0.1 - 0.2	ug/L
1,2-Dibromoethane (EDB)	0.1 - 0.2	ug/L
Bromochloroacetonitrile (BCAN)	0.1 - 0.2	ug/L
Bromodichloromethane (CHBrCl)	0.1 - 0.2	ug/L
Bromoform (CHBr3)	0.1 - 0.2	ug/L
Carbon tetrachloride (CCl4)	0.1 - 0.2	ug/L
Chloroform (CHCl3)	0.1 - 0.2	ug/L
Chloropicrin (ClPICR)	0.1 - 0.2	ug/L
Dibromoacetonitrile (DBAN)	0.1 - 0.2	ug/L
Dibromochloromethane (CHBr2C)	0.1 - 0.2	ug/L
Dichloroacetonitrile (DCAN)	0.1 - 0.2	ug/L
Tetrachloroethene (PCE)	0.1 - 0.2	ug/L
Total Trihalomethanes (TTHMs)	0.1 - 0.2	ug/L
Trichloroacetonitrile (TCAN)	0.1 - 0.2	ug/L

Laboratory Method: 551.1

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Trichloroethene (TCE)	0.1 - 0.2	ug/L

Laboratory: WECK LABORATORIES, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
1,1,1-Trichloro-2-propanone (TCPONE)	0.5	ug/L
1,1-Dichloro-2-propanone (11DC2P)	0.5	ug/L
Bromochloroacetonitrile (BCAN)	0.5	ug/L
Chloral Hydrate (ClHYDR)	0.5	ug/L
Chloropicrin (ClPICR)	0.5	ug/L
Dibromoacetonitrile (DBAN)	0.5	ug/L
Dichloroacetonitrile (DCAN)	0.5 - 3	ug/L
Trichloroacetonitrile (TCAN)	0.5	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	ug/L
Hexanal (HEXNAL)	2	ug/L
Methylglyoxal (MGLYOX)	2	ug/L
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: EUROFINS TESTAMERICA, IRVINE

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
1,2,4-Trichlorobenzene (124TCB)	9.7 - 10	ug/L
1,2-Dichlorobenzene (12DCB)	9.7 - 10	ug/L
1,2-Diphenylhydrazine (12DPH)	19 - 21	ug/L
1,3-Dichlorobenzene (13DCB)	9.7 - 10	ug/L
1,4-Dichlorobenzene (14DCB)	9.7 - 10	ug/L
2,4,5-Trichlorophenol (245TCP)	19 - 21	ug/L
2,4,6-Trichlorophenol (246TCP)	19 - 21	ug/L
2,4-Dichlorophenol (24DCPH)	9.7 - 10	ug/L
2,4-Dimethylphenol (24DMP)	19 - 21	ug/L
2,4-Dinitrophenol (24DNP)	39 - 41	ug/L
2,4-Dinitrotoluene (24DNT)	9.7 - 10	ug/L
2,6-Dinitrotoluene (26DNT)	9.7 - 10	ug/L
2-Chloronapthalene (2ClNAP)	9.7 - 10	ug/L
2-Chlorophenol (2ClPNL)	9.7 - 10	ug/L
2-Methyl naphthalene (2MNAP)	9.7 - 10	ug/L
2-Methyl-4,6-Dinitrophenol (2MDNP)	19 - 21	ug/L
2-Methylphenol (oCRESL)	9.7 - 10	ug/L
2-Nitroaniline (oNTANL)	19 - 21	ug/L
2-Nitrophenol (2NPNL)	9.7 - 10	ug/L
3- & 4-Methylphenol (mpCRESL)	9.7 - 10	ug/L
3,3'-Dichlorobenzidine (DCBZDE)	19 - 21	ug/L
3-Nitroaniline (mNTANL)	19 - 21	ug/L
4-Bromophenyl phenyl ether (4BrPPE)	9.7 - 10	ug/L
4-Chloro-3-methylphenol (43CMP)	19 - 21	ug/L
4-Chloroaniline (pClANL)	9.7 - 10	ug/L
4-Chlorophenyl phenyl ether (4ClPPE)	9.7 - 10	ug/L
4-Nitroaniline (pNTANL)	19 - 21	ug/L
4-Nitrophenol (4NPNL)	19 - 21	ug/L
Acenaphthene (ACNAPE)	9.7 - 10	ug/L
Acenaphthylene (ACENAP)	9.7 - 10	ug/L
Aniline (ANLN)	9.7 - 10	ug/L
Anthracene (ANTHRA)	9.7 - 10	ug/L
Benzidine (BNZDE)	39 - 41	ug/L
Benzo(a)anthracene (BaANTH)	9.7 - 10	ug/L

Laboratory Method: 625

Laboratory: EUROFINS TESTAMERICA, IRVINE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Benzo(a)pyrene (BaPYRE)	9.7 - 10	ug/L
Benzo(b)fluoranthene (BbFLUR)	9.7 - 10	ug/L
Benzo(g,h,i)perylene (BghiPR)	9.7 - 10	ug/L
Benzo[k]fluoranthene (BkFLUR)	9.7 - 10	ug/L
Benzoic Acid (BNZACD)	19 - 21	ug/L
Benzyl Alcohol (BNZALC)	19 - 21	ug/L
bis (2-chloroethoxy) methane (B2CEM)	9.7 - 10	ug/L
bis (2-chloroethyl) ether (B2CLEE)	9.7 - 10	ug/L
bis (2-chloroisopropyl) ether (B2CIPE)	9.7 - 10	ug/L
bis (2-ethylhexyl) phthalate (DEHP)	19 - 21	ug/L
Butylbenzyl phthalate (BBP)	19 - 21	ug/L
Chrysene (CHRYS)	9.7 - 10	ug/L
Dibenzo(a,h)anthracene (DBahAN)	19 - 21	ug/L
Dibenzofuran (DBFUR)	9.7 - 10	ug/L
Diethyl phthalate (DEP)	9.7 - 10	ug/L
Dimethyl phthalate (DMP)	9.7 - 10	ug/L
Di-n-butylphthalate (DnBP)	19 - 21	ug/L
Di-n-octyl phthalate (DnOP)	19 - 21	ug/L
Fluoranthene (FLANTH)	9.7 - 10	ug/L
Fluorene (FLUOR)	9.7 - 10	ug/L
Hexachlorobenzene (HEXCLB)	9.7 - 10	ug/L
Hexachlorobutadiene (HClBut)	9.7 - 10	ug/L
Hexachlorocyclopentadiene (HClCPD)	19 - 21	ug/L
Hexachloroethane (HCE)	9.7 - 10	ug/L
Indeno(1,2,3-cd)pyrene (INDPYR)	19 - 21	ug/L
Isophorone (IPHOR)	9.7 - 10	ug/L
Naphthalene (NAP)	9.7 - 10	ug/L
Nitrobenzene (NBENZ)	19 - 21	ug/L
n-Nitroso-di-n-propylamine (NDPA)	9,700 - 10,000	ng/L
n-Nitrosodiphenylamine (NDPhA)	9,700 - 10,000	ng/L
Pentachlorophenol (PCP) (PCP)	19 - 21	ug/L
Phenanthrene (PHENAN)	9.7 - 10	ug/L
Phenol (PHENOL)	9.7 - 10	ug/L
Pyrene (PYRENE)	9.7 - 10	ug/L

Laboratory Method: 625

Laboratory: TESTAMERICA IRVINE

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
1,2,4-Trichlorobenzene (124TCB)	9.6 - 9.9	ug/L
1,2-Dichlorobenzene (12DCB)	9.6 - 9.9	ug/L
1,2-Diphenylhydrazine (12DPH)	19 - 20	ug/L
1,3-Dichlorobenzene (13DCB)	9.6 - 9.9	ug/L
1,4-Dichlorobenzene (14DCB)	9.6 - 9.9	ug/L
2,4,5-Trichlorophenol (245TCP)	19 - 20	ug/L
2,4,6-Trichlorophenol (246TCP)	19 - 20	ug/L
2,4-Dichlorophenol (24DCPH)	9.6 - 9.9	ug/L
2,4-Dimethylphenol (24DMP)	19 - 20	ug/L
2,4-Dinitrophenol (24DNP)	38 - 40	ug/L
2,4-Dinitrotoluene (24DNT)	9.6 - 9.9	ug/L
2,6-Dinitrotoluene (26DNT)	9.6 - 9.9	ug/L
2-Chloronapthalene (2ClNAP)	9.6 - 9.9	ug/L
2-Chlorophenol (2ClPNL)	9.6 - 9.9	ug/L
2-Methyl naphthalene (2MNAP)	9.6 - 9.9	ug/L
2-Methyl-4,6-Dinitrophenol (2MDNP)	19 - 20	ug/L
2-Methylphenol (oCRESL)	9.6 - 9.9	ug/L
2-Nitroaniline (oNTANL)	19 - 20	ug/L
2-Nitrophenol (2NPNL)	9.6 - 9.9	ug/L
3- & 4-Methylphenol (mpCRESL)	9.6 - 9.9	ug/L
3,3'-Dichlorobenzidine (DCBZDE)	19 - 20	ug/L
3-Nitroaniline (mNTANL)	19 - 20	ug/L
4-Bromophenyl phenyl ether (4BrPPE)	9.6 - 9.9	ug/L
4-Chloro-3-methylphenol (43CMP)	19 - 20	ug/L
4-Chloroaniline (pClANL)	9.6 - 9.9	ug/L
4-Chlorophenyl phenyl ether (4ClPPE)	9.6 - 9.9	ug/L
4-Nitroaniline (pNTANL)	19 - 20	ug/L
4-Nitrophenol (4NPNL)	19 - 20	ug/L
Acenaphthene (ACNAPE)	9.6 - 9.9	ug/L
Acenaphthylene (ACENAP)	9.6 - 9.9	ug/L
Aniline (ANLN)	9.6 - 9.9	ug/L
Anthracene (ANTHRA)	9.6 - 9.9	ug/L
Benzidine (BNZDE)	38 - 40	ug/L
Benzo(a)anthracene (BaANTH)	9.6 - 9.9	ug/L

Laboratory Method: 625

Laboratory: TESTAMERICA IRVINE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Benzo(a)pyrene (BaPYRE)	9.6 - 9.9	ug/L
Benzo(b)fluoranthene (BbFLUR)	9.6 - 9.9	ug/L
Benzo(g,h,i)perylene (BghiPR)	9.6 - 9.9	ug/L
Benzo[k]fluoranthene (BkFLUR)	9.6 - 9.9	ug/L
Benzoic Acid (BNZACD)	19 - 20	ug/L
Benzyl Alcohol (BNZALC)	19 - 20	ug/L
bis (2-chloroethoxy) methane (B2CEM)	9.6 - 9.9	ug/L
bis (2-chloroethyl) ether (B2CLEE)	9.6 - 9.9	ug/L
bis (2-chloroisopropyl) ether (B2CIPE)	9.6 - 9.9	ug/L
bis (2-ethylhexyl) phthalate (DEHP)	19 - 20	ug/L
Butylbenzyl phthalate (BBP)	19 - 20	ug/L
Chrysene (CHRYS)	9.6 - 9.9	ug/L
Dibenzo(a,h)anthracene (DBahAN)	19 - 20	ug/L
Dibenzofuran (DBFUR)	9.6 - 9.9	ug/L
Diethyl phthalate (DEP)	9.6 - 9.9	ug/L
Dimethyl phthalate (DMP)	9.6 - 9.9	ug/L
Di-n-butylphthalate (DnBP)	19 - 20	ug/L
Di-n-octyl phthalate (DnOP)	19 - 20	ug/L
Fluoranthene (FLANTH)	9.6 - 9.9	ug/L
Fluorene (FLUOR)	9.6 - 9.9	ug/L
Hexachlorobenzene (HEXCLB)	9.6 - 9.9	ug/L
Hexachlorobutadiene (HClBut)	9.6 - 9.9	ug/L
Hexachlorocyclopentadiene (HClCPD)	19 - 20	ug/L
Hexachloroethane (HCE)	9.6 - 9.9	ug/L
Indeno(1,2,3-cd)pyrene (INDPYR)	19 - 20	ug/L
Isophorone (IPHOR)	9.6 - 9.9	ug/L
Naphthalene (NAP)	9.6 - 9.9	ug/L
Nitrobenzene (NBENZ)	19 - 20	ug/L
n-Nitroso-di-n-propylamine (NDPA)	9,600 - 9,900	ng/L
n-Nitrosodiphenylamine (NDPhA)	9,600 - 9,900	ng/L
Pentachlorophenol (PCP) (PCP)	19 - 20	ug/L
Phenanthrene (PHENAN)	9.6 - 9.9	ug/L
Phenol (PHENOL)	9.6 - 9.9	ug/L
Pyrene (PYRENE)	9.6 - 9.9	ug/L

Laboratory Method: 625.1

Laboratory: EUROFINS CALSCIENCE IRVINE

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
1,2,4-Trichlorobenzene (124TCB)	9.6 - 10	ug/L
1,2-Dichlorobenzene (12DCB)	9.6 - 10	ug/L
1,2-Diphenylhydrazine (12DPH)	19 - 20	ug/L
1,3-Dichlorobenzene (13DCB)	9.6 - 10	ug/L
1,4-Dichlorobenzene (14DCB)	9.6 - 10	ug/L
2,4,5-Trichlorophenol (245TCP)	19 - 20	ug/L
2,4,6-Trichlorophenol (246TCP)	19 - 20	ug/L
2,4-Dichlorophenol (24DCPH)	9.6 - 10	ug/L
2,4-Dimethylphenol (24DMP)	19 - 20	ug/L
2,4-Dinitrophenol (24DNP)	38 - 40	ug/L
2,4-Dinitrotoluene (24DNT)	9.6 - 10	ug/L
2,6-Dinitrotoluene (26DNT)	9.6 - 10	ug/L
2-Chloronapthalene (2ClNAP)	9.6 - 10	ug/L
2-Chlorophenol (2ClPNL)	9.6 - 10	ug/L
2-Methyl naphthalene (2MNAP)	9.6 - 10	ug/L
2-Methyl-4,6-Dinitrophenol (2MDNP)	19 - 20	ug/L
2-Methylphenol (oCRESL)	9.6 - 10	ug/L
2-Nitroaniline (oNTANL)	19 - 20	ug/L
2-Nitrophenol (2NPNL)	9.6 - 10	ug/L
3,3'-Dichlorobenzidine (DCBZDE)	19 - 20	ug/L
3-Nitroaniline (mNTANL)	19 - 20	ug/L
4-Bromophenyl phenyl ether (4BrPPE)	9.6 - 10	ug/L
4-Chloro-3-methylphenol (43CMP)	19 - 20	ug/L
4-Chloroaniline (pClANL)	9.6 - 10	ug/L
4-Chlorophenyl phenyl ether (4ClPPE)	9.6 - 10	ug/L
4-Methylphenol (pCRESL)	9.6 - 10	ug/L
4-Nitroaniline (pNTANL)	19 - 20	ug/L
4-Nitrophenol (4NPNL)	19 - 20	ug/L
Acenaphthene (ACNAPE)	9.6 - 10	ug/L
Acenaphthylene (ACENAP)	9.6 - 10	ug/L
Aniline (ANLN)	9.6 - 10	ug/L
Anthracene (ANTHRA)	9.6 - 10	ug/L
Benzidine (BNZDE)	38 - 40	ug/L
Benzo(a)anthracene (BaANTH)	9.6 - 10	ug/L

Laboratory Method: 625.1

Laboratory: EUROFINS CALSCIENCE IRVINE

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Benzo(a)pyrene (BaPYRE)	9.6 - 10	ug/L
Benzo(b)fluoranthene (BbFLUR)	9.6 - 10	ug/L
Benzo(g,h,i)perylene (BghiPR)	9.6 - 10	ug/L
Benzo[k]fluoranthene (BkFLUR)	9.6 - 10	ug/L
Benzoic Acid (BNZACD)	19 - 20	ug/L
Benzyl Alcohol (BNZALC)	19 - 20	ug/L
bis (2-chloroethoxy) methane (B2CEM)	9.6 - 10	ug/L
bis (2-chloroethyl) ether (B2CLEE)	9.6 - 10	ug/L
bis (2-chloroisopropyl) ether (B2CIPE)	9.6 - 10	ug/L
bis (2-ethylhexyl) phthalate (DEHP)	19 - 20	ug/L
Chrysene (CHRYS)	9.6 - 10	ug/L
Dibenzo(a,h)anthracene (DBahAN)	19 - 20	ug/L
Dibenzofuran (DBFUR)	9.6 - 10	ug/L
Diethyl phthalate (DEP)	9.6 - 10	ug/L
Dimethyl phthalate (DMP)	9.6 - 10	ug/L
Di-n-butylphthalate (DnBP)	19 - 20	ug/L
Di-n-octyl phthalate (DnOP)	19 - 20	ug/L
Fluoranthene (FLANTH)	9.6 - 10	ug/L
Fluorene (FLUOR)	9.6 - 10	ug/L
Hexachlorobenzene (HEXCLB)	9.6 - 10	ug/L
Hexachlorobutadiene (HClBut)	9.6 - 10	ug/L
Hexachlorocyclopentadiene (HClCPD)	19 - 20	ug/L
Hexachloroethane (HCE)	9.6 - 10	ug/L
Indeno(1,2,3-cd)pyrene (INDPYR)	19 - 20	ug/L
Isophorone (IPHOR)	9.6 - 10	ug/L
Naphthalene (NAP)	9.6 - 10	ug/L
Nitrobenzene (NBENZ)	19 - 20	ug/L
n-Nitroso-di-n-propylamine (NDPA)	9,600 - 10,000	ng/L
n-Nitrosodiphenylamine (NDPhA)	9,600 - 10,000	ng/L
Pentachlorophenol (PCP) (PCP)	19 - 20	ug/L
Phenanthrene (PHENAN)	9.6 - 10	ug/L
Phenol (PHENOL)	9.6 - 10	ug/L
Pyrene (PYRENE)	9.6 - 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: 8015B

Laboratory: EUROFINS TESTAMERICA, BUFFALO

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Ethylene Glycol (GLYCOL)	10,000	ug/L

Laboratory: EUROFINS TESTAMERICA, NASHVILLE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Diethylene Glycol (DEGLYCOL)	10,000	ug/L
Ethylene Glycol (GLYCOL)	10,000	ug/L
Propylene Glycol (PRGLYCOL)	10,000	ug/L

Laboratory: TESTAMERICA NASHVILLE

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Ethylene Glycol (GLYCOL)	10,000	ug/L

Laboratory Method: 8330A

Laboratory: EUROFINS TESTAMERICA, SACRAMENTO

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,4,6-Trinitrotoluene (246TNT)	0.099 - 0.1	ug/L
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.099 - 0.1	ug/L
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.099 - 0.1	ug/L

Laboratory: TESTAMERICA SACRAMENTO

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
2,4,6-Trinitrotoluene (246TNT)	0.1	ug/L

Laboratory Method: 8330A

Laboratory: TESTAMERICA SACRAMENTO

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.1	ug/L
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.1	ug/L

Laboratory Method: 900.0

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Total Beta (TOTb)	0.623 - 1.6	pCi/L
Total Beta Counting Error (TOTbCE)	0.623 - 1.6	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 - 0.47	pCi/L
Total Radium 226 Counting Error (TRa6CE)	0.274 - 0.47	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 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 - 0.391	pCi/L
Natural Uranium Counting Error (NTUrCE)	0.342 - 0.391	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 - 3400	MPN
Total Coliform (Colilert - MPN/100mL) (TCOLIQ)	1 - 3400	MPN

ORANGE COUNTY WATER DISTRICT
LABORATORY METHODS OF ANALYSES

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 - 10	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 - 0.5	ug/L
Acetaminophen (ACTMNP)	5	ng/L
Aspartame (ASPATM)	100	ng/L
Atenolol (ATENOL)	5	ng/L
Atrazine (ATRAZ)	0.001 - 0.005	ug/L
Azithromycin (AZTMCN)	10 - 100	ng/L
Bisphenol A (BisPHA)	0.2	ug/L
Caffeine (CAFFEI)	3 - 30	ng/L
Carbamazepine (CBMAZP)	1 - 5	ng/L
Diclofenac (DICLFN)	5 - 10	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 - 5	ng/L
Estriol (ESTRIO)	2 - 10	ng/L
Estrone (ESTRON)	1	ng/L
Fluoxetine (FLUXET)	5	ng/L
Gemfibrozil (GMFIBZ)	1 - 5	ng/L
Ibuprofen (IBPRFN)	1 - 50	ng/L
Iohexol (IOHEXL)	20 - 200	ng/L
Iopromide (IOPRMD)	10 - 20	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 - 50	ng/L
Neotam (NEOTAM)	10	ng/L
Nonylphenol (NONYPH)	0.2	ug/L

Laboratory Method: CEC

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
para-Chlorobenzene sulfonic acid (pCBSA)	200	ng/L
Pentachlorophenol (PCP) (PCP)	0.2	ug/L
PhenylPhenol (PHNYPH)	0.2	ug/L
Primidone (PRIMDN)	1	ng/L
Progesterone (PRGSTR)	1	ng/L
Simazine (SIMAZ)	0.005	ug/L
Sucralose (SUCRAL)	100 - 1,000	ng/L
Sulfamethoxazole (SULTHZ)	1 - 10	ng/L
Testosterone (trans-Testosterone) (TESTOR)	1	ng/L
Tetrabromobisphenol A (TBBISA)	0.2	ug/L
Triclosan (TRICLN)	1 - 5	ng/L
Trimethoprim (TRIMTP)	5	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

Laboratory Method: NDMA-LOW

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
n-Nitrosodimethylamine (NDMA)	2 - 10	ng/L
n-Nitroso-di-n-propylamine (NDPA)	2 - 10	ng/L
N-Nitrosomorpholine (NMOR)	2 - 10	ng/L

Laboratory Method: RA-05

Laboratory: FRUIT GROWERS LABORATORY, INC.

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Total Radium 228 (TRa228)	0.384 - 0.506	pCi/L
Total Radium 228 Counting Error (TRa8CE)	0.384 - 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)	0.384 - 0.506	pCi/L
Radium 226 + Radium 228 Counting Error (Ra68CE)	0.384 - 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 - 3.5	mg/L
Nitrate + Nitrite Nitrogen (NO3NO2-N)	0.1 - 0.4	mg/L
Nitrite (NO2)	0.007 - 0.026	mg/L
PFOA + PFOS (PFOAOS)	2 - 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

Laboratory Method: UNKWQAN

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
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 - 1	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 - 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	ug/L

Laboratory Method: X1-300.0

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	Reportable Detection Limit Range	Units
Bromide (Br)	0.1 - 0.4	mg/L
Chloride (Cl)	0.5 - 2.5	mg/L
Fluoride (F)	0.1 - 0.4	mg/L
Nitrate Nitrogen (NO3-N)	0.1 - 0.4	mg/L
Phosphate Phosphorus (orthophosphate) (PO4-P)	0.1	mg/L
Sulfate (SO4)	0.5 - 2.5	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 - 0.2	mg/L
Total Kjeldahl Nitrogen (TKN)	0.2 - 1	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	mg/L
Boron (dissolved) (B-DIS)	0.1	mg/L
Calcium (Ca)	0.5	mg/L
Calcium (dissolved) (Ca-DIS)	0.5	mg/L
Calcium Hardness (CaHRD)	0.25	mg/L
Iron (Fe)	5 - 20	ug/L
Iron (dissolved) (Fe-DIS)	5 - 10	ug/L
Magnesium (Mg)	0.5	mg/L
Magnesium (dissolved) (Mg-DIS)	0.5	mg/L
Potassium (K)	0.5	mg/L
Potassium (dissolved) (K-DIS)	0.5	mg/L
Sodium (Na)	0.5	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 - 2	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 - 10	ug/L
Barium (dissolved) (Ba-DIS)	1 - 5	ug/L
Beryllium (Be)	1	ug/L
Beryllium (dissolved) (Be-DIS)	1	ug/L
Cadmium (Cd)	1	ug/L
Cadmium (dissolved) (Cd-DIS)	1	ug/L
Chromium (Cr)	1 - 2	ug/L
Chromium (dissolved) (Cr-DIS)	1 - 2	ug/L
Cobalt (Co)	1 - 2	ug/L
Cobalt (dissolved) (Co-DIS)	1 - 2	ug/L
Copper (Cu)	1 - 2	ug/L
Copper (dissolved) (Cu-DIS)	1 - 2	ug/L
Gadolinium (Gd)	10	ng/L
Gadolinium (dissolved) (Gd-DIS)	10	ng/L
Lead (Pb)	1	ug/L
Lead (dissolved) (Pb-DIS)	1	ug/L
Manganese (Mn)	1 - 5	ug/L
Manganese (dissolved) (Mn-DIS)	1 - 5	ug/L
Mercury (Hg)	1	ug/L
Mercury (dissolved) (Hg-DIS)	1	ug/L
Nickel (Ni)	1 - 2	ug/L
Nickel (dissolved) (Ni-DIS)	1 - 2	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

Laboratory Method: X200.8

Laboratory: ORANGE COUNTY WATER DISTRICT

Constituent Name & Abbreviation	*Reportable Detection Limit Range*	*Units*
Trivalent Chromium (CrIII)	1	ug/L
Uranium (dissolved) (U-DIS)	1	ug/L
Vanadium (V)	1 - 2	ug/L
Vanadium (dissolved) (V-DIS)	1 - 2	ug/L
Zinc (Zn)	1 - 2	ug/L
Zinc (dissolved) (Zn-DIS)	1	ug/L

Appendix C

Water Quality Constituents
With Laboratory Methods

Orange County Water District
Groundwater Replenishment System
2019 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*
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 - 2	ug/L	OCWD
Ammonia Nitrogen (NH3-N)	350.1	0.1 - 0.5	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 - 9	UNITS	OCWD
Arsenic (As)	X200.8	1	ug/L	OCWD
Arsenic (dissolved) (As-DIS)	X200.8	1	ug/L	OCWD
Asbestos (ASBESTOS)	100.2	0.18	MFL	EUROFCEI

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Constituent Type: INORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Asbestos (ASBESTOS)	100.2	0.2	MFL	EUROFINS
Barium (Ba)	X200.8	1 - 10	ug/L	OCWD
Barium (dissolved) (Ba-DIS)	X200.8	1 - 5	ug/L	OCWD
Beryllium (Be)	X200.8	1	ug/L	OCWD
Beryllium (dissolved) (Be-DIS)	X200.8	1	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	4 - 6	mg/L	EURFTIRV
Biochemical Oxygen Demand (BOD)	5210B	8.6	mg/L	TESTAMER
Boron (B)	X200.7	0.1	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 - 0.4	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	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

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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
Chlorate (CLO3)	300.1B	10	ug/L	OCWD
Chloride (Cl)	X1-300.0	0.5 - 2.5	mg/L	OCWD
Chlorite (CLO2)	300.1B	10	ug/L	OCWD
Chromium (Cr)	X200.8	1 - 2	ug/L	OCWD
Chromium (dissolved) (Cr-DIS)	X200.8	1 - 2	ug/L	OCWD
Cobalt (Co)	X200.8	1 - 2	ug/L	OCWD
Cobalt (dissolved) (Co-DIS)	X200.8	1 - 2	ug/L	OCWD
Copper (Cu)	X200.8	1 - 2	ug/L	OCWD
Copper (dissolved) (Cu-DIS)	X200.8	1 - 2	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 - 0.13	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 - 2	ug/L	OCWD
Hexavalent Chromium (CrVI)	X1-218.7	0.2	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

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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*
Iron (Fe)	X200.7	5 - 20	ug/L	OCWD
Iron (dissolved) (Fe-DIS)	X200.7	5 - 10	ug/L	OCWD
Lead (Pb)	X200.8	1	ug/L	OCWD
Lead (dissolved) (Pb-DIS)	X200.8	1	ug/L	OCWD
Magnesium (Mg)	X200.7	0.5	mg/L	OCWD
Magnesium (dissolved) (Mg-DIS)	X200.7	0.5	mg/L	OCWD
Manganese (Mn)	X200.8	1 - 5	ug/L	OCWD
Manganese (dissolved) (Mn-DIS)	X200.8	1 - 5	ug/L	OCWD
Mercury (Hg)	X200.8	1	ug/L	OCWD
Mercury (dissolved) (Hg-DIS)	X200.8	1	ug/L	OCWD
Nickel (Ni)	X200.8	1 - 2	ug/L	OCWD
Nickel (dissolved) (Ni-DIS)	X200.8	1 - 2	ug/L	OCWD
Nitrate (NO3)	4500NO3F	0.4	mg/L	OCWD
Nitrate (NO3)	UNKWQAN	0.4 - 3.5	mg/L	OCWD
Nitrate + Nitrite Nitrogen (NO3NO2-N)	4500NO3F	0.1 - 0.2	mg/L	OCWD
Nitrate + Nitrite Nitrogen (NO3NO2-N)	UNKWQAN	0.1 - 0.4	mg/L	OCWD
Nitrate Nitrogen (NO3-N)	4500NO3F	0.1 - 0.8	mg/L	OCWD
Nitrate Nitrogen (NO3-N)	X1-300.0	0.1 - 0.4	mg/L	OCWD
Nitrite (NO2)	UNKWQAN	0.007 - 0.026	mg/L	OCWD
Nitrite Nitrogen (NO2-N)	4500NO3F	0.002 - 0.008	mg/L	OCWD
Odor Range High (ODORHI)	2150B	0	TON	OCWD
Odor Range Low (ODORLO)	2150B	0	TON	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*
Organic Nitrogen (ORG-N)	X1-351.2	0.1 - 0.2	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
Phosphate Phosphorus (orthophosphate) (PO4-P)	X1-300.0	0.1	mg/L	OCWD
Potassium (K)	X200.7	0.5	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 - 2	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	mg/L	OCWD
Sodium (dissolved) (Na-DIS)	X200.7	0.5	mg/L	OCWD
Sulfate (SO4)	X1-300.0	0.5 - 2.5	mg/L	OCWD
Surfactants (MBAS)	5540C	0.02	mg/L	OCWD
Suspended Solids (SUSSOL)	2540D	2.5	mg/L	OCWD
Temperature (Laboratory) (TEMP)	4500H+B	1	C	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

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Constituent Type: INORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
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 - 0.4	mg/L	OCWD
Total Alkalinity (as CaCO3) (TOTALK)	2320B	1 - 5	mg/L	OCWD
Total Anions (TOTANI)	UNKWQAN		meq/L	OCWD
Total Cations (TOTCAT)	UNKWQAN		meq/L	OCWD
Total Chlorine (TOTCL2)	4500CLF	0.1 - 0.2	mg/L	OCWD
Total Dissolved Solids (TDS)	2540C	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 - 1	mg/L	OCWD
Total Nitrogen (TOT-N)	UNKWQAN	0.2 - 1	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 - 9	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 - 2	ug/L	OCWD
Vanadium (dissolved) (V-DIS)	X200.8	1 - 2	ug/L	OCWD
Zinc (Zn)	X200.8	1 - 2	ug/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
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-Trichloro-2-propanone (TCPONE)	551.1	0.5	ug/L	WECKLAB
1,1,1-Trichloroethane (111TCA)	524.2	0.5	ug/L	OCWD
1,1,1-Trichloroethane (111TCA)	551.1	0.1 - 0.2	ug/L	OCWD
1,1,1-Trichloropropanone (111TCP)	551.1	0.1 - 0.2	ug/L	OCWD
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 - 0.2	ug/L	OCWD
1,1-Dichloro-2-propanone (11DC2P)	551.1	0.1 - 0.2	ug/L	OCWD
1,1-Dichloro-2-propanone (11DC2P)	551.1	0.5	ug/L	WECKLAB
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	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 - 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
1,2,4-Trichlorobenzene (124TCB)	524.2	0.5	ug/L	OCWD
1,2,4-Trichlorobenzene (124TCB)	625	9.6 - 9.9	ug/L	TESTAMER
1,2,4-Trichlorobenzene (124TCB)	625	9.7 - 10	ug/L	EURFTIRV
1,2,4-Trichlorobenzene (124TCB)	625.1	9.6 - 10	ug/L	EURFCAIR
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)	504.1	0.01	ug/L	WECKLAB
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 - 0.2	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)	504.1	0.02	ug/L	WECKLAB
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 - 0.2	ug/L	OCWD
1,2-Dichlorobenzene (12DCB)	524.2	0.5	ug/L	OCWD
1,2-Dichlorobenzene (12DCB)	625	9.6 - 9.9	ug/L	TESTAMER
1,2-Dichlorobenzene (12DCB)	625	9.7 - 10	ug/L	EURFTIRV
1,2-Dichlorobenzene (12DCB)	625.1	9.6 - 10	ug/L	EURFCAIR
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	19 - 20	ug/L	TESTAMER
1,2-Diphenylhydrazine (12DPH)	625	19 - 21	ug/L	EURFTIRV
1,2-Diphenylhydrazine (12DPH)	625.1	19 - 20	ug/L	EURFCAIR
1,3,5-Trimethylbenzene (135TMB)	524.2	0.5	ug/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
1,3-Dichlorobenzene (13DCB)	524.2	0.5	ug/L	OCWD
1,3-Dichlorobenzene (13DCB)	625	9.6 - 9.9	ug/L	TESTAMER
1,3-Dichlorobenzene (13DCB)	625	9.7 - 10	ug/L	EURFTIRV
1,3-Dichlorobenzene (13DCB)	625.1	9.6 - 10	ug/L	EURFCAIR
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	9.6 - 9.9	ug/L	TESTAMER
1,4-Dichlorobenzene (14DCB)	625	9.7 - 10	ug/L	EURFTIRV
1,4-Dichlorobenzene (14DCB)	625.1	9.6 - 10	ug/L	EURFCAIR
1,4-Dioxane (14DIOX)	14DIOX	1	ug/L	OCWD
11-chloroeicosafluoro-3-oxaundecane-1sulfonic acid (11CLPF)	537.1	2	ng/L	OCWD
17a-Estradiol (aESTRA)	CEC	1	ng/L	OCWD
17a-Ethynylestradiol (aETEST)	CEC	2 - 10	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 - 5	pg/L	EUTALKNX
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1613B	4.8 - 5	pg/L	EUROTSAC
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1613B	4.8 - 4.9	pg/L	TALSAC
2,4,5-Trichlorophenol (245TCP)	625	19 - 21	ug/L	EURFTIRV
2,4,5-Trichlorophenol (245TCP)	625	19 - 20	ug/L	TESTAMER
2,4,5-Trichlorophenol (245TCP)	625.1	19 - 20	ug/L	EURFCAIR
2,4,6-Trichlorophenol (246TCP)	625	19 - 20	ug/L	TESTAMER
2,4,6-Trichlorophenol (246TCP)	625	19 - 21	ug/L	EURFTIRV
2,4,6-Trichlorophenol (246TCP)	625.1	19 - 20	ug/L	EURFCAIR
2,4-Dichlorophenol (24DCPH)	625	9.6 - 9.9	ug/L	TESTAMER

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
2,4-Dichlorophenol (24DCPH)	625	9.7 - 10	ug/L	EURFTIRV
2,4-Dichlorophenol (24DCPH)	625.1	9.6 - 10	ug/L	EURFCAIR
2,4-Dimethylphenol (24DMP)	625	19 - 21	ug/L	EURFTIRV
2,4-Dimethylphenol (24DMP)	625	19 - 20	ug/L	TESTAMER
2,4-Dimethylphenol (24DMP)	625.1	19 - 20	ug/L	EURFCAIR
2,4-Dinitrophenol (24DNP)	625	39 - 41	ug/L	EURFTIRV
2,4-Dinitrophenol (24DNP)	625	38 - 40	ug/L	TESTAMER
2,4-Dinitrophenol (24DNP)	625.1	38 - 40	ug/L	EURFCAIR
2,4-Dinitrotoluene (24DNT)	525.2	0.1	ug/L	OCWD
2,4-Dinitrotoluene (24DNT)	625	9.6 - 9.9	ug/L	TESTAMER
2,4-Dinitrotoluene (24DNT)	625	9.7 - 10	ug/L	EURFTIRV
2,4-Dinitrotoluene (24DNT)	625.1	9.6 - 10	ug/L	EURFCAIR
2,6-Dinitrotoluene (26DNT)	525.2	0.1	ug/L	OCWD
2,6-Dinitrotoluene (26DNT)	625	9.6 - 9.9	ug/L	TESTAMER
2,6-Dinitrotoluene (26DNT)	625	9.7 - 10	ug/L	EURFTIRV
2,6-Dinitrotoluene (26DNT)	625.1	9.6 - 10	ug/L	EURFCAIR
2-Chloroethylvinyl ether (2ClEVE)	14DIOX	1	ug/L	OCWD
2-Chloronapthalene (2ClNAP)	625	9.6 - 9.9	ug/L	TESTAMER
2-Chloronapthalene (2ClNAP)	625	9.7 - 10	ug/L	EURFTIRV
2-Chloronapthalene (2ClNAP)	625.1	9.6 - 10	ug/L	EURFCAIR
2-Chlorophenol (2ClPNL)	625	9.6 - 9.9	ug/L	TESTAMER
2-Chlorophenol (2ClPNL)	625	9.7 - 10	ug/L	EURFTIRV
2-Chlorophenol (2ClPNL)	625.1	9.6 - 10	ug/L	EURFCAIR
2-Chlorotoluene (2CLTOL)	524.2	0.5	ug/L	OCWD
2-Methyl naphthalene (2MNAP)	625	9.6 - 9.9	ug/L	TESTAMER
2-Methyl naphthalene (2MNAP)	625	9.7 - 10	ug/L	EURFTIRV
2-Methyl naphthalene (2MNAP)	625.1	9.6 - 10	ug/L	EURFCAIR

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
2-Methyl-4,6-Dinitrophenol (2MDNP)	625	19 - 20	ug/L	TESTAMER
2-Methyl-4,6-Dinitrophenol (2MDNP)	625	19 - 21	ug/L	EURFTIRV
2-Methyl-4,6-Dinitrophenol (2MDNP)	625.1	19 - 20	ug/L	EURFCAIR
2-Methylphenol (oCRESL)	625	9.6 - 9.9	ug/L	TESTAMER
2-Methylphenol (oCRESL)	625	9.7 - 10	ug/L	EURFTIRV
2-Methylphenol (oCRESL)	625.1	9.6 - 10	ug/L	EURFCAIR
2-Nitroaniline (oNTANL)	625	19 - 20	ug/L	TESTAMER
2-Nitroaniline (oNTANL)	625	19 - 21	ug/L	EURFTIRV
2-Nitroaniline (oNTANL)	625.1	19 - 20	ug/L	EURFCAIR
2-Nitrophenol (2NPNL)	625	9.6 - 9.9	ug/L	TESTAMER
2-Nitrophenol (2NPNL)	625	9.7 - 10	ug/L	EURFTIRV
2-Nitrophenol (2NPNL)	625.1	9.6 - 10	ug/L	EURFCAIR
3- & 4-Methylphenol (mpCRESL)	625	9.6 - 9.9	ug/L	TESTAMER
3- & 4-Methylphenol (mpCRESL)	625	9.7 - 10	ug/L	EURFTIRV
3,3'-Dichlorobenzidine (DCBZDE)	625	19 - 20	ug/L	TESTAMER
3,3'-Dichlorobenzidine (DCBZDE)	625	19 - 21	ug/L	EURFTIRV
3,3'-Dichlorobenzidine (DCBZDE)	625.1	19 - 20	ug/L	EURFCAIR
3-Nitroaniline (mNTANL)	625	19 - 20	ug/L	TESTAMER
3-Nitroaniline (mNTANL)	625	19 - 21	ug/L	EURFTIRV
3-Nitroaniline (mNTANL)	625.1	19 - 20	ug/L	EURFCAIR
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	537.1	2	ng/L	OCWD
4-Androstene-3, 17-dione (ANDROS)	CEC	2	ng/L	OCWD
4-Bromophenyl phenyl ether (4BrPPE)	625	9.6 - 9.9	ug/L	TESTAMER
4-Bromophenyl phenyl ether (4BrPPE)	625	9.7 - 10	ug/L	EURFTIRV
4-Bromophenyl phenyl ether (4BrPPE)	625.1	9.6 - 10	ug/L	EURFCAIR
4-Chloro-3-methylphenol (43CMP)	625	19 - 20	ug/L	TESTAMER

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
4-Chloro-3-methylphenol (43CMP)	625	19 - 21	ug/L	EURFTIRV
4-Chloro-3-methylphenol (43CMP)	625.1	19 - 20	ug/L	EURFCAIR
4-Chloroaniline (pClANL)	625	9.6 - 9.9	ug/L	TESTAMER
4-Chloroaniline (pClANL)	625	9.7 - 10	ug/L	EURFTIRV
4-Chloroaniline (pClANL)	625.1	9.6 - 10	ug/L	EURFCAIR
4-Chlorophenyl phenyl ether (4ClPPE)	625	9.6 - 9.9	ug/L	TESTAMER
4-Chlorophenyl phenyl ether (4ClPPE)	625	9.7 - 10	ug/L	EURFTIRV
4-Chlorophenyl phenyl ether (4ClPPE)	625.1	9.6 - 10	ug/L	EURFCAIR
4-Chlorotoluene (4CLTOL)	524.2	0.5	ug/L	OCWD
4-Isopropyltoluene (4IPTOL)	524.2	0.5	ug/L	OCWD
4-Methylphenol (pCRESL)	625.1	9.6 - 10	ug/L	EURFCAIR
4-Nitroaniline (pNTANL)	625	19 - 21	ug/L	EURFTIRV
4-Nitroaniline (pNTANL)	625	19 - 20	ug/L	TESTAMER
4-Nitroaniline (pNTANL)	625.1	19 - 20	ug/L	EURFCAIR
4-Nitrophenol (4NPNL)	625	19 - 20	ug/L	TESTAMER
4-Nitrophenol (4NPNL)	625	19 - 21	ug/L	EURFTIRV
4-Nitrophenol (4NPNL)	625.1	19 - 20	ug/L	EURFCAIR
4-n-Octylphenol (4nOCPH)	CEC	0.2	ug/L	OCWD
4-tert-Octylphenol (4tOCPH)	CEC	0.2 - 0.5	ug/L	OCWD
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9CLPF3)	537.1	2	ng/L	OCWD
Acetaldehyde (ACEALD)	556	2	ug/L	WECKLAB
Acetone (ACETNE)	524.2	10 - 20	ug/L	OCWD
Aniline (ANLN)	625	9.6 - 9.9	ug/L	TESTAMER
Aniline (ANLN)	625	9.7 - 10	ug/L	EURFTIRV
Aniline (ANLN)	625.1	9.6 - 10	ug/L	EURFCAIR

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
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	38 - 40	ug/L	TESTAMER
Benzidine (BNZDE)	625	39 - 41	ug/L	EURFTIRV
Benzidine (BNZDE)	625.1	38 - 40	ug/L	EURFCAIR
Benzoic Acid (BNZACD)	625	19 - 20	ug/L	TESTAMER
Benzoic Acid (BNZACD)	625	19 - 21	ug/L	EURFTIRV
Benzoic Acid (BNZACD)	625.1	19 - 20	ug/L	EURFCAIR
Benzyl Alcohol (BNZALC)	625	19 - 20	ug/L	TESTAMER
Benzyl Alcohol (BNZALC)	625	19 - 21	ug/L	EURFTIRV
Benzyl Alcohol (BNZALC)	625.1	19 - 20	ug/L	EURFCAIR
bis (2-chloroethoxy) methane (B2CEM)	625	9.6 - 9.9	ug/L	TESTAMER
bis (2-chloroethoxy) methane (B2CEM)	625	9.7 - 10	ug/L	EURFTIRV
bis (2-chloroethoxy) methane (B2CEM)	625.1	9.6 - 10	ug/L	EURFCAIR
bis (2-chloroethyl) ether (B2CLEE)	524.2	5	ug/L	OCWD
bis (2-chloroethyl) ether (B2CLEE)	625	9.6 - 9.9	ug/L	TESTAMER
bis (2-chloroethyl) ether (B2CLEE)	625	9.7 - 10	ug/L	EURFTIRV
bis (2-chloroethyl) ether (B2CLEE)	625.1	9.6 - 10	ug/L	EURFCAIR
bis (2-chloroisopropyl) ether (B2CIPE)	625	9.6 - 9.9	ug/L	TESTAMER
bis (2-chloroisopropyl) ether (B2CIPE)	625	9.7 - 10	ug/L	EURFTIRV
bis (2-chloroisopropyl) ether (B2CIPE)	625.1	9.6 - 10	ug/L	EURFCAIR
Bisphenol A (BisPHA)	CEC	0.2	ug/L	OCWD
Bromobenzene (BRBENZ)	524.2	0.5	ug/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Bromochloroacetic Acid (BCAA)	552.2	1	ug/L	OCWD
Bromochloroacetonitrile (BCAN)	551.1	0.1 - 0.2	ug/L	OCWD
Bromochloroacetonitrile (BCAN)	551.1	0.5	ug/L	WECKLAB
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 - 0.2	ug/L	OCWD
Bromoform (CHBr3)	524.2	0.5	ug/L	OCWD
Bromoform (CHBr3)	551.1	0.1 - 0.2	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 - 0.2	ug/L	OCWD
Chloral Hydrate (ClHYDR)	551.1	0.5	ug/L	WECKLAB
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 - 5	ug/L	OCWD
Chloroform (CHCl3)	524.2	0.5	ug/L	OCWD
Chloroform (CHCl3)	551.1	0.1 - 0.2	ug/L	OCWD
Chloromethane (CH3Cl)	524.2	0.5 - 5	ug/L	OCWD
Chloropicrin (ClPICR)	551.1	0.1 - 0.2	ug/L	OCWD
Chloropicrin (ClPICR)	551.1	0.5	ug/L	WECKLAB

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
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
Decanal (DECNAL)	556	2	ug/L	WECKLAB
Dibenzofuran (DBFUR)	625	9.6 - 9.9	ug/L	TESTAMER
Dibenzofuran (DBFUR)	625	9.7 - 10	ug/L	EURFTIRV
Dibenzofuran (DBFUR)	625.1	9.6 - 10	ug/L	EURFCAIR
Dibromoacetic Acid (DBAA)	552.2	1	ug/L	OCWD
Dibromoacetonitrile (DBAN)	551.1	0.5	ug/L	WECKLAB
Dibromoacetonitrile (DBAN)	551.1	0.1 - 0.2	ug/L	OCWD
Dibromochloromethane (CHBr2C)	524.2	0.5	ug/L	OCWD
Dibromochloromethane (CHBr2C)	551.1	0.1 - 0.2	ug/L	OCWD
Dibromomethane (CH2Br2)	524.2	0.5	ug/L	OCWD
Dichloroacetic Acid (DCAA)	552.2	1	ug/L	OCWD
Dichloroacetonitrile (DCAN)	551.1	0.1 - 0.2	ug/L	OCWD
Dichloroacetonitrile (DCAN)	551.1	0.5 - 3	ug/L	WECKLAB
Dichlorodifluoromethane (CCl2F2)	524.2	0.5	ug/L	OCWD
Diclofenac (DICLFN)	CEC	5 - 10	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	WECKLAB

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Endosulfan II (ENDOII)	525.2	0.1	ug/L	OCWD
Epitestosterone (cis-Testosterone) (EPITES)	CEC	1	ng/L	OCWD
Equilin (EQUILN)	CEC	5	ng/L	OCWD
Estriol (ESTRIO)	CEC	2 - 10	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	ng/L	OCWD
Formaldehyde (FORALD)	556	2	ug/L	WECKLAB
Freon 123a (FR123A)	524.2	0.5 - 2	ug/L	OCWD
Glyoxal (GLYOXL)	556	2	ug/L	WECKLAB
HCH-alpha (Alpha-BHC) (BHCa)	508	0.01	ug/L	WECKLAB
HCH-alpha (Alpha-BHC) (BHCa)	525.2	0.1	ug/L	OCWD
HCH-beta (Beta-BHC) (BHCb)	508	0.01	ug/L	WECKLAB
HCH-beta (Beta-BHC) (BHCb)	525.2	0.1	ug/L	OCWD
HCH-delta (Delta-BHC) (BHCd)	508	0.01	ug/L	WECKLAB
HCH-delta (Delta-BHC) (BHCd)	525.2	0.1	ug/L	OCWD
Heptanal (HEPNAL)	556	2	ug/L	WECKLAB
Hexachlorobutadiene (HClBut)	524.2	0.5	ug/L	OCWD
Hexachlorobutadiene (HClBut)	625	9.6 - 9.9	ug/L	TESTAMER
Hexachlorobutadiene (HClBut)	625	9.7 - 10	ug/L	EURFTIRV
Hexachlorobutadiene (HClBut)	625.1	9.6 - 10	ug/L	EURFCAIR
Hexachloroethane (HCE)	625	9.7 - 10	ug/L	EURFTIRV
Hexachloroethane (HCE)	625	9.6 - 9.9	ug/L	TESTAMER

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Hexachloroethane (HCE)	625.1	9.6 - 10	ug/L	EURFCAIR
Hexafluoropropylene oxide dimer acid (GenX) (HFPODA)	537	4	ng/L	OCWD
Hexafluoropropylene oxide dimer acid (GenX) (HFPODA)	537.1	2	ng/L	OCWD
Hexanal (HEXNAL)	556	2	ug/L	WECKLAB
Iohexol (IOHEXL)	CEC	20 - 200	ng/L	OCWD
Iopromide (IOPRMD)	CEC	10 - 20	ng/L	OCWD
Isophorone (IPHOR)	525.2	0.1	ug/L	OCWD
Isophorone (IPHOR)	625	9.6 - 9.9	ug/L	TESTAMER
Isophorone (IPHOR)	625	9.7 - 10	ug/L	EURFTIRV
Isophorone (IPHOR)	625.1	9.6 - 10	ug/L	EURFCAIR
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
Metolachlor (METOCL)	525.2	0.1	ug/L	OCWD
Monobromoacetic Acid (MBAA)	552.2	1	ug/L	OCWD
Monochloroacetic Acid (MCAA)	552.2	1	ug/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Naphthalene (NAP)	524.2	0.5	ug/L	OCWD
Naphthalene (NAP)	525.2	0.1	ug/L	OCWD
Naphthalene (NAP)	625	9.6 - 9.9	ug/L	TESTAMER
Naphthalene (NAP)	625	9.7 - 10	ug/L	EURFTIRV
Naphthalene (NAP)	625.1	9.6 - 10	ug/L	EURFCAIR
Naproxen (NAPRXN)	CEC	5 - 50	ng/L	OCWD
n-Butylbenzene (nBBENZ)	524.2	0.5	ug/L	OCWD
Neotam (NEOTAM)	CEC	10	ng/L	OCWD
N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSA)	537	4	ng/L	OCWD
N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSA)	537.1	2	ng/L	OCWD
N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSA)	537RV1.1	4	ng/L	OCWD
Nitrobenzene (NBENZ)	625	19 - 20	ug/L	TESTAMER
Nitrobenzene (NBENZ)	625	19 - 21	ug/L	EURFTIRV
Nitrobenzene (NBENZ)	625.1	19 - 20	ug/L	EURFCAIR
N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSA)	537	4	ng/L	OCWD
N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSA)	537.1	2	ng/L	OCWD
N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSA)	537RV1.1	4	ng/L	OCWD
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	9,600 - 9,900	ng/L	TESTAMER
n-Nitroso-di-n-propylamine (NDPA)	625	9,700 - 10,000	ng/L	EURFTIRV
n-Nitroso-di-n-propylamine (NDPA)	625.1	9,600 - 10,000	ng/L	EURFCAIR
n-Nitroso-di-n-propylamine (NDPA)	NDMA-LOW	2 - 10	ng/L	OCWD
n-Nitrosodiphenylamine (NDPhA)	625	9,600 - 9,900	ng/L	TESTAMER
n-Nitrosodiphenylamine (NDPhA)	625	9,700 - 10,000	ng/L	EURFTIRV
n-Nitrosodiphenylamine (NDPhA)	625.1	9,600 - 10,000	ng/L	EURFCAIR

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
N-Nitrosomorpholine (NMOR)	NDMA-LOW	2 - 10	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	0.1	ug/L	WECKLAB
PCB-1221 (PCB21)	508	0.1	ug/L	WECKLAB
PCB-1232 (PCB32)	508	0.1	ug/L	WECKLAB
PCB-1242 (PCB42)	508	0.1	ug/L	WECKLAB
PCB-1248 (PCB48)	508	0.1	ug/L	WECKLAB
PCB-1254 (PCB54)	508	0.1	ug/L	WECKLAB
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 butane sulfonic acid (PFBS)	537.1	2	ng/L	OCWD
Perfluoro butane sulfonic acid (PFBS)	537RV1.1	4	ng/L	OCWD
Perfluoro heptanoic acid (PFHpA)	537	4	ng/L	OCWD
Perfluoro heptanoic acid (PFHpA)	537.1	2	ng/L	OCWD
Perfluoro heptanoic acid (PFHpA)	537RV1.1	4	ng/L	OCWD
Perfluoro hexane sulfonic acid (PFHxS)	537	4	ng/L	OCWD
Perfluoro hexane sulfonic acid (PFHxS)	537.1	2	ng/L	OCWD
Perfluoro hexane sulfonic acid (PFHxS)	537RV1.1	4	ng/L	OCWD
Perfluoro nonanoic acid (PFNA)	537	4	ng/L	OCWD
Perfluoro nonanoic acid (PFNA)	537.1	2	ng/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Perfluoro nonanoic acid (PFNA)	537RV1.1	4	ng/L	OCWD
Perfluoro octane sulfonic acid (PFOS)	537	4	ng/L	OCWD
Perfluoro octane sulfonic acid (PFOS)	537.1	2	ng/L	OCWD
Perfluoro octane sulfonic acid (PFOS)	537RV1.1	4	ng/L	OCWD
Perfluoro octanoic acid (PFOA)	537	4	ng/L	OCWD
Perfluoro octanoic acid (PFOA)	537.1	2	ng/L	OCWD
Perfluoro octanoic acid (PFOA)	537RV1.1	4	ng/L	OCWD
Perfluorodecanoic acid (PFDA)	537	4	ng/L	OCWD
Perfluorodecanoic acid (PFDA)	537.1	2	ng/L	OCWD
Perfluorodecanoic acid (PFDA)	537RV1.1	4	ng/L	OCWD
Perfluorododecanoic acid (PFDoA)	537	4	ng/L	OCWD
Perfluorododecanoic acid (PFDoA)	537.1	2	ng/L	OCWD
Perfluorododecanoic acid (PFDoA)	537RV1.1	4	ng/L	OCWD
Perfluorohexanoic acid (PFHxA)	537	4	ng/L	OCWD
Perfluorohexanoic acid (PFHxA)	537.1	2	ng/L	OCWD
Perfluorohexanoic acid (PFHxA)	537RV1.1	4 - 8	ng/L	OCWD
Perfluorotetradecanoic acid (PFTA)	537	4 - 10	ng/L	OCWD
Perfluorotetradecanoic acid (PFTA)	537.1	2	ng/L	OCWD
Perfluorotetradecanoic acid (PFTA)	537RV1.1	4	ng/L	OCWD
Perfluorotridecanoic acid (PFTrDA)	537	4	ng/L	OCWD
Perfluorotridecanoic acid (PFTrDA)	537.1	2	ng/L	OCWD
Perfluorotridecanoic acid (PFTrDA)	537RV1.1	4	ng/L	OCWD
Perfluoroundecanoic acid (PFUnA)	537	4	ng/L	OCWD
Perfluoroundecanoic acid (PFUnA)	537.1	2	ng/L	OCWD
Perfluoroundecanoic acid (PFUnA)	537RV1.1	4	ng/L	OCWD
PFOA + PFOS (PFOAOS)	537RV1.1	4	ng/L	OCWD
PFOA + PFOS (PFOAOS)	UNKWQAN	2 - 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	9.6 - 9.9	ug/L	TESTAMER
Phenol (PHENOL)	625	9.7 - 10	ug/L	EURFTIRV
Phenol (PHENOL)	625.1	9.6 - 10	ug/L	EURFCAIR
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 - 1,000	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	ug/L	OCWD
Tert-amyl methyl ether (TAME)	524.2	1	ug/L	OCWD
tert-butyl alcohol (TBA)	524.2	2	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 - 0.2	ug/L	OCWD
Toluene (TOLU)	524.2	0.5	ug/L	OCWD
Total 1,3-Dichloropropene (x13DCP)	524.2	0.5	ug/L	OCWD

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Constituent Type: ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Total Trihalomethanes (TTHMs)	524.2	0.5	ug/L	OCWD
Total Trihalomethanes (TTHMs)	551.1	0.1 - 0.2	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
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 - 0.2	ug/L	OCWD
Trichloroacetonitrile (TCAN)	551.1	0.5	ug/L	WECKLAB
Trichloroethene (TCE)	524.2	0.5	ug/L	OCWD
Trichloroethene (TCE)	551.1	0.1 - 0.2	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	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 - 0.391	pCi/L	FGL
Natural Uranium Counting Error (NTUrCE)	908.0	0.342 - 0.391	pCi/L	FGL

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Constituent Type: RADIOLOGICALS

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Radium 226 + Radium 228 (Ra6Ra8)	UNKWQAN	0.384 - 0.506	pCi/L	FGL
Radium 226 + Radium 228 Counting Error (Ra68CE)	UNKWQAN	0.384 - 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	0.623 - 1.6	pCi/L	FGL
Total Beta Counting Error (TOTbCE)	900.0	0.623 - 1.6	pCi/L	FGL
Total Radium 226 (TRa226)	903.0	0.274 - 0.47	pCi/L	FGL
Total Radium 226 Counting Error (TRa6CE)	903.0	0.274 - 0.47	pCi/L	FGL
Total Radium 228 (TRa228)	RA-05	0.384 - 0.506	pCi/L	FGL
Total Radium 228 Counting Error (TRa8CE)	RA-05	0.384 - 0.506	pCi/L	FGL
Total Strontium-90 (TS90)	905.0	0.546	pCi/L	FGL
Total Strontium-90 Counting Error (TS90CE)	905.0	0.546	pCi/L	FGL
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-T (245T)	515.4	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	0.2	ug/L	WECKLAB

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
2,4,6-Trinitrotoluene (246TNT)	8330A	0.1	ug/L	TALSAC
2,4,6-Trinitrotoluene (246TNT)	8330A	0.099 - 0.1	ug/L	EUROTSAC
2,4-DB (24DB)	515.3	2	ug/L	WECKLAB
2,4-DB (24DB)	515.4	2	ug/L	WECKLAB
2,4-Dichlorophenoxyacetic Acid (24D)	515.3	0.4	ug/L	WECKLAB
2,4-Dichlorophenoxyacetic Acid (24D)	515.4	0.4	ug/L	WECKLAB
3,5-Dichlorobenzoic Acid (35DBA)	515.3	1	ug/L	WECKLAB
3,5-Dichlorobenzoic Acid (35DBA)	515.4	1	ug/L	WECKLAB
3-Hydroxycarbofuran (HYDCFR)	531	2	ug/L	OCWD
4,4'-DDD (DDD)	508	0.01	ug/L	WECKLAB
4,4'-DDD (DDD)	525.2	0.1	ug/L	OCWD
4,4'-DDE (DDE)	508	0.01	ug/L	WECKLAB
4,4'-DDE (DDE)	525.2	0.1	ug/L	OCWD
4,4'-DDT (DDT)	508	0.01	ug/L	WECKLAB
4,4'-DDT (DDT)	525.2	0.1	ug/L	OCWD
Acenaphthene (ACNAPE)	525.2	0.1	ug/L	OCWD
Acenaphthene (ACNAPE)	625	9.6 - 9.9	ug/L	TESTAMER
Acenaphthene (ACNAPE)	625	9.7 - 10	ug/L	EURFTIRV
Acenaphthene (ACNAPE)	625.1	9.6 - 10	ug/L	EURFCAIR
Acenaphthylene (ACENAP)	525.2	0.1	ug/L	OCWD
Acenaphthylene (ACENAP)	625	9.6 - 9.9	ug/L	TESTAMER
Acenaphthylene (ACENAP)	625	9.7 - 10	ug/L	EURFTIRV
Acenaphthylene (ACENAP)	625.1	9.6 - 10	ug/L	EURFCAIR
Acetaminophen (ACTMNP)	CEC	5	ng/L	OCWD
Acetochlor (ACETOC)	525.2	0.1	ug/L	OCWD

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Acifluorfen (ACIFEN)	515.3	0.4	ug/L	WECKLAB
Acifluorfen (ACIFEN)	515.4	0.4	ug/L	WECKLAB
Alachlor (ALACHL)	525.2	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	0.01	ug/L	WECKLAB
Aldrin (ALDRIN)	525.2	0.1	ug/L	OCWD
Ametryn (AMERYN)	525.2	0.1	ug/L	OCWD
Anthracene (ANTHRA)	525.2	0.1	ug/L	OCWD
Anthracene (ANTHRA)	625	9.6 - 9.9	ug/L	TESTAMER
Anthracene (ANTHRA)	625	9.7 - 10	ug/L	EURFTIRV
Anthracene (ANTHRA)	625.1	9.6 - 10	ug/L	EURFCAIR
Atrazine (ATRAZ)	525.2	0.1	ug/L	OCWD
Atrazine (ATRAZ)	CEC	0.001 - 0.005	ug/L	OCWD
Azithromycin (AZTMCN)	CEC	10 - 100	ng/L	OCWD
Baygon (BAYGON)	531	1	ug/L	OCWD
Bentazon (BENTAZ)	515.3	2	ug/L	WECKLAB
Bentazon (BENTAZ)	515.4	2	ug/L	WECKLAB
Benzo(a)anthracene (BaANTH)	525.2	0.1	ug/L	OCWD
Benzo(a)anthracene (BaANTH)	625	9.6 - 9.9	ug/L	TESTAMER
Benzo(a)anthracene (BaANTH)	625	9.7 - 10	ug/L	EURFTIRV
Benzo(a)anthracene (BaANTH)	625.1	9.6 - 10	ug/L	EURFCAIR
Benzo(a)pyrene (BaPYRE)	525.2	0.1	ug/L	OCWD
Benzo(a)pyrene (BaPYRE)	625	9.6 - 9.9	ug/L	TESTAMER

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Benzo(a)pyrene (BaPYRE)	625	9.7 - 10	ug/L	EURFTIRV
Benzo(a)pyrene (BaPYRE)	625.1	9.6 - 10	ug/L	EURFCAIR
Benzo(b)fluoranthene (BbFLUR)	525.2	0.1	ug/L	OCWD
Benzo(b)fluoranthene (BbFLUR)	625	9.6 - 9.9	ug/L	TESTAMER
Benzo(b)fluoranthene (BbFLUR)	625	9.7 - 10	ug/L	EURFTIRV
Benzo(b)fluoranthene (BbFLUR)	625.1	9.6 - 10	ug/L	EURFCAIR
Benzo(g,h,i)perylene (BghiPR)	525.2	0.1	ug/L	OCWD
Benzo(g,h,i)perylene (BghiPR)	625	9.6 - 9.9	ug/L	TESTAMER
Benzo(g,h,i)perylene (BghiPR)	625	9.7 - 10	ug/L	EURFTIRV
Benzo(g,h,i)perylene (BghiPR)	625.1	9.6 - 10	ug/L	EURFCAIR
Benzo[k]fluoranthene (BkFLUR)	525.2	0.1	ug/L	OCWD
Benzo[k]fluoranthene (BkFLUR)	625	9.6 - 9.9	ug/L	TESTAMER
Benzo[k]fluoranthene (BkFLUR)	625	9.7 - 10	ug/L	EURFTIRV
Benzo[k]fluoranthene (BkFLUR)	625.1	9.6 - 10	ug/L	EURFCAIR
bis (2-ethylhexyl) adipate (DEHA)	525.2	2	ug/L	OCWD
bis (2-ethylhexyl) phthalate (DEHP)	525.2	2	ug/L	OCWD
bis (2-ethylhexyl) phthalate (DEHP)	625	19 - 20	ug/L	TESTAMER
bis (2-ethylhexyl) phthalate (DEHP)	625	19 - 21	ug/L	EURFTIRV
bis (2-ethylhexyl) phthalate (DEHP)	625.1	19 - 20	ug/L	EURFCAIR
Bromacil (BROMAC)	525.2	0.1	ug/L	OCWD
Butachlor (BUTACL)	525.2	0.1	ug/L	OCWD
Butanal (BUTAN)	556	2	ug/L	WECKLAB
Butylate (BTYATE)	525.2	0.1	ug/L	OCWD
Butylbenzyl phthalate (BBP)	525.2	2	ug/L	OCWD
Butylbenzyl phthalate (BBP)	625	19 - 20	ug/L	TESTAMER
Butylbenzyl phthalate (BBP)	625	19 - 21	ug/L	EURFTIRV

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Caffeine (CAFFEI)	525.2	100	ng/L	OCWD
Caffeine (CAFFEI)	CEC	3 - 30	ng/L	OCWD
Captan (CAPTAN)	525.2	0.1	ug/L	OCWD
Carbamazepine (CBMAZP)	CEC	1 - 5	ng/L	OCWD
Carbaryl (CARBAR)	531	2	ug/L	OCWD
Carbofuran (CARBOF)	531	1	ug/L	OCWD
Chlordane (ClDANE)	508	0.1	ug/L	WECKLAB
Chlordane-alpha (CLDA)	525.2	0.1	ug/L	OCWD
Chlordane-gamma (CLDG)	525.2	0.1	ug/L	OCWD
Chlorobenzilate (CLBZLA)	525.2	0.1	ug/L	OCWD
Chloroneb (CLNEB)	525.2	0.1	ug/L	OCWD
Chloropropham (CPRPHM)	525.2	0.1	ug/L	OCWD
Chlorothalonil (CLTNIL)	508	0.05	ug/L	WECKLAB
Chlorothalonil (CLTNIL)	525.2	0.1	ug/L	OCWD
Chlorpyrifos (ClPYRI)	525.2	0.1	ug/L	OCWD
Chrysene (CHRYS)	525.2	0.1	ug/L	OCWD
Chrysene (CHRYS)	625	9.7 - 10	ug/L	EURFTIRV
Chrysene (CHRYS)	625	9.6 - 9.9	ug/L	TESTAMER
Chrysene (CHRYS)	625.1	9.6 - 10	ug/L	EURFCAIR
Dalapon (DALAPN)	515.3	0.4	ug/L	WECKLAB
Dalapon (DALAPN)	515.4	0.4	ug/L	WECKLAB
Dalapon (DALAPN)	552.2	1	ug/L	OCWD
DCPA-Dacthal (DCPA)	515.3	0.1	ug/L	WECKLAB
DCPA-Dacthal (DCPA)	515.4	0.1	ug/L	WECKLAB

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
DCPA-Dacthal (DCPA)	525.2	0.1	ug/L	OCWD
Diazinon (DIAZI)	525.2	0.1	ug/L	OCWD
Dibenzo(a,h)anthracene (DBahAN)	525.2	0.1	ug/L	OCWD
Dibenzo(a,h)anthracene (DBahAN)	625	19 - 20	ug/L	TESTAMER
Dibenzo(a,h)anthracene (DBahAN)	625	19 - 21	ug/L	EURFTIRV
Dibenzo(a,h)anthracene (DBahAN)	625.1	19 - 20	ug/L	EURFCAIR
Dicamba (DICAMB)	515.3	0.6	ug/L	WECKLAB
Dicamba (DICAMB)	515.4	0.6	ug/L	WECKLAB
Dichlorprop (24DP)	515.3	0.3	ug/L	WECKLAB
Dichlorprop (24DP)	515.4	0.3	ug/L	WECKLAB
Dichlorvos (DCLVOS)	525.2	0.1	ug/L	OCWD
Dieldrin (DIELDR)	508	0.01	ug/L	WECKLAB
Dieldrin (DIELDR)	525.2	0.1	ug/L	OCWD
Diethyl phthalate (DEP)	525.2	2	ug/L	OCWD
Diethyl phthalate (DEP)	625	9.6 - 9.9	ug/L	TESTAMER
Diethyl phthalate (DEP)	625	9.7 - 10	ug/L	EURFTIRV
Diethyl phthalate (DEP)	625.1	9.6 - 10	ug/L	EURFCAIR
Diethylene Glycol (DEGLYCOL)	8015B	10,000	ug/L	EUROTNSH
Dimethoate (DMTH)	525.2	1	ug/L	OCWD
Dimethyl phthalate (DMP)	525.2	2	ug/L	OCWD
Dimethyl phthalate (DMP)	625	9.6 - 9.9	ug/L	TESTAMER
Dimethyl phthalate (DMP)	625	9.7 - 10	ug/L	EURFTIRV
Dimethyl phthalate (DMP)	625.1	9.6 - 10	ug/L	EURFCAIR
Di-n-butylphthalate (DnBP)	525.2	2	ug/L	OCWD
Di-n-butylphthalate (DnBP)	625	19 - 20	ug/L	TESTAMER
Di-n-butylphthalate (DnBP)	625	19 - 21	ug/L	EURFTIRV

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Di-n-butylphthalate (DnBP)	625.1	19 - 20	ug/L	EURFCAIR
Di-n-octyl phthalate (DnOP)	525.2	2	ug/L	OCWD
Di-n-octyl phthalate (DnOP)	625	19 - 21	ug/L	EURFTIRV
Di-n-octyl phthalate (DnOP)	625	19 - 20	ug/L	TESTAMER
Di-n-octyl phthalate (DnOP)	625.1	19 - 20	ug/L	EURFCAIR
Dinoseb (DINOSB)	515.3	0.4	ug/L	WECKLAB
Dinoseb (DINOSB)	515.4	0.4	ug/L	WECKLAB
Diphenamid (DPHNMD)	525.2	0.1	ug/L	OCWD
Diquat (DIQUAT)	549.2	4	ug/L	OCWD
Diuron (DIURON)	CEC	0.005	ug/L	OCWD
Endosulfan I (ENDOI)	508	0.01	ug/L	WECKLAB
Endosulfan I (ENDOI)	525.2	0.1	ug/L	OCWD
Endosulfan sulfate (ENDOSL)	508	0.01	ug/L	WECKLAB
Endosulfan sulfate (ENDOSL)	525.2	0.1	ug/L	OCWD
Endothall (ENDOTL)	548.1	45	ug/L	WECKLAB
Endrin (ENDRIN)	508	0.01	ug/L	WECKLAB
Endrin (ENDRIN)	525.2	0.1	ug/L	OCWD
Endrin Aldehyde (ENDR-A)	508	0.01	ug/L	WECKLAB
Endrin Aldehyde (ENDR-A)	525.2	0.1	ug/L	OCWD
EPTC (EPTC)	525.2	0.1	ug/L	OCWD
Erythromycin (ERYTHN)	CEC	1 - 5	ng/L	OCWD
Ethion (ETHION)	525.2	0.1	ug/L	OCWD
Ethoprop (ETHPRP)	525.2	0.1	ug/L	OCWD
Ethylene Glycol (GLYCOL)	8015B	10,000	ug/L	TALNSHV

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	Method	Reportable Detection Limit Range	Units	Laboratory
Ethylene Glycol (GLYCOL)	8015B	10,000	ug/L	EUROTNSH
Ethylene Glycol (GLYCOL)	8015B	10,000	ug/L	EUROFBUF
Etridiazole (ETRDZL)	525.2	0.1	ug/L	OCWD
Fluoranthene (FLANTH)	525.2	0.1	ug/L	OCWD
Fluoranthene (FLANTH)	625	9.6 - 9.9	ug/L	TESTAMER
Fluoranthene (FLANTH)	625	9.7 - 10	ug/L	EURFTIRV
Fluoranthene (FLANTH)	625.1	9.6 - 10	ug/L	EURFCAIR
Fluorene (FLUOR)	525.2	0.1	ug/L	OCWD
Fluorene (FLUOR)	625	9.6 - 9.9	ug/L	TESTAMER
Fluorene (FLUOR)	625	9.7 - 10	ug/L	EURFTIRV
Fluorene (FLUOR)	625.1	9.6 - 10	ug/L	EURFCAIR
Gemfibrozil (GMFIBZ)	CEC	1 - 5	ng/L	OCWD
Glyphosate (GLYPHO)	547	25	ug/L	OCWD
HCH-gamma (Lindane) (LINDNE)	508	0.01	ug/L	WECKLAB
HCH-gamma (Lindane) (LINDNE)	525.2	0.1	ug/L	OCWD
Heptachlor (HEPTA)	508	0.01	ug/L	WECKLAB
Heptachlor (HEPTA)	525.2	0.1	ug/L	OCWD
Heptachlor epoxide (HEPEPX)	508	0.01	ug/L	WECKLAB
Heptachlor epoxide (HEPEPX)	525.2	0.1	ug/L	OCWD
Hexachlorobenzene (HEXCLB)	508	0.05	ug/L	WECKLAB
Hexachlorobenzene (HEXCLB)	525.2	0.1	ug/L	OCWD
Hexachlorobenzene (HEXCLB)	625	9.6 - 9.9	ug/L	TESTAMER
Hexachlorobenzene (HEXCLB)	625	9.7 - 10	ug/L	EURFTIRV
Hexachlorobenzene (HEXCLB)	625.1	9.6 - 10	ug/L	EURFCAIR
Hexachlorocyclopentadiene (HCICPD)	508	0.05	ug/L	WECKLAB
Hexachlorocyclopentadiene (HCICPD)	525.2	0.1	ug/L	OCWD

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Hexachlorocyclopentadiene (HClCPD)	625	19 - 20	ug/L	TESTAMER
Hexachlorocyclopentadiene (HClCPD)	625	19 - 21	ug/L	EURFTIRV
Hexachlorocyclopentadiene (HClCPD)	625.1	19 - 20	ug/L	EURFCAIR
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330A	0.1	ug/L	TALSAC
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330A	0.099 - 0.1	ug/L	EUROTSAC
Hexazinone (HEXZON)	525.2	0.1	ug/L	OCWD
Ibuprofen (IBPRFN)	CEC	1 - 50	ng/L	OCWD
Indeno(1,2,3-cd)pyrene (INDPYR)	525.2	0.1	ug/L	OCWD
Indeno(1,2,3-cd)pyrene (INDPYR)	625	19 - 20	ug/L	TESTAMER
Indeno(1,2,3-cd)pyrene (INDPYR)	625	19 - 21	ug/L	EURFTIRV
Indeno(1,2,3-cd)pyrene (INDPYR)	625.1	19 - 20	ug/L	EURFCAIR
Malathion (MALATH)	525.2	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	ug/L	OCWD
methyl-Parathion (MPARA)	525.2	0.5	ug/L	OCWD
Metribuzin (MTRBZN)	525.2	0.1	ug/L	OCWD
Molinate (MOLINT)	525.2	0.1	ug/L	OCWD
N,N-diethyl-m-toluamide (DEET)	CEC	1 - 5	ng/L	OCWD
Norflurazon (NORFLR)	525.2	0.1 - 1	ug/L	OCWD
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330A	0.1	ug/L	TALSAC
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330A	0.099 - 0.1	ug/L	EUROTSAC
Oxamyl (OXAMYL)	531	2	ug/L	OCWD

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Paraquat (PARAQT)	549.2	4	ug/L	OCWD
Parathion (PARA)	525.2	0.5	ug/L	OCWD
Pentachlorophenol (PCP) (PCP)	515.3	0.2	ug/L	WECKLAB
Pentachlorophenol (PCP) (PCP)	515.4	0.2	ug/L	WECKLAB
Pentachlorophenol (PCP) (PCP)	525.2	1	ug/L	OCWD
Pentachlorophenol (PCP) (PCP)	625	19 - 20	ug/L	TESTAMER
Pentachlorophenol (PCP) (PCP)	625	19 - 21	ug/L	EURFTIRV
Pentachlorophenol (PCP) (PCP)	625.1	19 - 20	ug/L	EURFCAIR
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	ug/L	OCWD
Phenanthrene (PHENAN)	525.2	0.1	ug/L	OCWD
Phenanthrene (PHENAN)	625	9.6 - 9.9	ug/L	TESTAMER
Phenanthrene (PHENAN)	625	9.7 - 10	ug/L	EURFTIRV
Phenanthrene (PHENAN)	625.1	9.6 - 10	ug/L	EURFCAIR
Picloram (PICLOR)	515.3	0.6	ug/L	WECKLAB
Picloram (PICLOR)	515.4	0.6	ug/L	WECKLAB
Primidone (PRIMDN)	CEC	1	ng/L	OCWD
Prometryn (PROMET)	525.2	0.1	ug/L	OCWD
Pronamide (PROAMD)	525.2	0.1	ug/L	OCWD
Propachlor (PROPCL)	508	0.05	ug/L	WECKLAB
Propachlor (PROPCL)	525.2	0.1	ug/L	OCWD
Propanal (PROPNL)	556	2	ug/L	WECKLAB
Propazine (PROPAZ)	525.2	0.1	ug/L	OCWD
Propylene Glycol (PRGLYCOL)	8015B	10,000	ug/L	EUROTNSH

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Constituent Type: SEMI-ORGANIC

Constituent Name & Abbreviation	*Method*	*Reportable Detection Limit Range*	*Units*	*Laboratory*
Pyrene (PYRENE)	525.2	0.1	ug/L	OCWD
Pyrene (PYRENE)	625	9.6 - 9.9	ug/L	TESTAMER
Pyrene (PYRENE)	625	9.7 - 10	ug/L	EURFTIRV
Pyrene (PYRENE)	625.1	9.6 - 10	ug/L	EURFCAIR
Simazine (SIMAZ)	525.2	0.1	ug/L	OCWD
Simazine (SIMAZ)	CEC	0.005	ug/L	OCWD
Sulfamethoxazole (SULTHZ)	CEC	1 - 10	ng/L	OCWD
Tebuthiuron (TBTURN)	525.2	2	ug/L	OCWD
Terbacil (TRBACL)	525.2	0.1	ug/L	OCWD
Thiobencarb (THIO)	525.2	0.1	ug/L	OCWD
Toxaphene Mixture (TOXA)	508	1	ug/L	WECKLAB
Triclosan (TRICLN)	CEC	1 - 5	ng/L	OCWD
Trifluralin (TRFLRN)	508	0.01	ug/L	WECKLAB
Trifluralin (TRFLRN)	525.2	0.1	ug/L	OCWD
Trithion (TRTION)	525.2	0.1	ug/L	OCWD

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Appendix D

Operator Certifications, Operations and Maintenance Summary and Calibration Records

Orange County Water District Groundwater Replenishment System 2019 Annual Report

Orange County Water District
Groundwater Replenishment System
Advanced Water Purification Facility

Operations Certification Levels
(As of December 2019)

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
Derrick Mansell	Chief Plant Operator	M - F	5	V-28340
Steve Clark	Shift Supervisor	D2	5	V-8430
Russell Sutton	Shift Supervisor	N1	5	V-5143
Mario Manriquez	Lead Plant Operator	N2	5	V-10397
John Souza	Shift Supervisor	D1	4	IV-3998
Anthony Carreira	Shift Supervisor	N2	4	IV-27787
Mike Ewing	Lead Plant Operator	D1	3	III-10199
Luis Torres	Lead Plant Operator	N1	3	III-28285
Craig Liebzeit Jr.	Lead Plant Operator	N2	3	III-43546
Heinz Roehler	Sr. Plant Operator III	D1	3	III-3534
Thomas Nicholson	Sr. Plant Operator III	D2	3	III-9446
Curtis Sanders	Sr. Plant Operator III	N2	3	III-28461
Chris Vu	Plant Operator II	D1	3	III-10630
Philip Jacobs	Plant Operator II	N1	3	III-42110
Charles Spade	Plant Operator II	N1	2	II-7966
Eric Gautier	Plant Operator II	D1	2	II-10135
Bryan Bushay	Plant Operator II	D2	2	II-43759
Christopher Owens	Plant Operator II	N1	T-4	29560
Anthony Lockhart	Plant Operator II	D2	T-3	38600
Jacob Bermudez	Plant Operator I	N2	3	III-43637
vacant	Plant Operator I / II	N2		

Plant Shutdown Summary for Advanced Water Purification Facility
2019 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)	3.50	2.00	1.75										7.25
2	UV Interlock that shut down the UV Process	0.70			1.75									2.45
3	Scheduled Inspection of Electrical Systems and Other Maintenance					45.75								45.75
4	Communication issues closed GWR Pipeline valves							1.33						1.33
Total Hours Offline		**4.20**	**2.00**	**1.75**	**1.75**	**45.75**	**0.00**	**1.33**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**56.78**
Total Days Offline		**0.18**	**0.08**	**0.07**	**0.07**	**1.91**	**0.00**	**0.06**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.37**

Appendix D
Plant Shutdown Summary

D.1 January 2019

<u>January 1 - 31: Total Downtime 4.2 hours (0.6%)</u>

January 1: The GWRS shutdown unexpectedly for 0.7 hours (1250 – 1330 hours) due to a UV Interlock condition that shut down the UV process. The failure occurred when the power distribution center (PDC) for reactor 2:1 failed in UV Train I. The reactor's failure caused ROP production to exceed the UV system's treatment capacity which in turn instantly shut down the GWRS plant. A total of 0.07 MG of MWD OC-44 potable water was used during the shutdown period to maintain barrier system pressures until the plant could b restarted to resume normal FPW injection.

January 20: The GWRS experienced an unexpected 3.5-hour shutdown (1600 – 1930 hours) due to a brief Southern California Edison (SCE) power interruption. A total of 0.14 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.2 February 2019

<u>February 1 — 28: Total Downtime 2.0 hours (0.3%)</u>

February 20: The GWRS experienced an unexpected 2.0-hour shutdown (1550 – 1750 hours) due to a brief Southern California Edison (SCE) power interruption. A total of 0.15 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.3 March 2019

<u>March 1 - 31: Total Downtime 1.75 hours (0.2%)</u>

March 16: The GWRS experienced an unexpected 1.75-hour shutdown (0945 – 1130 hours) due to a brief Southern California Edison (SCE) power interruption. A total of 0.11 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.4 April 2019

<u>April 1 — 30: Total Downtime 1.75 hours (0.2%)</u>

April 26: The GWRS shutdown unexpectedly for 1.75 hours (0800 – 0945 hours) due to a UV Interlock condition that shutdown the UV process. 4/26 @0800 hrs: Plant shutdown unexpectedly due to UV Interlock. The condition occurred while UV train was offline for flow meter inspections and a second UV train was taken offline for standard lamp maintenance. The plant production rate was lowered from 100 to 95 mgd to account for the UV capacity limitation, but that wasn't enough to prevent ROP flow from exceeding UV system capacity while the RO units and their flows fluctuated (normal) while settling into the new production rate of 95 mgd. In essence, the control room operator was trying to maximize GWRS production around having two UV trains offline but did not lower the plant production rate low enough.

A total of 0.13 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.5 May 2019

May 1 — 31: Total Downtime 45.75 hours (6.4%)

May 6: At 1315 hours: The GWRS was shutdown to prepare for scheduled inspections on medium voltage electrical systems. Other activities performed during the plant shutdown included: gasket replacements on the manual feed valves for RO units F01, F02, and F03; manual valve preventive maintenance exercises in Areas 710, 720, 725, and 840; and correction of various MF valve actuator air leaks.

May 8: At 1100 hours: The GWRS plant was restarted and returned to normal operation. A total of 1.23 MG of MWD OC-44 potable water was used during the scheduled shutdown period to maintain barrier system pressures until the plant could be restarted to resume normal FPW injection.

D.6 June 2019

June 1 — 30: Total Downtime 0.0 hours (0.0%)

The AWPF / GWRS experienced no shutdowns or process interruptions during the month of June.

D.7 July 2019

July 1 —31: Total Downtime 1.33 hours (0.2%)

July 3: The GWRS experienced a 1.33-hour shutdown (2210 – 2330 hours) unexpectedly due to all three GWR Pipeline vault valves closing due to I/O communication issues. Received I/O input failure on pipeline valve vaults 1-3, as well as the inlet valves to offline Kraemer & Miller spreading basins. All three pipeline valves remained open and Kraemer / Miller inlet valves remained closed, GWRS was not affected.

Called standby I&E who determined the communication issue was on the plant's end and FHQ's. Called in standby PCS programmer to assist with investigation. During investigation I&E found they needed to re-boot a communications "Mynah card" and when they did that made all three SAR pipeline vault valves instantly default to closed positions and caused the PWPS to fail. Soon after that occurred the AWPF failed due to high FPWC levels because the plant could not be ramped down quickly enough to the Talbert Barrier's injection rate in order to prevent the FPWC level from rising too quickly in order to keep the plant online. Operations performed A450 CF deadhead flush before restarting the plant at 2330 hours.

D.8 August 2019

August 1 — 31: Total Downtime 0.0 hours (0.0%)

The AWPF / GWRS experienced no shutdowns or process interruptions during the month of August.

D.9 September 2019

<u>September 1 —30: Total Downtime 0.0 hours (0.0%)</u>

The AWPF / GWRS experienced no shutdowns or process interruptions during the month of September.

D.10 October 2019

<u>October 1 – 31: Total Downtime 0.0 hours (0.0%)</u>

The AWPF / GWRS experienced no shutdowns or process interruptions during the month of October.

D.11 November 2019

<u>November 1 — 30: Total Downtime 0.0 hours (0.0%)</u>

The GWRS / AWPF experienced no shutdowns or process interruptions during the month of November.

D.12 December 2019

<u>December 1 - 31: Total Downtime 0.0 hours (0.0%)</u>

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	1/26/19	21.0	7.24	4.61	3.99
February	2/21/19	21.0	8.53	4.49	4.10
March	3/19/19	21.0	8.67	4.52	4.59
April	4/14/19	21.0	7.15	4.12	4.16
May	5/11/19	21.0	6.98	4.37	3.72
June	6/6/19	21.0	7.27	4.50	4.00
July	7/2/19	21.0	6.78	4.16	3.96
	7/29/19	21.0	5.32	3.51	3.25
August	8/24/19	21.0	5.11	3.49	3.22
September	9/19/19	21.0	5.54	3.15	3.11
October	10/16/19	21.0	6.29	3.61	3.49
November	11/11/19	21.0	8.84	4.57	3.61
December	12/7/19	21.0	11.88	4.70	3.96

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	1/21/19	21.0	6.86	3.41	3.41
February	2/15/19	21.0	8.22	3.49	3.06
March	3/13/19	21.0	7.38	4.05	3.17
April	4/7/19	21.0	6.36	3.63	2.91
May	5/2/19	21.0	7.52	3.28	3.01
	5/30/19	21.0	5.93	3.31	3.04
June	6/24/19	21.0	5.99	3.15	2.79
July	7/20/19	21.0	4.98	2.88	2.47
August	8/15/19	21.0	4.19	2.57	2.57
September	9/9/19	21.0	4.14	2.10	2.01
October	10/6/19	21.0	4.79	2.70	2.88
November	11/1/119	21.0	6.94	3.69	3.14
	11/27/19	21.0	8.69	4.43	3.40
December	12/25/19	21.0	9.74	3.43	3.42

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	1/25/19	21.0	9.11	3.53	3.22
February	2/19/19	21.1	11.16	3.55	3.61
March	3/17/19	21.0	9.12	3.64	3.35
April	4/12/19	21.0	7.71	3.69	3.04
May	5/10/19	21.0	6.80	3.36	3.06
June	6/5/19	21.0	7.50	3.82	3.07
July	7/1/19	21.0	6.93	3.60	2.91
	7/28/19	21.0	5.62	3.25	2.97
August	8/24/19	21.0	5.23	2.96	2.84
September	9/19/19	21.0	5.63	2.85	2.66
October	10/16/19	21.0	5.90	3.06	2.67
November	11/12/19	21.0	10.96	3.69	3.25
December	12/5/19	18.9	12.50	4.42	3.37
	12/31/19	18.5	12.01	4.87	3.72

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	1/20/18	21.0	9.25	3.81	3.97
February	2/14/19	20.6	12.15	4.36	4.97
March	3/11/19	21.0	10.77	4.10	3.47
April	4/6/19	21.0	8.68	4.38	3.77
May	5/2/19	21.0	9.97	4.19	3.68
	5/29/19	21.0	7.85	4.85	3.78
June	6/25/19	21.0	6.76	3.53	3.70
July	7/21/19	21.0	6.68	3.62	3.49
August	8/16/19	21.0	5.53	3.21	3.16
September	9/11/19	21.0	5.61	3.47	3.26
October	10/7/19	21.0	6.84	3.50	3.35
November	11/2/19	21.0	11.00	4.35	3.78
	11/25/19	18.3	12.30	4.25	4.23
December	12/14/19	15.3	12.39	5.66	4.09

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	1/22/19	21.0	7.18	3.64	3.71
February	2/16/19	21.0	8.24	4.19	3.78
March	3/13/19	21.0	8.12	4.31	4.35
April	4/7/19	21.0	7.05	4.29	3.62
May	5/3/19	21.0	7.50	4.66	4.01
	5/31/19	21.0	6.86	4.60	4.23
June	6/25/19	21.3	7.09	4.58	4.01
July	7/21/19	21.0	5.76	4.30	4.22
August	8/16/19	21.0	5.60	3.89	3.80
September	9/10/19	21.0	5.35	3.81	3.76
October	10/5/19	21.0	6.00	4.39	4.22
	10/31/19	21.0	8.35	4.85	4.28
November	11/26/19	21.0	9.73	5.00	4.33
December	12/24/19	21.1	10.87	5.34	4.47

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	1/25/19	21.0	7.15	3.61	3.70
February	2/19/19	21.2	7.44	4.09	4.00
March	3/18/19	21.1	7.76	4.19	3.40
April	4/12/19	20.9	6.02	3.74	3.20
May	5/10/19	21.0	5.77	3.57	3.53
June	6/4/19	21.0	5.56	3.61	3.71
July	7/1/19	21.0	6.16	3.52	3.34
	7/27/19	21.0	5.22	3.59	2.05
August	8/22/19	21.0	4.98	3.05	3.17
September	9/17/19	21.1	5.35	3.25	3.12
October	10/14/19	21.0	5.50	2.59	3.14
November	11/9/19	21.0	7.70	3.93	3.50
December	12/5/19	21.1	7.91	3.85	3.69

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	1/1/19	21.0	6.70	3.90	4.18
	1/27/19	21.0	7.99	4.52	4.08
February	2/22/19	21.0	7.76	4.34	3.98
March	3/19/19	21.0	8.06	4.78	4.45
April	4/14/19	21.0	6.47	4.12	4.20
May	5/12/19	21.0	6.28	4.20	4.21
June	6/12/19	21.0	6.52	4.21	4.27
July	7/3/19	21.0	7.05	4.19	3.87
	7/29/19	21.1	6.01	3.97	4.44
August	8/25/19	21.1	5.76	3.96	3.72
September	9/20/19	21.0	5.84	3.76	3.70
October	10/16/19	21.0	6.12	4.26	4.44
November	11/12/19	21.0	8.87	4.71	4.17
December	12/9/19	21.0	9.39	4.78	4.67

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	1/2/19	21.0	7.56	4.12	4.29
	1/28/19	21.0	7.64	4.08	4.25
February	2/23/19	21.0	11.50	4.52	4.84
March	3/21/19	21.1	11.81	4.52	3.81
April	4/16/19	21.0	10.31	3.54	4.81
May	5/14/19	21.0	12.01	5.21	4.45
June	6/10/19	21.0	12.01	5.37	4.53
July	7/6/19	21.0	11.05	4.75	4.67
August	8/1/19	21.0	8.61	4.55	4.44
	8/28/19	21.0	7.55	4.35	4.52
September	9/23/19	21.0	8.50	4.54	4.45
October	10/21/19	21.0	9.40	4.72	4.40
November	11/14/19	19.2	12.45	5.47	5.75
December	12/6/19	17.2	12.15	5.62	5.15
	12/16/19	MW (See Note 1)			
	12/26/19	MW (See Note 1)			

[1] Maintenance Wash using dilute caustic and no citric

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	1/22/19	21.0	7.83	3.93	3.79
February	2/16/18	21.0	9.50	4.64	4.41
March	3/15/19	21.0	9.02	4.07	3.87
April	4/9/19	21.0	5.66	3.69	3.40
May	5/5/19	21.0	7.77	3.80	3.39
June	6/1/19	21.0	6.34	3.90	3.20
	6/26/19	21.0	6.86	3.58	3.32
July	7/22/19	21.0	5.94	3.52	3.59
August	8/16/19	21.0	5.45	3.19	3.25
September	9/11/19	21.1	5.11	3.21	3.18
October	10/7/19	21.0	5.04	3.29	3.28
November	11/2/19	21.0	8.07	4.05	3.67
	11/14/19	9.2	12.75	4.21	0.00
December	12/8/19	19.6	12.70	4.57	3.83

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	1/24/19	21.0	8.31	4.04	3.79
February	2/18/19	21.0	10.43	4.76	3.93
March	3/16/19	21.0	10.10	3.98	0.00
	3/18/19	1.2	4.48	3.90	3.86
April	4/13/19	21.0	7.44	3.89	3.98
May	5/11/19	21.0	7.36	4.14	3.49
June	6/5/19	21.0	8.26	4.38	3.97
July	7/1/19	21.0	7.83	4.66	4.08
	7/27/19	21.0	6.97	4.38	3.86
August	8/22/19	21.0	6.39	3.72	3.51
September	9/16/19	21.0	5.87	3.96	3.54
October	10/13/19	21.0	6.81	3.96	3.79
November	11/9/19	21.1	9.62	4.77	4.49
December	12/4/19	19.9	12.31	5.10	4.65
	12/31/19	20.0	12.85	5.32	4.70

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	1/2/19	21.0	6.55	3.98	3.69
	1/28/19	21.1	7.55	4.39	3.28
February	2/23/19	21.3	9.07	4.33	3.99
March	3/22/19	21.2	7.37	4.17	3.56
April	4/16/19	20.8	6.28	3.78	3.52
May	5/14/19	21.0	5.80	3.79	3.28
June	6/9/19	21.0	6.16	3.68	3.68
July	7/6/19	21.0	6.29	4.05	3.35
	7/31/19	21.0	5.05	3.97	3.22
August	8/26/19	21.0	4.56	3.34	3.21
September	9/21/19	21.0	4.57	2.94	2.87
October	10/18/19	21.0	5.32	3.31	3.76
November	11/13/19	21.0	13.00	5.11	0.00
December	12/1/19	14.8	12.04	5.35	4.57
	12/30/19	21.0	11.16	5.01	4.24

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	1/7/19	21.2	6.46	2.49	3.35
February	2/2/19	21.0	7.31	4.15	3.60
	2/28/19	21.0	8.69	3.93	3.61
March	3/25/19	21.3	7.23	4.14	3.88
April	4/20/19	21.0	6.34	3.73	3.41
May	5/17/19	21.0	7.01	4.35	3.28
June	6/12/19	21.0	6.70	3.78	3.66
July	7/8/19	21.0	6.13	3.62	3.30
August	8/2/19	21.0	4.91	2.38	3.40
	8/28/19	21.0	5.08	3.26	3.02
September	9/22/19	21.0	5.30	3.25	3.10
October	10/18/19	21.0	5.65	3.58	3.29
November	11/13/19	20.4	13.84	5.77	4.42
December	12/9/19	21.0	9.61	4.85	4.06

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	1/11/19	21.0	8.20	3.96	4.50
February	2/6/19	21.0	9.34	4.05	3.86
March	3/4/19	21.0	8.91	4.61	4.10
	3/30/19	21.0	8.51	5.05	3.98
April	4/25/19	21.2	7.73	4.60	4.09
May	5/25/19	21.0	9.15	4.90	4.15
June	6/20/19	21.0	8.44	4.37	4.03
July	7/16/19	21.0	6.79	4.28	3.80
August	8/11/19	21.1	6.50	4.04	3.50
September	9/6/19	21.0	5.39	3.24	3.14
October	10/2/19	21.0	6.72	3.62	3.03
	10/29/19	21.0	9.31	4.10	3.90
November	11/14/19	12.5	6.90	3.41	0.00
December	12/5/19	16.7	12.20	4.53	4.01
	12/31/19	19.0	12.03	5.33	4.39

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	1/6/19	21.0	6.39	3.73	3.68
February	2/1/19	21.0	7.50	3.88	4.02
	2/27/19	21.2	9.45	4.04	3.60
March	3/25/19	21.3	8.23	4.00	3.60
April	4/20/19	21.2	6.75	3.57	3.31
May	5/18/19	21.2	7.23	3.79	3.26
June	6/13/19	21.0	6.85	3.80	3.12
July	7/9/19	21.0	6.08	3.69	3.14
August	8/4/19	21.0	5.41	3.20	2.89
	8/30/19	21.0	4.91	3.15	2.92
September	9/25/19	21.0	5.42	3.11	2.92
October	10/21/19	21.0	6.06	3.39	3.17
November	11/13/19	18.2	8.75	3.85	0.00
December	12/3/19	16.0	12.35	4.32	4.20
	12/29/19	19.0	11.81	4.93	4.09

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	1/2/19	21.0	7.38	4.51	4.08
	1/27/19	21.0	9.08	4.45	3.89
February	2/22/19	21.0	8.70	4.94	4.87
March	3/21/19	21.2	7.70	4.34	4.10
April	4/16/19	21.0	5.58	3.25	4.39
May	5/14/19	21.0	5.17	3.07	4.00
June	6/8/19	20.9	7.96	4.56	3.83
July	7/4/19	21.0	7.50	4.28	4.06
	7/30/19	21.3	6.42	5.24	4.23
August	8/25/19	21.0	5.58	3.84	3.22
September	9/20/19	20.9	5.96	3.54	3.58
October	10/17/19	21.0	6.61	3.92	3.75
November	11/12/19	21.1	14.68	6.27	5.15
December	12/10/19	21.1	10.50	4.63	4.63

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	1/14/19	21.0	8.78	4.60	4.16
February	2/10/19	21.0	9.33	4.85	4.40
March	3/7/19	21.0	8.23	4.50	3.91
April	4/3/19	21.0	7.80	4.53	4.08
	4/29/19	21.0	7.41	4.35	3.40
May	5/27/19	21.0	7.66	4.46	3.94
June	6/23/19	21.0	6.14	3.93	3.66
July	7/20/19	21.0	3.82	2.41	2.21
August	8/14/19	21.0	5.38	4.25	3.43
September	9/9/19	21.0	5.33	3.64	3.21
October	10/5/19	21.0	5.91	3.63	3.28
November	11/1/19	21.0	6.02	3.99	3.87
	11/13/19	10.0	12.75	3.65	0.00
December	12/9/19	20.6	12.68	5.96	4.54

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	1/5/19	21.0	7.54	3.18	2.96
February	2/1/19	21.1	9.62	3.68	2.99
	2/26/19	21.0	11.00	3.48	3.92
March	3/24/19	21.0	8.62	3.78	3.27
April	4/19/19	20.9	7.71	3.32	2.70
May	5/18/19	21.2	8.11	3.91	2.96
June	6/14/19	21.0	5.27	3.34	2.84
July	7/11/19	21.0	6.28	3.35	3.03
August	8/6/19	21.0	4.83	2.96	2.86
September	9/1/19	21.0	4.82	2.98	2.75
	9/28/19	21.0	5.24	3.10	2.76
October	10/24/19	21.0	6.33	3.24	2.74
November	11/20/19	21.0	9.97	3.81	3.34
December	12/12/19	17.8	13.00	4.25	3.30

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	1/7/19	21.0	9.81	4.02	3.36
February	2/2/19	20.6	11.32	4.27	3.33
	2/24/19	18.6	12.60	4.60	3.92
March	3/19/19	18.0	11.63	4.10	3.60
April	4/13/19	21.0	10.35	3.75	3.24
May	5/12/19	21.0	8.01	3.87	3.26
June	6/7/19	21.1	7.85	3.38	3.32
July	7/4/19	21.0	7.83	3.69	3.20
	7/30/19	20.8	6.05	2.95	2.94
August	8/25/19	21.0	5.65	2.89	2.89
September	9/20/19	21.0	5.90	3.12	2.95
October	10/16/19	21.0	6.63	3.46	3.03
November	11/8/19	18.2	12.40	3.91	3.17
	11/29/19	16.4	12.50	4.10	3.34
December	12/17/19	13.1	12.57	4.52	4.17

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	1/9/19	20.8	8.82	4.08	3.46
February	2/7/19	20.8	12.62	4.30	3.61
March	3/5/19	19.5	12.12	4.23	3.91
	3/30/19	21.1	9.12	4.36	3.87
April	4/25/19	21.0	9.01	4.14	3.75
May	5/22/19	21.0	9.77	4.48	3.53
June	6/17/19	21.0	7.30	3.95	3.69
July	7/13/19	21.0	7.21	3.72	3.30
August	8/7/19	21.0	5.84	3.45	3.20
September	9/2/19	21.1	5.78	2.98	2.72
	9/27/19	21.0	5.68	3.46	2.81
October	10/23/19	21.0	6.80	3.27	3.31
November	11/17/19	20.0	12.65	4.47	3.52
December	12/6/19	15.3	12.80	4.47	3.65
	12/26/19	13.9	12.28	4.70	4.11

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	1/5/19	21.1	9.36	4.28	3.57
	1/31/19	21.0	12.01	4.26	4.12
February	2/22/19	18.0	12.10	4.09	3.99
March	3/15/19	17.6	12.43	4.38	4.08
April	4/10/19	21.0	9.71	4.20	3.54
May	5/5/19	20.9	9.51	3.96	3.35
June	6/2/19	21.0	7.16	3.70	3.47
	6/28/19	21.0	7.62	3.64	3.20
July	7/23/19	21.0	6.83	3.54	3.09
August	8/18/19	21.0	4.95	3.10	2.77
September	9/14/19	21.0	4.91	3.17	2.75
October	10/11/19	21.1	6.32	3.54	2.91
November	11/6/19	20.8	12.25	4.70	4.10
	11/27/19	16.8	12.20	4.58	3.54
December	12/14/19	12.6	12.28	8.13	7.90
	12/31/19	12.5	12.45	5.49	4.86

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	1/10/19	21.0	10.08	3.80	3.38
February	2/2/19	19.1	12.07	3.70	3.17
	2/27/19	19.7	12.42	3.64	3.67
March	3/25/19	20.9	12.37	3.86	3.62
April	4/20/19	21.2	9.92	3.97	3.80
May	5/18/19	20.3	12.80	3.99	3.84
June	6/12/19	20.9	12.50	4.51	3.37
July	7/8/19	21.0	9.51	2.39	3.27
August	8/3/19	20.9	6.59	3.51	3.27
	8/29/19	21.0	6.30	3.42	2.45
September	9/23/19	21.0	6.44	2.85	2.79
October	10/20/19	21.0	7.08	3.03	2.72
November	11/16/19	21.0	8.73	3.80	3.23
December	12/6/19	16.1	12.90	3.89	3.90
	12/26/19	14.1	13.05	5.02	4.30

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	1/29/19	21.2	11.51	3.90	3.57
February	2/23/19	21.1	11.38	4.14	4.15
March	3/20/19	20.5	12.18	4.04	3.72
April	4/14/19	21.0	8.70	4.16	3.45
May	5/13/19	21.0	6.84	4.00	3.78
June	6/9/19	21.0	7.70	3.57	3.57
July	7/5/19	21.0	7.53	3.52	3.30
	7/30/19	21.1	5.63	3.39	3.03
August	8/24/19	21.1	5.63	3.34	3.10
September	9/19/19	21.1	5.48	3.24	2.95
October	10/15/19	21.0	5.79	3.35	3.08
November	11/11/19	21.0	10.77	4.30	3.36
December	12/7/19	19.9	12.55	4.79	4.15
	12/27/19	14.0	12.80	4.68	4.15

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	1/1/19	21.0	8.22	3.50	3.52
	1/26/19	21.0	10.78	4.45	3.49
February	2/20/19	20.8	12.59	4.04	3.69
March	3/16/18	19.7	12.44	4.16	3.80
April	4/10/19	21.1	8.17	3.78	3.59
May	5/8/19	21.2	6.40	3.72	3.49
June	6/3/19	21.0	7.64	3.39	3.15
	6/28/19	21.0	6.75	3.36	2.87
July	7/24/19	21.0	6.08	3.31	2.95
August	8/19/19	21.1	5.28	2.90	2.87
September	9/15/19	21.0	4.87	2.85	2.80
October	10/11/19	21.0	5.73	3.42	3.10
November	11/6/19	21.0	9.43	3.51	3.40
	11/30/19	19.4	12.45	4.31	3.90
December	12/18/19	14.4	12.43	4.88	4.25

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	1/9/19	21.1	8.64	3.56	3.35
February	2/4/19	21.0	11.51	3.92	3.40
March	3/1/19	21.0	11.04	3.95	3.65
	3/27/19	21.0	10.98	3.97	3.42
April	4/21/19	21.0	8.10	3.72	3.30
May	5/19/19	21.0	10.70	3.85	3.55
June	6/14/19	21.0	9.76	3.90	3.13
July	7/9/19	21.0	8.98	3.91	3.29
August	8/4/19	21.2	5.92	3.11	2.84
	8/30/19	21.0	5.00	2.55	2.16
September	9/24/19	21.0	5.80	2.75	2.43
October	10/21/19	21.0	6.46	2.95	2.78
November	11/12/19	18.0	11.96	4.07	3.29
December	12/4/19	17.7	12.03	4.04	3.27
	12/26/19	16.0	12.60	3.69	3.34

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	1/25/19	21.0	5.86	3.50	3.10
February	2/19/19	21.0	7.79	4.10	3.66
March	3/17/19	21.0	7.73	4.19	4.17
April	4/13/19	21.0	6.37	3.34	2.94
May	5/11/19	21.0	6.22	3.64	2.93
June	6/5/19	21.0	6.76	4.19	3.21
July	7/1/19	21.0	6.16	3.90	3.15
	7/28/19	21.0	5.64	3.25	3.00
August	8/23/19	21.0	4.72	3.19	2.55
September	9/18/19	21.0	4.71	2.99	2.53
October	10/14/19	21.0	5.07	3.08	2.68
November	11/9/19	21.0	8.22	4.30	3.10
December	12/6/19	21.0	9.70	4.24	3.55

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	1/3/18	21.0	7.86	4.14	3.98
	1/28/19	21.0	7.64	4.28	4.00
February	2/23/19	21.0	8.12	4.26	4.27
March	3/20/19	21.0	8.99	4.04	3.81
April	4/15/19	21.0	6.67	3.72	3.58
May	5/12/19	21.0	6.67	3.96	3.56
June	6/7/19	21.0	7.09	3.94	3.46
July	7/3/19	21.0	7.35	3.80	3.35
	7/29/19	21.0	5.87	3.46	3.04
August	8/24/19	21.0	5.45	3.22	3.07
September	9/19/19	21.0	5.63	3.01	3.04
October	10/15/19	21.1	5.99	3.45	3.06
November	11/10/19	21.0	9.66	4.55	3.60
December	12/7/19	21.0	12.50	4.72	3.77

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	1/13/19	21.0	7.32	4.43	4.08
February	2/7/19	21.0	9.08	4.47	3.71
March	3/6/19	21.2	8.40	3.90	4.05
April	4/2/19	21.4	6.89	3.84	3.50
	4/28/19	21.0	7.50	3.92	3.67
May	5/26/19	21.0	7.30	4.18	3.86
June	6/21/19	21.0	6.77	3.86	3.68
July	7/18/19	21.0	6.46	3.64	3.71
August	8/13/19	21.0	5.40	3.63	3.41
September	9/8/19	21.0	5.66	3.14	2.97
October	10/5/19	21.0	5.79	3.42	3.24
	10/31/19	21.0	7.90	4.57	3.32
November	11/27/19	21.0	10.10	4.88	4.33
December	12/24/19	21.0	10.43	4.44	4.07

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	1/10/19	21.0	7.79	2.96	3.36
February	2/5/19	21.0	8.10	3.56	3.79
March	3/3/19	21.0	7.79	3.70	3.33
	3/29/19	21.0	7.97	4.04	4.04
April	4/23/19	21.0	7.15	3.64	3.71
May	5/21/19	21.1	7.72	4.68	3.90
June	6/16/19	21.0	7.36	3.46	3.27
July	7/13/19	21.1	6.33	3.28	3.28
August	8/8/19	21.0	5.18	3.60	3.60
September	9/3/19	21.0	5.01	3.14	2.95
	9/29/19	21.0	5.83	3.50	3.35
October	10/25/19	21.0	6.38	4.01	3.46
November	11/21/19	21.0	9.90	4.05	3.88
December	12/18/19	21.0	11.99	4.94	3.77

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	1/11/19	21.0	7.51	3.44	3.27
February	2/7/19	21.0	7.68	3.83	3.51
March	3/5/19	21.3	7.49	3.99	3.73
April	4/1/19	21.2	6.60	4.36	3.44
	4/29/19	21.1	6.29	3.31	3.05
May	5/28/19	21.0	6.76	3.50	2.17
June	6/23/19	21.0	6.02	3.51	2.46
July	7/20/19	21.0	5.30	1.80	2.86
August	8/15/19	21.0	4.78	3.06	2.54
September	9/10/19	21.1	4.65	2.99	2.69
October	10/6/19	21.0	5.27	2.98	2.67
November	11/2/19	21.0	7.49	3.92	3.60
	11/28/19	21.0	11.14	4.41	3.65
December	12/27/19	21.0	10.57	4.14	39.20

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	1/5/19	21.0	6.35	432.00	3.83
	1/31/19	21.1	7.24	4.08	3.65
February	2/26/19	21.0	7.99	3.94	3.80
March	3/23/19	21.0	6.89	3.92	3.68
April	4/19/19	21.0	5.57	3.15	3.25
May	5/17/19	21.0	5.46	3.53	3.30
June	6/13/19	21.0	5.47	3.46	3.27
July	7/9/19	21.0	5.40	3.52	3.33
August	8/9/19	21.0	4.27	3.08	2.84
September	9/4/19	21.0	4.38	2.86	2.79
	9/30/19	21.0	5.25	3.11	2.99
October	10/26/19	21.0	5.15	3.58	3.05
November	11/22/19	21.0	8.28	4.58	3.89
December	12/19/19	21.0	10.81	4.76	4.60

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	21.0	7.78	3.33	3.45
February	2/8/19	21.0	8.58	3.89	3.74
March	3/6/19	21.0	8.85	4.10	3.83
April	4/1/19	21.0	6.96	4.16	3.54
	4/27/19	21.0	6.41	3.61	3.76
May	5/25/19	21.0	7.27	3.95	3.46
June	6/20/19	21.0	6.74	3.54	3.56
July	7/16/19	21.0	6.15	3.71	3.60
August	8/11/19	21.0	5.18	3.25	3.13
September	9/6/19	21.0	5.01	2.89	2.78
October	10/2/19	21.1	5.79	3.33	3.33
	10/28/19	21.0	6.77	3.68	3.67
November	11/24/19	21.0	8.86	4.25	3.66
December	12/22/19	21.0	8.16	3.89	3.67

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	1/4/19	21.0	6.75	3.60	3.64
	1/29/19	21.0	8.28	3.93	3.47
February	2/24/19	21.0	8.81	4.04	3.73
March	3/22/19	21.0	7.86	3.71	3.77
April	4/16/19	21.0	6.82	3.96	3.71
May	5/14/19	21.0	6.62	2.68	2.02
June	6/9/19	21.0	6.72	3.29	3.05
July	7/5/19	21.0	5.60	3.44	3.05
	7/31/19	21.1	5.47	4.20	2.84
August	8/26/19	21.0	4.63	3.06	2.92
September	9/21/19	21.0	4.98	3.08	2.90
October	10/17/19	21.0	5.84	3.50	3.07
November	11/12/19	21.0	12.20	4.01	3.73
December	12/8/19	21.0	11.31	4.66	3.44

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	1/3/19	MW (See Note 1)			
	1/9/19	MW (See Note 1)			
	1/18/19	21.0	9.61	5.70	4.34
	1/26/19	MW (See Note 1)			
February	2/5/19	MW (See Note 1)			
	2/13/19	21.0	10.05	6.00	4.98
	2/22/19	MW (See Note 1)			
March	3/2/19	MW (See Note 1)			
	3/11/19	21.0	10.10	5.68	5.55
	3/16/19	4.40	8.80	4.77	5.71
	3/25/19	MW (See Note 1)			
April	4/2/19	MW (See Note 1)			
	4/11/19	21.0	10.81	6.68	5.61
	4/24/19	MW (See Note 1)			
	4/27/19	13.2	12.50	5.55	5.43
May	5/12/19	MW (See Note 1)			
	5/20/19	17.0	12.22	7.34	5.82
	5/30/19	MW (See Note 1)			
June	6/7/19	MW (See Note 1)			
	6/15/19	21.0	9.75	3.71	5.35
	6/24/19	MW (See Note 1)			
July	7/3/19	MW (See Note 1)			
	7/12/19	21.0	9.45	5.28	5.31
	7/21/19	MW (See Note 1)			
	7/29/19	MW (See Note 1)			
August	8/7/19	21.0	8.28	5.07	5.40
	8/15/19	MW (See Note 1)			
	8/24/19	MW (See Note 1)			
September	9/2/19	21.0	8.05	4.00	5.10
	9/10/19	MW (See Note 1)			
	9/19/19	MW (See Note 1)			
	9/27/19	21.0	9.00	5.25	5.25
October	10/8/19	MW (See Note 1)			
	10/15/19	MW (See Note 1)			
	10/24/19	21.0	10.80	6.41	5.95
November	11/2/19	MW (See Note 1)			
	11/11/19	MW (See Note 1)			
	11/18/19	19.9	12.30	6.37	5.72
	11/27/19	MW (See Note 1)			
December	12/4/19	MW (See Note 1)			
	12/6/19	MW (See Note 1)			
	12/11/19	18.2	12.50	6.35	6.09
	12/20/19	MW (See Note 1)			
	12/29/19	MW (See Note 1)			

[1] Maintenance Wash using dilute caustic and no citric

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	1/22/19	21.0	6.46	4.11	3.33
February	2/16/19	21.0	9.28	3.97	3.53
March	3/14/19	21.0	8.33	4.02	4.22
April	4/9/19	21.1	6.05	3.03	3.72
May	5/5/19	20.9	7.16	3.85	3.13
June	6/2/19	21.0	6.20	3.80	3.08
	6/30/19	21.0	6.65	3.37	3.05
July	7/26/19	21.2	5.23	3.18	2.73
August	8/21/19	21.1	4.89	2.77	2.62
September	9/16/19	21.0	4.96	3.14	2.95
October	10/12/19	21.0	4.51	3.11	2.76
November	11/7/19	21.0	10.08	4.06	3.52
December	12/4/19	21.0	11.64	5.22	4.20
	12/30/19	21.0	11.00	5.69	4.42

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	1/7/19	9.5	6.68	0.00	0.00
	1/16/19	New PVDF UF filters brought online (See Note 1).			
February	2/11/19	21.1	12.50	4.55	3.53
March	3/5/19	18.0	13.49	4.79	3.18
	3/24/19	14.9	13.82	4.67	3.31
	3/27/19	MW (See Note 2)			
	3/30/19	MW (See Note 2)			
April	4/2/19	MW (See Note 2)			
	4/5/19	MW (See Note 2)			
	4/8/19	MW (See Note 2)			
	4/11/19	MW (See Note 2)			
	4/14/19	MW (See Note 2)			
	4/17/19	MW (See Note 2)			
	4/20/19	MW (See Note 2)			
	4/23/19	24.2	5.63	3.49	3.36
	4/26/19	MW (See Note 2)			
	4/29/19	MW (See Note 2)			
May	5/2/19	MW (See Note 2)			
	5/5/19	MW (See Note 2)			
	5/10/19	MW (See Note 2)			
	5/13/19	MW (See Note 2)			
	5/16/19	MW (See Note 2)			
	5/19/19	MW (See Note 2)			
	5/22/19	MW (See Note 2)			
	5/25/19	24.0	6.92	4.17	3.24
	5/28/19	MW (See Note 2)			
	5/31/19	MW (See Note 2)			
June	6/3/19	MW (See Note 2)			
	6/6/19	MW (See Note 2)			
	6/11/19	MW (See Note 2)			
	6/14/19	MW (See Note 2)			
	6/17/19	MW (See Note 2)			
	6/20/19	MW (See Note 2)			
	6/23/19	MW (See Note 2)			
	6/26/19	23.5	4.70	2.67	2.23
	6/29/19	MW (See Note 2)			
July	7/2/19	MW (See Note 2)			
	7/5/19	MW (See Note 2)			
	7/8/19	MW (See Note 2)			
	7/11/19	MW (See Note 2)			
	7/14/19	MW (See Note 2)			
	7/17/19	MW (See Note 2)			
	7/20/19	MW (See Note 2)			
	7/23/19	MW (See Note 2)			
	7/26/19	23.6	4.60	2.70	2.45
	7/29/19	MW (See Note 2)			

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)
August	8/1/19	MW (See Note 2)			
	8/4/19	MW (See Note 2)			
	8/7/19	MW (See Note 2)			
	8/10/19	MW (See Note 2)			
	8/13/19	MW (See Note 2)			
	8/16/19	MW (See Note 2)			
	8/19/19	MW (See Note 2)			
	8/22/19	MW (See Note 2)			
	8/25/19	MW (See Note 2)			
	8/28/19	MW (See Note 2)			
	8/31/19	29.0	3.75	2.57	2.12
September	9/3/19	MW (See Note 2)			
	9/6/19	MW (See Note 2)			
	9/9/19	MW (See Note 2)			
	9/12/19	MW (See Note 2)			
	9/15/19	MW (See Note 2)			
	9/18/19	MW (See Note 2)			
	9/21/19	MW (See Note 2)			
	9/24/19	MW (See Note 2)			
	9/27/19	MW (See Note 2)			
	9/30/19	23.7	4.50	2.36	2.10
October	10/3/19	MW (See Note 2)			
	10/6/19	MW (See Note 2)			
	10/9/16	MW (See Note 2)			
	10/12/19	MW (See Note 2)			
	10/15/19	MW (See Note 2)			
	10/18/19	MW (See Note 2)			
	10/21/19	MW (See Note 2)			
	10/24/19	MW (See Note 2)			
	10/27/19	MW (See Note 2)			
	10/30/19	23.0	5.20	2.34	2.35
November	11/2/19	MW (See Note 2)			
	11/5/19	MW (See Note 2)			
	11/8/19	MW (See Note 2)			
	11/11/19	MW (See Note 2)			
	11/14/19	MW (See Note 2)			
	11/17/19	MW (See Note 2)			
	11/20/19	MW (See Note 2)			
	11/23/19	MW (See Note 2)			
	11/26/19	MW (See Note 2)			
	11/29/19	23.0	5.45	2.02	1.85
December	12/2/19	MW (See Note 2)			
	12/5/19	MW (See Note 2)			
	12/8/19	MW (See Note 2)			
	12/11/19	MW (See Note 2)			
	12/14/19	MW (See Note 2)			
	12/17/19	MW (See Note 2)			
	12/20/19	MW (See Note 2)			
	12/23/19	MW (See Note 2)			
	12/26/19	MW (See Note 2)			
	12/29/19	23.1	8.05	3.68	2.75

1 MF E03 taken out-of-service on 1/7/19 for scheduled replacement of its Evoqua CMF-S filter modules, installed 8/2014, with new Evoqua PVDF UF filters.

2 Maintenance Wash using sodium hypochlorite and citric

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	1/2/19	MW (See Note 1)			
	1/5/19	MW (See Note 1)			
	1/8/19	MW (See Note 1)			
	1/11/19	MW (See Note 1)			
	1/14/19	MW (See Note 1)			
	1/17/19	MW (See Note 1)			
	1/20/19	MW (See Note 1)			
	1/23/19	21.4	13.50	3.63	2.35
	1/26/19	MW (See Note 1)			
	1/29/19	MW (See Note 1)			
February	2/1/19	MW (See Note 1)			
	2/4/19	MW (See Note 1)			
	2/7/19	MW (See Note 1)			
	2/9/19	MW (See Note 1)			
	2/11/19	MW (See Note 1)			
	2/12/19	MW (See Note 1)			
	2/14/19	17.1	14.80	3.74	3.10
	2/17/19	MW (See Note 1)			
	2/20/19	MW (See Note 1)			
	2/23/19	MW (See Note 1)			
	2/26/19	MW (See Note 1)			
March	3/1/19	MW (See Note 1)			
	3/4/19	MW (See Note 1)			
	3/7/19	MW (See Note 1)			
	3/10/19	MW (See Note 1)			
	3/13/19	MW (See Note 1)			
	3/16/19	23.6	12.00	2.95	2.90
	3/19/19	MW (See Note 1)			
	3/22/19	MW (See Note 2)			
	3/25/19	MW (See Note 2)			
	3/28/19	MW (See Note 2)			
	3/31/19	MW (See Note 2)			
April	4/3/19	MW (See Note 2)			
	4/6/19	MW (See Note 2)			
	4/9/19	MW (See Note 2)			
	4/12/19	MW (See Note 2)			
	4/15/19	23.3	9.20	3.03	2.91
	4/18/19	MW (See Note 2)			
	4/21/19	MW (See Note 2)			
	4/23/19	MW (See Note 2)			
	4/27/19	MW (See Note 2)			
	4/30/19	MW (See Note 2)			
May	5/3/19	MW (See Note 2)			
	5/6/19	MW (See Note 2)			
	5/11/19	MW (See Note 2)			
	5/14/19	MW (See Note 2)			
	5/17/19	23.1	9.96	3.78	2.98
	5/20/19	MW (See Note 2)			
	5/23/19	MW (See Note 2)			
	5/26/19	MW (See Note 2)			
	5/29/19	MW (See Note 2)			

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)
June	6/1/19	MW (See Note 2)			
	6/4/19	MW (See Note 2)			
	6/7/19	MW (See Note 2)			
	6/10/19	MW (See Note 2)			
	6/13/19	MW (See Note 2)			
	6/16/19	23.1	6.95	2.16	1.88
	6/19/19	MW (See Note 2)			
	6/22/19	MW (See Note 2)			
	6/25/19	MW (See Note 2)			
	6/28/19	MW (See Note 2)			
July	7/1/19	MW (See Note 2)			
	7/4/19	MW (See Note 2)			
	7/7/19	MW (See Note 2)			
	7/10/19	MW (See Note 2)			
	7/13/19	MW (See Note 2)			
	7/16/19	22.8	6.75	2.83	2.75
	7/19/19	MW (See Note 2)			
	7/22/19	MW (See Note 2)			
	7/25/19	MW (See Note 2)			
	7/28/19	MW (See Note 2)			
	7/31/19	MW (See Note 2)			
August	8/3/19	MW (See Note 2)			
	8/5/19	MW (See Note 2)			
	8/9/19	MW (See Note 2)			
	8/12/19	MW (See Note 2)			
	8/15/19	22.9	6.30	2.77	2.55
	8/18/19	MW (See Note 2)			
	8/21/19	MW (See Note 2)			
	8/24/19	MW (See Note 2)			
	8/27/19	MW (See Note 2)			
	8/30/19	11.8	5.65	2.73	2.57
September	9/2/19	MW (See Note 2)			
	9/5/19	MW (See Note 2)			
	9/8/19	MW (See Note 2)			
	9/11/19	MW (See Note 2)			
	9/14/19	MW (See Note 2)			
	9/17/19	MW (See Note 2)			
	9/20/19	MW (See Note 2)			
	9/23/19	MW (See Note 2)			
	9/26/19	MW (See Note 2)			
	9/29/19	23.9	6.00	2.68	2.60
October	10/2/19	MW (See Note 2)			
	10/5/19	MW (See Note 2)			
	10/8/19	MW (See Note 2)			
	10/11/19	MW (See Note 2)			
	10/14/19	MW (See Note 2)			
	10/17/19	MW (See Note 2)			
	10/20/19	MW (See Note 2)			
	10/23/19	MW (See Note 2)			
	10/26/19	MW (See Note 2)			
	10/29/19	22.7	8.40	4.63	3.00

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)
November	11/1/19	MW (See Note 2)			
	11/4/19	MW (See Note 2)			
	11/7/19	MW (See Note 2)			
	11/10/19	MW (See Note 2)			
	11/13/19	MW (See Note 2)			
	11/16/19	MW (See Note 2)			
	11/19/19	MW (See Note 2)			
	11/22/19	MW (See Note 2)			
	11/25/19	MW (See Note 2)			
	11/28/19	22.0	10.45	3.65	3.00
December	12/1/19				
	12/4/19				
	12/7/19				
	12/10/19				
	12/13/19				
	12/16/19				
	12/19/19				
	12/22/19				
	12/25/19				
	12/28/19	22.6	12.90	3.91	3.35
	12/31/19	MW (See Note 2)			

1 Maintenance Wash using caustic and sodium hypochlorite.

2 Maintenance Wash using caustic, sodium hypochorite and citric.

Reverse Osmosis Plant Cleaning Summary

Unit A01

Date of Cleaning	Treatment Performed
2019	

Reverse Osmosis Plant Cleaning Summary

<u>Unit A02</u>

Date of Cleaning	Treatment Performed
2019	

Reverse Osmosis Plant Cleaning Summary

Unit A03

Date of Cleaning	Treatment Performed
2019	

Reverse Osmosis Plant Cleaning Summary

Unit B01

Date of Cleaning	Treatment Performed
1/8/2019	3rd Stage Only CIP: Using 2.5% STPP & 0.17% SDDBSat 10.5 pH / 95^{o}F. 2 hrs recirc then 2 hrs soadk then 2 hr recirc then final 2 hr soak. Ended with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 2.55 gals of caustic to bring pH up to 10.5. All recirculation flows through 1 micron CFs. Performed "simultaneously" with RO B02's 3rd stage-only CIP.

Reverse Osmosis Plant Cleaning Summary

<u>Unit B02</u>

Date of Cleaning	Treatment Performed
1/8/2019	<u>B02 3rd stage only CIP</u>: Using 2.5% STPP & 0.17% SDDBS at 10.5 pH / 95^{o}F. 2 hrs recirc then 2 hrs soak then 2 hr recirc then final 2 hr soak. Ended with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 2.55 gals of caustic to bring pH up to 10.5 pH. Al recirculation flows through 1 micron CFs. Performed "simultaneously" with RO B01's 3rd stage-only CIP.

Reverse Osmosis Plant Cleaning Summary

Unit B03

Date of Cleaning	Treatment Performed
2019	

Reverse Osmosis Plant Cleaning Summary

Unit C01

Date of Cleaning	Treatment Performed
1/31/2019	Full unit CIP: Using 3% STPP & 0.2% SDDBS at 10.5 pH / 95oF. One 2hour recirculation per sub-stage, then a second 2 hour recirculation per sub-stage. Three of the four sub-stages soaked while the 'fourth' was in recirculation. Ended with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 10 gals of caustic to bring pH up to 10.5 pH. All recirculation flows through 1 micron CFs.
6/24-27/2019	Full unit CIP using 2% C-227 (AWC): CIPs were performed "stage-by-stage", one at a time, new solution for each. Each CIP was started at a pH of 11, and no heat first hour. After the first hour at pH 11 at ambient temperature, the CIP tank heaters were started to bring the solution's temperature up to 95^{o}F & caustic soda was added to raise the solution's pH. The 1st & 2nd stage solutions were increased to 11.8, while the 3rd stage solution was increased to pH 12. The higher pH levels were maintained during each of the sub-stages remaining 5 hours of CIP, resulting in a total contacttime of 6 hours. Used ROP stored in unused RO CIP tank to flush 1A-1B-and 2nd sub-stages. Ended CIPwith normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit C02

Date of Cleaning	Treatment Performed
2019	

Reverse Osmosis Plant Cleaning Summary

Unit C03

Date of Cleaning	Treatment Performed
2/21/2019	Full Unit CIP: Using 3% STPP & 0.2% SDDBS at 10.5 pH / 95°F. One 2 hour recirculation per sub-stage, then a second 2 hourrecirculation per sub-stage. Three of the four sub-stages soaked while the 'fourth' was in recirculation. Ended with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit D01

Date of Cleaning	Treatment Performed
2019	

Reverse Osmosis Plant Cleaning Summary

Unit D02

Date of Cleaning	Treatment Performed
1/30/2019	Full Unit CIP: Using 3% STPP & 0.2% SDDBS at 10.5 pH / 95°F. One 2 hour recirculation per sub-stage, then a second 2 hour recirculation per sub-stage. Three of the four sub-stages soaked while the 'fourth' was in recirculation. Ended with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 10.5 gals of caustic to bring pH up to 10.5 pH. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit D03

Date of Cleaning	Treatment Performed
2/27/2019	Full Unit CIP: Using 3% STPP & 0.2% SDDBS at 10.5 pH / 95oF. One 2 hour recirculation per sub-stage, then a second 2 hour recirculation per sub-stage. Three of the four sub-stages soaked while the 'fourth' was in recirculation. Ended with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit E01

Date of Cleaning	Treatment Performed
1/10/2019	3rd Stage Only CIP: Using 2.5% STPP & 0.17% SDDBS at 10.5 pH / 95°F. 2 hrs recirc then 2 hrs soak then 2 hr recirc then final 2 hr soak. Ended with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 3 gals of caustic to bring pH up to 10.5 pH. All recirculation flows through 1 micron CFs. Performed "simultaneously" with RO E02's 3rd stage-only CIP.

Reverse Osmosis Plant Cleaning Summary

Unit E02

Date of Cleaning	Treatment Performed
1/10/2019	3rd Stage Only CIP: Using 2.5% STPP & 0.17% SDDBS at 10.5 pH / 95°F. 2 hrs recirc then 2 hrs soak then 2 hr recirc then final 2 hr soak. Ended with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 3 gals of caustic to bring pH up to 10.5 pH. All recirculation flows through 1 micron CFs. Performed "simultaneously" with RO E01's 3rd stage-only CIP.

Reverse Osmosis Plant Cleaning Summary

Unit E03

Date of Cleaning	Treatment Performed
2019	

Reverse Osmosis Plant Cleaning Summary

Unit F01

Date of Cleaning	Treatment Performed
5/11/2019	Used "full strength" 3% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95°F: Displaced 1st & 2nd stages with heated / 11.5 pH generic solution. Performed 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage soaked in solution while one received recirculation. Then repeated 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage again soaked in solution while one received recirculation. 1st stage membranes received approx. 12 hours contact time total, 2nd stage received approx. 8 hours contact time total. The CIPs were followed with normal full unit 45 min permeate flush (4"PCR open for first 30 minutes). Used total of 16.5 gals caustic to maintain pH 11.5 throughout CIPs. All recirculation flows through 1 micron CFs.
5/16/2019	3rd stage only CIP using 2% C-227 (AWC): Kept RO F01 offline after completing its 1st & 2nd stage generic CIPs on 5/11. Began this 3rd stage C227 CIP at 11 pH and no heat first hour, then start heaters & add caustic to target 95°F / 12 pH remaining 5 hours of CIP for an approx. total of 6 hours contact time). Ended CIP with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 24.5 gals caustic to bring (and keep) 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
5/13/2019	Used "full strength" 3% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95°F: Displaced 1st & 2nd stages with heated / 11.5 pH generic solution. Performed 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage soaked in solution while one received recirculation. Then repeated 2 hour recirculations throug each 1A-1B-sub-stage, one sub-stageat a time. Each sub-stage again soaked in solution while one received recirculation. 1st stage membranes received approx 12 hours contact time total, 2nd stage received approx 8 hours contact time total. The CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 16.5 gals. caustic to maintain pH 11.5 throughout CIPs. All recirculation flows through 1 micron CFs.
5/17/2019	3rd stage only CIP using 2% C-227 (AWC): Kept RO F02 offline after completing its 1st & 2nd stage generic CIPs on 5/13. Began this 3rd stage C227 CIP at 11 pH and no heat first hour, then start heaters & add caustic to target 95°F / 12 pH remaining 5 hours of CIP (for an approx. total of 6 hours contact time). Ended CIP with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 27.5 gals caustic to bring (and keep) 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
5/14/2019	Used "full strength" 3% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95°F: Displaced 1st & 2nd stages with heated /11.5 pH generic solution. Performed 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage soaked in solution while one received recirculation. Then repeated 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage again soaked in solution while one received recirculation. 1st stage membranes received approx 12 hours contact time total, 2nd stage received approx 8 hours contact time total. The CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 15.25 gals caustic to maintain pH 11.5 throughout CIPs. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit G01

Date of Cleaning	Treatment Performed
6/1/2019	Used "full strength" 3% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95°F: Displaced 1st & 2nd stages with heated / 11.5 pH generic solution. Performed 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage soaked in solution while one received recirculation. Then repeated 2 hour recircultations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage again soaked in solution while one received recirculation. 1st stage membranes received approx 12 hours contact time total, 2nd stage received approx 8 hours contact time total. The CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 18.75 gals. caustic to maintain pH 11.5 throughout CIPs. All recirculation flows through 1 micron CFs.
6/5/2019	3rd stage only CIP using 2% C-227 (AWC): Kept RO G01 offline after completing its 1st & 2nd stage generic CIPs on 6/1. Began this 3rd stage C227 CIP at 11 pH and no heat first hour, then start heaters & add caustic to target 95°F / 12 pH remaining 5 hours of CIP for an approx total of 6 hours contact time. Ended CIP with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 27 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
5/30/2019	Used "full strength" 3% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95^{o}F: Displaced 1st & 2nd stages with heated / 11.5 pH generic solution. Performed 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage soaked in solution while one received recirculation. Then repeated 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage again soaked in solution while one received recirculation. 1st stage membranes received approx 12 hours contact time total, 2nd stage received approx 8 hours contact time total. The CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 13.5 gals. caustic to maintain pH 11.5 throughout CIPs. All recirculation flows through 1 micron CFs.

Reverse Osmosis Plant Cleaning Summary

Unit G03

Date of Cleaning	Treatment Performed
5/24/2019	Used "full strength" 3% STPP / 0.2% SDDBS @ pH 11.5 CIP at 95°F: Displaced 1st & 2nd stages with heated / 11.5 pH generic solution. Performed 2 hour recirculations through each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage soaked in solution while one received recirculation. Then repeated 2 hour recirculations throug each 1A-1B-2nd sub-stage, one sub-stage at a time. Each sub-stage again soaked in solution while one received recirculation. 1st stage membranes reeived approx 12 hours contact time total, 2nd stage received approx 8 hours contact time total. The CIPs were followed with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 17.7 gals. caustic to maintain pH 11.5 throughout the CIPs. All recirculation flows through 1 micron CFs. CIPs go on hold due to loop pipe break under A-skid's tree developing during loop and tank flushes after G03's 3rd stage CIP was completed.
6/3/2019	3rd stage only CIP using 2% C-227 (AWC): Kept RO G03 offline after completing its 1st & 2nd stage generic CIPs on 5/25. Began this 3rd stage C227 CIP at 11 pH and no heat first hour, then start heaters & add caustic to target 95°F / 12 pH remaining 5 hours of CIP (for an approx total of 6 hours contact time. Ended DIP with normal full unit 45 min permeate flush (4" PCR open for first 30 minutes). Used total of 30 galscaustic to bring (and keep) 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	19-Sep-19	6	MONTHS	16-Mar-20
3053	AVFM Enclosure PM on 100-FIT-5530-910 Bldg. North Wall	Transmitter Flow Indicating - north side 910 building	100-PIP-SD-SITE-MAIN	11-Sep-19	6	MONTHS	15-Mar-20
3055	AVFM Enclosure PM 100-FIT-5020-East MF CIP Tank E01	Transmitter Flow Indicating - East MF CIP Tank E01	100-PIP-SW	11-Sep-19	6	MONTHS	14-Mar-20
1111	Power reading-GAP Feeder(NOT GAP MAIN)-See Job Plan	Transformer T-GAP1 3360 KVA 12KV-480/277V	100-XFR-TGAP1	30-Jan-20	1	MONTHS	28-Feb-20
9303	SEFE Tank A01 Flush & Clean LIT-0130B Transmitter	Transmitter Level Indicating	142-A01-TNK-0130		1	YEARS	05-Nov-20
9307	Inspect and Clean SEFE Tank A01-LSH-130 Warrick	Switch Level High	142-A01-TNK-0130	31-Jan-20	1	YEARS	14-Jan-21
9302	SEFE Tank A01 Flush & Clean LIT-0130A Transmitter	Transmitter Level Indicating	142-A01-TNK-0130		1	YEARS	05-Nov-20
9305	SEFE Tank A02 Flush & Clean LIT-0130B Transmitter	Transmitter Level Indicating	142-A02-TNK-0130		1	YEARS	05-Nov-20
9304	SEFE Tank A02 Flush & Clean LIT-0130A Transmitter	Transmitter Level Indicating	142-A02-TNK-0130		1	YEARS	05-Nov-20
9308	Inspect and Clean SEFE Tank A02-LSH-130 Warrick	Switch Level High	142-A02-TNK-0130	13-Feb-20	1	YEARS	14-Jan-21
2316	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 1 MFE	Transmitter Level Indicating	210-A01-TNK-0340	17-Jan-20	1	YEARS	18-Jan-21
7390	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 1 MFE	Transmitter Level Indicating	210-A01-TNK-0340	08-Mar-19	1	YEARS	09-Mar-20
7391	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 2 MFE	Transmitter Level Indicating	210-A02-TNK-0340	08-Mar-19	1	YEARS	09-Mar-20
2317	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 2 MFE	Transmitter Level Indicating	210-A02-TNK-0340	17-Jan-20	1	YEARS	18-Jan-21
7392	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 3 MFE	Transmitter Level Indicating	210-A03-TNK-0340	08-Mar-19	1	YEARS	09-Mar-20
2318	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 3 MFE	Transmitter Level Indicating	210-A03-TNK-0340	17-Jan-20	1	YEARS	18-Jan-21
7393	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 4 MFE	Transmitter Level Indicating	210-A04-TNK-0340	08-Mar-19	1	YEARS	09-Mar-20
2319	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 4 MFE	Transmitter Level Indicating	210-A04-TNK-0340	17-Jan-20	1	YEARS	18-Jan-21
7394	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 5 MFE	Transmitter Level Indicating	210-A05-TNK-0340	05-Apr-19	1	YEARS	16-Mar-20
2320	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 5 MFE	Transmitter Level Indicating	210-A05-TNK-0340	31-Jan-20	1	YEARS	25-Jan-21
7395	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 6 MFE	Transmitter Level Indicating	210-A06-TNK-0340	05-Apr-19	1	YEARS	16-Mar-20
2321	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 6 MFE	Transmitter Level Indicating	210-A06-TNK-0340	31-Jan-20	1	YEARS	25-Jan-21
7396	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 7 MFE	Transmitter Level Indicating	210-A07-TNK-0340	05-Apr-19	1	YEARS	16-Mar-20
2322	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 7 MFE	Transmitter Level Indicating	210-A07-TNK-0340	31-Jan-20	1	YEARS	25-Jan-21
7397	Check calibration of Cell Level Transmitter LIT-0345 Train A Cell 8 MFE	Transmitter Level Indicating	210-A08-TNK-0340	05-Apr-19	1	YEARS	16-Mar-20
2324	Flush Feed Tubing Transmitter LIT-0345 Train A Cell 8 MFE	Transmitter Level Indicating	210-A08-TNK-0340	31-Jan-20	1	YEARS	25-Jan-21
2244	Rosemount pH analyzer annual-Element Analyzer pH - MF Train A CIP-A02-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400A	08-Jan-20	1	YEARS	29-Dec-20
2243	Rosemount pH analyzer annual-Element Analyzer pH - MF Train A CIP-A01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400A	21-Nov-19	1	YEARS	03-Nov-20
2245	Rosemount pH analyzer annual-Element Analyzer pH - MF Train B CIP-B01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400B	06-Nov-19	1	YEARS	04-Nov-20
2246	Rosemount pH analyzer annual-Element Analyzer pH - MF Train B CIP-B02-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400B	07-Feb-20	1	YEARS	12-Jan-21
3596	Rosemount pH analyzer Annual Element Analyzer pH MF Train C02-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400C	10-Jun-19	1	YEARS	01-Jun-20
3595	Rosemount pH Analyzer Annual Element Analyzer pH MF Train C CIP-C01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400C	07-Jun-19	1	YEARS	06-Jun-20
2247	Rosemount pH analyzer annual-Element Analyzer pH - MF Train D CIP-D01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400D	31-Jan-20	1	YEARS	26-Jan-21
2248	Rosemount pH analyzer annual-Element Analyzer pH - MF Train D CIP-D02-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400D	19-Feb-20	1	YEARS	09-Feb-21
2249	Rosemount pH analyzer annual-Element Analyzer pH - MF Train E CIP-E01-AIT-0480	Transmitter Analyzer Indicating pH	210-AS-0400E	19-Feb-20	1	YEARS	23-Feb-21
2326	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 1 MFE	Transmitter Level Indicating	210-B01-TNK-0340	05-Feb-20	1	YEARS	01-Feb-21
7398	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 1 MFE	Transmitter Level Indicating	210-B01-TNK-0340	22-Mar-19	1	YEARS	23-Mar-20
2327	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 2 MFE	Transmitter Level Indicating	210-B02-TNK-0340	05-Feb-20	1	YEARS	01-Feb-21
7399	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 2 MFE	Transmitter Level Indicating	210-B02-TNK-0340	22-Mar-19	1	YEARS	23-Mar-20
2328	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 3 MFE	Transmitter Level Indicating	210-B03-TNK-0340	05-Feb-20	1	YEARS	01-Feb-21
7400	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 3 MFE	Transmitter Level Indicating	210-B03-TNK-0340	22-Mar-19	1	YEARS	23-Mar-20
2329	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 4 MFE	Transmitter Level Indicating	210-B04-TNK-0340	05-Feb-20	1	YEARS	01-Feb-21
7401	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 4 MFE	Transmitter Level Indicating	210-B04-TNK-0340	22-Mar-19	1	YEARS	23-Mar-20
7402	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 5 MFE	Transmitter Level Indicating	210-B05-TNK-0340	05-Apr-19	1	YEARS	30-Mar-20
2330	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 5 MFE	Transmitter Level Indicating	210-B05-TNK-0340	13-Feb-20	1	YEARS	15-Feb-21
7403	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 6 MFE	Transmitter Level Indicating	210-B06-TNK-0340	05-Apr-19	1	YEARS	30-Mar-20
2331	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 6 MFE	Transmitter Level Indicating	210-B06-TNK-0340	13-Feb-20	1	YEARS	15-Feb-21
2332	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 7 MFE	Transmitter Level Indicating	210-B07-TNK-0340	13-Feb-20	1	YEARS	15-Feb-21
7404	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 7 MFE	Transmitter Level Indicating	210-B07-TNK-0340	05-Apr-19	1	YEARS	30-Mar-20
2333	Flush Feed Tubing Transmitter LIT-0345 Train B Cell 8 MFE	Transmitter Level Indicating	210-B08-TNK-0340	13-Feb-20	1	YEARS	15-Feb-21
7405	Check calibration of Cell Level Transmitter LIT-0345 Train B Cell 8 MFE	Transmitter Level Indicating	210-B08-TNK-0340	05-Apr-19	1	YEARS	30-Mar-20
2335	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 1 MFW	Transmitter Level Indicating	210-B08-TNK-0340	19-Feb-20	1	YEARS	22-Feb-21
3537	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 1 MFE	Transmitter Level Indicating	210-C01-TNK-0340	19-Mar-19	1	YEARS	14-Mar-20
3587	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 1	Transmitter Level Indicating	210-C01-TNK-0340	29-May-19	1	YEARS	01-Jun-20
3538	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 2 MFE	Transmitter Level Indicating	210-C02-TNK-0340	19-Mar-19	1	YEARS	14-Mar-20
3588	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 2	Transmitter Level Indicating	210-C02-TNK-0340	29-May-19	1	YEARS	01-Jun-20
3539	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 3 MFE	Transmitter Level Indicating	210-C03-TNK-0340	19-Mar-19	1	YEARS	14-Mar-20
3589	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 3	Transmitter Level Indicating	210-C03-TNK-0340	29-May-19	1	YEARS	01-Jun-20
3540	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 4 MFE	Transmitter Level Indicating	210-C04-TNK-0340	19-Mar-19	1	YEARS	14-Mar-20
3590	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 4	Transmitter Level Indicating	210-C04-TNK-0340	31-May-19	1	YEARS	01-Jun-20
3541	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 5 MFE	Transmitter Level Indicating	210-C05-TNK-0340	18-Mar-19	1	YEARS	14-Mar-20
3591	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 5	Transmitter Level Indicating	210-C05-TNK-0340	31-May-19	1	YEARS	01-Jun-20
3542	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell6 MFE	Transmitter Level Indicating	210-C06-TNK-0340	18-Mar-19	1	YEARS	14-Mar-20
3592	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 6	Transmitter Level Indicating	210-C06-TNK-0340	31-May-19	1	YEARS	01-Jun-20
3543	Check Calibration of Cell Level transmitter LIT-0345 Train C Cell 7 MFE	Transmitter Level Indicating	210-C07-TNK-0340	18-Mar-19	1	YEARS	14-Mar-20
3593	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 7	Transmitter Level Indicating	210-C07-TNK-0340	31-May-19	1	YEARS	01-Jun-20

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
3594	Flush Feed Tubing Transmitter LIT-0345 Train C Cell 8	Transmitter Level Indicating	210-C08-TNK-0340	31-May-19	1	YEARS	01-Jun-20
3544	Check Calibration of Cell Level Transmitter LIT-0345 Train C Cell 8 MFE	Transmitter Level Indicating	210-C08-TNK-0340	19-Mar-19	1	YEARS	14-Mar-20
7406	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 1 MFW	Transmitter Level Indicating	210-D01-TNK-0340	05-Apr-19	1	YEARS	07-Apr-20
2334	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 1 MFW	Transmitter Level Indicating	210-D01-TNK-0340	13-Feb-20	1	YEARS	15-Feb-21
7407	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 2 MFW	Transmitter Level Indicating	210-D02-TNK-0340	05-Apr-19	1	YEARS	07-Apr-20
2336	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 2 MFW	Transmitter Level Indicating	210-D02-TNK-0340	19-Feb-20	1	YEARS	22-Feb-21
7408	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 3 MFW	Transmitter Level Indicating	210-D03-TNK-0340	05-Apr-19	1	YEARS	07-Apr-20
2337	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 3 MFW	Transmitter Level Indicating	210-D03-TNK-0340	19-Feb-20	1	YEARS	22-Feb-21
7409	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 4 MFW	Transmitter Level Indicating	210-D04-TNK-0340	05-Apr-19	1	YEARS	07-Apr-20
2338	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 4 MFW	Transmitter Level Indicating	210-D04-TNK-0340	19-Feb-20	1	YEARS	22-Feb-21
2339	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 5 MFW	Transmitter Level Indicating	210-D05-TNK-0340	14-Mar-19	1	YEARS	01-Mar-20
7410	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 5 MFW	Transmitter Level Indicating	210-D05-TNK-0340	10-Apr-19	1	YEARS	14-Apr-20
2340	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 6 MFW	Transmitter Level Indicating	210-D06-TNK-0340	14-Mar-19	1	YEARS	01-Mar-20
7411	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 6 MFW	Transmitter Level Indicating	210-D06-TNK-0340	10-Apr-19	1	YEARS	14-Apr-20
2341	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 7 MFW	Transmitter Level Indicating	210-D07-TNK-0340	14-Mar-19	1	YEARS	01-Mar-20
7412	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 7 MFW	Transmitter Level Indicating	210-D07-TNK-0340	12-Apr-19	1	YEARS	14-Apr-20
7413	Check calibration of Cell Level Transmitter LIT-0345 Train D Cell 8 MFW	Transmitter Level Indicating	210-D08-TNK-0340	12-Apr-19	1	YEARS	14-Apr-20
2342	Flush Feed Tubing Transmitter LIT-0345 Train D Cell 8 MFW	Transmitter Level Indicating	210-D08-TNK-0340	14-Mar-19	1	YEARS	01-Mar-20
2343	Flush Feed Tubing Transmitter LIT-0345 Train E Cell 1 MFW	Transmitter Level Indicating	210-E01-TNK-0340	14-Mar-19	1	YEARS	01-Mar-20
7414	Check calibration of Cell Level Transmitter LIT-0345 Train E Cell 1 MFW	Transmitter Level Indicating	210-E01-TNK-0340	19-Apr-19	1	YEARS	21-Apr-20
2344	Flush Feed Tubing Transmitter LIT-0345 Train E Cell 2 MFW	Transmitter Level Indicating	210-E02-TNK-0340	14-Mar-19	1	YEARS	01-Mar-20
7415	Check calibration of Cell Level Transmitter LIT-0345 Train E Cell 2 MFW	Transmitter Level Indicating	210-E02-TNK-0340	19-Apr-19	1	YEARS	21-Apr-20
3648	Check Calibration of Cell Level Transmitter LIT-0345 Train E Cell 3	Transmitter Level Indicating	210-E03-TNK-0340	07-Jun-19	1	YEARS	06-Jun-20
3650	Flush Feed Tubing Transmitter LIT-0345 Train E Cell 3	Transmitter Level Indicating	210-E03-TNK-0340	07-Jun-19	1	YEARS	06-Jun-20
3651	Flush Feed Tubing Transmitter LIT-0345 Train E Cell 4	Transmitter Level Indicating	210-E04-TNK-0340	07-Jun-19	1	YEARS	06-Jun-20
3649	Check Calibration of Cell Level Transmitter LIT-0345 Train E Cell 4	Transmitter Level Indicating	210-E04-TNK-0340	07-Jun-19	1	YEARS	06-Jun-20
7550	Check Calibration of PIT-0471, MF Filtrate Header Train A Cells 1-4	Transmitter Pressure Indicating	210-PIP-MFE-MEMA	26-Nov-19	2	YEARS	27-Nov-21
7551	Check Calibration of PIT-0471, MF Filtrate Header Train A Cells 5-8	Transmitter Pressure Indicating	210-PIP-MFE-MEMA	26-Nov-19	2	YEARS	27-Nov-21
7560	Check Calibration of BFV-0460, MF Filtrate Train A Cell 1	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA1	22-Oct-19	1	YEARS	17-Oct-20
7515	Check Calibration of PIT-0454, MF Effluent Train A Cell 1	Transmitter Pressure Indicating	210-PIP-MFE-MEMA1	07-Nov-19	2	YEARS	04-Nov-21
7595	Check Calibration of TIT-0420, MF Filtrate Train A Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEMA1	09-Jan-20	6	MONTHS	07-Jul-20
7561	Check Calibration of BFV-0460, MF Filtrate Train A Cell 2	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA2	22-Oct-19	1	YEARS	17-Oct-20
7516	Check Calibration of PIT-0454, MF Effluent Train A Cell 2	Transmitter Pressure Indicating	210-PIP-MFE-MEMA2	07-Nov-19	2	YEARS	04-Nov-21
7596	Check Calibration of TIT-0420, MF Filtrate Train A Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEMA2	12-Sep-19	6	MONTHS	09-Mar-20
7517	Check Calibration of PIT-0454, MF Effluent Train A Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMA3	07-Nov-19	2	YEARS	04-Nov-21
7562	Check Calibration of BFV-0460, MF Filtrate Train A Cell 3	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA3	22-Oct-19	1	YEARS	17-Oct-20
7597	Check Calibration of TIT-0420, MF Filtrate Train A Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEMA3	12-Sep-19	6	MONTHS	09-Mar-20
7563	Check Calibration of BFV-0460, MF Filtrate Train A Cell 4	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA4	22-Oct-19	1	YEARS	17-Oct-20
7518	Check Calibration of PIT-0454, MF Effluent Train A Cell 4	Transmitter Pressure Indicating	210-PIP-MFE-MEMA4	07-Nov-19	2	YEARS	04-Nov-21
7598	Check Calibration of TIT-0420, MF Filtrate Train A Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEMA4	12-Sep-19	6	MONTHS	09-Mar-20
7519	Check Calibration of PIT-0454, MF Effluent Train A Cell 5	Transmitter Pressure Indicating	210-PIP-MFE-MEMA5	13-Nov-19	2	YEARS	11-Nov-21
7564	Check Calibration of BFV-0460, MF Filtrate Train A Cell 5	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA5	20-Nov-19	1	YEARS	23-Oct-20
7599	Check Calibration of TIT-0420, MF Filtrate Train A Cell 5	Transmitter Temperature Indicating	210-PIP-MFE-MEMA5	20-Sep-19	6	MONTHS	16-Mar-20
7520	Check Calibration of PIT-0454, MF Effluent Train A Cell 6	Transmitter Pressure Indicating	210-PIP-MFE-MEMA6	13-Nov-19	2	YEARS	11-Nov-21
7565	Check Calibration of BFV-0460, MF Filtrate Train A Cell 6	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA6	20-Nov-19	1	YEARS	23-Oct-20
7600	Check Calibration of TIT-0420, MF Filtrate Train A Cell 6	Transmitter Temperature Indicating	210-PIP-MFE-MEMA6	20-Sep-19	6	MONTHS	16-Mar-20
7601	Check Calibration of TIT-0420, MF Filtrate Train A Cell 7	Transmitter Temperature Indicating	210-PIP-MFE-MEMA7	20-Sep-19	6	MONTHS	16-Mar-20
7521	Check Calibration of PIT-0454, MF Effluent Train A Cell 7	Transmitter Pressure Indicating	210-PIP-MFE-MEMA7	13-Nov-19	2	YEARS	11-Nov-21
7566	Check Calibration of BFV-0460, MF Filtrate Train A Cell 7	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA7	20-Nov-19	1	YEARS	23-Oct-20
7567	Check Calibration of BFV-0460, MF Filtrate Train A Cell 8	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMA8	20-Nov-19	1	YEARS	23-Oct-20
7522	Check Calibration of PIT-0454, MF Effluent Train A Cell 8	Transmitter Pressure Indicating	210-PIP-MFE-MEMA8	13-Nov-19	2	YEARS	11-Nov-21
7602	Check Calibration of TIT-0420, MF Filtrate Train A Cell 8	Transmitter Temperature Indicating	210-PIP-MFE-MEMA8	20-Sep-19	6	MONTHS	16-Mar-20
7553	Check Calibration of PIT-0471, MF Filtrate Header Train B Cells 5-8	Transmitter Pressure Indicating	210-PIP-MFE-MEMB	04-Dec-19	2	YEARS	27-Nov-21
7552	Check Calibration of PIT-0471, MF Filtrate Header Train B Cells 1-4	Transmitter Pressure Indicating	210-PIP-MFE-MEMB	04-Dec-19	2	YEARS	27-Nov-21
7568	Check Calibration of BFV-0460, MF Filtrate Train B Cell 1	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB1	29-Oct-19	1	YEARS	03-Nov-20
7523	Check Calibration of PIT-0454, MF Effluent Train B Cell 1	Transmitter Pressure Indicating	210-PIP-MFE-MEMB1	27-Nov-19	2	YEARS	18-Nov-21
7603	Check Calibration of TIT-0420, MF Filtrate Train B Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEMB1	24-Sep-19	6	MONTHS	23-Mar-20
7524	Check Calibration of PIT-0454, MF Effluent Train B Cell 2	Transmitter Pressure Indicating	210-PIP-MFE-MEMB2	27-Nov-19	2	YEARS	18-Nov-21
7569	Check Calibration of BFV-0460, MF Filtrate Train B Cell 2	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB2	29-Oct-19	1	YEARS	03-Nov-20
7604	Check Calibration of TIT-0420, MF Filtrate Train B Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEMB2	24-Sep-19	6	MONTHS	23-Mar-20
7525	Check Calibration of PIT-0454, MF Effluent Train B Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMB3	27-Nov-19	2	YEARS	18-Nov-21
7605	Check Calibration of TIT-0420, MF Filtrate Train B Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEMB3	24-Sep-19	6	MONTHS	23-Mar-20
7570	Check Calibration of BFV-0460, MF Filtrate Train B Cell 3	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB3	29-Oct-19	1	YEARS	03-Nov-20
7571	Check Calibration of BFV-0460, MF Filtrate Train B Cell 4	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB4	29-Oct-19	1	YEARS	03-Nov-20
7526	Check Calibration of PIT-0454, MF Effluent Train B Cell 4	Transmitter Pressure Indicating	210-PIP-MFE-MEMB4	27-Nov-19	2	YEARS	18-Nov-21
7606	Check Calibration of TIT-0420, MF Filtrate Train B Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEMB4	24-Sep-19	6	MONTHS	23-Mar-20

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
7572	Check Calibration of BFV-0460, MF Filtrate Train B Cell 5	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB5	26-Nov-19	1	YEARS	19-Nov-20
7607	Check Calibration of TIT-0420, MF Filtrate Train B Cell 5	Transmitter Temperature Indicating	210-PIP-MFE-MEMB5	04-Oct-19	6	MONTHS	30-Mar-20
7527	Check Calibration of PIT-0454, MF Effluent Train B Cell 5	Transmitter Pressure Indicating	210-PIP-MFE-MEMB5	26-Nov-19	2	YEARS	25-Nov-21
7573	Check Calibration of BFV-0460, MF Filtrate Train B Cell 6	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB6	26-Nov-19	1	YEARS	19-Nov-20
7528	Check Calibration of PIT-0454, MF Effluent Train B Cell 6	Transmitter Pressure Indicating	210-PIP-MFE-MEMB6	26-Nov-19	2	YEARS	25-Nov-21
7608	Check Calibration of TIT-0420, MF Filtrate Train B Cell 6	Transmitter Temperature Indicating	210-PIP-MFE-MEMB6	04-Oct-19	6	MONTHS	30-Mar-20
7529	Check Calibration of PIT-0454, MF Effluent Train B Cell 7	Transmitter Pressure Indicating	210-PIP-MFE-MEMB7	26-Nov-19	2	YEARS	25-Nov-21
7574	Check Calibration of BFV-0460, MF Filtrate Train B Cell 7	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB7	26-Nov-19	1	YEARS	19-Nov-20
7609	Check Calibration of TIT-0420, MF Filtrate Train B Cell 7	Transmitter Temperature Indicating	210-PIP-MFE-MEMB7	04-Oct-19	6	MONTHS	30-Mar-20
7538	Check Calibration of PIT-0454, MF Effluent Train B Cell 8	Transmitter Pressure Indicating	210-PIP-MFE-MEMB8	26-Nov-19	2	YEARS	25-Nov-21
7575	Check Calibration of BFV-0460, MF Filtrate Train B Cell 8	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMB8	26-Nov-19	1	YEARS	19-Nov-20
7610	Check Calibration of TIT-0420, MF Filtrate Train B Cell 8	Transmitter Temperature Indicating	210-PIP-MFE-MEMB8	09-Jan-20	6	MONTHS	07-Jul-20
3552	Check Calibration of PIT-0454, MF Effluent Train C Cell 1	Transmitter Pressure Indication	210-PIP-MFE-MEMC1	02-Aug-19	2	YEARS	01-Aug-21
3515	Check Calibration of TIT-0420 MF Filtrate Train C Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEMC1	13-Feb-20	6	MONTHS	10-Aug-20
3560	Check Calibration of BFV-0460 MF Filtrate Train C Cell1	Actuator	210-PIP-MFE-MEMC1	31-May-19	1	YEARS	01-Jun-20
3553	Check Calibration of PIT-0454, MF Effluent Train C Cell 2	Transmitter Pressure Indication	210-PIP-MFE-MEMC2	02-Aug-19	2	YEARS	01-Aug-21
3516	Check Calibration of TIT-0420 MF Filtrate Train C Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEMC2	13-Feb-20	6	MONTHS	10-Aug-20
3561	Check Calibration of BFV-0460 MF Filtrate Train C Cell 2	Actuator	210-PIP-MFE-MEMC2	31-May-19	1	YEARS	01-Jun-20
3568	Check Calibration of PIT-0454 MF Effluent Train C Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMC3	02-Aug-19	2	YEARS	01-Aug-21
3517	Check Calibration of TIT-0420 MF Filtrate Train C Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEMC3	13-Feb-20	6	MONTHS	10-Aug-20
3562	Check Calibration of BFV-0460 MF Filtrate Train C Cell 3	Actuator	210-PIP-MFE-MEMC3	31-May-19	1	YEARS	01-Jun-20
3563	Check Calibration of BFV-0460 MF Filtrate Train C Cell 4	Actuator	210-PIP-MFE-MEMC4	31-May-19	1	YEARS	01-Jun-20
3518	Check Calibration of TIT-0420 MF Filtrate Train C Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEMC4	13-Feb-20	6	MONTHS	10-Aug-20
3555	Check Calibration of PIT-0454, MF Effluent Train C Cell 4	Transmitter Pressure Indicating	210-PIP-MFE-MEMC4	02-Aug-19	2	YEARS	01-Aug-21
3519	Check Calibration of TIT-0420 MF Filtrate Train C Cell 5	Transmitter Temperature Indicating	210-PIP-MFE-MEMC5	18-Feb-20	6	MONTHS	10-Aug-20
3556	Check Calibration of PIT-0454, MF Effluent Train C Cell 5	Transmitter Pressure Indicating	210-PIP-MFE-MEMC5	01-Aug-19	2	YEARS	01-Aug-21
3564	Check Calibration of BFV-0460 MF Filtrate Train C Cell 5	Actuator	210-PIP-MFE-MEMC5	10-Jun-19	1	YEARS	01-Jun-20
3565	Check Calibration of BFV-0460 MF Filtrate Train C Cell 6	Actuator	210-PIP-MFE-MEMC6	10-Jun-19	1	YEARS	01-Jun-20
3557	Check Calibration of PIT-0454, MF Effluent Train C Cell 6	Transmitter Pressure Indicating	210-PIP-MFE-MEMC6	01-Aug-19	2	YEARS	01-Aug-21
3520	Check Calibration of TIT-0420 MF Filtrate Train C Cell 6	Transmitter Temperature Indicating	210-PIP-MFE-MEMC6	18-Feb-20	6	MONTHS	10-Aug-20
3566	Check Calibration of BFV-0460 MF Filtrate Train C Cell 7	Valve Butterfly 12"	210-PIP-MFE-MEMC7	10-Jun-19	1	YEARS	01-Jun-20
3558	Check Calibration of PIT-0454, MF Effluent Train C Cell 7	Transmitter Pressure Indicating	210-PIP-MFE-MEMC7	01-Aug-19	2	YEARS	01-Aug-21
3521	Check Calibration of TIT-0420 MF Filtrate Train C Cell 7	Transmitter Temperature Indicating	210-PIP-MFE-MEMC7	18-Feb-20	6	MONTHS	10-Aug-20
3559	Check Calibration of PIT-0454, MF Effluent Train C Cell 8	Transmitter Pressure Indicating	210-PIP-MFE-MEMC8	01-Aug-19	2	YEARS	01-Aug-21
3522	Check Calibration of TIT-0420 MF Filtrate Train C Cell 8	Transmitter Temperature Indicating	210-PIP-MFE-MEMC8	18-Feb-20	6	MONTHS	10-Aug-20
3567	Check Calibration of BFV-0460 MF Filtrate Train C Cell 8	Valve Butterfly 12"	210-PIP-MFE-MEMC8	10-Jun-19	1	YEARS	01-Jun-20
7554	Check Calibration of PIT-0471, MF Filtrate Header Train D Cells 1-4	Transmitter Pressure Indicating	210-PIP-MFE-MEMD	17-Dec-19	2	YEARS	27-Nov-21
7556	Check Calibration of PIT-0471, MF Filtrate Header Train D Cells 5-8	Transmitter Pressure Indicating	210-PIP-MFE-MEMD	17-Dec-19	2	YEARS	27-Nov-21
7576	Check Calibration of BFV-0460, MF Filtrate Train D Cell 1	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD1	26-Nov-19	1	YEARS	26-Nov-20
7611	Check Calibration of TIT-0420, MF Filtrate Train D Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEMD1	31-Oct-19	6	MONTHS	07-Apr-20
7530	Check Calibration of PIT-0454, MF Effluent Train D Cell 1	Transmitter Pressure Indicating	210-PIP-MFE-MEMD1	03-Dec-19	2	YEARS	02-Dec-21
7612	Check Calibration of TIT-0420, MF Filtrate Train D Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEMD2	15-Nov-19	6	MONTHS	07-Apr-20
7531	Check Calibration of PIT-0454, MF Effluent Train D Cell 2	Transmitter Pressure Indicating	210-PIP-MFE-MEMD2	03-Dec-19	2	YEARS	02-Dec-21
7577	Check Calibration of BFV-0460, MF Filtrate Train D Cell 2	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD2	26-Nov-19	1	YEARS	26-Nov-20
7532	Check Calibration of PIT-0454, MF Effluent Train D Cell 3	Transmitter Pressure Indicating	210-PIP-MFE-MEMD3	03-Dec-19	2	YEARS	02-Dec-21
7613	Check Calibration of TIT-0420, MF Filtrate Train D Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEMD3	15-Nov-19	6	MONTHS	07-Apr-20
7578	Check Calibration of BFV-0460, MF Filtrate Train D Cell 3	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD3	26-Nov-19	1	YEARS	26-Nov-20
7614	Check Calibration of TIT-0420, MF Filtrate Train D Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEMD4	15-Nov-19	6	MONTHS	07-Apr-20
7533	Check Calibration of PIT-0454, MF Effluent Train D Cell 4	Transmitter Pressure Indicating	210-PIP-MFE-MEMD4	03-Dec-19	2	YEARS	02-Dec-21
7579	Check Calibration of BFV-0460, MF Filtrate Train D Cell 4	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD4	26-Nov-19	1	YEARS	26-Nov-20
7534	Check Calibration of PIT-0454, MF Effluent Train D Cell 5	Transmitter Pressure Indicating	210-PIP-MFE-MEMD5	11-Dec-19	2	YEARS	09-Dec-21
7615	Check Calibration of TIT-0420, MF Filtrate Train D Cell 5	Transmitter Temperature Indicating	210-PIP-MFE-MEMD5	18-Oct-19	6	MONTHS	14-Apr-20
7580	Check Calibration of BFV-0460, MF Filtrate Train D Cell 5	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD5	13-Dec-19	1	YEARS	09-Dec-20
7535	Check Calibration of PIT-0454, MF Effluent Train D Cell 6	Transmitter Pressure Indicating	210-PIP-MFE-MEMD6	11-Dec-19	2	YEARS	09-Dec-21
7581	Check Calibration of BFV-0460, MF Filtrate Train D Cell 6	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD6	13-Dec-19	1	YEARS	09-Dec-20
7616	Check Calibration of TIT-0420, MF Filtrate Train D Cell 6	Transmitter Temperature Indicating	210-PIP-MFE-MEMD6	18-Oct-19	6	MONTHS	14-Apr-20
7582	Check Calibration of BFV-0460, MF Filtrate Train D Cell 7	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD7	13-Dec-19	1	YEARS	09-Dec-20
7536	Check Calibration of PIT-0454, MF Effluent Train D Cell 7	Transmitter Pressure Indicating	210-PIP-MFE-MEMD7	11-Dec-19	2	YEARS	09-Dec-21
7617	Check Calibration of TIT-0420, MF Filtrate Train D Cell 7	Transmitter Temperature Indicating	210-PIP-MFE-MEMD7	18-Oct-19	6	MONTHS	14-Apr-20
7583	Check Calibration of BFV-0460, MF Filtrate Train D Cell 8	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEMD8	13-Dec-19	1	YEARS	09-Dec-20
7618	Check Calibration of TIT-0420, MF Filtrate Train D Cell 8	Transmitter Temperature Indicating	210-PIP-MFE-MEMD8	18-Oct-19	6	MONTHS	14-Apr-20
7537	Check Calibration of PIT-0454, MF Effluent Train D Cell 8	Transmitter Pressure Indicating	210-PIP-MFE-MEMD8	11-Dec-19	2	YEARS	09-Dec-21
7557	Check Calibration of PIT-0471, MF Filtrate Header Train E Cells 1-4	Transmitter Pressure Indicating	210-PIP-MFE-MEME	17-Dec-19	2	YEARS	27-Nov-21
7539	Check Calibration of PIT-0454, MF Effluent Train E Cell 1	Transmitter Pressure Indicating	210-PIP-MFE-MEME1	17-Dec-19	2	YEARS	16-Dec-21
7619	Check Calibration of TIT-0420, MF Filtrate Train E Cell 1	Transmitter Temperature Indicating	210-PIP-MFE-MEME1	30-Oct-19	6	MONTHS	21-Apr-20
7584	Check Calibration of BFV-0460, MF Filtrate Train E Cell 1	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEME1	10-Jan-20	1	YEARS	17-Dec-20

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
7620	Check Calibration of TIT-0420, MF Filtrate Train E Cell 2	Transmitter Temperature Indicating	210-PIP-MFE-MEME2	30-Oct-19	6	MONTHS	21-Apr-20
7585	Check Calibration of BFV-0460, MF Filtrate Train E Cell 2	Actuator Pneumatic Operated with Positioner	210-PIP-MFE-MEME2	10-Jan-20	1	YEARS	17-Dec-20
7540	Check Calibration of PIT-0454, MF Effluent Train E Cell 2	Transmitter Pressure Indicating	210-PIP-MFE-MEME2	17-Dec-19	2	YEARS	16-Dec-21
3640	Check Calibration of TIT-0420 MF Filtrate Train E Cell 3	Transmitter Temperature Indicating	210-PIP-MFE-MEME3	21-Nov-19	6	MONTHS	23-May-20
3642	Check Calibration of BFV-0460 MF Filtrate Train E Cell 3	Actuator	210-PIP-MFE-MEME3	23-Jul-19	1	YEARS	04-Jul-20
3644	Check Calibration of PIT-0454 MF Effluent Train E Cell 3	Transmitter Pressure Indication	210-PIP-MFE-MEME3	07-Jun-19	2	YEARS	05-Jun-21
3643	Check Calibration of BFV-0460 MF Filtrate Train E Cell 4	Actuator	210-PIP-MFE-MEME4	23-Jul-19	1	YEARS	04-Jul-20
3645	Check Calibration of PIT-0454 MF Effluent Train E Cell 4	Transmitter Pressure Indication	210-PIP-MFE-MEME4	07-Jun-19	2	YEARS	05-Jun-21
3641	Check Calibration of TIT-0420 MF Flitrate Train E Cell 4	Transmitter Temperature Indicating	210-PIP-MFE-MEME4	20-Nov-19	6	MONTHS	23-May-20
7510	Check Calibration of Train Feed Valve A02-BFV-0320 MFE	Valve Butterfly 60"	210-PIP-MFF-MEM	12-Jun-19	12	MONTHS	11-Jun-20
7511	Check Calibration of Train Feed Valve B02-BFV-0320 MFE	Valve Butterfly 60"	210-PIP-MFF-MEM	12-Jun-19	12	MONTHS	11-Jun-20
7512	Check Calibration of Train Feed Valve D02-BFV-0320 MFW	Valve Butterfly 60"	210-PIP-MFF-MEM	12-Jun-19	12	MONTHS	11-Jun-20
7513	Check Calibration of Train Feed Valve E01-E02-BFV-0320 MFW	Valve Butterfly 36"	210-PIP-MFF-MEM	12-Jun-19	12	MONTHS	11-Jun-20
3577	Check Calibration of Train Feed Valve C02-BFV-0320	Actuator	210-PIP-MFF-MEM	31-May-19	1	YEARS	01-Jun-20
7350	Check calibration of DPIT-0405, Train A Cell 1 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA1	03-Dec-19	1	YEARS	07-Dec-20
2290	Block, Bleed and Check Zero - A01-DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA1	09-Jan-20	6	MONTHS	07-Jul-20
7470	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 1 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA1	18-Mar-19	12	MONTHS	09-Mar-20
7471	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 2 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA2	14-Mar-19	12	MONTHS	09-Mar-20
2291	Block, Bleed and Check Zero -A02- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA2	02-Jul-19	1	YEARS	07-Jul-20
7351	Check calibration of DPIT-0405, Train A Cell 2 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA2	10-Dec-19	1	YEARS	07-Dec-20
7472	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 3 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA3	14-Mar-19	12	MONTHS	09-Mar-20
2292	Block, Bleed and Check Zero -A03- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA3	02-Jul-19	1	YEARS	07-Jul-20
7352	Check calibration of DPIT-0405, Train A Cell 3 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA3	10-Dec-19	1	YEARS	07-Dec-20
7473	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 4 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA4	14-Mar-19	12	MONTHS	09-Mar-20
7353	Check calibration of DPIT-0405, Train A Cell 4 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA4	10-Dec-19	1	YEARS	07-Dec-20
2293	Block, Bleed and Check Zero -A04- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA4	02-Jul-19	1	YEARS	07-Jul-20
7474	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 5 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA5	28-Mar-19	12	MONTHS	16-Mar-20
7354	Check calibration of DPIT-0405, Train A Cell 5 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA5	07-Feb-20	1	YEARS	04-Jan-21
2294	Block, Bleed and Check Zero -A05- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA5	19-Jul-19	1	YEARS	21-Jul-20
7355	Check calibration of DPIT-0405, Train A Cell 6 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA6	07-Feb-20	1	YEARS	04-Jan-21
7475	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 6 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA6	28-Mar-19	12	MONTHS	16-Mar-20
2295	Block, Bleed and Check Zero -A06- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA6	19-Jul-19	1	YEARS	21-Jul-20
7476	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 7 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA7	28-Mar-19	12	MONTHS	16-Mar-20
7356	Check calibration of DPIT-0405, Train A Cell 7 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA7	07-Feb-20	1	YEARS	04-Jan-21
2296	Block, Bleed and Check Zero -A07- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA7	19-Jul-19	1	YEARS	21-Jul-20
2297	Block, Bleed and Check Zero -A08- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA8	19-Jul-19	1	YEARS	21-Jul-20
7477	Check Calibration of Unit Feed Valve BFV-0330 Train A Cell 8 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMA8	28-Mar-19	12	MONTHS	16-Mar-20
7357	Check calibration of DPIT-0405, Train A Cell 8 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMA8	07-Feb-20	1	YEARS	04-Jan-21
7478	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 1 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB1	28-Mar-19	12	MONTHS	23-Mar-20
7358	Check calibration of DPIT-0405, Train B Cell 1 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB1	31-Jan-20	1	YEARS	18-Jan-21
2298	Block, Bleed and Check Zero -B01- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB1	02-Aug-19	1	YEARS	03-Aug-20
2299	Block, Bleed and Check Zero -B02- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB2	02-Aug-19	1	YEARS	03-Aug-20
7359	Check calibration of DPIT-0405, Train B Cell 2 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB2	31-Jan-20	1	YEARS	18-Jan-21
7479	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 2 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB2	28-Mar-19	12	MONTHS	23-Mar-20
7360	Check calibration of DPIT-0405, Train B Cell 3 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB3	31-Jan-20	1	YEARS	18-Jan-21
2300	Block, Bleed and Check Zero -B03- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB3	02-Aug-19	1	YEARS	03-Aug-20
7480	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 3 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB3	28-Mar-19	12	MONTHS	23-Mar-20
7481	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 4 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB4	28-Mar-19	12	MONTHS	23-Mar-20
7361	Check calibration of DPIT-0405, Train B Cell 4 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB4	31-Jan-20	1	YEARS	18-Jan-21
7482	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 5 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB5	28-Mar-19	12	MONTHS	30-Mar-20
2302	Block, Bleed and Check Zero -B05- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB5	20-Aug-19	1	YEARS	17-Aug-20
7362	Check calibration of DPIT-0405, Train B Cell 5 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB5	05-Feb-20	1	YEARS	08-Feb-21
2303	Block, Bleed and Check Zero -B06- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB6	20-Aug-19	1	YEARS	17-Aug-20
7363	Check calibration of DPIT-0405, Train B Cell 6 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB6	05-Feb-20	1	YEARS	08-Feb-21
7483	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 6 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB6	28-Mar-19	12	MONTHS	30-Mar-20
2304	Block, Bleed and Check Zero -B07- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB7	20-Aug-19	1	YEARS	17-Aug-20
7484	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 7 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB7	28-Mar-19	12	MONTHS	30-Mar-20
7364	Check calibration of DPIT-0405, Train B Cell 7 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB7	05-Feb-20	1	YEARS	08-Feb-21
7365	Check calibration of DPIT-0405, Train B Cell 8 MFE	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB8	05-Feb-20	1	YEARS	08-Feb-21
7485	Check Calibration of Unit Feed Valve BFV-0330 Train B Cell 8 MFE	Valve Butterfly 24"	210-PIP-MFF-MEMB8	28-Mar-19	12	MONTHS	30-Mar-20
2305	Block, Bleed and Check Zero -B08- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMB8	20-Aug-19	1	YEARS	17-Aug-20
3579	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 1	Actuator	210-PIP-MFF-MEMC1	19-Jul-19	1	YEARS	01-Jul-20
3507	Block, Bleed, and Check Zero - C01-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC1	30-Aug-19	1	YEARS	01-Sep-20
3569	Check Calibration of DPIT-0405 Train C Cell 1	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC1	02-May-19	1	YEARS	02-May-20
3570	Check Calibration of DPIT-0405 Train C Cell 2	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC2	02-May-19	1	YEARS	02-May-20
3508	Block, Bleed, and Check Zero - C02-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC2	30-Aug-19	1	YEARS	01-Sep-20

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
3580	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 2	Actuator	210-PIP-MFF-MEMC2	19-Jul-19	1	YEARS	01-Jul-20
3509	Block, Bleed, and Check Zero C03-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC3	30-Aug-19	1	YEARS	01-Sep-20
3571	Check Calibration of DPIT-0405 Train C Cell 3	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC3	02-May-19	1	YEARS	02-May-20
3581	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 3	Actuator	210-PIP-MFF-MEMC3	19-Jul-19	1	YEARS	01-Jul-20
3510	Block, Bleed, and Check Zero - C04-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC4	30-Aug-19	1	YEARS	01-Sep-20
3572	Check Calibration of DPIT-0405 Train C Cell 4	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC4	29-Apr-19	1	YEARS	02-May-20
3573	Check Calibration of DPIT-0405 Train C Cell 5	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC5	29-Apr-19	1	YEARS	02-May-20
3511	Block, Bleed, and Check Zero - C05-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC5	30-Aug-19	1	YEARS	01-Sep-20
3583	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell5	Actuator	210-PIP-MFF-MEMC5	19-Jul-19	1	YEARS	01-Jul-20
3574	Check Calibration of DPIT-0405 Train C Cell 6	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC6	29-Apr-19	1	YEARS	02-May-20
3512	Block, Bleed, and Check Zero - C06-PDIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC6	30-Aug-19	1	YEARS	01-Sep-20
3584	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 6	Actuator	210-PIP-MFF-MEMC6	19-Jul-19	1	YEARS	01-Jul-20
3513	Block, Bleed, and Check Zero C07-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC7	30-Aug-19	1	YEARS	01-Sep-20
3585	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 7	Actuator	210-PIP-MFF-MEMC7	19-Jul-19	1	YEARS	01-Jul-20
3575	Check Calibration of DPIT-0405 Train C Cell 7	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC7	29-Apr-19	1	YEARS	02-May-20
3576	Check Calibration of DPIT-0405 Train C Cell 8	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC8	29-Apr-19	1	YEARS	02-May-20
3514	Block, Bleed, and Check Zero C08-DPIT-0405 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMC8	30-Aug-19	1	YEARS	01-Sep-20
3586	Check Calibration of Unit Feed Valve BFV-0330 Train C Cell 8	Actuator	210-PIP-MFF-MEMC8	18-Jul-19	1	YEARS	01-Jul-20
7486	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 1 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD1	03-Apr-19	12	MONTHS	07-Apr-20
7366	Check calibration of DPIT-0405, Train D Cell 1 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD1	19-Mar-19	1	YEARS	22-Feb-21
2306	Block, Bleed and Check Zero -D01- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD1	02-Aug-19	1	YEARS	03-Aug-20
7367	Check calibration of DPIT-0405, Train D Cell 2 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD2	19-Mar-19	1	YEARS	22-Feb-21
7487	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 2 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD2	03-Apr-19	12	MONTHS	07-Apr-20
2307	Block, Bleed and Check Zero -D02- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD2	02-Aug-19	1	YEARS	03-Aug-20
2308	Block, Bleed and Check Zero -D03- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD3	02-Aug-19	1	YEARS	03-Aug-20
7488	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 3 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD3	03-Apr-19	12	MONTHS	07-Apr-20
7368	Check calibration of DPIT-0405, Train D Cell 3 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD3	19-Mar-19	1	YEARS	22-Feb-21
7369	Check calibration of DPIT-0405, Train D Cell 4 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD4	19-Mar-19	1	YEARS	22-Feb-21
2309	Block, Bleed and Check Zero -D04- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD4	31-Jul-19	1	YEARS	03-Aug-20
7489	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 4 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD4	03-Apr-19	12	MONTHS	07-Apr-20
7370	Check calibration of DPIT-0405, Train D Cell 5 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD5	01-Mar-19	1	YEARS	08-Mar-20
7490	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 5 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD5	03-May-19	12	MONTHS	14-Apr-20
2310	Block, Bleed and Check Zero -D05- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD5	20-Aug-19	1	YEARS	17-Aug-20
2311	Block, Bleed and Check Zero -D06- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD6	20-Aug-19	1	YEARS	17-Aug-20
7371	Check calibration of DPIT-0405, Train D Cell 6 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD6	01-Mar-19	1	YEARS	08-Mar-20
7491	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 6 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD6	03-May-19	12	MONTHS	14-Apr-20
7372	Check calibration of DPIT-0405, Train D Cell 7 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD7	01-Mar-19	1	YEARS	08-Mar-20
7492	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 7 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD7	03-May-19	12	MONTHS	14-Apr-20
2312	Block, Bleed and Check Zero -D07- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD7	20-Aug-19	1	YEARS	17-Aug-20
2313	Block, Bleed and Check Zero -D08- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD8	20-Aug-19	1	YEARS	17-Aug-20
7493	Check Calibration of Unit Feed Valve BFV-0330 Train D Cell 8 MFW	Valve Butterfly 24"	210-PIP-MFF-MEMD8	03-May-19	12	MONTHS	14-Apr-20
7373	Check calibration of DPIT-0405, Train D Cell 8 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEMD8	01-Mar-19	1	YEARS	08-Mar-20
7494	Check Calibration of Unit Feed Valve BFV-0330 Train E Cell 1 MFW	Valve Butterfly 24"	210-PIP-MFF-MEME1	19-Apr-19	12	MONTHS	21-Apr-20
7374	Check calibration of DPIT-0405, Train E Cell 1 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME1	11-Mar-19	1	YEARS	08-Mar-20
2314	Block, Bleed and Check Zero -E01- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME1	23-Aug-19	1	YEARS	17-Aug-20
7375	Check calibration of DPIT-0405, Train E Cell 2 MFW	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME2	11-Mar-19	1	YEARS	08-Mar-20
7495	Check Calibration of Unit Feed Valve BFV-0330 Train E Cell 2 MFW	Valve Butterfly 24"	210-PIP-MFF-MEME2	19-Apr-19	12	MONTHS	21-Apr-20
2315	Block, Bleed and Check Zero -E02- DPIT-0405 Every 6 MO	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME2	23-Aug-19	1	YEARS	17-Aug-20
3646	Check Calibration of Unit Feed Valve BFV-0330 Train E Cell 3	Actuator	210-PIP-MFF-MEME3	07-Jun-19	1	YEARS	06-Jun-20
3652	Check Calibration of DPIT-0405 Train E Cell 3	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME3	21-Jun-19	1	YEARS	01-Jun-20
3653	Check Calibration of DPIT-0405 Train E Cell 4	Transmitter Differential Pressure Indicating	210-PIP-MFF-MEME4	14-Jun-19	1	YEARS	01-Jun-20
3647	Check Calibration of Unit Feed Valve BFV-0330 Train E Cell 4	Actuator	210-PIP-MFF-MEME4	07-Jun-19	1	YEARS	06-Jun-20
2301	Block, Bleed and Check Zero -B04- DPIT-0405 Every 6 MO	Valve Ball 1/2"	216-PIP-PA-MEMDE	02-Aug-19	1	YEARS	03-Aug-20
7713	Check Calibration of LIT-1207, MF CIP Tank A01	Transmitter Level Indicating 0 - 12 FT	220-A01-TNK-1200	19-Jul-19	1	YEARS	09-Jul-20
7721	Test Overtemperature Thermocouple, TIT-1226 Train A01	Transmitter Temperature Indicating	220-A01-TNK-1200	19-Jul-19	1	YEARS	09-Jul-20
7714	Check Calibration of LIT-1207, MF CIP Tank B01	Transmitter Level Indicating 0 - 12 FT	220-B01-TNK-1200	19-Jul-19	1	YEARS	09-Jul-20
7722	Test Overtemperature Thermocouple, TIT-1226 Train B01	Transmitter Temperature Indicating	220-B01-TNK-1200	19-Jul-19	1	YEARS	09-Jul-20
7723	Test Overtemperature Thermocouple, TIT-1226 Train D01	Transmitter Temperature Indicating	220-D01-TNK-1200	19-Jul-19	1	YEARS	09-Jul-20
7715	Check Calibration of LIT-1207, MF CIP Tank D01	Transmitter Level Indicating 0 - 12 FT	220-D01-TNK-1200	19-Jul-19	1	YEARS	09-Jul-20
7724	Test Overtemperature Thermocouple, TIT-1226 Train E01	Transmitter Temperature Indicating	220-E01-TNK-1200	19-Jul-19	1	YEARS	09-Jul-20
7716	Check Calibration of LIT-1207, MF CIP Tank E01	Transmitter Level Indicating 0 - 12 FT	220-E01-TNK-1200	19-Jul-19	1	YEARS	09-Jul-20
9242	MF Effluent Trubidity Wet Calibration HACH FT 660SC	MF Process Effluent Turbidity	250-PIP-MFE	04-Feb-20	3	MONTHS	16-Apr-20
9667	MFE Clean Roto Flush NTU Body 2 Wk 250-AIT-0495	MF Process Effluent Turbidity	250-PIP-MFE	27-Jan-20	2	WEEKS	03-Mar-20
7712	Check Calibration of PIT-0750, MF backwash - Do during plant shutdown	Transmitter Pressure Indicating 0 - 60 psi	255-PIP-BW	04-Feb-20	1	YEARS	24-Nov-20
2238	Rosemount pH analyzer annual- MF Feedwater-B B01-AIT-0305	Transmitter Analyzer Indicating pH - MF Feedwater B	255-PIP-MFF-WQAS	05-Sep-19	1	YEARS	26-Aug-20
2234	Rosemount pH Analyzer 9 Month RO Feed: 450-AIT-2140	Transmitter Analyzer Indicating pH	450-CPF-0001	10-May-19	9	MONTHS	10-Nov-20

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
3253	Ammonia Sensor Replacement 1 YR 450-AE-2185	Element Analyzer Ammonia	450-CPF-0001	26-Dec-19	9	MONTHS	01-Oct-20
9149	Replace Consumables ROF TOC M5310 Analyzer 3 MO.	Analyzer Total Organic Compound	450-CPF-0001	10-Jan-20	3	MONTHS	09-Apr-20
7343	3 Mo. Rosemount Chlorine Analyzer Maintenance 450-AE-2164	Element Analyzer Total Chlorine - RO Feed	450-CPF-0001	18-Feb-20	3	MONTHS	21-Apr-20
2231	Rosemount pH Analyzer 9 Month RO Feed: 450-AIT-2120	Transmitter Analyzer Indicating pH	450-CPF-0001	15-May-19	9	MONTHS	12-Nov-20
7342	Rosemount Free Chlorine Maintenance 450-AE-2162	Element Analyzer Free Chlorine and pH- RO Feed	450-CPF-0001	30-Jan-20	3	MONTHS	11-Apr-20
9239	Replace Consumables ROF TOC M5310 Analyzer 3 MO.	RO Feed TOC Analyzer	450-PIP-ROF	10-Jan-20	3	MONTHS	09-Apr-20
7345	3 Mo. Rosemount Chlorine Analyzer Maintenance 460-AE-0314	Element Analyzer Total Chlorine - MF Feedwater	460-CPF-0001	14-Jan-20	3	MONTHS	14-Apr-20
7344	3 Mo. Rosemount Chlorine Analyzer Maintenance 460-AE-0312	Element Analyzer Total Chlorine - MF Feedwater	460-CPF-0001	17-Jan-20	3	MONTHS	14-Apr-20
2055	Element Analyzer Conductivity - RO Concentrate Train A Unit 1	Element Analyzer Conductivity - RO Concentrate Train A Unit 1	510-A01-CPF-5101	26-Dec-19	3	MONTHS	26-Mar-20
2057	Element Analyzer Conductivity - RO Concentrate Train A Unit 2	Element Analyzer Conductivity - RO Concentrate Train A Unit 2	510-A02-CPF-5101	14-Nov-19	3	MONTHS	14-May-20
2059	Element Analyzer Conductivity - RO Concentrate Train A Unit 3	Element Analyzer Conductivity - RO Concentrate Train A Unit 2	510-A02-CPF-5101	14-Nov-19	3	MONTHS	14-May-20
2061	Element Analyzer Conductivity - RO Concentrate Train B Unit 1	Element Analyzer Conductivity - RO Concentrate Train B Unit 1	510-B01-CPF-5101	26-Dec-19	3	MONTHS	26-Mar-20
2063	Element Analyzer Conductivity - RO Concentrate Train B Unit 2	Element Analyzer Conductivity - RO Concentrate Train B Unit 2	510-B02-CPF-5101	14-Nov-19	3	MONTHS	14-May-20
9681	M9 Portable TOC No. 1 Replace Consumables 3 MO.	Portable M9 TOC Analyzer No.1 RO Feed	510-B02-RO-2200	30-Dec-19	3	MONTHS	23-Mar-20
2067	Element Analyzer Conductivity - RO Concentrate Train C Unit 1	Element Analyzer Conductivity - RO Concentrate Train C Unit 1	510-C01-CPF-5101	09-Jan-20	3	MONTHS	09-Apr-20
2069	Element Analyzer Conductivity - RO Concentrate Train C Unit 2	Element Analyzer Conductivity - RO Concentrate Train C Unit 2	510-C02-CPF-5101	13-Dec-19	3	MONTHS	13-Mar-20
2071	Element Analyzer Conductivity - RO Concentrate Train C Unit 3	Element Analyzer Conductivity - RO Concentrate Train C Unit 3	510-C03-CPF-5101	14-Nov-19	3	MONTHS	14-May-20
3467	Prominent H2O2 Sensor Calibration Method 1 YR	UV FEED PROMINENT PEROXIDE ANALYZER	510-CPF-0010	17-May-19	1	YEARS	16-May-20
3463	Prominent H2O2 Sensor Standardization Method	UV FEED PROMINENT PEROXIDE ANALYZER	510-CPF-0010	13-Feb-20	2	WEEKS	26-Feb-20
3135	ROP / UVP CL2 Analyzer Weekly Calibration	ROP/UVP CL2 510-AIT-2250 Analyzer	510-CPF-0010	13-Feb-20	1	WEEKS	25-Feb-20
2235	Rosemount pH analyzer annual-RO PW: 510-AIT-2241	Transmitter Analyzer Indicating pH	510-CPF-0010	15-Aug-19	1	YEARS	12-Aug-20
9296	UVT 2240 Optiview Cleaning & Transmittance Monthly	UV Transmittance Analyzer	510-CPF-0010	07-Feb-20	1	MONTHS	01-Mar-20
9150	Replace Consumables ROP TOC M5310 Analyzer 3 MO.	Analyzer Total Organic Compound	510-CPF-0010	10-Jan-20	3	MONTHS	09-Apr-20
9241	UV Transmittance Calibration Check 1 Yr. 610-AE-2240	UV Transmittance Analyzer	510-CPF-0010	29-Apr-19	1	YEARS	22-Apr-20
9240	Replace Consumables ROP TOC M5310 Analyzer 3 MO.	RO Permate TOC Analyzer	510-CPF-0010	14-Nov-19	3	MONTHS	15-May-20
9044	ROP/UVP CL2 ANALYZER 1 YR	ROP/UVP CL2 510-AIT-2250 Analyzer	510-CPF-0010	09-Apr-19	1	YEARS	04-Apr-20
2073	Element Analyzer Conductivity - RO Concentrate Train D Unit 1	Element Analyzer Conductivity - RO Concentrate Train D Unit 1	510-D01-CPF-5101	14-Nov-19	3	MONTHS	14-May-20
2075	Element Analyzer Conductivity - RO Concentrate Train D Unit 2	Element Analyzer Conductivity - RO Concentrate Train D Unit 2	510-D02-CPF-5101	10-Dec-19	3	MONTHS	10-Mar-20
2077	Element Analyzer Conductivity - RO Concentrate Train D Unit 3	Element Analyzer Conductivity - RO Concentrate Train D Unit 3	510-D03-CPF-5101	26-Nov-19	3	MONTHS	26-Feb-20
2079	Element Analyzer Conductivity - RO Concentrate Train E Unit 1	Element Analyzer Conductivity - RO Concentrate Train E Unit 1	510-E01-CPF-5101	26-Nov-19	3	MONTHS	26-Feb-20
2081	Element Analyzer Conductivity - RO Concentrate Train E Unit 2	Element Analyzer Conductivity - RO Concentrate Train E Unit 2	510-E02-CPF-5101	19-Feb-20	3	MONTHS	14-May-20
2083	Element Analyzer Conductivity - RO Concentrate Train E Unit 3	Element Analyzer Conductivity - RO Concentrate Train E Unit 3	510-E03-CPF-5101	19-Feb-20	3	MONTHS	14-May-20
3471	Element Analyzer Conductivity - RO Concentrate Train F Unit 1	Element Analyzer Conductivity - RO Concentrate Train F Unit 1	510-F01-CPF-5101	16-Jan-20	3	MONTHS	16-Apr-20
3472	Element Analyzer Conductivity - RO Concentrate Train F Unit 2	Element Analyzer Conductivity - RO Concentrate Train F Unit 2	510-F02-CPF-5101	16-Jan-20	3	MONTHS	16-Apr-20
3474	Element Analyzer Conductivity - RO Concentrate Train F Unit 3	Element Analyzer Conductivity - RO Concentrate Train F Unit 3	510-F03-CPF-5101	16-Jan-20	3	MONTHS	16-Apr-20
3479	Element Analyzer Conductivity - RO Concentrate Train G Unit 1	Element Analyzer Conductivity - RO Concentrate Train G Unit 1	510-G01-CPF-5101	16-Jan-20	3	MONTHS	16-Apr-20
3480	Element Analyzer Conductivity - RO Concentrate Train G Unit 2	Element Analyzer Conductivity - RO Concentrate Train G Unit 2	510-G02-CPF-5101	16-Jan-20	3	MONTHS	16-Apr-20
3481	Element Analyzer Conductivity - RO Concentrate Train G Unit 3	Element Analyzer Conductivity - RO Concentrate Train G Unit 3	510-G03-CPF-5101	16-Jan-20	3	MONTHS	16-Apr-20
9682	M9 Portable TOC No. 2 Replace Consumables 3 MO.	M9 Portable TOC Analyzer No. 2 Permeate	510-PIP-ROP-ROB2	30-Dec-19	3	MONTHS	23-Mar-20
2983	RO CIP TANK HEATER CONTROL PANEL A01-5201 PM	Panel Control CIP TANK HEATER CP A01	520-A01-CPE-5201	02-May-19	1	YEARS	03-May-20
2984	RO CIP TANK HEATER CONTROL PANEL A02-5201 PM	Panel Control CIP TANK HEATER CP A02	520-A02-CPE-5201	09-May-19	1	YEARS	10-May-20
2985	RO CIP TANK HEATER CONTROL PANEL B01-5201 PM	Panel Control CIP TANK HEATER CP B01	520-B01-CPE-5201	18-Jun-19	1	YEARS	17-May-20
2986	RO CIP TANK HEATER CONTROL PANEL B02-5201 PM	Panel Control CIP TANK HEATER CP B02	520-B02-CPE-5201	29-May-19	1	YEARS	24-May-20
7339	UV Transmittance Calibration Check 1 Yr. 610-AE-2220	Element Analyzer UV Transmittance - Infeed	610-UVT-2220	14-May-19	1	YEARS	15-May-20
2237	Rosemount pH analyzer annual-DPW 710-AIT-3310	Transmitter Analyzer Indicating pH	710-CPF-0008	21-Aug-19	1	YEARS	19-Aug-20
2232	Rosemount pH analyzer annual-FPW: 710-AIT-3410	Transmitter Analyzer Indicating pH	710-CPF-0009	09-Aug-19	1	YEARS	05-Aug-20
7346	3 Mo. Rosemount Chlorine Analyzer Maintenance 710-AE-3425	Element Analyzer Chlorine - Finished Product Water to PWPS	710-CPF-0009	30-Jan-20	3	MONTHS	28-Apr-20
3114	Lime Silo A01 Dust Collector Air Coils Inspection	Collector Dust Train A01	730-A01-BWR-5235	18-Dec-19	6	MONTHS	05-Jun-20
2982	Polymer Blend Controller 730-A01-FDR-7200 6 mo. PM	Polymer Blend and Feed System Train A	730-A01-FDR-7200	22-Aug-19	6	MONTHS	23-Aug-20
3116	Lime Silo A03 Dust Collector Air Coils Inspection	Collector Dust Train A03	730-A03-BWR-5235	18-Dec-19	6	MONTHS	06-Jun-20
3117	Lime Silo B01 Dust Collector Air Coils Inspection	Collector Dust Train B01	730-B01-BWR-5235	18-Dec-19	6	MONTHS	07-Jun-20
2981	Polymer Blend Controller 730-B01-FDR-7200 6 mo. PM	Polymer Blend and Feed System Train B	730-B01-FDR-7200	03-Oct-19	6	MONTHS	13-Mar-20
3118	Lime Silo B02 Dust Collector Air Coils Inspection	Collector Dust Train B02	730-B02-BWR-5235	18-Dec-19	6	MONTHS	08-Jun-20
2980	Polymer Blend Controller 730-C01-FDR-7200 - 6 mo. PM	Polymer Blend and Feed System Train C	730-C01-FDR-7200	06-Nov-19	6	MONTHS	19-Apr-20
3633	Polymer Blend Controller 730-D01-FDR-7200 6 MO. PM	Polymer Blend and Feed System Train D	730-D01-FDR-7200	18-Feb-20	6	MONTHS	08-Aug-20
9669	LOTO, Remove, Clean, and Inspect 730-A12-FE-4235	Element Flow 1" Pipe	730-DA		6	MONTHS	09-Apr-20
9668	LOTO, Remove, Clean, and Inspect 730-A11-FE-4235	Element Flow 1" Pipe	730-DA		6	MONTHS	08-Apr-20
9672	LOTO, Remove, Clean, and Inspect 730-C-11-FE-4235	Element Flow 1" Pipe	730-DA		6	MONTHS	22-Apr-20
9671	LOTO, Remove, Clean, and Inspect 730-B12-FE-4235	Element Flow 1" Pipe	730-DA		6	MONTHS	16-Apr-20
9673	LOTO, Remove, Clean, and Inspect 730-C-12-FE-4235	Element Flow 1" Pipe	730-DA		6	MONTHS	23-Apr-20
9670	LOTO, Remove, Clean, and Inspect 730-B11-FE-4235	Element Flow 1" Pipe	730-DA		6	MONTHS	15-Apr-20
2866	Calibration of O2 Analyzer 750- AE-4040	Element Analyzer Oxygen - North Building	750-CPF-0030	06-Sep-19	6	MONTHS	22-Aug-20
2867	Calibration of O2 Analyzer 750- AE-4045	Element Analyzer Oxygen - South Building	750-CPF-0030	06-Sep-19	6	MONTHS	22-Aug-20
2868	Calibration of O2 Analyzer 750- AE-4050	Element Analyzer Oxygen - North Trench	750-CPF-0030	06-Sep-19	6	MONTHS	22-Aug-20
2869	Calibration of O2 Analyzer 750- AE-4055	Element Analyzer Oxygen - South Trench	750-CPF-0030	06-Sep-19	6	MONTHS	22-Aug-20
2236	Rosemount pH analyzer annual-SAR Bypass: 805-AIT-3580	Transmitter Analyzer Indicating pH	805-CPD-0002	25-Apr-19	1	YEARS	28-Apr-20

PMNUM	MAXIMO_PM.DESCRIPTION	MAXIMO_ASSET.DESCRIPTION	LOCATION	LASTCOMPDATE	FREQUENCY	FREQUNIT	NEXTDATE
2116	Transmitter Analyzer Indicating Chlorine	Element Analyzer Chlorine - SAR Bypass	805-CPD-0002	13-Feb-20	1	WEEKS	25-Feb-20
3465	Prominent H2O2 Sensor Standardization Method	UV PRODUCT PROMINET PEROXIDE ANALYZER	805-CPD-0002	13-Feb-20	2	WEEKS	26-Feb-20
3466	Prominent H2O2 Sensor Calibration Method 1 YR	UV PRODUCT PROMINET PEROXIDE ANALYZER	805-CPD-0002	17-May-19	1	YEARS	16-May-20
3017	Surge tank level control functional check - 830-A01-TNK-3410	Tank steel 30430 gal	830-A01-TNK-3410	01-May-19	1	YEARS	29-Apr-20
2960	Surge tank level control functional check - 830-A02-TNK-3410	Tank steel 30430 gal	830-A02-TNK-3410	01-May-19	1	YEARS	29-Apr-20
2961	Surge tank level control functional check - 830-A03-TNK-3410	Tank steel 30430 gal	830-A03-TNK-3410	01-May-19	1	YEARS	29-Apr-20
2962	Surge tank level control functional check - 830-A04-TNK-3410	Tank steel 30430 gal	830-A04-TNK-3410	01-May-19	1	YEARS	29-Apr-20
2963	Surge tank level control functional check - 830-B01-TNK-3410	Tank steel 5984 gal	830-B01-TNK-3410	01-May-19	1	YEARS	29-Apr-20
7003	Replace pH probe of I&E handheld	pH meter, handheld (s/n 003366)	TOOLS	25-Sep-19	1	YEARS	22-Sep-20
7004	Replace pH probe of I&E handheld	pH meter, handheld (s/n C03416)	TOOLS	25-Sep-19	1	YEARS	22-Sep-20

Appendix E

Critical Control Points

Orange County Water District
Groundwater Replenishment System
2019 Annual Report

Figure E-1
MFF Chlorine Residual

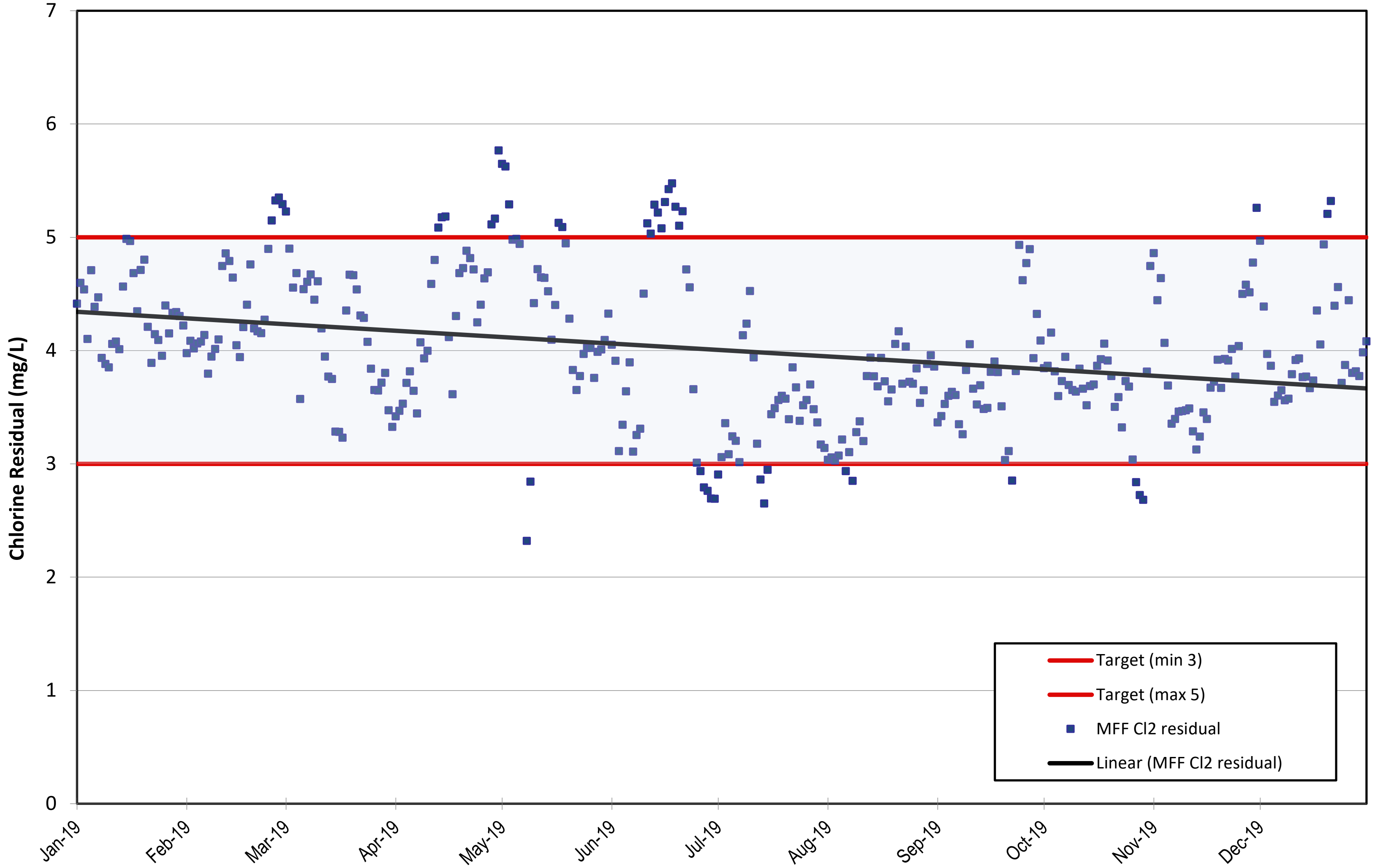


Figure E-2
ROF Chlorine Residual

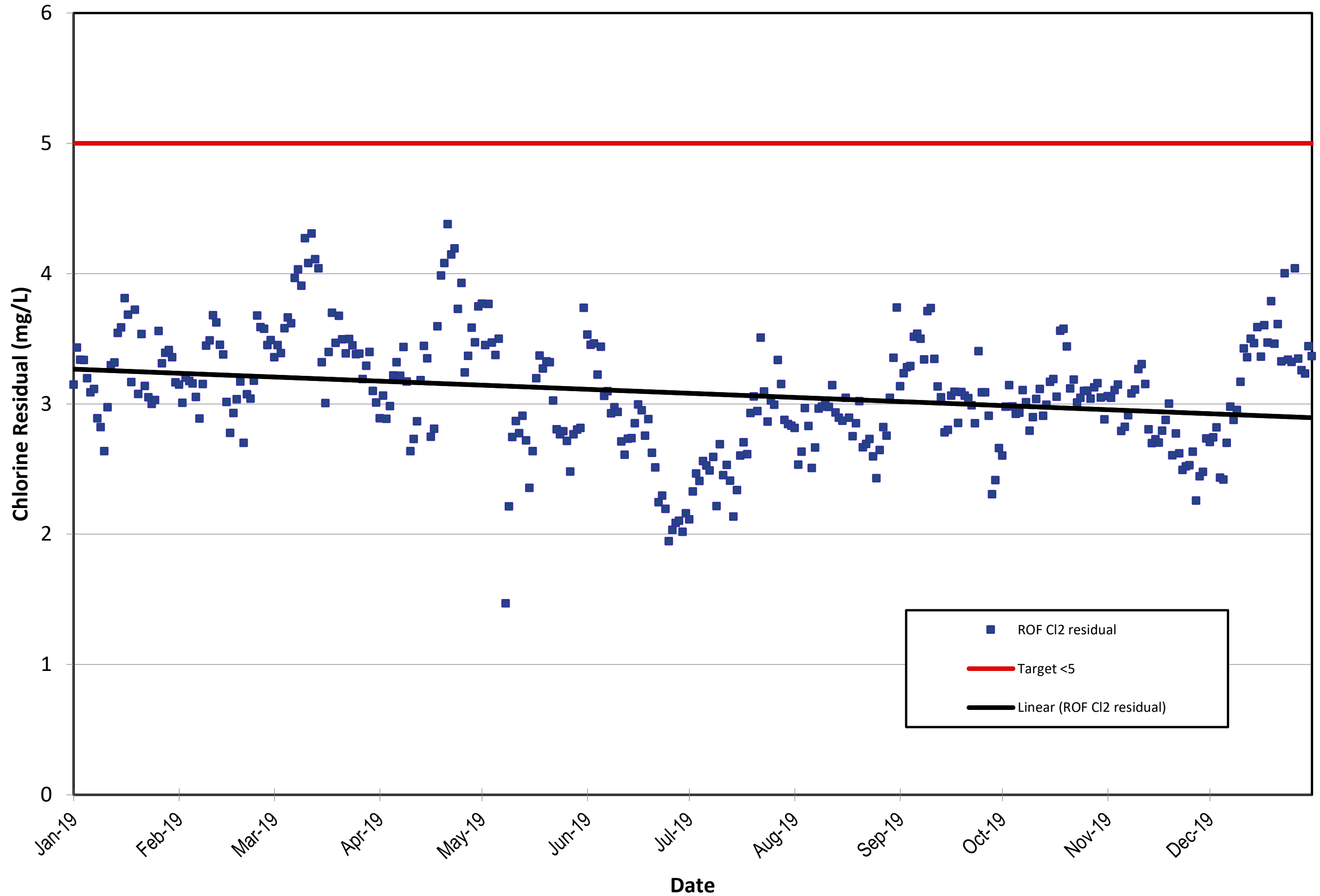


Figure E-3
MFF Turbidity

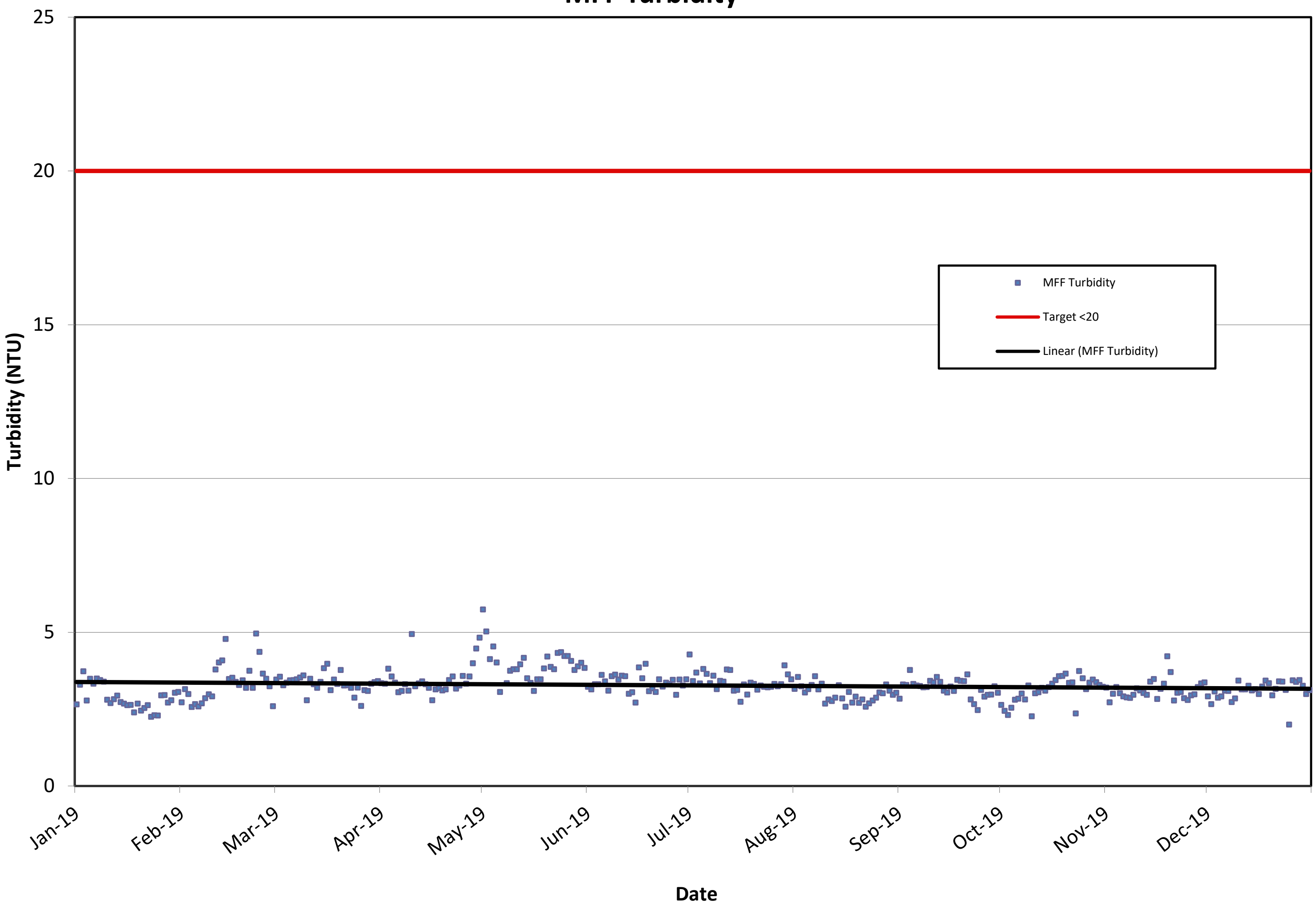


Figure E-4
MFE Turbidity

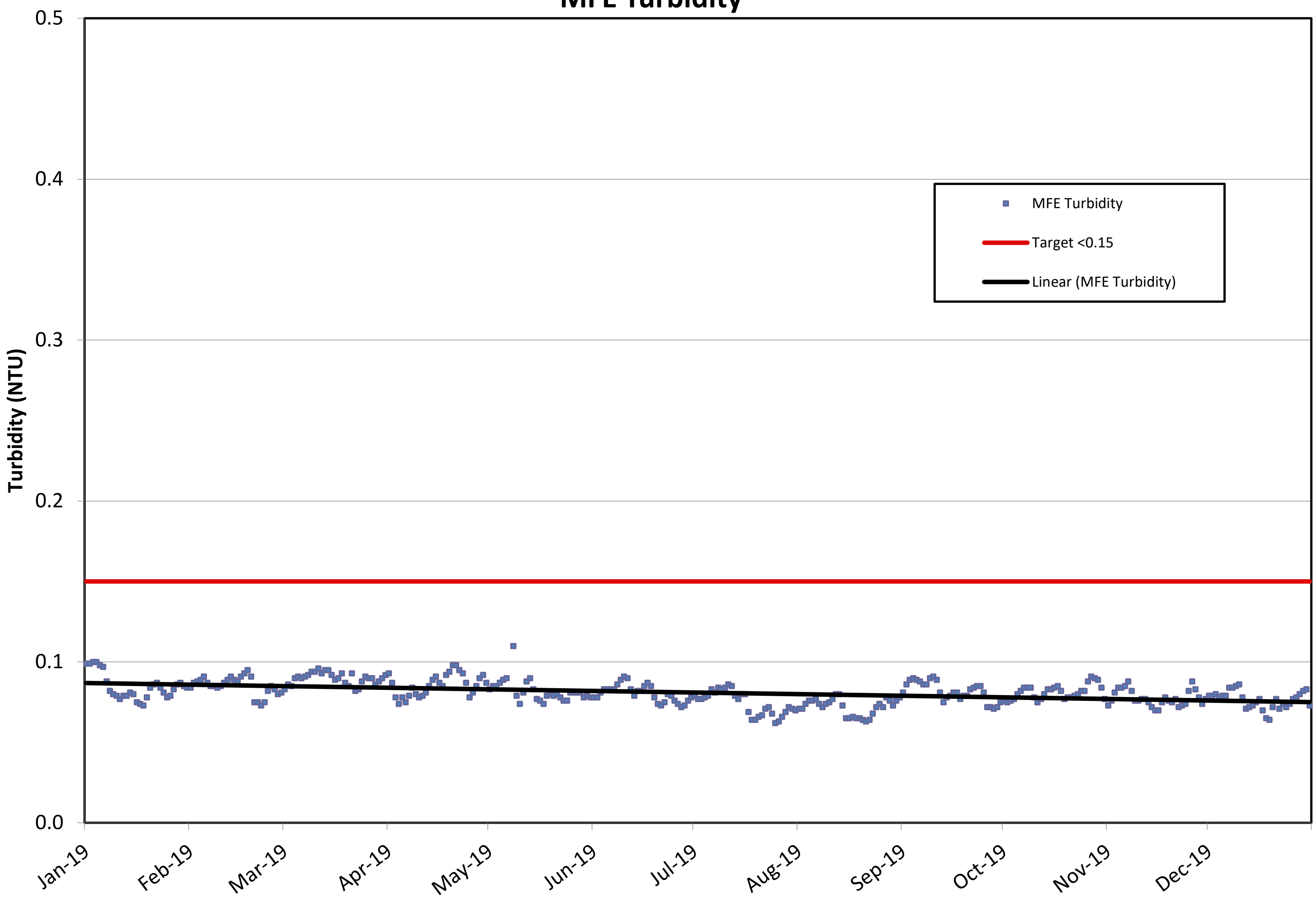
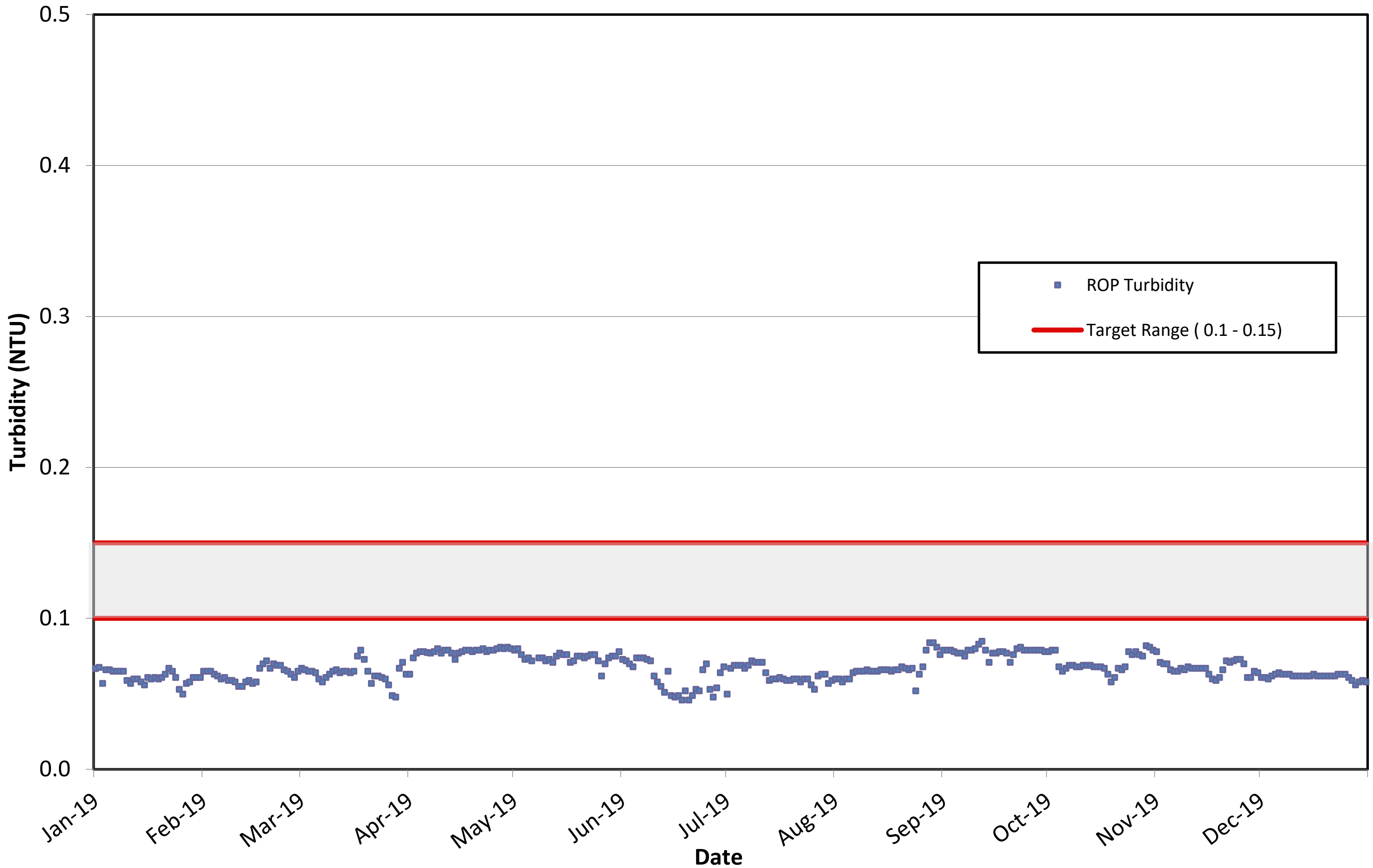


Figure E-5
ROP Turbidity[1]



[1] Turbidity shown for UVF, which is effectively ROP downstream of hydrogen peroxide addition.

Figure E-6
MF Transmembrane Pressure (TMP)
All Cells A01-E04

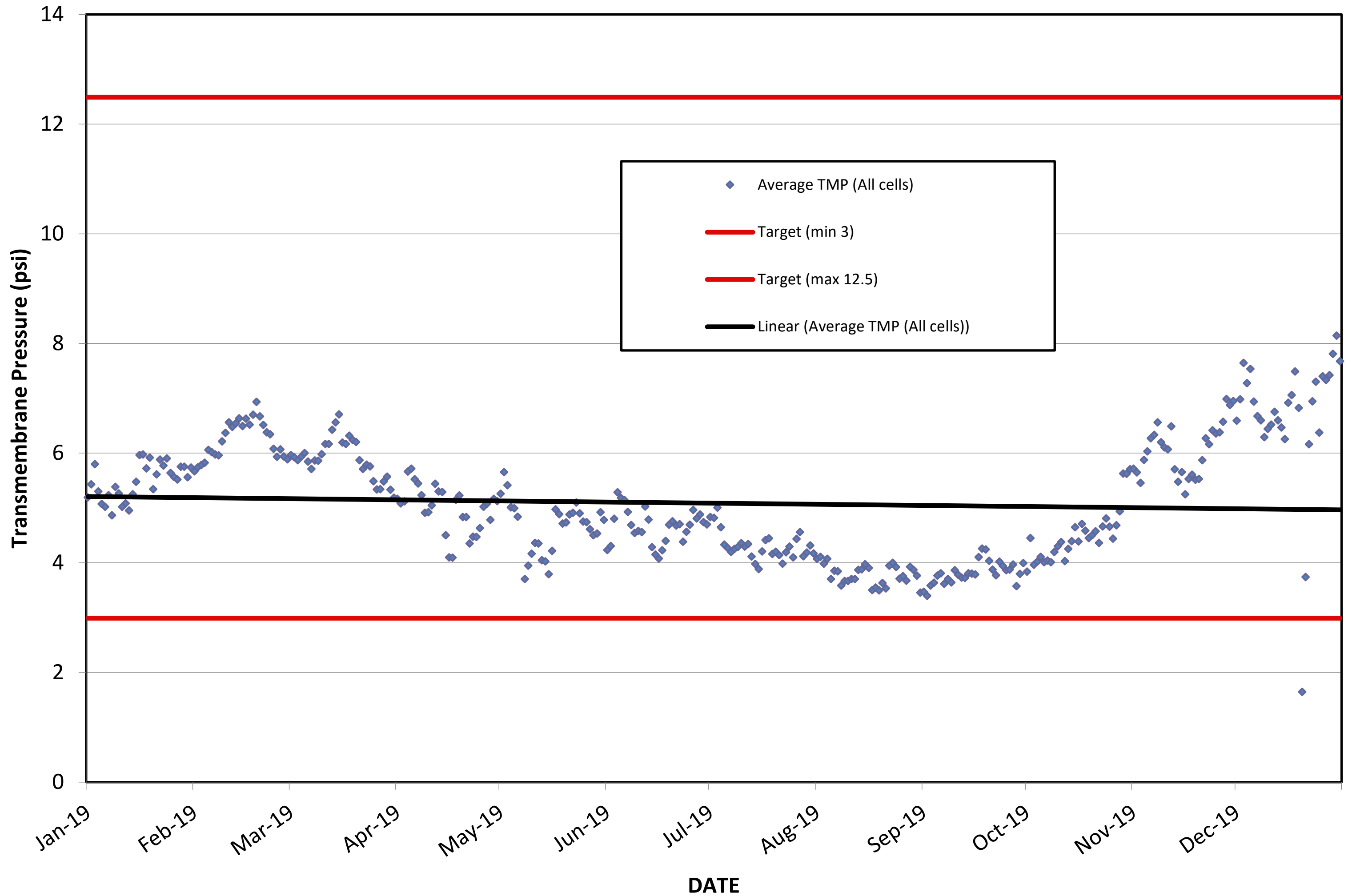


**Figure E-7
MF Pressure Decay Test (PDT)
All Cells A01-E04**

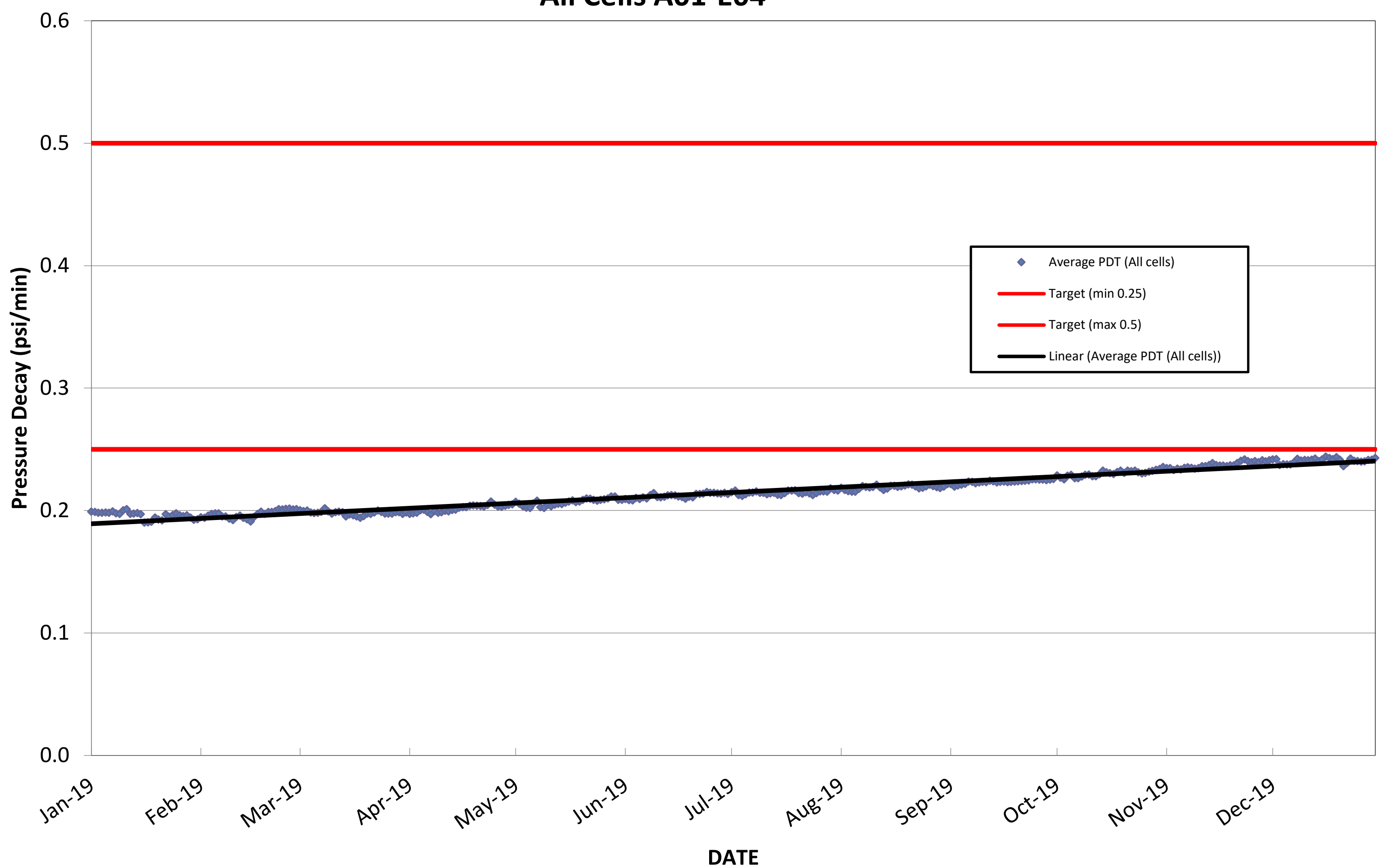
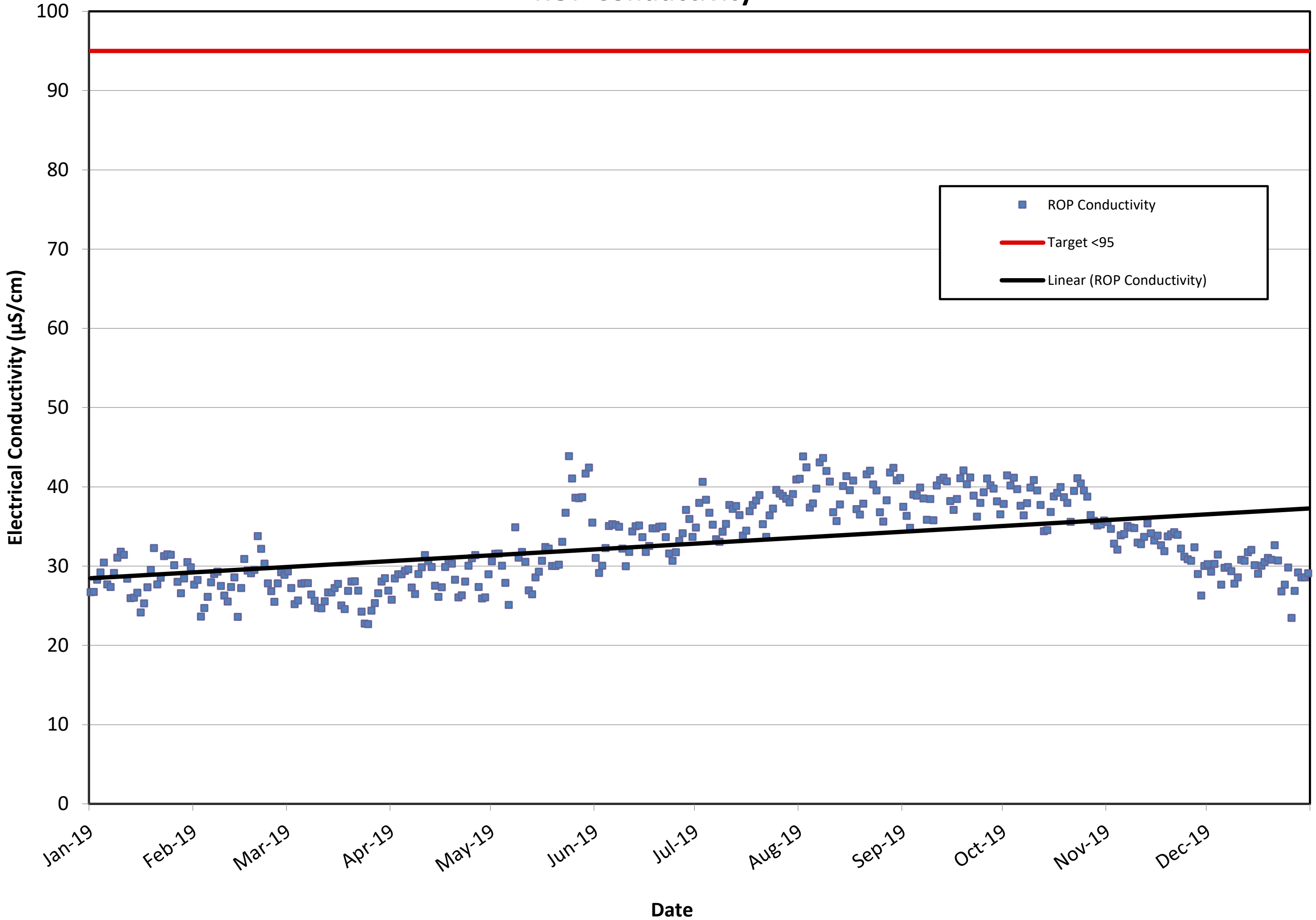


Figure E-8
ROP Conductivity[1]



[1] Electrical conductivity data for ROP are not normalized

Figure E-9
ROP Total Organic Carbon (TOC)

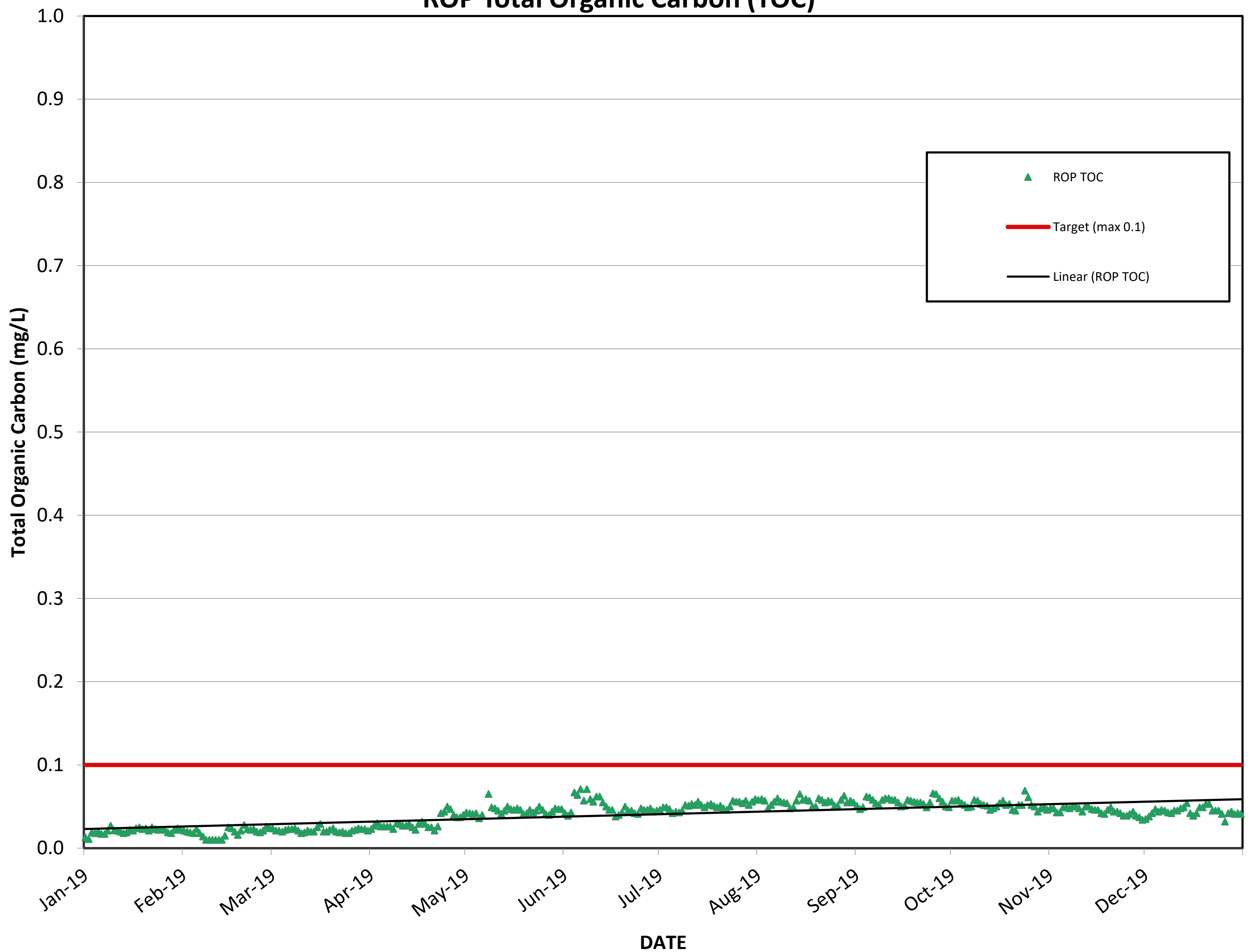
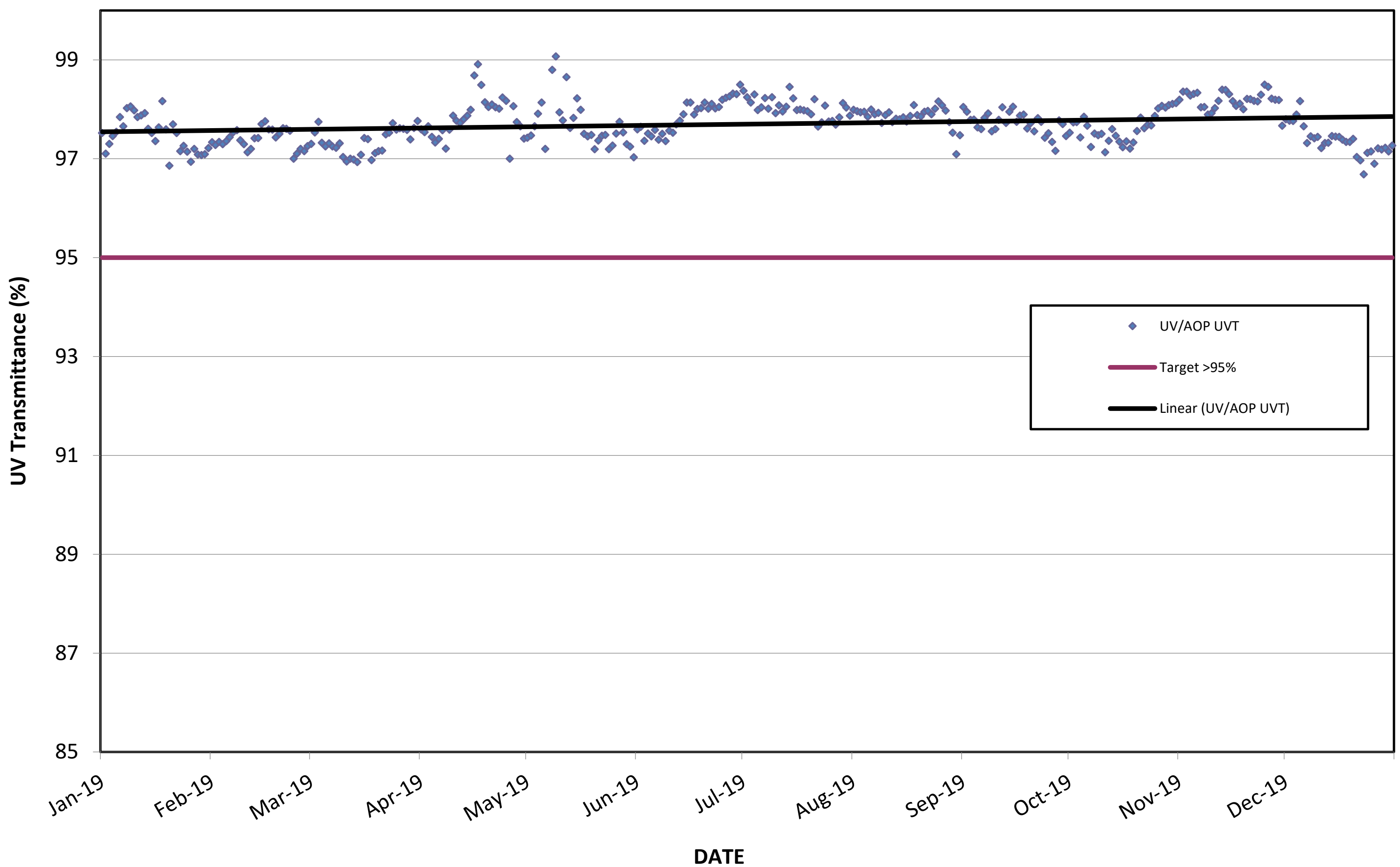


Figure E-10
UV/AOP UV Transmittance[1]



[1] UV Transmittance shown for UVF, which is effectively ROP downstream of hydrogen peroxide addition

Figure E-11
UV/AOP Electrical Energy Dose (EED)

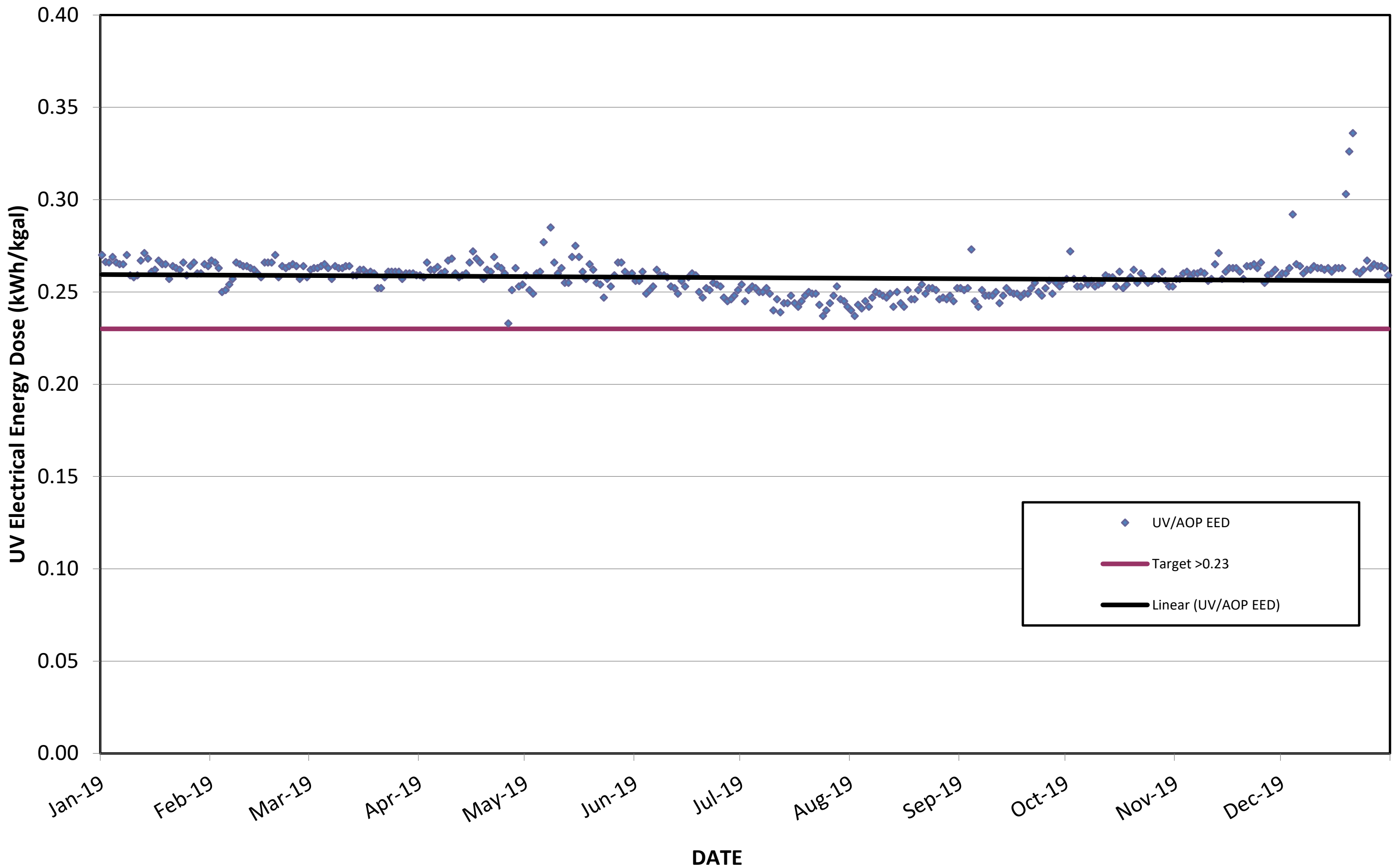


Figure E-12
UV Train Power Consumption - Average All Trains

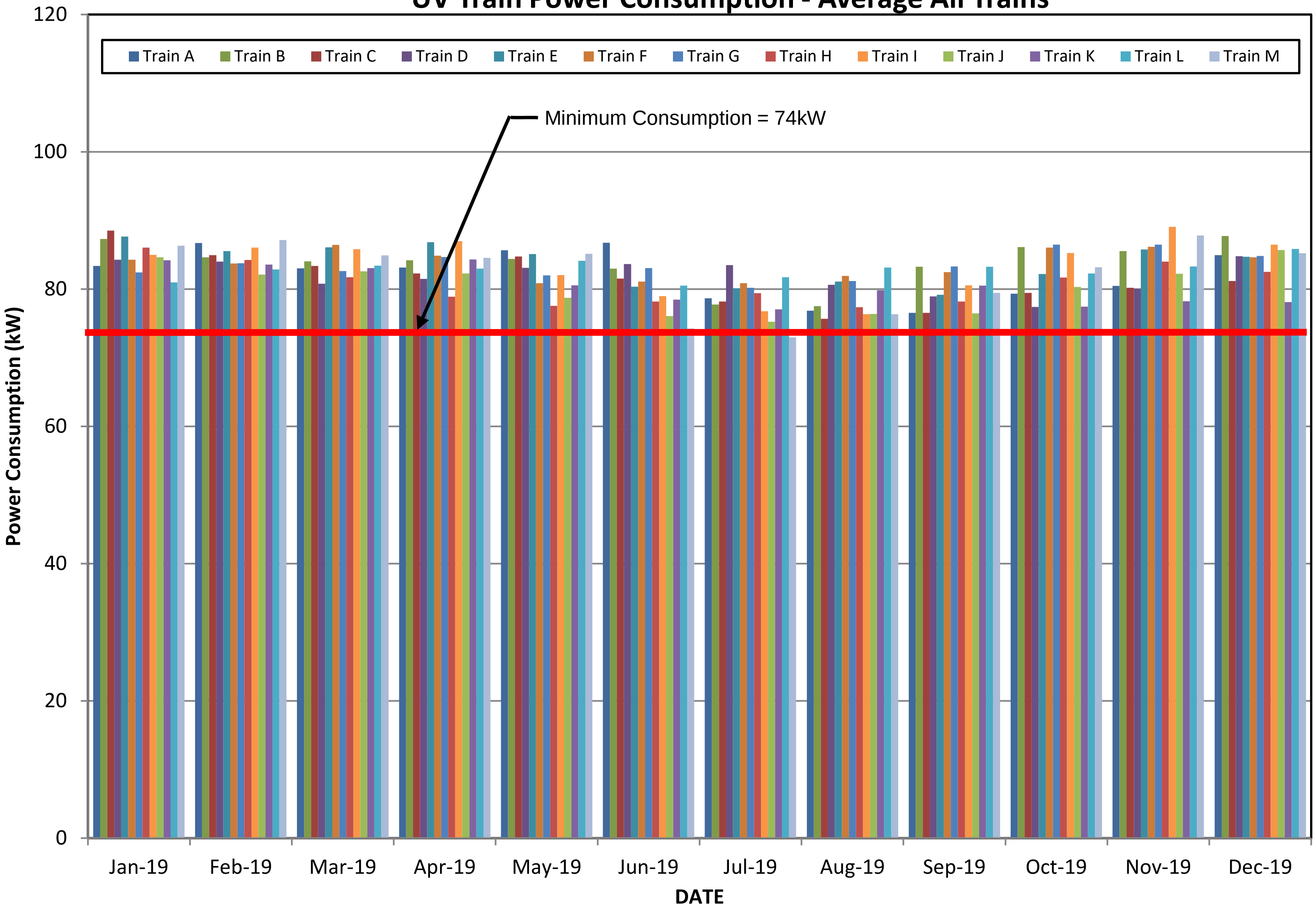


Figure E-13
UV/AOP CALCULATED UV DOSAGE PER TRAIN

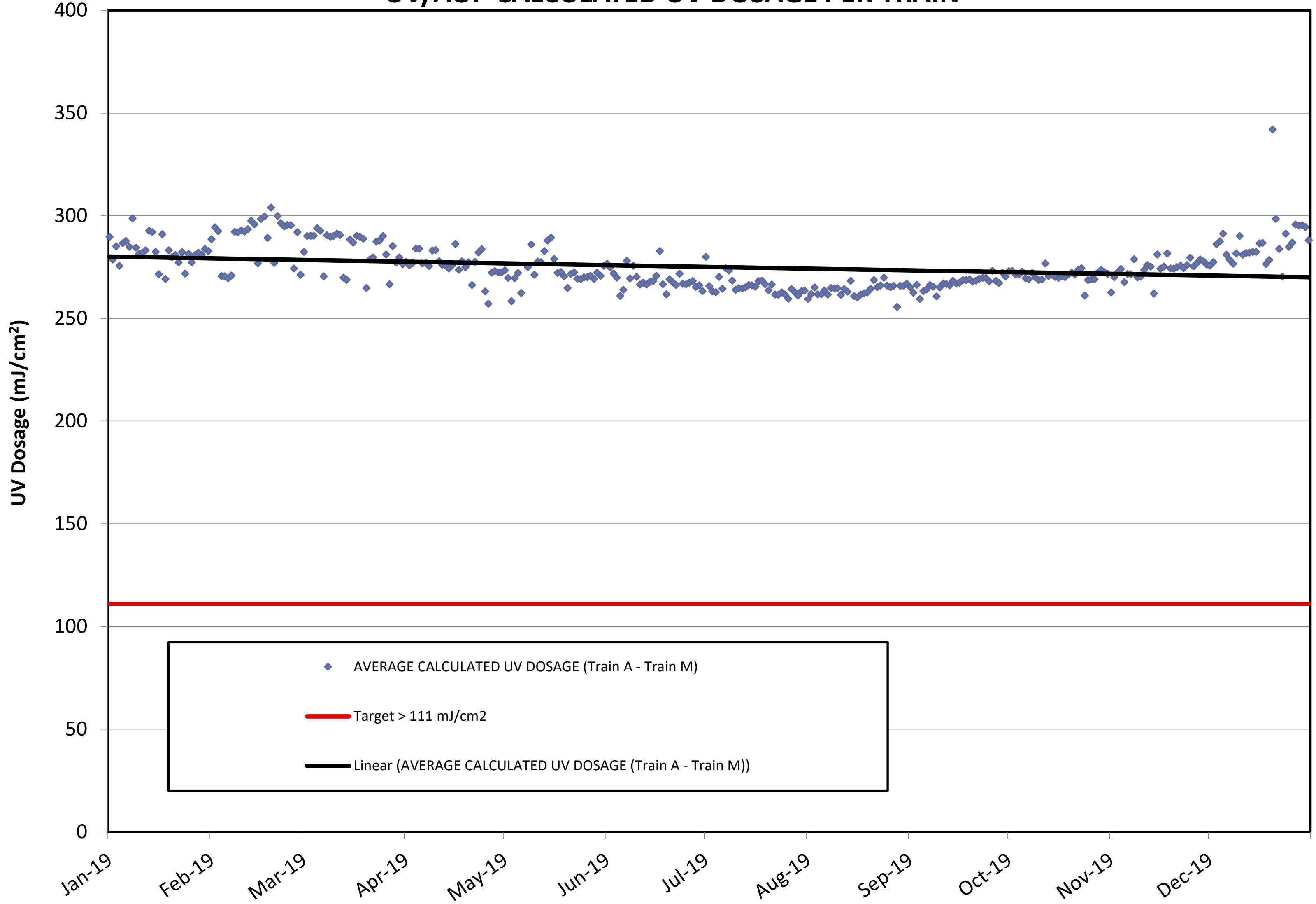
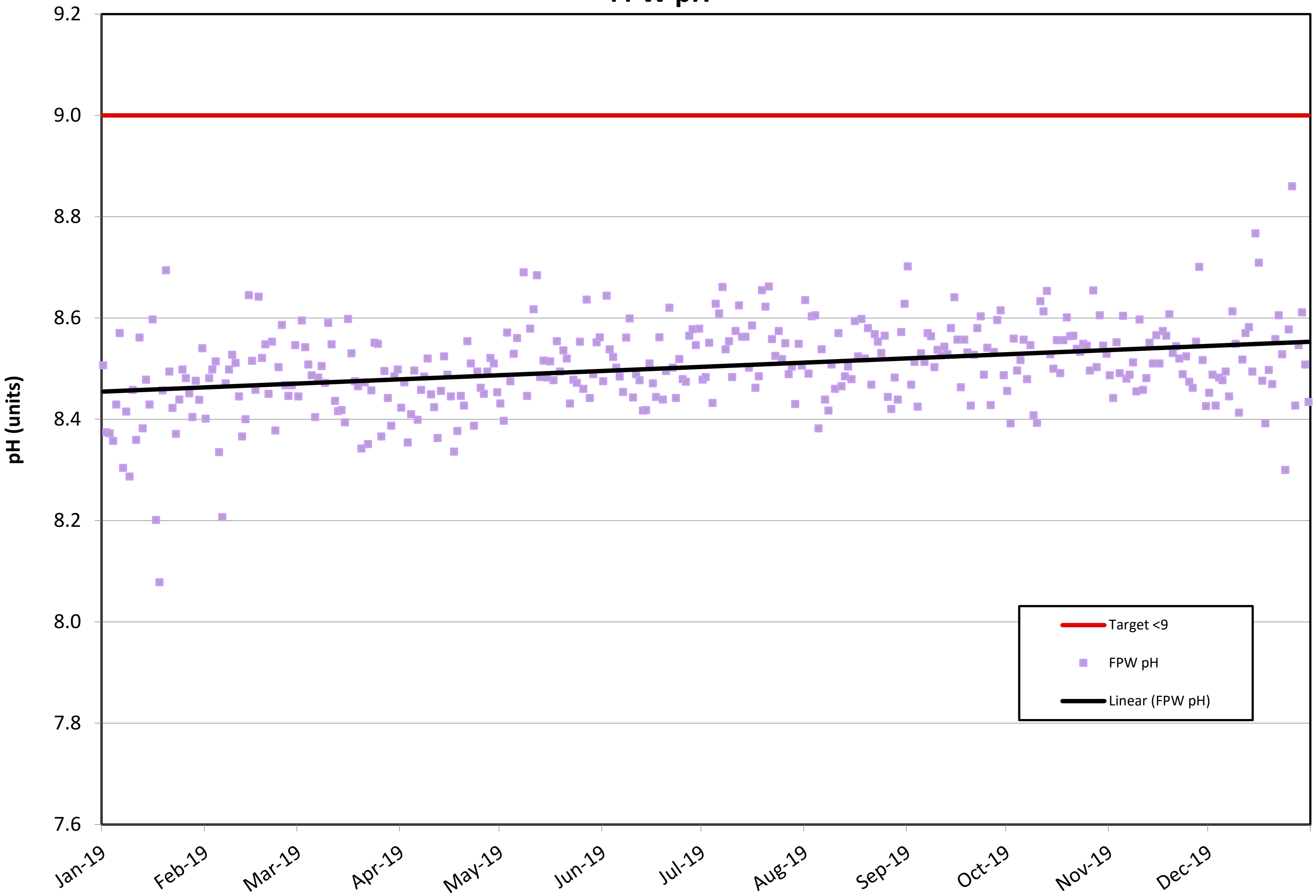


Figure E-14
FPW pH



Appendix F

Pathogenic Microorganism Reduction Reports

Orange County Water District
Groundwater Replenishment System
2019 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
01/01/19	13.14	13.14	12.76	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/02/19	13.22	13.22	12.84	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/03/19	13.04	13.04	12.63	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/04/19	13.02	13.02	12.65	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/05/19	13.00	13.00	12.58	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/06/19	13.06	13.06	12.64	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/07/19	13.11	13.11	12.69	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/08/19	12.99	12.99	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/09/19	12.89	12.89	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/10/19	12.98	12.98	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/11/19	13.00	13.00	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/12/19	12.99	12.99	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/13/19	13.05	13.05	12.62	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/14/19	13.02	13.02	12.60	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/15/19	12.94	12.94	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/16/19	12.98	12.98	12.52	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/17/19	12.90	12.90	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/18/19	12.88	12.88	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/19/19	12.91	12.91	12.50	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/20/19	12.75	12.75	12.52	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/21/19	12.95	12.95	12.54	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/22/19	12.83	12.83	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/23/19	12.77	12.77	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/24/19	12.95	12.95	12.54	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/25/19	12.95	12.95	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/26/19	12.93	12.93	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/27/19	13.00	13.00	12.63	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/28/19	13.03	13.03	12.63	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/29/19	12.91	12.91	12.54	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/30/19	12.83	12.83	12.49	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
01/31/19	12.85	12.85	12.54	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*
01/01/19	0.00	4.38	2.76	6.00	0.00	13.14
01/02/19	0.00	4.38	2.84	6.00	0.00	13.22
01/03/19	0.00	4.41	2.63	6.00	0.00	13.04
01/04/19	0.00	4.37	2.65	6.00	0.00	13.02
01/05/19	0.00	4.42	2.58	6.00	0.00	13.00
01/06/19	0.00	4.42	2.64	6.00	0.00	13.06
01/07/19	0.00	4.43	2.69	6.00	0.00	13.11
01/08/19	0.00	4.43	2.56	6.00	0.00	12.99
01/09/19	0.00	4.43	2.47	6.00	0.00	12.89
01/10/19	0.00	4.43	2.56	6.00	0.00	12.98
01/11/19	0.00	4.43	2.57	6.00	0.00	13.00
01/12/19	0.00	4.43	2.57	6.00	0.00	12.99
01/13/19	0.00	4.43	2.62	6.00	0.00	13.05
01/14/19	0.00	4.43	2.60	6.00	0.00	13.02
01/15/19	0.00	4.43	2.51	6.00	0.00	12.94
01/16/19	0.00	4.45	2.52	6.00	0.00	12.98
01/17/19	0.00	4.44	2.46	6.00	0.00	12.90
01/18/19	0.00	4.44	2.44	6.00	0.00	12.88
01/19/19	0.00	4.41	2.50	6.00	0.00	12.91
01/20/19	0.00	4.23	2.52	6.00	0.00	12.75
01/21/19	0.00	4.41	2.54	6.00	0.00	12.95
01/22/19	0.00	4.35	2.48	6.00	0.00	12.83
01/23/19	0.00	4.26	2.51	6.00	0.00	12.77
01/24/19	0.00	4.41	2.54	6.00	0.00	12.95
01/25/19	0.00	4.39	2.56	6.00	0.00	12.95
01/26/19	0.00	4.37	2.56	6.00	0.00	12.93
01/27/19	0.00	4.37	2.63	6.00	0.00	13.00
01/28/19	0.00	4.40	2.63	6.00	0.00	13.03
01/29/19	0.00	4.37	2.54	6.00	0.00	12.91
01/30/19	0.00	4.34	2.49	6.00	0.00	12.83
01/31/19	0.00	4.31	2.54	6.00	0.00	12.85

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*
01/01/19	0.00	0.00	2.76	6.00	4.00	12.76
01/02/19	0.00	0.00	2.84	6.00	4.00	12.84
01/03/19	0.00	0.00	2.63	6.00	4.00	12.63
01/04/19	0.00	0.00	2.65	6.00	4.00	12.65
01/05/19	0.00	0.00	2.58	6.00	4.00	12.58
01/06/19	0.00	0.00	2.64	6.00	4.00	12.64
01/07/19	0.00	0.00	2.69	6.00	4.00	12.69
01/08/19	0.00	0.00	2.56	6.00	4.00	12.56
01/09/19	0.00	0.00	2.47	6.00	4.00	12.47
01/10/19	0.00	0.00	2.56	6.00	4.00	12.56
01/11/19	0.00	0.00	2.57	6.00	4.00	12.57
01/12/19	0.00	0.00	2.57	6.00	4.00	12.57
01/13/19	0.00	0.00	2.62	6.00	4.00	12.62
01/14/19	0.00	0.00	2.60	6.00	4.00	12.60
01/15/19	0.00	0.00	2.51	6.00	4.00	12.51
01/16/19	0.00	0.00	2.52	6.00	4.00	12.52
01/17/19	0.00	0.00	2.46	6.00	4.00	12.46
01/18/19	0.00	0.00	2.44	6.00	4.00	12.44
01/19/19	0.00	0.00	2.50	6.00	4.00	12.50
01/20/19	0.00	0.00	2.52	6.00	4.00	12.52
01/21/19	0.00	0.00	2.54	6.00	4.00	12.54
01/22/19	0.00	0.00	2.48	6.00	4.00	12.48
01/23/19	0.00	0.00	2.51	6.00	4.00	12.51
01/24/19	0.00	0.00	2.54	6.00	4.00	12.54
01/25/19	0.00	0.00	2.56	6.00	4.00	12.56
01/26/19	0.00	0.00	2.56	6.00	4.00	12.56
01/27/19	0.00	0.00	2.63	6.00	4.00	12.63
01/28/19	0.00	0.00	2.63	6.00	4.00	12.63
01/29/19	0.00	0.00	2.54	6.00	4.00	12.54
01/30/19	0.00	0.00	2.49	6.00	4.00	12.49
01/31/19	0.00	0.00	2.54	6.00	4.00	12.54

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
01/01/19	4.96	5.01	4.98	4.83	4.90	4.90	4.80	4.73	4.66	4.66	4.59	4.87	4.60	4.53	4.38	4.60
01/02/19	4.91	4.94	5.04	4.75	4.93	4.91	4.93	4.68	4.64	4.66	4.59	4.86	4.60	4.51	4.38	4.61
01/03/19	4.84	4.91	4.95	4.77	4.89	4.80	4.99	4.84	4.62	4.58	4.73	4.83	4.56	4.49	4.50	4.58
01/04/19	4.92	4.94	5.01	4.70	4.86	4.83	4.90	4.82	4.62	4.61	4.74	4.81	4.57	4.44	4.53	4.58
01/05/19	4.92	4.99	4.95	4.78	4.90	4.86	4.91	4.82	4.62	4.64	4.74	4.83	4.56	4.44	4.53	4.58
01/06/19	4.89	4.99	5.05	4.81	4.97	4.84	4.89	4.87	4.67	4.61	4.74	4.79	4.55	4.42	4.53	4.58
01/07/19	4.89	4.93	4.97	4.80	4.91	4.82	4.91	4.87	4.60	4.58	4.74	4.82	4.52	4.56	4.54	4.57
01/08/19	4.85	4.92	4.96	4.73	4.92	4.79	4.93	4.83	4.59	4.56	4.74	5.01	4.52	4.65	4.54	4.55
01/09/19	4.93	4.94	5.00	4.72	4.89	4.80	4.90	4.84	4.61	4.56	4.72	5.02	4.52	4.60	4.54	4.52
01/10/19	4.87	4.77	4.93	4.64	4.92	4.76	4.90	4.84	4.59	4.52	4.71	4.99	4.46	4.56	4.51	4.51
01/11/19	4.88	4.81	4.95	4.66	4.96	4.79	4.90	4.81	4.58	4.50	4.68	4.97	4.44	4.55	4.52	4.53
01/12/19	4.92	4.83	4.94	4.72	4.93	4.79	4.91	4.79	4.59	4.53	4.83	4.96	4.64	4.54	4.52	4.51
01/13/19	4.81	4.88	4.91	4.63	4.90	4.76	4.92	4.77	4.56	4.48	4.85	4.94	4.73	4.55	4.50	4.48
01/14/19	4.89	4.88	4.95	4.58	4.90	4.77	4.88	4.80	4.51	4.53	4.85	4.92	4.71	4.57	4.51	4.47
01/15/19	4.87	4.83	4.85	4.57	4.88	4.78	4.86	4.76	4.45	4.50	4.81	4.90	4.69	4.52	4.48	4.64
01/16/19	4.79	4.84	4.80	4.66	4.87	4.78	4.83	4.75	4.49	4.45	4.81	4.92	4.68	4.47	4.46	4.69
01/17/19	4.77	4.79	4.84	4.61	4.87	4.78	4.83	4.76	4.49	4.48	4.82	4.93	4.65	4.49	4.44	4.67
01/18/19	4.81	4.74	4.85	4.56	4.86	4.75	4.80	4.74	4.44	4.50	4.82	4.89	4.66	4.49	4.44	4.64
01/19/19	4.84	4.73	4.83	4.60	4.85	4.76	4.81	4.71	4.41	4.50	4.80	4.91	4.68	4.49	4.44	4.63
01/20/19	4.84	4.75	4.85	4.58	4.81	4.75	4.79	4.73	4.41	4.47	4.79	4.90	4.70	4.49	4.45	4.63
01/21/19	4.82	4.79	4.87	4.85	4.80	4.78	4.83	4.72	4.41	4.49	4.77	4.91	4.68	4.49	4.45	4.65
01/22/19	4.77	4.97	4.79	4.76	4.78	4.71	4.85	4.74	4.39	4.45	4.78	4.87	4.65	4.44	4.43	4.63
01/23/19	4.80	4.99	4.78	4.81	4.97	4.70	4.85	4.72	4.56	4.43	4.81	4.85	4.64	4.42	4.43	4.59
01/24/19	4.75	4.98	4.73	4.81	4.97	4.66	4.81	4.69	4.67	4.43	4.77	4.83	4.63	4.43	4.41	4.60
01/25/19	4.75	4.89	4.71	4.72	4.94	4.68	4.80	4.67	4.61	4.62	4.77	4.81	4.62	4.42	4.39	4.58
01/26/19	4.80	4.98	5.08	4.73	4.97	4.88	4.78	4.70	4.59	4.66	4.76	4.81	4.61	4.45	4.37	4.55
01/27/19	4.96	4.86	4.94	4.79	4.90	4.83	4.78	4.71	4.59	4.59	4.72	4.81	4.58	4.44	4.37	4.57
01/28/19	4.86	4.89	4.99	4.71	4.90	4.80	4.93	4.67	4.61	4.59	4.69	4.82	4.55	4.42	4.53	4.57
01/29/19	4.91	4.83	4.99	4.67	4.90	4.80	4.93	4.78	4.55	4.59	4.86	4.82	4.55	4.37	4.56	4.57
01/30/19	4.91	4.83	4.95	4.74	4.87	4.79	4.89	4.83	4.56	4.54	4.90	4.81	4.55	4.34	4.53	4.56
01/31/19	4.90	4.88	4.95	4.75	4.90	4.78	4.84	4.76	4.58	4.59	4.89	4.77	4.55	4.31	4.53	4.53

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
01/01/19	4.49	4.58	4.67	4.52	4.59	4.50	4.62	4.58	4.91	4.68	4.63	4.72	4.92	4.51	4.69	4.73
01/02/19	4.51	4.57	4.69	4.48	4.56	4.49	4.78	4.57	4.92	4.68	4.63	4.74	4.96	4.53	4.76	4.72
01/03/19	4.51	4.53	4.63	4.43	4.59	4.59	4.72	4.58	4.91	4.76	4.62	4.68	4.82	4.52	4.71	4.69
01/04/19	4.46	4.49	4.59	4.44	4.59	4.71	4.66	4.55	4.89	4.87	4.59	4.68	4.85	4.50	4.67	4.76
01/05/19	4.66	4.49	4.57	4.42	4.56	4.69	4.65	4.55	4.88	4.86	4.62	4.67	4.87	4.52	4.68	4.99
01/06/19	4.76	4.50	4.56	4.57	4.55	4.68	4.66	4.56	4.84	4.87	4.62	4.67	4.85	4.57	4.70	4.91
01/07/19	4.71	4.48	4.55	4.69	4.55	4.63	4.65	4.55	4.84	4.83	4.63	4.67	4.82	4.65	4.70	4.91
01/08/19	4.72	4.69	4.55	4.68	4.51	4.61	4.64	4.54	4.87	4.84	4.61	4.64	4.81	4.65	4.66	4.92
01/09/19	4.74	4.76	4.68	4.66	4.49	4.60	4.63	4.50	4.85	4.81	4.57	4.60	4.82	4.60	4.62	4.89
01/10/19	4.74	4.73	4.81	4.62	4.70	4.61	4.60	4.64	4.86	4.76	4.57	4.54	4.79	4.69	4.60	4.86
01/11/19	4.72	4.71	4.78	4.62	4.85	4.63	4.57	4.78	4.84	4.77	4.56	4.63	4.80	4.73	4.64	4.87
01/12/19	4.65	4.70	4.76	4.59	4.75	4.61	4.53	4.75	4.86	4.80	4.56	4.76	4.86	4.68	4.61	4.86
01/13/19	4.64	4.71	4.78	4.62	4.76	4.65	4.57	4.74	4.89	4.78	4.64	4.78	4.96	4.63	4.71	4.86
01/14/19	4.67	4.73	4.76	4.61	4.76	4.63	4.57	4.70	4.83	4.73	4.73	4.78	4.93	4.65	4.83	4.82
01/15/19	4.63	4.68	4.76	4.59	4.73	4.57	4.54	4.68	4.79	4.75	4.68	4.74	4.95	4.65	4.76	4.78
01/16/19	4.61	4.62	4.77	4.58	4.69	4.54	4.52	4.68	4.79	4.75	4.70	4.75	4.96	4.69	4.75	4.78
01/17/19	4.57	4.63	4.74	4.53	4.64	4.51	4.45	4.65	4.77	4.74	4.68	4.73	4.98	4.69	4.74	4.79
01/18/19	4.60	4.64	4.75	4.53	4.66	4.50	4.46	4.68	4.80	4.74	4.65	4.73	4.98	4.66	4.79	4.81
01/19/19	4.62	4.61	4.71	4.53	4.67	4.50	4.51	4.65	4.81	4.74	4.68	4.75	4.95	4.60	4.80	4.79
01/20/19	4.61	4.61	4.69	4.53	4.63	4.51	4.51	4.63	4.75	4.72	4.66	4.72	4.89	4.57	4.75	4.78
01/21/19	4.60	4.62	4.71	4.55	4.64	4.51	4.51	4.67	4.76	4.73	4.65	4.73	4.94	4.64	4.76	4.79
01/22/19	4.57	4.63	4.68	4.49	4.66	4.49	4.49	4.65	4.77	4.73	4.65	4.73	4.92	4.62	4.78	4.75
01/23/19	4.55	4.63	4.65	4.45	4.66	4.46	4.46	4.61	4.73	4.70	4.63	4.70	4.90	4.58	4.74	4.76
01/24/19	4.55	4.59	4.64	4.47	4.64	4.45	4.45	4.61	4.68	4.66	4.63	4.70	4.93	4.60	4.73	4.79
01/25/19	4.53	4.56	4.65	4.42	4.62	4.42	4.41	4.61	4.79	4.67	4.64	4.71	4.91	4.57	4.73	4.77
01/26/19	4.52	4.52	4.66	4.42	4.59	4.40	4.39	4.58	4.97	4.67	4.61	4.72	4.84	4.57	4.72	4.75
01/27/19	4.49	4.52	4.62	4.43	4.54	4.43	4.56	4.51	4.92	4.65	4.62	4.68	4.84	4.57	4.73	4.71
01/28/19	4.48	4.51	4.62	4.40	4.50	4.43	4.70	4.49	4.91	4.61	4.63	4.65	4.88	4.55	4.69	4.69
01/29/19	4.48	4.49	4.62	4.37	4.55	4.56	4.64	4.53	4.89	4.70	4.63	4.64	4.90	4.49	4.66	4.72
01/30/19	4.45	4.48	4.59	4.37	4.54	4.66	4.63	4.52	4.93	4.85	4.61	4.66	4.85	4.55	4.65	4.77
01/31/19	4.42	4.44	4.59	4.53	4.45	4.58	4.66	4.49	4.95	4.79	4.60	4.65	4.85	4.62	4.67	4.86

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												
01/01/19	4.65	4.82	4.50	5.32												
01/02/19	4.65	4.84	4.45	5.20												
01/03/19	4.62	4.88	4.41	5.17												
01/04/19	4.69	4.87	4.37	5.00												
01/05/19	4.75	4.89	4.42	5.21												
01/06/19	4.73	4.84	4.44	5.32												
01/07/19	4.57	4.79	4.43	5.23												
01/08/19	4.48	4.78	4.43	5.00												
01/09/19	4.60	4.80	4.43	5.01												
01/10/19	4.47	4.80	4.43	5.07												
01/11/19	4.48	4.76	4.43	5.06												
01/12/19	4.55	4.78	4.43	5.20												
01/13/19	4.57	4.73	4.43	5.19												
01/14/19	4.63	4.75	4.43	4.99												
01/15/19	4.60	4.70	4.43	5.09												
01/16/19	4.49	4.74	4.63	5.01												
01/17/19	4.55	4.68	5.27	5.11												
01/18/19	4.55	4.66	5.22	5.16												
01/19/19	4.41	4.69	5.22	4.88												
01/20/19	4.23	4.71	5.21	5.00												
01/21/19	4.58	4.71	5.16	5.18												
01/22/19	4.35	4.72	5.14	4.96												
01/23/19	4.26	4.90	5.25	5.03												
01/24/19	4.49	4.83	5.17	5.40												
01/25/19	4.40	4.82	5.12	5.21												
01/26/19	4.41	4.85	5.13	5.31												
01/27/19	4.40	4.83	5.09	5.28												
01/28/19	4.55	4.84	5.04	5.27												
01/29/19	4.58	4.82	4.97	5.32												
01/30/19	4.61	4.77	4.99	5.44												
01/31/19	4.78	4.82	4.97	5.19												

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 avg	A01-A04 max	A05-A08 avg	A05-A08 max	B01-B04 avg	B01-B04 max	B05-B08 avg	B05-B08 max	C01-C04 avg	C01-C04 max	C05-C08 avg	C05-C08 max	D01-D04 avg	D01-D04 max	D05-D08 avg	D05-D08 max	E01-E04 avg	E01-E04 max	MFE avg
01/01/19	0.08	0.09	0.10	0.11	0.09	0.10	0.09	0.10	0.11	0.19	0.15	0.18	0.11	0.18	0.10	0.10	0.05	0.06	0.10
01/02/19	0.09	0.10	0.10	0.11	0.09	0.10	0.10	0.10	0.11	0.15	0.15	0.16	0.11	0.23*	0.10	0.11	0.05	0.06	0.10
01/03/19	0.08	0.09	0.11	0.11	0.10	0.11	0.10	0.10	0.11	0.13	0.15	0.21*	0.10	0.11	0.10	0.11	0.05	0.06	0.10
01/04/19	0.08	0.09	0.10	0.11	0.09	0.10	0.09	0.10	0.11	0.15	0.15	0.17	0.11	0.11	0.10	0.11	0.05	0.06	0.10
01/05/19	0.08	0.09	0.10	0.11	0.09	0.10	0.09	0.10	0.11	0.14	0.16	0.17	0.10	0.11	0.10	0.10	0.05	0.06	0.10
01/06/19	0.08	0.09	0.10	0.10	0.09	0.09	0.09	0.09	0.11	0.13	0.15	0.16	0.10	0.12	0.10	0.10	0.05	0.05	0.10
01/07/19	0.08	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.08	0.12	0.11	0.15	0.10	0.11	0.10	0.10	0.05	0.06	0.09
01/08/19	0.08	0.09	0.10	0.10	0.09	0.10	0.09	0.09	0.06	0.07	0.06	0.08	0.12	0.13	0.10	0.10	0.05	0.06	0.08
01/09/19	0.07	0.09	0.09	0.10	0.09	0.10	0.10	0.11	0.06	0.07	0.07	0.09	0.10	0.13	0.10	0.10	0.05	0.05	0.08
01/10/19	0.08	0.09	0.09	0.10	0.09	0.10	0.10	0.11	0.06	0.10	0.07	0.14	0.07	0.08	0.10	0.10	0.04	0.05	0.08
01/11/19	0.07	0.08	0.09	0.10	0.09	0.09	0.10	0.11	0.07	0.08	0.07	0.08	0.06	0.06	0.10	0.10	0.05	0.05	0.08
01/12/19	0.07	0.08	0.09	0.10	0.09	0.09	0.10	0.10	0.07	0.08	0.07	0.08	0.07	0.08	0.10	0.10	0.05	0.05	0.08
01/13/19	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.07	0.09	0.07	0.09	0.08	0.08	0.09	0.10	0.04	0.05	0.08
01/14/19	0.09	0.12	0.09	0.09	0.09	0.09	0.10	0.10	0.08	0.09	0.07	0.08	0.08	0.10	0.10	0.10	0.04	0.05	0.08
01/15/19	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.11	0.07	0.11	0.07	0.15	0.09	0.09	0.09	0.10	0.04	0.05	0.08
01/16/19	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.05	0.05	0.07	0.07	0.08	0.09	0.09	0.10	0.04	0.05	0.07
01/17/19	0.09	0.10	0.08	0.09	0.09	0.09	0.09	0.09	0.05	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.04	0.05	0.07
01/18/19	0.09	0.09	0.08	0.08	0.09	0.09	0.09	0.10	0.05	0.06	0.07	0.08	0.07	0.08	0.08	0.09	0.04	0.04	0.07
01/19/19	0.09	0.10	0.08	0.09	0.09	0.09	0.10	0.10	0.06	0.06	0.08	0.09	0.07	0.08	0.09	0.09	0.04	0.05	0.08
01/20/19	0.09	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.06	0.07	0.10	0.10	0.09	0.10	0.09	0.09	0.05	0.08	0.08
01/21/19	0.10	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.06	0.07	0.10	0.11	0.09	0.10	0.09	0.09	0.05	0.05	0.09
01/22/19	0.09	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.07	0.08	0.11	0.12	0.10	0.10	0.09	0.09	0.05	0.06	0.09
01/23/19	0.07	0.10	0.09	0.10	0.10	0.11	0.10	0.11	0.06	0.08	0.09	0.12	0.09	0.10	0.09	0.10	0.06	0.07	0.08
01/24/19	0.06	0.07	0.09	0.10	0.10	0.11	0.10	0.11	0.07	0.09	0.07	0.08	0.08	0.09	0.09	0.10	0.06	0.06	0.08
01/25/19	0.06	0.07	0.08	0.09	0.10	0.11	0.10	0.10	0.07	0.08	0.08	0.08	0.07	0.08	0.09	0.10	0.06	0.06	0.08
01/26/19	0.06	0.07	0.09	0.09	0.10	0.10	0.09	0.09	0.07	0.10	0.09	0.09	0.07	0.12	0.09	0.10	0.06	0.06	0.08
01/27/19	0.07	0.08	0.09	0.10	0.10	0.10	0.09	0.09	0.08	0.08	0.10	0.11	0.08	0.09	0.10	0.10	0.06	0.06	0.08
01/28/19	0.08	0.08	0.09	0.10	0.10	0.10	0.09	0.09	0.08	0.08	0.11	0.12	0.07	0.08	0.10	0.10	0.06	0.06	0.09
01/29/19	0.07	0.08	0.09	0.10	0.09	0.10	0.09	0.09	0.08	0.08	0.11	0.13	0.08	0.09	0.09	0.10	0.06	0.07	0.09
01/30/19	0.07	0.08	0.09	0.10	0.09	0.10	0.09	0.09	0.08	0.08	0.12	0.13	0.08	0.09	0.09	0.10	0.05	0.06	0.09
01/31/19	0.06	0.06	0.08	0.08	0.09	0.09	0.09	0.09	0.08	0.09	0.12	0.13	0.09	0.10	0.09	0.09	0.05	0.06	0.08

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

* Maximum values observed while cell out of service for daily PDT.

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
01/01/19	0.070	0.071	7.202	6.755	8.668	0.013	0.006	0.023	1,559	1,499	1,613	26	23	28	99.83	2.76	98.36	1.79
01/02/19	0.067	0.070	7.277	6.533	8.493	0.011	0.005	0.020	1,544	1,476	1,643	27	25	31	99.85	2.84	98.27	1.76
01/03/19	0.056	0.065	7.966	7.223	8.797	0.019	0.009	0.029	1,698	1,596	1,828	28	26	32	99.77	2.63	98.34	1.78
01/04/19	0.066	0.071	7.822	7.024	8.686	0.017	0.007	0.027	1,766	1,684	1,845	29	25	33	99.78	2.65	98.35	1.78
01/05/19	0.067	0.068	7.898	7.140	8.932	0.021	0.015	0.030	1,787	1,736	1,863	31	28	34	99.74	2.58	98.29	1.77
01/06/19	0.065	0.066	7.703	7.151	8.403	0.018	0.013	0.021	1,670	1,596	1,771	28	25	32	99.77	2.64	98.33	1.78
01/07/19	0.065	0.065	7.623	6.773	8.531	0.016	0.011	0.022	1,647	1,529	1,831	27	23	33	99.79	2.69	98.35	1.78
01/08/19	0.065	0.066	7.745	6.987	8.696	0.021	0.014	0.028	1,758	1,697	1,833	29	26	33	99.72	2.56	98.34	1.78
01/09/19	0.065	0.065	8.045	7.143	9.564	0.028	0.019	0.045	1,797	1,715	1,914	31	28	34	99.66	2.47	98.27	1.76
01/10/19	0.060	0.063	7.696	7.176	8.339	0.021	0.018	0.026	1,851	1,782	1,929	32	29	35	99.72	2.56	98.28	1.77
01/11/19	0.057	0.059	7.470	6.940	8.132	0.020	0.015	0.024	1,826	1,768	1,902	32	30	34	99.73	2.57	98.27	1.76
01/12/19	0.060	0.060	7.517	6.975	8.177	0.020	0.014	0.027	1,761	1,659	1,836	29	27	32	99.73	2.57	98.37	1.79
01/13/19	0.059	0.060	7.264	6.722	7.909	0.017	0.010	0.023	1,632	1,564	1,685	26	24	29	99.76	2.62	98.41	1.80
01/14/19	0.059	0.059	7.299	6.692	7.891	0.018	0.011	0.025	1,630	1,561	1,717	26	24	29	99.75	2.60	98.41	1.80
01/15/19	0.056	0.057	7.238	6.653	7.887	0.022	0.020	0.027	1,706	1,631	1,821	27	24	30	99.69	2.51	98.44	1.81
01/16/19	0.061	0.062	6.882	6.112	8.056	0.021	0.015	0.025	1,627	1,465	1,776	24	20	29	99.70	2.52	98.51	1.83
01/17/19	0.060	0.061	6.898	6.404	7.537	0.024	0.015	0.028	1,707	1,644	1,748	25	24	26	99.65	2.46	98.52	1.83
01/18/19	0.061	0.064	7.000	6.469	7.786	0.025	0.020	0.033	1,825	1,700	1,984	27	24	31	99.64	2.44	98.51	1.83
01/19/19	0.061	0.061	7.436	6.858	7.985	0.023	0.018	0.029	1,928	1,848	2,039	29	26	34	99.69	2.50	98.47	1.82
01/20/19	0.061	0.063	7.278	6.719	7.957	0.022	0.015	0.032	1,837	1,786	1,885	29	27	41	99.69	2.52	98.40	1.80
01/21/19	0.063	0.064	7.273	6.659	8.215	0.021	0.018	0.031	1,790	1,679	1,941	28	25	31	99.71	2.54	98.45	1.81
01/22/19	0.067	0.067	7.506	6.926	8.379	0.025	0.020	0.036	1,865	1,775	2,016	28	25	33	99.67	2.48	98.48	1.82
01/23/19	0.066	0.067	7.552	7.005	8.058	0.023	0.019	0.028	1,962	1,884	2,032	31	28	34	99.69	2.51	98.41	1.80
01/24/19	0.062	0.064	7.556	7.098	8.267	0.022	0.007	0.028	1,948	1,861	2,018	31	29	34	99.71	2.54	98.39	1.79
01/25/19	0.053	0.060	7.593	7.073	8.296	0.021	0.013	0.026	1,953	1,871	2,033	31	29	34	99.72	2.56	98.39	1.79
01/26/19	0.055	0.058	7.637	6.979	8.356	0.021	0.001	0.028	1,914	1,860	2,008	30	28	33	99.72	2.56	98.42	1.80
01/27/19	0.057	0.058	7.807	7.226	8.565	0.018	0.011	0.026	1,796	1,722	1,844	28	26	30	99.77	2.63	98.44	1.81
01/28/19	0.058	0.060	7.648	6.974	8.418	0.018	0.013	0.024	1,716	1,615	1,846	27	24	30	99.77	2.63	98.45	1.81
01/29/19	0.061	0.062	7.582	7.026	8.515	0.022	0.015	0.031	1,825	1,752	1,923	28	26	31	99.71	2.54	98.44	1.81
01/30/19	0.061	0.063	7.490	6.945	8.228	0.024	0.020	0.029	1,893	1,810	1,986	31	27	35	99.68	2.49	98.39	1.79
01/31/19	0.061	0.064	7.487	7.062	8.073	0.022	0.015	0.029	1,887	1,796	1,949	30	28	32	99.71	2.54	98.41	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
01/01/19	97.31	96.488	26,049.8	0.27	3.0	6
01/02/19	97.12	85.956	23,917.1	0.28	3.0	6
01/03/19	97.26	92.469	24,761.0	0.27	3.0	6
01/04/19	97.47	96.104	25,734.2	0.27	3.0	6
01/05/19	97.51	93.612	24,987.1	0.27	3.0	6
01/06/19	97.82	91.280	24,216.8	0.27	3.0	6
01/07/19	97.67	94.497	25,066.2	0.27	3.0	6
01/08/19	98.03	94.373	24,989.9	0.26	3.0	6
01/09/19	98.07	90.004	24,278.5	0.27	3.0	6
01/10/19	97.94	95.721	24,634.6	0.26	3.0	6
01/11/19	97.80	94.424	24,349.9	0.26	3.0	6
01/12/19	97.85	94.626	24,492.1	0.26	3.0	6
01/13/19	97.88	96.926	25,929.6	0.27	3.0	6
01/14/19	97.59	92.975	24,929.7	0.27	3.0	6
01/15/19	97.50	96.278	25,730.5	0.27	3.0	6
01/16/19	97.33	97.333	25,446.3	0.26	3.0	6
01/17/19	97.70	99.774	26,194.6	0.26	3.0	6
01/18/19	98.15	100.107	26,634.4	0.27	3.0	6
01/19/19	97.59	97.590	25,973.5	0.27	3.0	6
01/20/19	97.83	95.986	25,383.3	0.26	3.0	6
01/21/19	97.67	77.266	20,965.9	0.27	3.0	6
01/22/19	97.53	97.731	25,643.2	0.26	3.0	6
01/23/19	97.18	96.733	25,346.5	0.26	3.0	6
01/24/19	97.25	96.506	25,300.9	0.26	3.0	6
01/25/19	97.11	96.836	25,650.5	0.26	3.0	6
01/26/19	96.93	94.597	24,698.5	0.26	3.0	6
01/27/19	97.16	94.401	24,899.8	0.26	3.0	6
01/28/19	97.06	95.952	25,411.1	0.26	3.0	6
01/29/19	97.03	96.260	25,083.3	0.26	3.0	6
01/30/19	97.01	96.437	25,161.5	0.26	3.0	6
01/31/19	97.22	97.038	25,608.6	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		ROP TOC
	LRV	LRV	LRV	Y/N	Y/N	Y/N	>0.2	>0.5	>0.2	>0.5	>0.5
02/01/19	12.36	12.36	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/02/19	12.51	12.51	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/03/19	12.47	12.47	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/04/19	12.53	12.53	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/05/19	12.52	12.52	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/06/19	12.51	12.51	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/07/19	12.52	12.52	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/08/19	12.54	12.54	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/09/19	12.51	12.51	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/10/19	12.51	12.51	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/11/19	12.53	12.53	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/12/19	12.55	12.55	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/13/19	12.52	12.52	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/14/19	12.43	12.43	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/15/19	12.37	12.37	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/16/19	12.46	12.46	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/17/19	12.39	12.39	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/18/19	12.31	12.31	12.03	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/19/19	12.37	12.37	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/20/19	12.38	12.38	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/21/19	12.38	12.38	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/22/19	12.37	12.37	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/23/19	12.40	12.40	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/24/19	12.48	12.48	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/25/19	12.49	12.49	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/26/19	12.48	12.48	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/27/19	12.56	12.56	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
02/28/19	12.49	12.49	12.08	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*
02/01/19	0.00	4.33	2.04	6.00	0.00	12.36
02/02/19	0.00	4.44	2.07	6.00	0.00	12.51
02/03/19	0.00	4.43	2.04	6.00	0.00	12.47
02/04/19	0.00	4.47	2.06	6.00	0.00	12.53
02/05/19	0.00	4.43	2.09	6.00	0.00	12.52
02/06/19	0.00	4.42	2.09	6.00	0.00	12.51
02/07/19	0.00	4.43	2.09	6.00	0.00	12.52
02/08/19	0.00	4.43	2.11	6.00	0.00	12.54
02/09/19	0.00	4.39	2.13	6.00	0.00	12.51
02/10/19	0.00	4.39	2.13	6.00	0.00	12.51
02/11/19	0.00	4.37	2.16	6.00	0.00	12.53
02/12/19	0.00	4.38	2.17	6.00	0.00	12.55
02/13/19	0.00	4.38	2.14	6.00	0.00	12.52
02/14/19	0.00	4.33	2.10	6.00	0.00	12.43
02/15/19	0.00	4.25	2.12	6.00	0.00	12.37
02/16/19	0.00	4.33	2.13	6.00	0.00	12.46
02/17/19	0.00	4.34	2.05	6.00	0.00	12.39
02/18/19	0.00	4.28	2.03	6.00	0.00	12.31
02/19/19	0.00	4.33	2.04	6.00	0.00	12.37
02/20/19	0.00	4.30	2.08	6.00	0.00	12.38
02/21/19	0.00	4.32	2.06	6.00	0.00	12.38
02/22/19	0.00	4.31	2.06	6.00	0.00	12.37
02/23/19	0.00	4.32	2.08	6.00	0.00	12.40
02/24/19	0.00	4.39	2.09	6.00	0.00	12.48
02/25/19	0.00	4.39	2.09	6.00	0.00	12.49
02/26/19	0.00	4.39	2.10	6.00	0.00	12.48
02/27/19	0.00	4.44	2.13	6.00	0.00	12.56
02/28/19	0.00	4.41	2.08	6.00	0.00	12.49

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
02/01/19	0.00	0.00	2.04	6.00	4.00	12.04
02/02/19	0.00	0.00	2.07	6.00	4.00	12.07
02/03/19	0.00	0.00	2.04	6.00	4.00	12.04
02/04/19	0.00	0.00	2.06	6.00	4.00	12.06
02/05/19	0.00	0.00	2.09	6.00	4.00	12.09
02/06/19	0.00	0.00	2.09	6.00	4.00	12.09
02/07/19	0.00	0.00	2.09	6.00	4.00	12.09
02/08/19	0.00	0.00	2.11	6.00	4.00	12.11
02/09/19	0.00	0.00	2.13	6.00	4.00	12.13
02/10/19	0.00	0.00	2.13	6.00	4.00	12.13
02/11/19	0.00	0.00	2.16	6.00	4.00	12.16
02/12/19	0.00	0.00	2.17	6.00	4.00	12.17
02/13/19	0.00	0.00	2.14	6.00	4.00	12.14
02/14/19	0.00	0.00	2.10	6.00	4.00	12.10
02/15/19	0.00	0.00	2.12	6.00	4.00	12.12
02/16/19	0.00	0.00	2.13	6.00	4.00	12.13
02/17/19	0.00	0.00	2.05	6.00	4.00	12.05
02/18/19	0.00	0.00	2.03	6.00	4.00	12.03
02/19/19	0.00	0.00	2.04	6.00	4.00	12.04
02/20/19	0.00	0.00	2.08	6.00	4.00	12.08
02/21/19	0.00	0.00	2.06	6.00	4.00	12.06
02/22/19	0.00	0.00	2.06	6.00	4.00	12.06
02/23/19	0.00	0.00	2.08	6.00	4.00	12.08
02/24/19	0.00	0.00	2.09	6.00	4.00	12.09
02/25/19	0.00	0.00	2.09	6.00	4.00	12.09
02/26/19	0.00	0.00	2.10	6.00	4.00	12.10
02/27/19	0.00	0.00	2.13	6.00	4.00	12.13
02/28/19	0.00	0.00	2.08	6.00	4.00	12.08

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	MicroFiltration Process online monitoring results Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
02/01/19	4.96	4.92	4.93	4.77	4.91	4.84	4.90	4.78	4.56	4.56	4.86	4.75	4.56	4.33	4.54	4.52
02/02/19	4.94	4.93	4.94	4.71	4.91	4.78	4.89	4.84	4.57	4.56	4.86	4.75	4.54	4.52	4.53	4.53
02/03/19	4.92	4.89	4.91	4.64	4.89	4.81	4.90	4.80	4.55	4.52	4.85	4.90	4.50	4.59	4.50	4.53
02/04/19	4.92	4.89	4.87	4.66	4.86	4.77	4.85	4.76	4.54	4.54	4.84	4.95	4.49	4.57	4.47	4.52
02/05/19	4.88	4.83	4.91	4.64	4.81	4.78	4.89	4.71	4.53	4.55	4.81	4.90	4.46	4.54	4.48	4.49
02/06/19	4.88	4.77	4.90	4.56	4.83	4.74	4.83	4.69	4.50	4.51	4.82	4.86	4.44	4.50	4.47	4.45
02/07/19	4.86	4.77	4.89	4.53	4.84	4.75	4.89	4.70	4.49	4.48	4.86	4.92	4.64	4.55	4.45	4.43
02/08/19	4.83	4.75	4.84	4.60	4.79	4.77	4.88	4.70	4.43	4.46	4.85	4.91	4.68	4.68	4.43	4.44
02/09/19	4.83	4.75	4.83	4.59	4.78	4.75	4.87	4.67	4.39	4.48	4.85	4.87	4.68	4.71	4.45	4.43
02/10/19	4.84	4.71	4.82	4.55	4.75	4.76	4.84	4.66	4.39	4.42	4.81	4.90	4.69	4.67	4.46	4.58
02/11/19	4.77	4.67	4.70	4.51	4.73	4.74	4.81	4.63	4.37	4.44	4.78	4.89	4.70	4.64	4.43	4.64
02/12/19	4.77	4.62	4.76	4.43	4.77	4.71	4.81	4.66	4.38	4.43	4.77	4.85	4.69	4.66	4.41	4.60
02/13/19	4.75	4.66	4.76	4.49	4.75	4.69	4.83	4.65	4.38	4.43	4.78	4.83	4.64	4.67	4.40	4.61
02/14/19	4.81	4.61	4.75	4.46	4.78	4.71	4.83	4.68	4.33	4.39	4.73	4.79	4.58	4.64	4.37	4.56
02/15/19	4.72	4.65	4.79	4.77	4.75	4.72	4.84	4.66	4.32	4.39	4.75	4.85	4.60	4.63	4.38	4.57
02/16/19	4.76	4.93	4.68	4.79	4.75	4.72	4.79	4.64	4.33	4.38	4.77	4.85	4.63	4.63	4.37	4.59
02/17/19	4.69	4.97	4.73	4.75	4.89	4.72	4.79	4.58	4.54	4.34	4.75	4.80	4.61	4.62	4.37	4.59
02/18/19	4.71	4.93	4.66	4.82	4.89	4.66	4.80	4.54	4.56	4.28	4.73	4.77	4.59	4.60	4.35	4.59
02/19/19	4.70	4.93	4.59	4.66	4.87	4.65	4.74	4.59	4.59	4.57	4.69	4.78	4.60	4.59	4.33	4.58
02/20/19	4.70	4.86	4.99	4.67	4.90	4.85	4.77	4.54	4.59	4.64	4.65	4.77	4.58	4.58	4.30	4.59
02/21/19	4.71	4.93	5.07	4.73	4.88	4.90	4.74	4.54	4.60	4.59	4.68	4.77	4.58	4.55	4.35	4.56
02/22/19	4.93	4.90	4.98	4.69	4.86	4.84	4.96	4.57	4.59	4.60	4.67	4.75	4.54	4.55	4.35	4.54
02/23/19	4.90	4.90	4.97	4.68	4.85	4.81	5.01	4.53	4.58	4.57	4.62	4.73	4.52	4.56	4.47	4.53
02/24/19	4.93	4.81	4.98	4.72	4.89	4.84	4.92	4.74	4.59	4.59	4.85	4.76	4.50	4.55	4.55	4.54
02/25/19	4.95	4.89	4.98	4.67	4.83	4.86	4.97	4.77	4.57	4.52	4.91	4.73	4.48	4.54	4.55	4.52
02/26/19	4.93	4.86	4.98	4.74	4.85	4.83	4.95	4.77	4.54	4.55	4.89	4.72	4.49	4.52	4.53	4.50
02/27/19	4.93	4.84	4.98	4.66	4.87	4.81	4.90	4.76	4.53	4.56	4.86	4.71	4.46	4.49	4.50	4.49
02/28/19	4.91	4.88	4.96	4.62	4.85	4.76	4.91	4.76	4.51	4.54	4.83	4.96	4.44	4.67	4.53	4.49

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
02/01/19	4.66	4.43	4.59	4.69	4.45	4.56	4.65	4.48	4.92	4.77	4.58	4.61	4.88	4.73	4.66	4.88
02/02/19	4.76	4.67	4.54	4.64	4.48	4.58	4.61	4.44	4.89	4.76	4.56	4.61	4.80	4.68	4.65	4.90
02/03/19	4.71	4.77	4.52	4.62	4.65	4.58	4.61	4.43	4.88	4.76	4.57	4.56	4.75	4.62	4.63	4.91
02/04/19	4.66	4.73	4.50	4.60	4.80	4.54	4.59	4.63	4.89	4.80	4.57	4.56	4.74	4.64	4.64	4.89
02/05/19	4.66	4.68	4.43	4.62	4.75	4.50	4.54	4.82	4.88	4.79	4.56	4.63	4.74	4.67	4.62	4.88
02/06/19	4.69	4.64	4.42	4.62	4.71	4.50	4.52	4.76	4.90	4.76	4.54	4.86	4.69	4.66	4.56	4.86
02/07/19	4.68	4.63	4.65	4.58	4.69	4.54	4.50	4.73	4.90	4.75	4.51	4.77	4.81	4.65	4.50	4.84
02/08/19	4.65	4.66	4.83	4.57	4.66	4.55	4.47	4.71	4.84	4.74	4.60	4.75	4.99	4.63	4.62	4.79
02/09/19	4.63	4.64	4.76	4.53	4.61	4.49	4.48	4.70	4.76	4.70	4.69	4.74	4.93	4.64	4.77	4.80
02/10/19	4.62	4.62	4.74	4.50	4.61	4.50	4.49	4.69	4.75	4.74	4.68	4.71	4.95	4.63	4.77	4.76
02/11/19	4.58	4.58	4.71	4.49	4.62	4.47	4.43	4.67	4.73	4.72	4.65	4.72	4.91	4.64	4.76	4.74
02/12/19	4.55	4.53	4.69	4.46	4.60	4.45	4.40	4.63	4.74	4.68	4.63	4.72	4.94	4.63	4.75	4.72
02/13/19	4.54	4.53	4.70	4.46	4.62	4.45	4.40	4.59	4.72	4.69	4.65	4.70	4.93	4.63	4.73	4.74
02/14/19	4.54	4.52	4.71	4.45	4.58	4.42	4.39	4.58	4.72	4.71	4.66	4.68	4.89	4.57	4.69	4.77
02/15/19	4.53	4.53	4.67	4.25	4.53	4.40	4.38	4.61	4.75	4.70	4.66	4.69	4.90	4.56	4.71	4.74
02/16/19	4.53	4.54	4.67	4.42	4.54	4.39	4.38	4.61	4.72	4.70	4.62	4.68	4.91	4.61	4.70	4.68
02/17/19	4.51	4.53	4.67	4.41	4.53	4.39	4.38	4.60	4.67	4.65	4.60	4.69	4.92	4.57	4.71	4.70
02/18/19	4.50	4.50	4.65	4.40	4.54	4.37	4.36	4.60	4.65	4.61	4.61	4.69	4.88	4.54	4.71	4.70
02/19/19	4.48	4.47	4.64	4.39	4.54	4.35	4.34	4.55	4.66	4.64	4.61	4.70	4.90	4.55	4.70	4.71
02/20/19	4.43	4.43	4.60	4.35	4.50	4.34	4.46	4.50	4.77	4.57	4.60	4.65	4.89	4.53	4.71	4.71
02/21/19	4.42	4.43	4.56	4.32	4.48	4.32	4.70	4.50	4.91	4.55	4.61	4.61	4.88	4.52	4.67	4.65
02/22/19	4.40	4.42	4.55	4.55	4.49	4.31	4.68	4.50	4.93	4.58	4.61	4.68	4.87	4.53	4.65	4.62
02/23/19	4.42	4.41	4.55	4.70	4.49	4.32	4.64	4.52	4.92	4.67	4.60	4.67	4.85	4.45	4.65	4.61
02/24/19	4.41	4.39	4.55	4.63	4.45	4.49	4.62	4.51	4.88	4.77	4.57	4.60	4.82	4.44	4.63	4.71
02/25/19	4.39	4.64	4.52	4.63	4.41	4.62	4.63	4.48	4.87	4.75	4.57	4.62	4.82	4.48	4.67	4.99
02/26/19	4.39	4.76	4.49	4.62	4.42	4.59	4.60	4.48	4.87	4.79	4.56	4.61	4.80	4.55	4.66	4.85
02/27/19	4.62	4.70	4.50	4.60	4.64	4.55	4.58	4.44	4.89	4.78	4.53	4.59	4.76	4.70	4.63	4.82
02/28/19	4.73	4.68	4.48	4.58	4.82	4.55	4.58	4.41	4.86	4.74	4.53	4.52	4.76	4.65	4.61	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			
	E01	**E02**	**E03**	**E04**
Date	LRV	LRV	LRV	LRV
02/01/19	4.72	4.81	4.84	5.07
02/02/19	4.67	4.78	4.82	5.16
02/03/19	4.72	4.77	4.76	5.29
02/04/19	4.71	4.76	4.78	5.09
02/05/19	4.67	4.76	4.67	5.01
02/06/19	4.71	4.72	4.66	5.06
02/07/19	4.72	4.72	4.63	5.15
02/08/19	4.72	4.67	4.59	5.16
02/09/19	4.67	4.66	4.51	4.91
02/10/19	4.67	4.72	4.49	4.89
02/11/19	4.67	4.69	4.65	4.83
02/12/19	4.66	4.62	5.10	4.91
02/13/19	4.74	4.67	4.96	4.98
02/14/19	4.83	4.63	4.88	4.95
02/15/19	4.76	4.59	4.99	5.02
02/16/19	4.71	4.56	4.91	5.20
02/17/19	4.73	4.59	4.78	5.15
02/18/19	4.71	4.75	4.72	5.20
02/19/19	4.71	4.76	4.73	5.06
02/20/19	4.66	4.72	4.73	5.15
02/21/19	4.64	4.76	4.75	5.34
02/22/19	4.72	4.73	4.68	5.16
02/23/19	4.81	4.77	4.70	5.12
02/24/19	4.77	4.74	4.67	5.29
02/25/19	4.76	4.75	4.61	5.09
02/26/19	4.68	4.81	4.61	4.98
02/27/19	4.66	4.76	4.56	5.21
02/28/19	4.67	4.70	4.61	5.15

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
02/01/19	0.07	0.08	0.08	0.09	0.08	0.09	0.08	0.08	0.08	0.09	0.13	0.14	0.09	0.09	0.09	0.09	0.05	0.06	0.08
02/02/19	0.07	0.08	0.09	0.09	0.09	0.09	0.08	0.09	0.08	0.09	0.13	0.14	0.10	0.10	0.09	0.10	0.05	0.06	0.09
02/03/19	0.07	0.08	0.09	0.09	0.09	0.09	0.08	0.09	0.08	0.09	0.14	0.15	0.10	0.11	0.09	0.10	0.05	0.06	0.09
02/04/19	0.07	0.08	0.09	0.09	0.09	0.10	0.08	0.09	0.08	0.09	0.14	0.15	0.10	0.11	0.09	0.10	0.05	0.06	0.09
02/05/19	0.07	0.08	0.08	0.09	0.09	0.10	0.09	0.10	0.08	0.09	0.14	0.15	0.11	0.11	0.09	0.09	0.06	0.06	0.09
02/06/19	0.07	0.08	0.08	0.08	0.10	0.10	0.10	0.10	0.07	0.17	0.11	0.15	0.11	0.12	0.09	0.10	0.06	0.06	0.09
02/07/19	0.07	0.08	0.09	0.09	0.10	0.10	0.09	0.10	0.06	0.06	0.09	0.10	0.12	0.12	0.09	0.10	0.06	0.06	0.09
02/08/19	0.08	0.09	0.09	0.09	0.09	0.10	0.09	0.09	0.06	0.07	0.10	0.10	0.09	0.13	0.09	0.10	0.06	0.06	0.08
02/09/19	0.08	0.11	0.09	0.09	0.09	0.10	0.09	0.09	0.07	0.07	0.10	0.11	0.08	0.08	0.09	0.10	0.06	0.07	0.08
02/10/19	0.08	0.09	0.09	0.10	0.09	0.10	0.09	0.09	0.07	0.09	0.11	0.12	0.08	0.09	0.09	0.10	0.06	0.06	0.08
02/11/19	0.09	0.09	0.09	0.10	0.10	0.12	0.09	0.09	0.07	0.08	0.12	0.14	0.08	0.09	0.09	0.10	0.05	0.06	0.09
02/12/19	0.08	0.09	0.09	0.10	0.10	0.10	0.09	0.09	0.08	0.08	0.13	0.19	0.09	0.09	0.09	0.10	0.06	0.08	0.09
02/13/19	0.09	0.09	0.09	0.09	0.09	0.10	0.09	0.09	0.08	0.09	0.13	0.15	0.10	0.11	0.10	0.10	0.06	0.06	0.09
02/14/19	0.08	0.09	0.09	0.10	0.08	0.09	0.09	0.09	0.08	0.10	0.13	0.15	0.10	0.11	0.10	0.10	0.05	0.06	0.09
02/15/19	0.08	0.08	0.09	0.09	0.08	0.08	0.09	0.09	0.08	0.09	0.13	0.14	0.10	0.11	0.10	0.10	0.05	0.05	0.09
02/16/19	0.08	0.08	0.09	0.13	0.08	0.09	0.08	0.09	0.08	0.09	0.14	0.17	0.11	0.12	0.10	0.10	0.05	0.06	0.09
02/17/19	0.08	0.08	0.09	0.10	0.08	0.09	0.08	0.09	0.09	0.13	0.14	0.17	0.12	0.12	0.10	0.10	0.05	0.06	0.09
02/18/19	0.08	0.10	0.10	0.10	0.08	0.09	0.09	0.09	0.09	0.09	0.15	0.17	0.12	0.13	0.10	0.10	0.05	0.06	0.09
02/19/19	0.08	0.08	0.10	0.11	0.09	0.09	0.09	0.09	0.07	0.10	0.12	0.19	0.13	0.14	0.10	0.10	0.06	0.07	0.09
02/20/19	0.08	0.09	0.10	0.11	0.08	0.10	0.09	0.13	0.05	0.05	0.08	0.15	0.10	0.14	0.10	0.13	0.06	0.10	0.08
02/21/19	0.07	0.09	0.09	0.10	0.09	0.09	0.07	0.09	0.04	0.05	0.08	0.11	0.08	0.09	0.09	0.10	0.06	0.06	0.07
02/22/19	0.07	0.08	0.09	0.10	0.09	0.09	0.06	0.06	0.05	0.05	0.08	0.12	0.08	0.09	0.09	0.10	0.06	0.06	0.07
02/23/19	0.08	0.09	0.09	0.10	0.09	0.10	0.06	0.07	0.05	0.16	0.09	0.12	0.07	0.09	0.09	0.10	0.06	0.07	0.08
02/24/19	0.09	0.09	0.09	0.10	0.10	0.10	0.06	0.07	0.06	0.06	0.10	0.13	0.08	0.10	0.10	0.10	0.06	0.07	0.08
02/25/19	0.08	0.09	0.09	0.10	0.09	0.10	0.06	0.07	0.06	0.10	0.11	0.14	0.10	0.13	0.10	0.10	0.07	0.09	0.08
02/26/19	0.08	0.09	0.09	0.10	0.09	0.10	0.06	0.07	0.06	0.08	0.10	0.14	0.10	0.13	0.10	0.11	0.06	0.08	0.08
02/27/19	0.08	0.09	0.09	0.10	0.09	0.09	0.07	0.10	0.05	0.06	0.09	0.15	0.09	0.10	0.09	0.11	0.06	0.07	0.08
02/28/19	0.08	0.09	0.09	0.10	0.09	0.09	0.08	0.09	0.06	0.07	0.10	0.15	0.08	0.09	0.09	0.10	0.06	0.07	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

	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
02/01/19	0.065	0.065	7.074	6.555	8.064	0.065	0.066	0.021	1,794	1,705	1,903	27	24	32	99.08	2.04	98.47	1.81
02/02/19	0.066	0.066	7.587	7.030	8.237	0.065	0.065	0.020	1,828	1,626	1,920	28	25	31	99.14	2.07	98.44	1.81
02/03/19	0.065	0.065	7.069	6.474	7.671	0.064	0.065	0.019	1,647	1,520	1,776	24	21	27	99.09	2.04	98.57	1.84
02/04/19	0.063	0.065	7.193	6.557	8.271	0.063	0.064	0.018	1,697	1,645	1,778	25	23	27	99.13	2.06	98.55	1.84
02/05/19	0.061	0.063	7.441	6.829	8.193	0.061	0.063	0.023	1,812	1,721	1,931	26	24	29	99.18	2.09	98.56	1.84
02/06/19	0.060	0.061	7.336	6.844	7.994	0.060	0.061	0.032	1,931	1,845	2,000	28	25	30	99.19	2.09	98.55	1.84
02/07/19	0.061	0.062	7.497	6.822	8.322	0.061	0.062	0.045	1,936	1,835	2,031	29	26	32	99.18	2.09	98.51	1.83
02/08/19	0.059	0.060	7.603	6.861	8.421	0.059	0.060	0.046	1,926	1,858	1,990	29	27	32	99.23	2.11	98.48	1.82
02/09/19	0.059	0.059	7.824	7.129	8.551	0.059	0.059	0.046	1,884	1,823	1,936	28	26	29	99.25	2.13	98.53	1.83
02/10/19	0.059	0.059	7.824	7.274	8.529	0.059	0.059	0.043	1,795	1,721	1,888	26	24	30	99.25	2.13	98.54	1.83
02/11/19	0.055	0.059	7.846	7.160	8.672	0.055	0.057	0.042	1,727	1,602	1,856	25	22	29	99.30	2.16	98.52	1.83
02/12/19	0.054	0.058	8.048	7.200	8.861	0.054	0.058	0.047	1,835	1,735	1,952	27	24	31	99.33	2.17	98.51	1.83
02/13/19	0.058	0.061	8.043	7.320	8.891	0.058	0.059	0.047	1,903	1,796	2,010	29	25	32	99.28	2.14	98.50	1.82
02/14/19	0.059	0.061	7.300	6.203	8.891	0.058	0.059	0.043	1,735	1,559	1,991	24	20	31	99.20	2.10	98.62	1.86
02/15/19	0.056	0.060	7.266	6.668	8.235	0.055	0.060	0.047	1,828	1,626	1,989	27	21	33	99.24	2.12	98.53	1.83
02/16/19	0.057	0.067	7.660	7.186	8.331	0.057	0.067	0.046	1,942	1,870	2,045	31	29	34	99.25	2.13	98.40	1.80
02/17/19	0.067	0.069	7.549	7.045	8.215	0.067	0.069	0.043	1,851	1,790	1,926	29	28	33	99.11	2.05	98.41	1.80
02/18/19	0.070	0.073	7.545	6.927	8.310	0.070	0.071	0.040	1,803	1,714	1,909	29	26	33	99.08	2.03	98.39	1.79
02/19/19	0.072	0.072	7.778	7.154	8.398	0.072	0.072	0.048	1,839	1,759	1,946	29	27	33	99.08	2.04	98.40	1.80
02/20/19	0.067	0.069	8.045	7.312	8.706	0.067	0.069	0.051	1,905	1,837	1,998	32	28	47	99.17	2.08	98.31	1.77
02/21/19	0.068	0.068	7.891	7.365	8.782	0.068	0.068	0.047	1,925	1,841	1,985	32	29	35	99.14	2.06	98.33	1.78
02/22/19	0.068	0.070	7.857	7.070	9.300	0.069	0.071	0.047	1,906	1,810	1,979	30	26	33	99.12	2.06	98.40	1.80
02/23/19	0.069	0.071	8.245	5.589	9.380	0.068	0.071	0.048	1,856	1,793	1,926	28	26	30	99.17	2.08	98.50	1.82
02/24/19	0.066	0.067	8.024	7.201	8.689	0.065	0.067	0.044	1,740	1,659	1,803	27	25	30	99.18	2.09	98.46	1.81
02/25/19	0.064	0.068	7.994	7.240	8.814	0.065	0.069	0.043	1,663	1,556	1,779	25	22	29	99.19	2.09	98.47	1.82
02/26/19	0.064	0.066	7.980	7.152	8.828	0.064	0.066	0.046	1,781	1,692	1,886	28	25	32	99.20	2.10	98.44	1.81
02/27/19	0.061	0.065	8.189	7.356	8.822	0.061	0.065	0.050	1,821	1,730	1,892	29	26	33	99.26	2.13	98.40	1.80
02/28/19	0.065	0.066	7.883	7.128	8.823	0.065	0.066	0.048	1,797	1,733	1,859	29	26	32	99.17	2.08	98.39	1.79

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
02/01/19	97.32	97.564	25,865.4	0.27	3.0	6
02/02/19	97.26	99.386	26,517.6	0.27	3.0	6
02/03/19	97.38	99.610	26,434.1	0.27	3.0	6
02/04/19	97.32	99.351	25,884.3	0.26	3.0	6
02/05/19	97.31	99.724	24,952.4	0.25	3.0	6
02/06/19	97.42	99.705	25,027.0	0.25	3.0	6
02/07/19	97.49	97.789	24,905.6	0.25	3.0	6
02/08/19	97.59	98.036	25,227.3	0.26	3.0	6
02/09/19	97.36	99.603	26,445.9	0.27	3.0	6
02/10/19	97.28	99.621	26,407.5	0.27	3.0	6
02/11/19	97.11	99.704	26,317.1	0.26	3.0	6
02/12/19	97.20	99.772	26,313.3	0.26	3.0	6
02/13/19	97.43	99.664	26,208.9	0.26	3.0	6
02/14/19	97.43	99.662	26,053.9	0.26	3.0	6
02/15/19	97.68	99.674	25,925.2	0.26	3.0	6
02/16/19	97.75	99.801	25,857.4	0.26	3.0	6
02/17/19	97.57	99.455	26,459.0	0.27	3.0	6
02/18/19	97.60	99.891	26,498.9	0.27	3.0	6
02/19/19	97.44	99.331	26,558.1	0.27	3.0	6
02/20/19	97.70	97.806	26,384.1	0.27	3.0	6
02/21/19	97.65	84.291	22,865.3	0.27	3.0	6
02/22/19	97.61	99.697	26,289.1	0.26	3.0	6
02/23/19	97.57	99.631	26,259.4	0.26	3.0	6
02/24/19	97.02	99.532	26,268.1	0.26	3.0	6
02/25/19	97.11	99.656	26,328.1	0.26	3.0	6
02/26/19	97.19	99.668	26,238.2	0.26	3.0	6
02/27/19	97.12	99.606	25,647.1	0.26	3.0	6
02/28/19	97.23	99.686	26,250.8	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				
							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
03/01/19	12.62	12.62	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/02/19	12.64	12.64	12.23	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/03/19	12.61	12.61	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/04/19	12.62	12.62	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/05/19	12.68	12.68	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/06/19	12.77	12.77	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/07/19	12.88	12.88	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/08/19	12.88	12.88	12.47	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/09/19	12.93	12.93	12.55	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/10/19	12.99	12.99	12.59	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/11/19	12.95	12.95	12.58	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/12/19	12.91	12.91	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/13/19	12.90	12.90	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/14/19	12.66	12.66	12.35	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/15/19	12.61	12.61	12.32	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/16/19	12.70	12.70	12.44	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/17/19	12.93	12.93	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/18/19	12.92	12.92	12.59	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/19/19	12.87	12.87	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/20/19	12.90	12.90	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/21/19	12.95	12.95	12.57	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/22/19	12.98	12.98	12.59	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/23/19	12.92	12.92	12.56	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/24/19	12.96	12.96	12.60	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/25/19	13.04	13.04	12.60	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/26/19	12.96	12.96	12.53	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/27/19	12.99	12.99	12.54	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/28/19	12.91	12.91	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/29/19	12.89	12.89	12.50	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/30/19	12.89	12.89	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
03/31/19	12.98	12.98	12.53	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*
03/01/19	0.00	4.40	2.22	6.00	0.00	12.62
03/02/19	0.00	4.41	2.23	6.00	0.00	12.64
03/03/19	0.00	4.39	2.22	6.00	0.00	12.61
03/04/19	0.00	4.39	2.24	6.00	0.00	12.62
03/05/19	0.00	4.46	2.22	6.00	0.00	12.68
03/06/19	0.00	4.42	2.35	6.00	0.00	12.77
03/07/19	0.00	4.40	2.48	6.00	0.00	12.88
03/08/19	0.00	4.41	2.47	6.00	0.00	12.88
03/09/19	0.00	4.38	2.55	6.00	0.00	12.93
03/10/19	0.00	4.39	2.59	6.00	0.00	12.99
03/11/19	0.00	4.36	2.58	6.00	0.00	12.95
03/12/19	0.00	4.35	2.56	6.00	0.00	12.91
03/13/19	0.00	4.33	2.57	6.00	0.00	12.90
03/14/19	0.00	4.31	2.35	6.00	0.00	12.66
03/15/19	0.00	4.29	2.32	6.00	0.00	12.61
03/16/19	0.00	4.26	2.44	6.00	0.00	12.70
03/17/19	0.00	4.36	2.56	6.00	0.00	12.93
03/18/19	0.00	4.33	2.59	6.00	0.00	12.92
03/19/19	0.00	4.31	2.56	6.00	0.00	12.87
03/20/19	0.00	4.39	2.51	6.00	0.00	12.90
03/21/19	0.00	4.38	2.57	6.00	0.00	12.95
03/22/19	0.00	4.39	2.59	6.00	0.00	12.98
03/23/19	0.00	4.36	2.56	6.00	0.00	12.92
03/24/19	0.00	4.37	2.60	6.00	0.00	12.96
03/25/19	0.00	4.43	2.60	6.00	0.00	13.04
03/26/19	0.00	4.43	2.53	6.00	0.00	12.96
03/27/19	0.00	4.45	2.54	6.00	0.00	12.99
03/28/19	0.00	4.43	2.48	6.00	0.00	12.91
03/29/19	0.00	4.39	2.50	6.00	0.00	12.89
03/30/19	0.00	4.38	2.51	6.00	0.00	12.89
03/31/19	0.00	4.45	2.53	6.00	0.00	12.98

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*
03/01/19	0.00	0.00	2.22	6.00	4.00	12.22
03/02/19	0.00	0.00	2.23	6.00	4.00	12.23
03/03/19	0.00	0.00	2.22	6.00	4.00	12.22
03/04/19	0.00	0.00	2.24	6.00	4.00	12.24
03/05/19	0.00	0.00	2.22	6.00	4.00	12.22
03/06/19	0.00	0.00	2.35	6.00	4.00	12.35
03/07/19	0.00	0.00	2.48	6.00	4.00	12.48
03/08/19	0.00	0.00	2.47	6.00	4.00	12.47
03/09/19	0.00	0.00	2.55	6.00	4.00	12.55
03/10/19	0.00	0.00	2.59	6.00	4.00	12.59
03/11/19	0.00	0.00	2.58	6.00	4.00	12.58
03/12/19	0.00	0.00	2.56	6.00	4.00	12.56
03/13/19	0.00	0.00	2.57	6.00	4.00	12.57
03/14/19	0.00	0.00	2.35	6.00	4.00	12.35
03/15/19	0.00	0.00	2.32	6.00	4.00	12.32
03/16/19	0.00	0.00	2.44	6.00	4.00	12.44
03/17/19	0.00	0.00	2.56	6.00	4.00	12.56
03/18/19	0.00	0.00	2.59	6.00	4.00	12.59
03/19/19	0.00	0.00	2.56	6.00	4.00	12.56
03/20/19	0.00	0.00	2.51	6.00	4.00	12.51
03/21/19	0.00	0.00	2.57	6.00	4.00	12.57
03/22/19	0.00	0.00	2.59	6.00	4.00	12.59
03/23/19	0.00	0.00	2.56	6.00	4.00	12.56
03/24/19	0.00	0.00	2.60	6.00	4.00	12.60
03/25/19	0.00	0.00	2.60	6.00	4.00	12.60
03/26/19	0.00	0.00	2.53	6.00	4.00	12.53
03/27/19	0.00	0.00	2.54	6.00	4.00	12.54
03/28/19	0.00	0.00	2.48	6.00	4.00	12.48
03/29/19	0.00	0.00	2.50	6.00	4.00	12.50
03/30/19	0.00	0.00	2.51	6.00	4.00	12.51
03/31/19	0.00	0.00	2.53	6.00	4.00	12.53

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
03/01/19	4.90	4.88	4.93	4.66	4.83	4.79	4.88	4.76	4.47	4.55	4.84	4.98	4.43	4.76	4.57	4.50
03/02/19	4.91	4.81	4.96	4.63	4.86	4.81	4.84	4.71	4.46	4.52	4.85	4.95	4.41	4.75	4.59	4.49
03/03/19	4.91	4.86	4.92	4.61	4.83	4.81	4.83	4.76	4.50	4.50	4.87	4.94	4.39	4.74	4.58	4.47
03/04/19	4.84	4.81	4.88	4.65	4.82	4.79	4.92	4.74	4.51	4.48	4.87	4.95	4.39	4.75	4.56	4.48
03/05/19	4.86	4.77	4.90	4.61	4.81	4.74	4.84	4.70	4.49	4.50	4.85	4.95	4.54	4.73	4.57	4.46
03/06/19	4.79	4.75	4.86	4.60	4.79	4.76	4.83	4.70	4.44	4.42	4.86	4.93	4.57	4.71	4.57	4.43
03/07/19	4.83	4.73	4.85	4.57	4.83	4.79	4.85	4.68	4.45	4.46	4.81	4.90	4.60	4.71	4.59	4.40
03/08/19	4.81	4.75	4.86	4.57	4.80	4.77	4.82	4.67	4.41	4.42	4.82	4.86	4.61	4.69	4.64	4.57
03/09/19	4.85	4.77	4.87	4.55	4.80	4.75	4.82	4.68	4.45	4.38	4.81	4.85	4.60	4.71	4.61	4.65
03/10/19	4.81	4.77	4.82	4.54	4.75	4.78	4.84	4.69	4.44	4.40	4.80	4.86	4.57	4.71	4.59	4.64
03/11/19	4.83	4.77	4.82	4.51	4.70	4.75	4.85	4.66	4.43	4.39	4.81	4.86	4.60	4.66	4.58	4.61
03/12/19	4.77	4.68	4.74	4.81	4.75	4.76	4.77	4.64	4.38	4.35	4.80	4.90	4.62	4.67	4.56	4.59
03/13/19	4.76	4.93	4.78	4.85	4.73	4.69	4.78	4.66	4.40	4.33	4.76	4.86	4.60	4.62	4.56	4.55
03/14/19	4.72	4.98	4.70	4.80	4.87	4.68	4.77	4.64	4.44	4.32	4.78	4.84	4.57	4.61	4.55	4.57
03/15/19	4.74	4.95	4.67	4.75	4.88	4.70	4.74	4.63	4.68	4.33	4.77	4.81	4.57	4.63	4.53	4.58
03/16/19	4.71	4.86	4.64	4.80	4.88	4.65	4.75	4.59	4.69	4.26	4.73	4.78	4.56	4.58	4.52	4.56
03/17/19	4.73	4.91	4.66	4.75	4.88	4.67	4.74	4.60	4.72	4.54	4.70	4.79	4.55	4.57	4.53	4.57
03/18/19	4.70	4.90	5.05	4.72	4.93	4.89	4.74	4.53	4.70	4.59	4.70	4.78	4.55	4.57	4.54	4.55
03/19/19	4.64	4.95	4.99	4.70	4.95	4.86	4.75	4.53	4.72	4.62	4.66	4.76	4.50	4.55	4.51	4.55
03/20/19	4.90	4.85	5.02	4.74	4.96	4.82	4.93	4.51	4.75	4.57	4.64	4.75	4.50	4.51	4.47	4.54
03/21/19	4.87	4.95	4.96	4.74	4.88	4.86	4.89	4.47	4.71	4.59	4.67	4.79	4.52	4.51	4.45	4.52
03/22/19	4.85	4.92	4.95	4.70	4.89	4.88	4.92	4.77	4.70	4.67	4.90	4.79	4.51	4.49	4.59	4.51
03/23/19	4.84	4.92	5.01	4.71	4.86	4.86	4.88	4.80	4.67	4.61	4.92	4.77	4.49	4.50	4.63	4.51
03/24/19	4.94	4.93	4.95	4.74	4.89	4.84	4.88	4.73	4.67	4.62	4.88	4.75	4.46	4.48	4.62	4.47
03/25/19	4.90	4.90	5.03	4.65	4.85	4.82	4.86	4.75	4.67	4.62	4.89	4.74	4.43	4.47	4.61	4.48
03/26/19	4.90	4.85	5.01	4.74	4.85	4.80	4.86	4.74	4.64	4.60	4.88	4.93	4.44	4.65	4.61	4.49
03/27/19	4.85	4.85	4.99	4.65	4.86	4.80	4.89	4.72	4.61	4.59	4.89	5.00	4.45	4.70	4.62	4.48
03/28/19	4.89	4.82	4.95	4.62	4.85	4.81	4.85	4.72	4.62	4.57	4.90	5.00	4.45	4.71	4.59	4.48
03/29/19	4.85	4.86	4.90	4.69	4.80	4.79	4.80	4.68	4.62	4.57	4.83	4.99	4.39	4.69	4.58	4.44
03/30/19	4.85	4.85	4.95	4.66	4.80	4.82	4.83	4.70	4.63	4.57	4.85	4.99	4.38	4.75	4.57	4.44
03/31/19	4.82	4.82	4.97	4.61	4.79	4.77	4.88	4.66	4.63	4.55	4.85	4.98	4.56	4.72	4.57	4.45

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
03/01/19	4.71	4.67	4.44	4.56	4.73	4.55	4.52	4.40	4.83	4.71	4.52	4.50	4.78	4.61	4.60	4.77
03/02/19	4.67	4.66	4.43	4.55	4.69	4.53	4.50	4.56	4.85	4.74	4.49	4.52	4.76	4.60	4.53	4.79
03/03/19	4.64	4.64	4.41	4.53	4.71	4.56	4.53	4.71	4.88	4.76	4.51	4.67	4.76	4.60	4.49	4.78
03/04/19	4.65	4.64	4.39	4.50	4.71	4.57	4.52	4.73	4.88	4.76	4.50	4.80	4.75	4.59	4.54	4.80
03/05/19	4.66	4.62	4.58	4.51	4.70	4.53	4.49	4.76	4.85	4.75	4.47	4.74	4.73	4.59	4.53	4.79
03/06/19	4.66	4.63	4.78	4.50	4.69	4.50	4.48	4.73	4.77	4.74	4.59	4.73	4.82	4.62	4.57	4.76
03/07/19	4.64	4.62	4.75	4.49	4.64	4.50	4.48	4.70	4.76	4.70	4.74	4.74	4.96	4.61	4.76	4.80
03/08/19	4.63	4.59	4.71	4.47	4.60	4.48	4.44	4.68	4.79	4.67	4.66	4.74	4.90	4.59	4.71	4.81
03/09/19	4.61	4.57	4.73	4.43	4.63	4.47	4.41	4.65	4.81	4.67	4.66	4.73	4.90	4.56	4.72	4.77
03/10/19	4.60	4.56	4.74	4.44	4.63	4.44	4.39	4.66	4.81	4.69	4.68	4.73	4.96	4.56	4.73	4.75
03/11/19	4.58	4.53	4.68	4.42	4.59	4.42	4.36	4.66	4.76	4.67	4.63	4.73	4.94	4.56	4.71	4.76
03/12/19	4.57	4.52	4.69	4.38	4.55	4.41	4.36	4.64	4.72	4.66	4.62	4.67	4.94	4.59	4.70	4.71
03/13/19	4.54	4.50	4.69	4.36	4.54	4.36	4.37	4.59	4.71	4.64	4.64	4.69	4.93	4.60	4.66	4.70
03/14/19	4.48	4.48	4.68	4.34	4.52	4.35	4.31	4.57	4.70	4.62	4.63	4.72	4.90	4.58	4.65	4.70
03/15/19	4.45	4.47	4.65	4.29	4.53	4.34	4.31	4.58	4.68	4.62	4.60	4.72	4.90	4.55	4.64	4.63
03/16/19	4.48	4.43	4.63	4.51	4.52	4.36	4.52	4.55	4.72	4.64	4.58	4.71	4.91	4.53	4.65	4.68
03/17/19	4.46	4.43	4.62	4.65	4.49	4.36	4.72	4.57	4.74	4.65	4.57	4.71	4.95	4.56	4.68	4.70
03/18/19	4.46	4.42	4.59	4.61	4.49	4.33	4.63	4.56	4.76	4.58	4.58	4.66	4.90	4.53	4.69	4.65
03/19/19	4.43	4.65	4.57	4.58	4.44	4.31	4.57	4.53	4.86	4.55	4.58	4.64	4.87	4.51	4.66	4.59
03/20/19	4.39	4.75	4.53	4.56	4.39	4.50	4.58	4.52	4.87	4.56	4.55	4.58	4.87	4.48	4.61	4.56
03/21/19	4.40	4.73	4.50	4.58	4.38	4.66	4.59	4.49	4.85	4.69	4.56	4.58	4.89	4.45	4.64	4.60
03/22/19	4.39	4.72	4.52	4.57	4.39	4.59	4.56	4.46	4.83	4.82	4.58	4.57	4.88	4.44	4.64	4.69
03/23/19	4.36	4.69	4.54	4.56	4.41	4.55	4.57	4.47	4.85	4.79	4.57	4.55	4.86	4.45	4.59	4.87
03/24/19	4.37	4.68	4.51	4.55	4.40	4.57	4.59	4.46	4.87	4.80	4.54	4.56	4.86	4.51	4.61	4.85
03/25/19	4.61	4.65	4.48	4.51	4.64	4.54	4.54	4.45	4.85	4.81	4.53	4.53	4.86	4.65	4.60	4.86
03/26/19	4.74	4.67	4.46	4.51	4.79	4.53	4.53	4.43	4.85	4.81	4.52	4.54	4.84	4.66	4.62	4.86
03/27/19	4.72	4.67	4.45	4.49	4.74	4.57	4.55	4.59	4.84	4.77	4.52	4.52	4.79	4.65	4.61	4.84
03/28/19	4.68	4.63	4.43	4.47	4.74	4.52	4.53	4.75	4.82	4.73	4.50	4.49	4.75	4.63	4.58	4.84
03/29/19	4.67	4.61	4.42	4.47	4.70	4.48	4.52	4.70	4.80	4.75	4.50	4.58	4.76	4.61	4.55	4.82
03/30/19	4.69	4.61	4.42	4.48	4.68	4.50	4.51	4.72	4.81	4.74	4.49	4.69	4.74	4.62	4.51	4.82
03/31/19	4.65	4.62	4.60	4.48	4.68	4.51	4.51	4.74	4.78	4.76	4.48	4.66	4.75	4.61	4.52	4.81

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												
03/01/19	4.65	4.72	4.55	5.30												
03/02/19	4.64	4.72	4.51	5.19												
03/03/19	4.67	4.70	4.46	5.02												
03/04/19	4.76	4.69	4.44	5.13												
03/05/19	4.75	4.68	4.53	5.19												
03/06/19	4.75	4.69	4.89	5.14												
03/07/19	4.74	4.67	4.90	5.08												
03/08/19	4.71	4.66	4.79	5.25												
03/09/19	4.74	4.69	4.69	5.12												
03/10/19	4.69	4.65	4.78	5.08												
03/11/19	4.72	4.64	4.75	5.13												
03/12/19	4.81	4.64	4.64	5.04												
03/13/19	4.77	4.60	4.68	5.21												
03/14/19	4.76	4.63	4.72	5.30												
03/15/19	4.77	4.86	4.94	5.02												
03/16/19	4.74	4.81	4.91	5.01												
03/17/19	4.73	4.78	4.82	5.56												
03/18/19	4.80	4.80	4.81	5.34												
03/19/19	4.70	4.84	4.72	5.14												
03/20/19	4.70	4.78	4.55	5.26												
03/21/19	4.70	4.77	4.61	5.19												
03/22/19	4.69	4.77	4.60	5.06												
03/23/19	4.73	4.80	4.59	5.27												
03/24/19	4.67	4.78	4.64	5.16												
03/25/19	4.73	4.81	4.98	5.17												
03/26/19	4.82	4.79	5.04	5.26												
03/27/19	4.73	4.79	5.01	5.17												
03/28/19	4.75	4.76	5.09	5.09												
03/29/19	4.75	4.74	5.06	5.16												
03/30/19	4.73	4.69	5.00	5.15												
03/31/19	4.68	4.73	5.08	5.14												

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
03/01/19	0.08	0.09	0.09	0.10	0.09	0.10	0.08	0.09	0.06	0.07	0.11	0.16	0.08	0.09	0.09	0.10	0.06	0.06	0.08
03/02/19	0.08	0.09	0.09	0.10	0.09	0.09	0.09	0.09	0.06	0.07	0.12	0.15	0.08	0.09	0.10	0.10	0.06	0.06	0.09
03/03/19	0.08	0.09	0.09	0.10	0.09	0.09	0.08	0.09	0.06	0.07	0.12	0.13	0.09	0.10	0.10	0.11	0.05	0.06	0.09
03/04/19	0.09	0.13	0.09	0.10	0.09	0.09	0.08	0.09	0.07	0.08	0.12	0.14	0.10	0.11	0.10	0.11	0.06	0.06	0.09
03/05/19	0.09	0.09	0.10	0.10	0.09	0.09	0.08	0.09	0.07	0.08	0.13	0.15	0.09	0.10	0.11	0.11	0.06	0.07	0.09
03/06/19	0.07	0.09	0.09	0.11	0.10	0.10	0.08	0.10	0.07	0.09	0.14	0.16	0.09	0.13	0.11	0.12	0.06	0.07	0.09
03/07/19	0.07	0.08	0.08	0.08	0.10	0.10	0.10	0.15	0.07	0.10	0.14	0.16	0.09	0.10	0.11	0.12	0.06	0.07	0.09
03/08/19	0.07	0.10	0.08	0.09	0.10	0.10	0.09	0.09	0.08	0.10	0.14	0.15	0.09	0.10	0.11	0.12	0.06	0.07	0.09
03/09/19	0.08	0.09	0.08	0.09	0.09	0.10	0.09	0.09	0.08	0.10	0.15	0.16	0.09	0.11	0.12	0.12	0.07	0.08	0.09
03/10/19	0.08	0.12	0.08	0.09	0.09	0.10	0.08	0.09	0.08	0.09	0.15	0.17	0.09	0.10	0.12	0.12	0.07	0.07	0.09
03/11/19	0.08	0.10	0.09	0.09	0.10	0.10	0.08	0.09	0.08	0.10	0.16	0.17	0.09	0.11	0.11	0.13	0.08	0.30*	0.10
03/12/19	0.08	0.10	0.09	0.09	0.09	0.10	0.08	0.08	0.08	0.10	0.16	0.18	0.10	0.12	0.09	0.10	0.06	0.07	0.09
03/13/19	0.10	0.10	0.09	0.10	0.10	0.10	0.08	0.08	0.08	0.10	0.16	0.18	0.09	0.11	0.09	0.10	0.06	0.07	0.09
03/14/19	0.08	0.10	0.09	0.10	0.10	0.10	0.09	0.10	0.09	0.10	0.17	0.18	0.09	0.12	0.09	0.10	0.07	0.08	0.10
03/15/19	0.09	0.10	0.09	0.09	0.10	0.11	0.10	0.10	0.09	0.10	0.10	0.17	0.11	0.12	0.09	0.10	0.07	0.08	0.09
03/16/19	0.09	0.10	0.09	0.09	0.09	0.11	0.09	0.10	0.10	0.12	0.05	0.08	0.13	0.14	0.09	0.09	0.07	0.08	0.09
03/17/19	0.09	0.11	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.11	0.05	0.06	0.13	0.16	0.09	0.09	0.07	0.08	0.09
03/18/19	0.09	0.11	0.09	0.10	0.10	0.10	0.09	0.10	0.11	0.13	0.06	0.08	0.13	0.14	0.09	0.10	0.08	0.08	0.09
03/19/19	0.09	0.10	0.09	0.09	0.09	0.10	0.09	0.10	0.07	0.11	0.06	0.13	0.13	0.14	0.09	0.10	0.07	0.08	0.09
03/20/19	0.09	0.12	0.09	0.09	0.10	0.11	0.09	0.10	0.05	0.07	0.06	0.06	0.13	0.16	0.08	0.09	0.07	0.07	0.09
03/21/19	0.07	0.09	0.08	0.09	0.10	0.10	0.10	0.10	0.05	0.06	0.06	0.07	0.13	0.15	0.08	0.09	0.07	0.07	0.08
03/22/19	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.06	0.08	0.07	0.07	0.11	0.13	0.08	0.09	0.06	0.07	0.08
03/23/19	0.09	0.11	0.09	0.09	0.10	0.10	0.09	0.10	0.06	0.07	0.07	0.08	0.09	0.11	0.09	0.10	0.06	0.07	0.08
03/24/19	0.10	0.11	0.09	0.09	0.10	0.10	0.09	0.10	0.07	0.08	0.08	0.08	0.10	0.12	0.09	0.11	0.06	0.07	0.09
03/25/19	0.10	0.11	0.09	0.10	0.10	0.10	0.09	0.10	0.08	0.09	0.09	0.12	0.11	0.13	0.09	0.10	0.07	0.07	0.09
03/26/19	0.10	0.11	0.09	0.09	0.10	0.11	0.09	0.09	0.08	0.10	0.09	0.11	0.11	0.11	0.09	0.10	0.06	0.07	0.09
03/27/19	0.10	0.11	0.09	0.09	0.10	0.10	0.09	0.09	0.08	0.09	0.08	0.09	0.11	0.13	0.09	0.10	0.06	0.07	0.09
03/28/19	0.08	0.10	0.08	0.09	0.09	0.10	0.08	0.09	0.09	0.09	0.08	0.09	0.11	0.12	0.09	0.10	0.06	0.07	0.09
03/29/19	0.07	0.08	0.08	0.08	0.09	0.09	0.08	0.09	0.09	0.10	0.09	0.09	0.13	0.14	0.09	0.10	0.07	0.07	0.09
03/30/19	0.07	0.08	0.08	0.09	0.09	0.10	0.09	0.09	0.10	0.12	0.08	0.09	0.13	0.13	0.10	0.10	0.07	0.07	0.09
03/31/19	0.08	0.08	0.09	0.09	0.10	0.10	0.09	0.10	0.10	0.10	0.08	0.08	0.13	0.13	0.10	0.11	0.07	0.07	0.09

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

* High value due to analyzer maintenance issue, fixed with flush and calibration check.

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
03/01/19	0.067	0.070	7.781	7.020	8.640	0.047	0.042	0.051	1,821	1,771	1,867	29	27	31	99.40	2.22	98.39	1.79
03/02/19	0.066	0.066	7.750	7.164	8.557	0.046	0.041	0.051	1,748	1,678	1,862	27	26	30	99.41	2.23	98.43	1.81
03/03/19	0.065	0.066	7.305	6.684	7.928	0.044	0.037	0.054	1,654	1,587	1,729	25	23	28	99.39	2.22	98.48	1.82
03/04/19	0.065	0.066	7.467	6.685	8.291	0.043	0.038	0.047	1,664	1,546	1,795	26	23	31	99.42	2.24	98.46	1.81
03/05/19	0.063	0.064	7.568	6.854	8.334	0.046	0.043	0.049	1,785	1,698	1,888	28	25	32	99.40	2.22	98.45	1.81
03/06/19	0.058	0.059	7.461	5.969	8.186	0.034	0.017	0.051	1,812	1,757	1,878	28	26	30	99.55	2.35	98.45	1.81
03/07/19	0.058	0.060	7.019	6.491	7.695	0.023	0.016	0.028	1,792	1,717	1,915	28	26	32	99.67	2.48	98.45	1.81
03/08/19	0.061	0.062	7.261	6.651	8.057	0.024	0.014	0.049	1,833	1,772	1,889	26	24	30	99.66	2.47	98.56	1.84
03/09/19	0.063	0.064	7.439	6.718	8.157	0.021	0.013	0.027	1,840	1,783	1,935	26	24	28	99.72	2.55	98.61	1.86
03/10/19	0.065	0.065	7.176	6.647	7.802	0.018	0.013	0.025	1,729	1,653	1,792	25	23	28	99.75	2.59	98.57	1.85
03/11/19	0.066	0.066	7.350	6.441	7.960	0.019	0.015	0.027	1,704	1,590	1,810	25	22	28	99.74	2.58	98.55	1.84
03/12/19	0.065	0.066	7.542	6.936	8.171	0.021	0.016	0.024	1,772	1,705	1,855	26	23	28	99.72	2.56	98.56	1.84
03/13/19	0.065	0.065	7.672	7.047	8.307	0.020	0.013	0.026	1,829	1,744	1,883	27	24	29	99.73	2.57	98.54	1.84
03/14/19	0.065	0.065	7.839	7.202	18.471*	0.035	0.013	0.046	1,817	1,721	1,958	27	24	30	99.55	2.35	98.54	1.83
03/15/19	0.065	0.065	7.772	5.565	8.453	0.037	0.028	0.047	1,857	1,779	1,928	27	25	30	99.52	2.32	98.53	1.83
03/16/19	0.066	0.069	7.746	5.426	11.546	0.028	0.017	0.040	1,829	1,756	1,915	29	24	56	99.64	2.44	98.44	1.81
03/17/19	0.075	0.083	7.346	6.492	8.183	0.020	0.012	0.027	1,691	1,624	1,757	25	23	28	99.73	2.56	98.51	1.83
03/18/19	0.079	0.083	7.880	5.923	8.963	0.020	0.014	0.031	1,623	1,516	1,753	24	22	29	99.74	2.59	98.49	1.82
03/19/19	0.072	0.076	7.854	7.085	9.075	0.022	0.017	0.026	1,780	1,686	1,884	27	24	31	99.73	2.56	98.49	1.82
03/20/19	0.066	0.070	7.915	7.334	8.583	0.024	0.018	0.034	1,855	1,762	1,976	28	25	32	99.69	2.51	98.49	1.82
03/21/19	0.058	0.064	7.587	7.092	8.364	0.021	0.014	0.027	1,861	1,781	1,938	28	26	30	99.73	2.57	98.49	1.82
03/22/19	0.061	0.070	7.475	5.400	8.346	0.019	0.014	0.026	1,845	1,801	1,934	27	26	30	99.74	2.59	98.54	1.84
03/23/19	0.062	0.064	7.277	6.683	7.956	0.020	0.013	0.026	1,741	1,691	1,807	24	23	27	99.72	2.56	98.60	1.86
03/24/19	0.062	0.063	7.153	6.388	7.884	0.018	0.013	0.023	1,638	1,578	1,697	23	21	26	99.75	2.60	98.61	1.86
03/25/19	0.060	0.061	7.076	6.365	8.315	0.018	0.013	0.023	1,609	1,531	1,728	23	20	25	99.75	2.60	98.60	1.85
03/26/19	0.054	0.057	7.348	6.583	7.984	0.021	0.015	0.024	1,729	1,638	1,840	24	22	28	99.71	2.53	98.60	1.85
03/27/19	0.050	0.052	7.519	7.067	8.092	0.022	0.015	0.030	1,787	1,695	1,886	25	23	28	99.71	2.54	98.59	1.85
03/28/19	0.046	0.064	7.300	6.657	10.153	0.024	0.015	0.033	1,829	1,733	1,932	26	23	30	99.67	2.48	98.56	1.84
03/29/19	0.066	0.071	7.242	6.858	7.940	0.023	0.016	0.028	1,881	1,784	2,004	28	25	31	99.68	2.50	98.51	1.83
03/30/19	0.070	0.071	7.499	7.132	8.310	0.023	0.015	0.033	1,911	1,863	1,967	29	27	31	99.69	2.51	98.51	1.83
03/31/19	0.062	0.069	7.173	6.783	7.918	0.021	0.012	0.027	1,782	1,725	1,839	27	25	29	99.71	2.53	98.49	1.82

Notes:

* Temporary high value due to analyzer issue, not confirmed by secondary 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	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
03/01/19	97.30	99.146	25,779.7	0.26	3.0	6
03/02/19	97.53	99.684	26,048.7	0.26	3.0	6
03/03/19	97.76	99.578	26,237.0	0.26	3.0	6
03/04/19	97.33	99.520	26,229.8	0.26	3.0	6
03/05/19	97.25	99.360	26,254.7	0.26	3.0	6
03/06/19	97.31	97.432	26,296.9	0.26	3.0	6
03/07/19	97.26	99.631	26,072.7	0.26	3.0	6
03/08/19	97.22	99.550	25,755.3	0.26	3.0	6
03/09/19	97.30	99.516	26,223.5	0.26	3.0	6
03/10/19	97.04	95.684	26,003.7	0.26	3.0	6
03/11/19	96.94	99.820	25,424.2	0.26	3.0	6
03/12/19	97.00	99.579	26,343.5	0.26	3.0	6
03/13/19	96.98	99.566	26,305.2	0.26	3.0	6
03/14/19	96.93	98.815	25,845.6	0.26	3.0	6
03/15/19	97.09	99.821	26,066.9	0.26	3.0	6
03/16/19	97.44	84.724	24,716.4	0.26	3.0	6
03/17/19	97.39	99.535	23,786.8	0.26	3.0	6
03/18/19	96.98	99.502	25,925.6	0.26	3.0	6
03/19/19	97.10	99.586	25,823.9	0.26	3.0	6
03/20/19	97.17	98.385	25,894.8	0.26	3.0	6
03/21/19	97.16	94.988	24,846.8	0.25	3.0	6
03/22/19	97.49	96.963	23,987.9	0.25	3.0	6
03/23/19	97.53	99.724	25,030.0	0.26	3.0	6
03/24/19	97.72	99.681	26,045.8	0.26	3.0	6
03/25/19	97.61	99.692	25,983.5	0.26	3.0	6
03/26/19	97.62	99.398	25,991.1	0.26	3.0	6
03/27/19	97.60	99.805	25,912.2	0.26	3.0	6
03/28/19	97.58	99.824	25,613.8	0.26	3.0	6
03/29/19	97.39	99.599	25,910.8	0.26	3.0	6
03/30/19	97.61	93.849	25,654.2	0.26	3.0	6
03/31/19	97.76	94.537	24,371.6	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				
							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
04/01/19	12.94	12.94	12.51	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/02/19	12.88	12.88	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/03/19	12.82	12.82	12.42	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/04/19	12.83	12.83	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/05/19	12.81	12.81	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/06/19	12.85	12.85	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/07/19	12.85	12.85	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/08/19	12.88	12.88	12.49	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/09/19	12.78	12.78	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/10/19	12.80	12.80	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/11/19	12.87	12.87	12.45	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/12/19	12.87	12.87	12.46	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/13/19	12.84	12.84	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/14/19	12.87	12.87	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/15/19	13.00	13.00	12.53	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/16/19	12.85	12.85	12.40	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/17/19	12.79	12.79	12.36	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/18/19	12.88	12.88	12.43	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/19/19	12.94	12.94	12.49	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/20/19	12.88	12.88	12.48	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/21/19	13.01	13.01	12.55	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/22/19	12.87	12.87	12.41	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/23/19	12.63	12.63	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/24/19	12.57	12.57	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/25/19	12.50	12.50	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/26/19	12.60	12.60	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/27/19	12.62	12.62	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/28/19	12.63	12.63	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/29/19	12.69	12.69	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
04/30/19	12.66	12.66	12.23	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
04/01/19	0.00	4.43	2.51	6.00	0.00	12.94
04/02/19	0.00	4.43	2.46	6.00	0.00	12.88
04/03/19	0.00	4.40	2.42	6.00	0.00	12.82
04/04/19	0.00	4.37	2.46	6.00	0.00	12.83
04/05/19	0.00	4.35	2.46	6.00	0.00	12.81
04/06/19	0.00	4.39	2.46	6.00	0.00	12.85
04/07/19	0.00	4.41	2.45	6.00	0.00	12.85
04/08/19	0.00	4.39	2.49	6.00	0.00	12.88
04/09/19	0.00	4.38	2.41	6.00	0.00	12.78
04/10/19	0.00	4.39	2.41	6.00	0.00	12.80
04/11/19	0.00	4.42	2.45	6.00	0.00	12.87
04/12/19	0.00	4.41	2.46	6.00	0.00	12.87
04/13/19	0.00	4.40	2.43	6.00	0.00	12.84
04/14/19	0.00	4.39	2.48	6.00	0.00	12.87
04/15/19	0.00	4.47	2.53	6.00	0.00	13.00
04/16/19	0.00	4.45	2.40	6.00	0.00	12.85
04/17/19	0.00	4.43	2.36	6.00	0.00	12.79
04/18/19	0.00	4.45	2.43	6.00	0.00	12.88
04/19/19	0.00	4.44	2.49	6.00	0.00	12.94
04/20/19	0.00	4.39	2.48	6.00	0.00	12.88
04/21/19	0.00	4.46	2.55	6.00	0.00	13.01
04/22/19	0.00	4.46	2.41	6.00	0.00	12.87
04/23/19	0.00	4.44	2.20	6.00	0.00	12.63
04/24/19	0.00	4.41	2.16	6.00	0.00	12.57
04/25/19	0.00	4.39	2.11	6.00	0.00	12.50
04/26/19	0.00	4.44	2.16	6.00	0.00	12.60
04/27/19	0.00	4.41	2.21	6.00	0.00	12.62
04/28/19	0.00	4.39	2.24	6.00	0.00	12.63
04/29/19	0.00	4.44	2.25	6.00	0.00	12.69
04/30/19	0.00	4.43	2.23	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					
	OCSD	$MF+Cl_2$	RO	UV/AOP	Underground travel time (1)	Total
Date	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*	*LRV*
04/01/19	0.00	0.00	2.51	6.00	4.00	12.51
04/02/19	0.00	0.00	2.46	6.00	4.00	12.46
04/03/19	0.00	0.00	2.42	6.00	4.00	12.42
04/04/19	0.00	0.00	2.46	6.00	4.00	12.46
04/05/19	0.00	0.00	2.46	6.00	4.00	12.46
04/06/19	0.00	0.00	2.46	6.00	4.00	12.46
04/07/19	0.00	0.00	2.45	6.00	4.00	12.45
04/08/19	0.00	0.00	2.49	6.00	4.00	12.49
04/09/19	0.00	0.00	2.41	6.00	4.00	12.41
04/10/19	0.00	0.00	2.41	6.00	4.00	12.41
04/11/19	0.00	0.00	2.45	6.00	4.00	12.45
04/12/19	0.00	0.00	2.46	6.00	4.00	12.46
04/13/19	0.00	0.00	2.43	6.00	4.00	12.43
04/14/19	0.00	0.00	2.48	6.00	4.00	12.48
04/15/19	0.00	0.00	2.53	6.00	4.00	12.53
04/16/19	0.00	0.00	2.40	6.00	4.00	12.40
04/17/19	0.00	0.00	2.36	6.00	4.00	12.36
04/18/19	0.00	0.00	2.43	6.00	4.00	12.43
04/19/19	0.00	0.00	2.49	6.00	4.00	12.49
04/20/19	0.00	0.00	2.48	6.00	4.00	12.48
04/21/19	0.00	0.00	2.55	6.00	4.00	12.55
04/22/19	0.00	0.00	2.41	6.00	4.00	12.41
04/23/19	0.00	0.00	2.20	6.00	4.00	12.20
04/24/19	0.00	0.00	2.16	6.00	4.00	12.16
04/25/19	0.00	0.00	2.11	6.00	4.00	12.11
04/26/19	0.00	0.00	2.16	6.00	4.00	12.16
04/27/19	0.00	0.00	2.21	6.00	4.00	12.21
04/28/19	0.00	0.00	2.24	6.00	4.00	12.24
04/29/19	0.00	0.00	2.25	6.00	4.00	12.25
04/30/19	0.00	0.00	2.23	6.00	4.00	12.23

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
04/01/19	4.89	4.83	4.95	4.60	4.82	4.79	4.86	4.65	4.62	4.54	4.84	4.96	4.65	4.73	4.54	4.43
04/02/19	4.86	4.81	4.87	4.56	4.80	4.78	4.83	4.69	4.63	4.54	4.81	4.98	4.64	4.72	4.53	4.43
04/03/19	4.87	4.77	4.88	4.56	4.80	4.79	4.84	4.72	4.63	4.53	4.82	4.93	4.63	4.71	4.53	4.60
04/04/19	4.87	4.72	4.85	4.52	4.78	4.76	4.81	4.70	4.55	4.52	4.80	4.91	4.59	4.70	4.52	4.60
04/05/19	4.81	4.75	4.85	4.56	4.76	4.75	4.80	4.66	4.51	4.51	4.80	4.92	4.58	4.67	4.51	4.59
04/06/19	4.73	4.74	4.80	4.53	4.79	4.78	4.79	4.63	4.50	4.52	4.82	4.91	4.59	4.68	4.50	4.61
04/07/19	4.79	4.70	4.82	4.80	4.76	4.79	4.81	4.63	4.53	4.47	4.80	4.90	4.59	4.63	4.51	4.61
04/08/19	4.81	4.95	4.84	4.79	4.97	4.75	4.81	4.61	4.54	4.49	4.79	4.89	4.59	4.63	4.53	4.61
04/09/19	4.81	4.96	4.88	4.83	4.98	4.78	4.83	4.62	4.56	4.50	4.82	4.90	4.57	4.66	4.55	4.59
04/10/19	4.75	4.99	4.77	4.85	4.95	4.70	4.83	4.61	4.69	4.52	4.79	4.89	4.58	4.67	4.53	4.60
04/11/19	4.79	5.02	4.81	4.81	4.92	4.72	4.82	4.64	4.78	4.48	4.77	4.92	4.61	4.66	4.50	4.60
04/12/19	4.78	5.00	4.81	4.75	4.88	4.71	4.80	4.59	4.74	4.47	4.77	4.87	4.58	4.63	4.49	4.58
04/13/19	4.74	4.98	5.01	4.79	4.93	4.85	4.80	4.55	4.75	4.44	4.75	4.83	4.57	4.59	4.48	4.56
04/14/19	4.69	4.97	4.99	4.81	4.93	4.82	4.75	4.55	4.66	4.61	4.71	4.84	4.54	4.58	4.47	4.54
04/15/19	4.85	4.94	4.99	4.76	4.88	4.89	4.85	4.58	4.71	4.66	4.70	4.86	4.52	4.58	4.47	4.54
04/16/19	4.90	4.95	5.10	4.80	4.92	4.89	4.90	4.53	4.75	4.68	4.72	4.85	4.54	4.58	4.60	4.55
04/17/19	4.90	4.98	5.05	4.82	4.89	4.88	4.91	4.72	4.71	4.67	4.86	4.84	4.54	4.57	4.65	4.54
04/18/19	4.87	4.90	5.05	4.77	4.83	4.81	4.89	4.74	4.68	4.61	4.87	4.82	4.48	4.54	4.62	4.54
04/19/19	4.88	4.85	4.95	4.66	4.82	4.79	4.88	4.73	4.65	4.57	4.89	4.77	4.45	4.53	4.60	4.51
04/20/19	4.86	4.89	4.94	4.74	4.82	4.78	4.90	4.72	4.69	4.59	4.89	4.92	4.45	4.51	4.61	4.49
04/21/19	4.86	4.88	4.97	4.75	4.83	4.84	4.89	4.71	4.65	4.63	4.87	4.99	4.46	4.69	4.61	4.49
04/22/19	4.89	4.92	4.96	4.72	4.82	4.82	4.86	4.71	4.65	4.58	4.88	4.97	4.46	4.79	4.59	4.50
04/23/19	4.80	4.86	4.98	4.70	4.80	4.78	4.86	4.68	4.65	4.59	4.87	4.98	4.44	4.76	4.59	4.48
04/24/19	4.81	4.87	4.92	4.67	4.81	4.80	4.86	4.67	4.64	4.58	4.85	5.00	4.41	4.72	4.58	4.48
04/25/19	4.84	4.91	4.96	4.68	4.78	4.81	4.84	4.68	4.60	4.53	4.82	4.96	4.39	4.74	4.59	4.49
04/26/19	4.82	4.81	4.94	4.58	4.72	4.75	4.84	4.68	4.59	4.51	4.82	4.91	4.54	4.70	4.58	4.44
04/27/19	4.82	4.81	4.90	4.66	4.73	4.77	4.86	4.69	4.57	4.54	4.84	4.92	4.63	4.73	4.57	4.41
04/28/19	4.83	4.75	4.89	4.66	4.72	4.73	4.83	4.65	4.55	4.55	4.82	4.93	4.64	4.73	4.56	4.39
04/29/19	4.81	4.80	4.86	4.63	4.70	4.80	4.82	4.66	4.56	4.50	4.81	4.94	4.60	4.67	4.57	4.54
04/30/19	4.78	4.76	4.85	4.55	4.61	4.77	4.79	4.61	4.54	4.46	4.83	4.93	4.57	4.64	4.57	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

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
04/01/19	4.64	4.59	4.75	4.46	4.65	4.50	4.48	4.68	4.82	4.74	4.46	4.68	4.76	4.63	4.60	4.84
04/02/19	4.65	4.55	4.73	4.44	4.63	4.50	4.45	4.67	4.86	4.73	4.54	4.70	4.86	4.60	4.81	4.82
04/03/19	4.64	4.54	4.71	4.40	4.61	4.48	4.43	4.71	4.83	4.74	4.67	4.66	5.01	4.57	4.74	4.81
04/04/19	4.62	4.54	4.67	4.37	4.61	4.44	4.41	4.70	4.84	4.72	4.65	4.64	5.02	4.58	4.75	4.81
04/05/19	4.60	4.52	4.63	4.35	4.62	4.45	4.40	4.68	4.80	4.72	4.65	4.66	5.02	4.59	4.74	4.76
04/06/19	4.62	4.55	4.69	4.39	4.62	4.49	4.39	4.67	4.79	4.71	4.65	4.64	4.99	4.57	4.78	4.73
04/07/19	4.62	4.52	4.69	4.41	4.60	4.50	4.43	4.68	4.78	4.70	4.66	4.65	4.92	4.55	4.82	4.75
04/08/19	4.60	4.49	4.64	4.39	4.56	4.47	4.43	4.65	4.75	4.70	4.66	4.65	4.94	4.65	4.73	4.76
04/09/19	4.57	4.51	4.66	4.38	4.56	4.42	4.39	4.62	4.75	4.71	4.65	4.66	4.97	4.62	4.73	4.78
04/10/19	4.56	4.52	4.66	4.54	4.57	4.40	4.39	4.61	4.76	4.70	4.65	4.64	4.94	4.64	4.73	4.76
04/11/19	4.58	4.53	4.66	4.70	4.56	4.42	4.54	4.62	4.75	4.70	4.66	4.64	4.89	4.69	4.72	4.75
04/12/19	4.56	4.48	4.63	4.64	4.55	4.41	4.67	4.63	4.75	4.69	4.64	4.66	4.91	4.68	4.72	4.73
04/13/19	4.54	4.45	4.61	4.62	4.54	4.40	4.65	4.62	4.79	4.68	4.61	4.65	4.91	4.63	4.67	4.70
04/14/19	4.54	4.64	4.61	4.61	4.50	4.39	4.67	4.58	4.90	4.65	4.61	4.62	4.86	4.55	4.62	4.68
04/15/19	4.54	4.77	4.61	4.60	4.47	4.51	4.64	4.56	4.93	4.74	4.61	4.60	4.90	4.51	4.66	4.71
04/16/19	4.54	4.75	4.61	4.61	4.45	4.64	4.64	4.55	4.90	4.89	4.62	4.60	4.91	4.60	4.70	4.71
04/17/19	4.55	4.74	4.61	4.63	4.43	4.65	4.66	4.55	4.91	4.86	4.63	4.61	4.89	4.60	4.72	4.79
04/18/19	4.53	4.73	4.61	4.62	4.45	4.63	4.63	4.57	4.91	4.84	4.61	4.60	4.89	4.58	4.67	4.93
04/19/19	4.45	4.71	4.57	4.57	4.44	4.58	4.60	4.53	4.88	4.81	4.59	4.59	4.86	4.60	4.62	4.86
04/20/19	4.65	4.68	4.55	4.57	4.39	4.59	4.60	4.47	4.90	4.81	4.59	4.57	4.85	4.67	4.65	4.85
04/21/19	4.77	4.68	4.56	4.60	4.63	4.59	4.65	4.47	4.86	4.83	4.57	4.54	4.85	4.68	4.67	4.85
04/22/19	4.77	4.69	4.55	4.56	4.80	4.56	4.63	4.64	4.86	4.80	4.57	4.53	4.85	4.67	4.64	4.85
04/23/19	4.72	4.69	4.52	4.53	4.74	4.59	4.58	4.77	4.89	4.81	4.58	4.52	4.83	4.71	4.62	4.84
04/24/19	4.69	4.66	4.48	4.52	4.68	4.59	4.56	4.74	4.87	4.80	4.56	4.61	4.82	4.71	4.61	4.83
04/25/19	4.67	4.66	4.59	4.52	4.66	4.57	4.53	4.74	4.85	4.79	4.54	4.72	4.78	4.70	4.59	4.82
04/26/19	4.65	4.67	4.79	4.53	4.69	4.64	4.55	4.74	4.87	4.81	4.53	4.71	4.77	4.68	4.56	4.85
04/27/19	4.65	4.62	4.78	4.49	4.71	4.64	4.53	4.71	4.85	4.81	4.50	4.69	4.76	4.67	4.62	4.81
04/28/19	4.65	4.58	4.74	4.46	4.68	4.61	4.52	4.70	4.78	4.75	4.55	4.66	4.73	4.68	4.80	4.78
04/29/19	4.63	4.57	4.74	4.44	4.65	4.58	4.47	4.69	4.79	4.71	4.74	4.69	4.81	4.64	4.77	4.77
04/30/19	4.62	4.56	4.73	4.46	4.62	4.54	4.43	4.63	4.79	4.72	4.68	4.67	4.95	4.64	4.77	4.77

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
04/01/19	4.64	4.71	5.00	5.31
04/02/19	4.61	4.72	4.88	5.13
04/03/19	4.60	4.67	5.03	4.96
04/04/19	4.73	4.66	4.96	5.07
04/05/19	4.76	4.67	4.90	5.10
04/06/19	4.73	4.63	5.03	5.16
04/07/19	4.70	4.63	5.01	5.12
04/08/19	4.71	4.69	5.01	5.05
04/09/19	4.73	4.68	5.07	5.08
04/10/19	4.68	4.73	4.91	5.28
04/11/19	4.70	4.88	4.97	5.22
04/12/19	4.89	4.88	4.94	5.08
04/13/19	4.78	4.87	5.00	5.33
04/14/19	4.78	4.83	5.06	5.29
04/15/19	4.76	4.82	5.04	5.17
04/16/19	4.75	4.87	5.06	5.26
04/17/19	4.78	4.84	5.03	5.13
04/18/19	4.72	4.83	5.07	5.19
04/19/19	4.70	4.82	5.05	5.37
04/20/19	4.71	4.78	5.07	5.19
04/21/19	4.72	4.78	5.14	5.21
04/22/19	4.69	4.78	5.03	5.35
04/23/19	4.68	4.78	5.03	5.24
04/24/19	4.62	4.77	5.11	5.12
04/25/19	4.67	4.74	5.01	5.11
04/26/19	4.62	4.74	4.95	5.01
04/27/19	4.63	4.71	5.09	5.10
04/28/19	4.64	4.68	5.00	5.26
04/29/19	4.80	4.67	4.98	5.22
04/30/19	4.77	4.66	5.06	5.20

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
04/01/19	0.08	0.09	0.09	0.09	0.10	0.10	0.09	0.10	0.10	0.11	0.08	0.08	0.13	0.14	0.10	0.11	0.07	0.08	0.09
04/02/19	0.08	0.09	0.08	0.09	0.09	0.10	0.09	0.09	0.07	0.10	0.07	0.11	0.13	0.14	0.10	0.12	0.07	0.07	0.09
04/03/19	0.07	0.08	0.08	0.09	0.10	0.10	0.09	0.09	0.05	0.06	0.05	0.06	0.10	0.13	0.09	0.10	0.06	0.07	0.08
04/04/19	0.07	0.07	0.08	0.08	0.10	0.11	0.09	0.09	0.05	0.06	0.05	0.06	0.08	0.09	0.09	0.10	0.06	0.06	0.07
04/05/19	0.08	0.09	0.08	0.09	0.10	0.11	0.09	0.10	0.05	0.07	0.06	0.09	0.08	0.12	0.10	0.11	0.06	0.07	0.08
04/06/19	0.08	0.09	0.08	0.09	0.10	0.11	0.08	0.09	0.05	0.07	0.06	0.07	0.08	0.08	0.09	0.10	0.06	0.06	0.08
04/07/19	0.08	0.09	0.09	0.09	0.10	0.11	0.08	0.09	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.06	0.07	0.08
04/08/19	0.08	0.09	0.09	0.10	0.10	0.11	0.09	0.09	0.06	0.07	0.08	0.08	0.09	0.10	0.10	0.10	0.06	0.07	0.08
04/09/19	0.08	0.09	0.09	0.10	0.10	0.11	0.08	0.09	0.06	0.08	0.07	0.11	0.10	0.13	0.09	0.10	0.06	0.07	0.08
04/10/19	0.07	0.08	0.09	0.10	0.10	0.10	0.08	0.09	0.06	0.07	0.06	0.07	0.08	0.10	0.09	0.10	0.06	0.06	0.08
04/11/19	0.07	0.08	0.09	0.10	0.10	0.10	0.09	0.10	0.07	0.08	0.06	0.07	0.07	0.08	0.10	0.10	0.06	0.06	0.08
04/12/19	0.07	0.08	0.08	0.09	0.10	0.10	0.10	0.10	0.08	0.09	0.07	0.08	0.08	0.09	0.09	0.10	0.06	0.06	0.08
04/13/19	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.08	0.09	0.08	0.09	0.08	0.09	0.10	0.10	0.06	0.07	0.09
04/14/19	0.08	0.09	0.09	0.10	0.10	0.10	0.09	0.10	0.09	0.10	0.09	0.10	0.09	0.11	0.10	0.11	0.06	0.07	0.09
04/15/19	0.09	0.09	0.09	0.10	0.10	0.10	0.09	0.10	0.09	0.11	0.10	0.11	0.10	0.11	0.10	0.11	0.06	0.07	0.09
04/16/19	0.08	0.09	0.08	0.09	0.09	0.10	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.10	0.11	0.06	0.06	0.09
04/17/19	0.07	0.08	0.08	0.09	0.09	0.10	0.08	0.08	0.09	0.15	0.10	0.11	0.10	0.11	0.10	0.11	0.05	0.06	0.08
04/18/19	0.07	0.08	0.09	0.10	0.10	0.12	0.08	0.09	0.10	0.13	0.11	0.11	0.11	0.11	0.10	0.11	0.06	0.07	0.09
04/19/19	0.07	0.08	0.09	0.10	0.11	0.12	0.08	0.09	0.10	0.12	0.11	0.11	0.12	0.13	0.10	0.11	0.06	0.07	0.09
04/20/19	0.07	0.08	0.10	0.10	0.11	0.12	0.08	0.09	0.11	0.12	0.11	0.12	0.13	0.14	0.10	0.11	0.07	0.07	0.10
04/21/19	0.08	0.08	0.10	0.10	0.11	0.12	0.08	0.09	0.11	0.12	0.12	0.13	0.12	0.13	0.11	0.11	0.07	0.08	0.10
04/22/19	0.08	0.09	0.10	0.10	0.10	0.11	0.07	0.08	0.11	0.13	0.11	0.12	0.12	0.13	0.11	0.11	0.06	0.07	0.10
04/23/19	0.07	0.08	0.09	0.10	0.10	0.11	0.08	0.08	0.11	0.11	0.11	0.12	0.12	0.13	0.10	0.11	0.06	0.07	0.09
04/24/19	0.06	0.07	0.09	0.09	0.10	0.10	0.08	0.08	0.08	0.11	0.08	0.12	0.13	0.15	0.10	0.11	0.06	0.07	0.09
04/25/19	0.07	0.08	0.09	0.10	0.09	0.10	0.08	0.08	0.06	0.08	0.06	0.07	0.10	0.14	0.10	0.11	0.06	0.07	0.08
04/26/19	0.08	0.09	0.09	0.10	0.10	0.10	0.08	0.09	0.07	0.12	0.07	0.07	0.09	0.10	0.10	0.11	0.06	0.06	0.08
04/27/19	0.08	0.09	0.09	0.10	0.10	0.11	0.08	0.09	0.07	0.08	0.08	0.08	0.09	0.15	0.11	0.11	0.06	0.07	0.09
04/28/19	0.08	0.09	0.10	0.10	0.11	0.14	0.09	0.09	0.08	0.11	0.09	0.09	0.10	0.11	0.11	0.11	0.07	0.08	0.09
04/29/19	0.09	0.10	0.09	0.10	0.11	0.11	0.09	0.09	0.08	0.11	0.09	0.09	0.10	0.11	0.11	0.12	0.07	0.07	0.09
04/30/19	0.08	0.09	0.09	0.09	0.10	0.11	0.08	0.09	0.08	0.11	0.08	0.09	0.11	0.13	0.11	0.11	0.06	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

	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
04/01/19	0.062	0.071	7.293	5.511	11.444	0.023	0.018	0.028	1,674	1,579	1,811	26	23	29	99.69	2.51	98.47	1.81
04/02/19	0.074	0.077	7.599	7.061	8.331	0.027	0.019	0.032	1,846	1,737	1,991	28	25	33	99.65	2.46	98.47	1.81
04/03/19	0.078	0.078	7.985	7.380	8.619	0.031	0.020	0.041	1,910	1,849	1,976	29	27	32	99.62	2.42	98.48	1.82
04/04/19	0.079	0.080	7.520	7.143	8.365	0.026	0.020	0.031	1,919	1,851	1,999	29	27	32	99.66	2.46	98.49	1.82
04/05/19	0.077	0.081	7.435	5.304	8.115	0.026	0.019	0.032	1,908	1,847	1,978	29	27	32	99.65	2.46	98.46	1.81
04/06/19	0.078	0.079	7.493	6.934	8.014	0.026	0.020	0.033	1,880	1,831	1,939	30	28	32	99.65	2.46	98.43	1.80
04/07/19	0.077	0.078	7.181	6.793	7.934	0.026	0.015	0.037	1,738	1,681	1,809	27	26	30	99.64	2.45	98.42	1.80
04/08/19	0.078	0.079	7.252	5.474	10.702	0.024	0.017	0.046	1,649	1,568	1,776	26	24	30	99.68	2.49	98.40	1.80
04/09/19	0.079	0.080	7.240	6.607	8.132	0.028	0.020	0.036	1,825	1,719	1,978	29	27	33	99.61	2.41	98.40	1.79
04/10/19	0.077	0.078	7.512	5.305	8.209	0.029	0.022	0.062	1,905	1,837	1,984	30	27	32	99.61	2.41	98.44	1.81
04/11/19	0.079	0.079	7.673	7.251	8.290	0.027	0.015	0.042	1,938	1,858	2,005	31	28	34	99.64	2.45	98.39	1.79
04/12/19	0.079	0.080	7.687	6.230	8.314	0.027	0.020	0.033	1,920	1,848	1,993	31	27	34	99.65	2.46	98.40	1.80
04/13/19	0.077	0.078	7.789	5.373	8.376	0.029	0.022	0.038	1,891	1,836	1,956	30	28	32	99.63	2.43	98.42	1.80
04/14/19	0.073	0.075	7.482	6.013	8.167	0.025	0.017	0.035	1,737	1,676	1,819	28	26	31	99.67	2.48	98.41	1.80
04/15/19	0.077	0.077	7.417	6.986	8.200	0.022	0.017	0.027	1,621	1,541	1,731	26	24	30	99.71	2.53	98.40	1.79
04/16/19	0.078	0.078	7.257	6.810	7.992	0.029	0.024	0.033	1,741	1,677	1,855	27	25	30	99.60	2.40	98.43	1.80
04/17/19	0.078	0.078	7.324	6.913	8.130	0.032	0.024	0.042	1,875	1,797	1,977	30	27	33	99.56	2.36	98.41	1.80
04/18/19	0.079	0.079	7.706	5.826	8.869	0.029	0.020	0.041	1,890	1,812	1,972	31	28	33	99.63	2.43	98.38	1.79
04/19/19	0.079	0.080	7.780	5.465	11.205	0.025	0.017	0.029	1,902	1,851	1,958	30	28	32	99.68	2.49	98.40	1.80
04/20/19	0.079	0.080	7.484	6.739	8.164	0.025	0.017	0.031	1,776	1,710	1,895	28	26	31	99.67	2.48	98.40	1.80
04/21/19	0.079	0.079	7.380	5.274	8.180	0.021	0.014	0.028	1,647	1,591	1,700	26	24	29	99.72	2.55	98.42	1.80
04/22/19	0.079	0.079	7.398	6.800	8.072	0.029	0.015	0.071	1,621	1,544	1,729	26	23	30	99.61	2.41	98.38	1.79
04/23/19	0.079	0.079	7.506	6.813	8.146	0.048	0.041	0.056	1,737	1,638	1,859	28	25	31	99.37	2.20	98.39	1.79
04/24/19	0.079	0.079	7.655	5.656	8.231	0.053	0.045	0.070	1,853	1,777	1,937	30	27	33	99.31	2.16	98.38	1.79
04/25/19	0.080	0.082	7.770	5.656	11.149	0.060	0.051	0.075	1,892	1,812	1,993	31	28	35	99.23	2.11	98.36	1.79
04/26/19	0.080	0.081	7.804	7.267	8.491	0.054	0.047	0.068	1,845	1,810	1,913	31	28	43	99.31	2.16	98.30	1.77
04/27/19	0.081	0.082	7.708	6.198	8.482	0.048	0.043	0.055	1,712	1,629	1,796	27	26	29	99.38	2.21	98.40	1.80
04/28/19	0.081	0.081	7.795	6.578	10.948	0.045	0.041	0.051	1,591	1,538	1,631	26	24	28	99.42	2.24	98.37	1.79
04/29/19	0.081	0.082	8.107	7.487	9.009	0.046	0.039	0.054	1,574	1,477	1,729	26	23	30	99.44	2.25	98.35	1.78
04/30/19	0.081	0.081	8.111	6.715	9.126	0.048	0.041	0.056	1,711	1,664	1,783	29	26	31	99.41	2.23	98.31	1.77

Notes:

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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	UltraViolet / AOP Process online monitoring results					
Date	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
04/01/19	97.58	93.917	24,504.9	0.26	3.0	6
04/02/19	97.54	91.549	24,348.6	0.26	3.0	6
04/03/19	97.65	92.746	23,725.7	0.26	3.0	6
04/04/19	97.45	99.823	24,666.9	0.27	3.0	6
04/05/19	97.32	99.861	26,200.4	0.26	3.0	6
04/06/19	97.39	96.139	26,193.8	0.26	3.0	6
04/07/19	97.57	97.400	25,301.7	0.26	3.0	6
04/08/19	97.20	94.165	25,253.9	0.26	3.0	6
04/09/19	97.57	89.664	24,448.5	0.26	3.0	6
04/10/19	97.86	89.047	23,905.8	0.27	3.0	6
04/11/19	97.77	91.310	23,837.2	0.27	3.0	6
04/12/19	97.72	96.795	23,712.1	0.26	3.0	6
04/13/19	97.82	95.851	24,856.2	0.26	3.0	6
04/14/19	97.86	95.245	24,785.7	0.26	3.0	6
04/15/19	97.99	83.522	24,781.7	0.26	3.0	6
04/16/19	98.67	79.591	22,310.8	0.27	3.0	6
04/17/19	98.91	82.862	21,298.5	0.27	3.0	6
04/18/19	98.49	93.459	22,132.5	0.27	3.0	6
04/19/19	98.16	96.065	24,694.3	0.26	3.0	6
04/20/19	98.05	91.572	24,740.2	0.26	3.0	6
04/21/19	98.09	92.757	23,140.9	0.26	3.0	6
04/22/19	98.04	87.638	23,542.8	0.26	3.0	6
04/23/19	98.02	86.986	23,486.9	0.27	3.0	6
04/24/19	98.24	87.305	23,003.3	0.26	3.0	6
04/25/19	98.16	88.051	23,592.1	0.27	3.0	6
04/26/19	98.18	83.024	22,877.3	0.26	3.0	6
04/27/19	98.06	94.700	20,869.0	0.25	3.0	6
04/28/19	97.74	90.441	23,761.2	0.25	3.0	6
04/29/19	97.65	93.891	23,736.8	0.26	3.0	6
04/30/19	97.42	93.616	23,755.7	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				
							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
05/01/19	12.62	12.62	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/02/19	12.61	12.61	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/03/19	12.58	12.58	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/04/19	12.58	12.58	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/05/19	12.64	12.64	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/06/19	12.65	12.65	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/07/19 *	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0
05/08/19	12.48	12.48	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/09/19	12.60	12.60	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/10/19	12.62	12.62	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/11/19	12.60	12.60	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/12/19	12.64	12.64	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/13/19	12.63	12.63	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/14/19	12.56	12.56	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/15/19	12.55	12.55	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/16/19	12.56	12.56	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/17/19	12.53	12.53	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/18/19	12.53	12.53	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/19/19	12.58	12.58	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/20/19	12.61	12.61	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/21/19	12.53	12.53	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/22/19	12.55	12.55	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/23/19	12.50	12.50	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/24/19	12.42	12.42	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/25/19	12.51	12.51	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/26/19	12.54	12.54	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/27/19	12.64	12.64	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/28/19	12.62	12.62	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/29/19	12.63	12.63	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/30/19	12.60	12.60	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
05/31/19	12.57	12.57	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.

* Plant offline for maintenance event on 5/7/19.

Orange County Water District - Ground Water Replenishment System (GWRS)
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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*
05/01/19	0.00	4.43	2.19	6.00	0.00	12.62
05/02/19	0.00	4.42	2.18	6.00	0.00	12.61
05/03/19	0.00	4.40	2.18	6.00	0.00	12.58
05/04/19	0.00	4.42	2.16	6.00	0.00	12.58
05/05/19	0.00	4.43	2.21	6.00	0.00	12.64
05/06/19	0.00	4.41	2.24	6.00	0.00	12.65
05/07/19 *	N/A	N/A	N/A	N/A	N/A	N/A
05/08/19	0.00	4.43	2.05	6.00	0.00	12.48
05/09/19	0.00	4.49	2.11	6.00	0.00	12.60
05/10/19	0.00	4.48	2.13	6.00	0.00	12.62
05/11/19	0.00	4.44	2.17	6.00	0.00	12.60
05/12/19	0.00	4.45	2.19	6.00	0.00	12.64
05/13/19	0.00	4.46	2.18	6.00	0.00	12.63
05/14/19	0.00	4.43	2.13	6.00	0.00	12.56
05/15/19	0.00	4.41	2.15	6.00	0.00	12.55
05/16/19	0.00	4.41	2.15	6.00	0.00	12.56
05/17/19	0.00	4.38	2.15	6.00	0.00	12.53
05/18/19	0.00	4.39	2.14	6.00	0.00	12.53
05/19/19	0.00	4.41	2.18	6.00	0.00	12.58
05/20/19	0.00	4.40	2.21	6.00	0.00	12.61
05/21/19	0.00	4.39	2.14	6.00	0.00	12.53
05/22/19	0.00	4.37	2.18	6.00	0.00	12.55
05/23/19	0.00	4.35	2.16	6.00	0.00	12.50
05/24/19	0.00	4.31	2.11	6.00	0.00	12.42
05/25/19	0.00	4.38	2.13	6.00	0.00	12.51
05/26/19	0.00	4.39	2.14	6.00	0.00	12.54
05/27/19	0.00	4.49	2.16	6.00	0.00	12.64
05/28/19	0.00	4.49	2.12	6.00	0.00	12.62
05/29/19	0.00	4.50	2.13	6.00	0.00	12.63
05/30/19	0.00	4.47	2.13	6.00	0.00	12.60
05/31/19	0.00	4.43	2.13	6.00	0.00	12.57

Notes:

* Plant offline for maintenance event on 5/7/19.

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*
05/01/19	0.00	0.00	2.19	6.00	4.00	12.19
05/02/19	0.00	0.00	2.18	6.00	4.00	12.18
05/03/19	0.00	0.00	2.18	6.00	4.00	12.18
05/04/19	0.00	0.00	2.16	6.00	4.00	12.16
05/05/19	0.00	0.00	2.21	6.00	4.00	12.21
05/06/19	0.00	0.00	2.24	6.00	4.00	12.24
05/07/19 *	N/A	N/A	N/A	N/A	N/A	N/A
05/08/19	0.00	0.00	2.05	6.00	4.00	12.05
05/09/19	0.00	0.00	2.11	6.00	4.00	12.11
05/10/19	0.00	0.00	2.13	6.00	4.00	12.13
05/11/19	0.00	0.00	2.17	6.00	4.00	12.17
05/12/19	0.00	0.00	2.19	6.00	4.00	12.19
05/13/19	0.00	0.00	2.18	6.00	4.00	12.18
05/14/19	0.00	0.00	2.13	6.00	4.00	12.13
05/15/19	0.00	0.00	2.15	6.00	4.00	12.15
05/16/19	0.00	0.00	2.15	6.00	4.00	12.15
05/17/19	0.00	0.00	2.15	6.00	4.00	12.15
05/18/19	0.00	0.00	2.14	6.00	4.00	12.14
05/19/19	0.00	0.00	2.18	6.00	4.00	12.18
05/20/19	0.00	0.00	2.21	6.00	4.00	12.21
05/21/19	0.00	0.00	2.14	6.00	4.00	12.14
05/22/19	0.00	0.00	2.18	6.00	4.00	12.18
05/23/19	0.00	0.00	2.16	6.00	4.00	12.16
05/24/19	0.00	0.00	2.11	6.00	4.00	12.11
05/25/19	0.00	0.00	2.13	6.00	4.00	12.13
05/26/19	0.00	0.00	2.14	6.00	4.00	12.14
05/27/19	0.00	0.00	2.16	6.00	4.00	12.16
05/28/19	0.00	0.00	2.12	6.00	4.00	12.12
05/29/19	0.00	0.00	2.13	6.00	4.00	12.13
05/30/19	0.00	0.00	2.13	6.00	4.00	12.13
05/31/19	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.

* Plant offline for maintenance event on 5/7/19.

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
05/01/19	4.78	4.74	4.81	4.57	4.61	4.76	4.80	4.61	4.53	4.46	4.80	4.91	4.57	4.66	4.52	4.58
05/02/19	4.69	4.74	4.81	4.52	4.59	4.69	4.78	4.57	4.50	4.45	4.76	4.87	4.55	4.64	4.49	4.55
05/03/19	4.74	4.97	4.82	4.81	4.54	4.71	4.78	4.58	4.50	4.42	4.75	4.90	4.54	4.64	4.51	4.56
05/04/19	4.78	4.98	4.81	4.80	4.74	4.72	4.78	4.57	4.48	4.43	4.77	4.87	4.55	4.64	4.51	4.60
05/05/19	4.75	4.99	4.75	4.79	4.78	4.72	4.76	4.56	4.72	4.43	4.78	4.88	4.58	4.63	4.50	4.61
05/06/19	4.69	4.96	4.76	4.83	4.74	4.65	4.76	4.55	4.76	4.41	4.76	4.86	4.54	4.63	4.50	4.60
05/07/19 *	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
05/08/19	4.71	5.00	4.77	4.85	4.77	4.68	4.75	4.58	4.79	4.43	4.76	4.88	4.54	4.64	4.50	4.61
05/09/19	4.75	5.06	4.86	4.88	4.78	4.76	4.82	4.56	4.81	4.49	4.76	4.92	4.55	4.66	4.50	4.61
05/10/19	4.76	5.05	4.88	4.85	4.76	4.70	4.81	4.54	4.80	4.48	4.79	4.92	4.55	4.65	4.50	4.61
05/11/19	4.70	4.99	5.09	4.75	4.82	4.84	4.74	4.49	4.77	4.44	4.76	4.88	4.54	4.64	4.47	4.59
05/12/19	4.91	4.97	5.04	4.81	4.85	4.84	4.75	4.50	4.78	4.62	4.74	4.87	4.50	4.61	4.45	4.57
05/13/19	4.87	4.96	5.08	4.79	4.80	4.85	4.88	4.49	4.73	4.67	4.72	4.86	4.46	4.56	4.46	4.55
05/14/19	4.91	5.03	5.06	4.78	4.83	4.85	4.90	4.43	4.73	4.68	4.76	4.84	4.48	4.58	4.58	4.56
05/15/19	4.91	4.97	5.07	4.81	4.86	4.85	4.89	4.65	4.75	4.64	4.87	4.80	4.48	4.56	4.63	4.57
05/16/19	4.92	4.96	5.06	4.77	4.82	4.86	4.91	4.69	4.76	4.66	4.92	4.81	4.48	4.57	4.62	4.53
05/17/19	4.87	4.93	5.03	4.74	4.79	4.83	4.84	4.69	4.71	4.62	4.89	4.82	4.50	4.51	4.61	4.50
05/18/19	4.82	4.84	4.92	4.75	4.78	4.82	4.83	4.68	4.66	4.63	4.86	4.93	4.45	4.45	4.58	4.48
05/19/19	4.82	4.88	5.02	4.71	4.80	4.83	4.84	4.64	4.68	4.60	4.86	4.99	4.41	4.66	4.60	4.46
05/20/19	4.78	4.89	4.94	4.69	4.81	4.80	4.83	4.67	4.66	4.60	4.83	4.94	4.40	4.75	4.58	4.45
05/21/19	4.77	4.82	4.90	4.70	4.80	4.74	4.82	4.67	4.65	4.59	4.83	4.93	4.39	4.71	4.57	4.45
05/22/19	4.81	4.85	4.95	4.68	4.79	4.76	4.82	4.65	4.62	4.59	4.84	4.92	4.37	4.72	4.58	4.44
05/23/19	4.82	4.83	4.86	4.65	4.76	4.78	4.79	4.67	4.64	4.54	4.85	4.94	4.35	4.72	4.56	4.44
05/24/19	4.80	4.80	4.95	4.67	4.75	4.75	4.83	4.63	4.58	4.52	4.86	4.95	4.31	4.69	4.54	4.41
05/25/19	4.76	4.84	4.92	4.63	4.72	4.74	4.78	4.58	4.55	4.53	4.83	4.93	4.54	4.68	4.54	4.38
05/26/19	4.77	4.77	4.90	4.65	4.75	4.75	4.78	4.64	4.58	4.53	4.81	4.94	4.62	4.70	4.54	4.39
05/27/19	4.81	4.79	4.88	4.57	4.74	4.71	4.76	4.64	4.58	4.49	4.79	4.92	4.60	4.66	4.54	4.54
05/28/19	4.75	4.79	4.87	4.60	4.76	4.68	4.77	4.59	4.59	4.49	4.80	4.93	4.60	4.62	4.55	4.61
05/29/19	4.81	4.84	4.89	4.63	4.73	4.73	4.76	4.60	4.59	4.50	4.80	4.94	4.59	4.62	4.55	4.58
05/30/19	4.75	4.74	4.85	4.87	4.73	4.67	4.81	4.60	4.53	4.49	4.78	4.89	4.58	4.61	4.51	4.58
05/31/19	4.70	4.97	4.84	4.87	4.72	4.68	4.76	4.58	4.50	4.46	4.79	4.89	4.59	4.61	4.49	4.56

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* Plant offline for maintenance event on 5/7/19.

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	C01	C02	C03	C04	C05	C06	C07	C08	D01	D02	D03	D04	D05	D06	D07	D08
	MicroFiltration Process online monitoring results Log Removal Value															
	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
05/01/19	4.59	4.55	4.73	4.47	4.58	4.56	4.43	4.63	4.77	4.68	4.67	4.63	4.95	4.64	4.72	4.73
05/02/19	4.59	4.51	4.68	4.44	4.56	4.55	4.42	4.63	4.75	4.67	4.67	4.63	4.92	4.63	4.70	4.74
05/03/19	4.58	4.51	4.64	4.40	4.57	4.55	4.42	4.59	4.71	4.69	4.64	4.62	4.92	4.63	4.71	4.72
05/04/19	4.59	4.54	4.68	4.42	4.56	4.56	4.43	4.60	4.73	4.68	4.64	4.62	4.93	4.65	4.68	4.73
05/05/19	4.60	4.55	4.74	4.43	4.55	4.57	4.43	4.57	4.73	4.69	4.63	4.66	4.91	4.64	4.70	4.72
05/06/19	4.59	4.51	4.70	4.62	4.56	4.55	4.43	4.56	4.68	4.67	4.62	4.66	4.84	4.65	4.73	4.72
05/07/19 *	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
05/08/19	4.59	4.51	4.66	4.76	4.58	4.55	4.44	4.61	4.74	4.71	4.67	4.67	4.96	4.65	4.78	4.76
05/09/19	4.62	4.56	4.68	4.76	4.58	4.61	4.57	4.61	4.79	4.72	4.71	4.66	4.99	4.66	4.84	4.80
05/10/19	4.62	4.58	4.71	4.77	4.56	4.60	4.71	4.59	4.76	4.69	4.72	4.65	4.93	4.67	4.77	4.78
05/11/19	4.59	4.56	4.69	4.75	4.54	4.55	4.71	4.56	4.87	4.66	4.69	4.63	4.90	4.66	4.74	4.78
05/12/19	4.56	4.69	4.66	4.70	4.51	4.53	4.68	4.53	4.97	4.62	4.64	4.62	4.89	4.61	4.72	4.73
05/13/19	4.55	4.79	4.66	4.69	4.49	4.50	4.66	4.54	4.93	4.73	4.64	4.61	4.86	4.62	4.72	4.71
05/14/19	4.54	4.78	4.67	4.68	4.43	4.61	4.68	4.51	4.95	4.84	4.66	4.62	4.90	4.62	4.72	4.68
05/15/19	4.54	4.76	4.65	4.67	4.41	4.69	4.67	4.45	4.96	4.87	4.63	4.60	4.87	4.60	4.67	4.76
05/16/19	4.51	4.76	4.60	4.66	4.41	4.69	4.65	4.42	4.92	4.90	4.62	4.58	4.85	4.60	4.67	4.95
05/17/19	4.46	4.75	4.58	4.65	4.38	4.69	4.60	4.40	4.89	4.84	4.60	4.58	4.83	4.66	4.65	4.90
05/18/19	4.43	4.72	4.57	4.63	4.59	4.68	4.58	4.39	4.90	4.81	4.56	4.57	4.78	4.79	4.62	4.83
05/19/19	4.60	4.69	4.55	4.63	4.74	4.67	4.60	4.55	4.92	4.82	4.57	4.52	4.80	4.73	4.58	4.83
05/20/19	4.71	4.68	4.52	4.60	4.67	4.62	4.59	4.79	4.88	4.79	4.57	4.46	4.75	4.69	4.56	4.83
05/21/19	4.67	4.68	4.47	4.57	4.65	4.61	4.57	4.72	4.82	4.79	4.54	4.44	4.70	4.69	4.56	4.80
05/22/19	4.66	4.67	4.45	4.56	4.67	4.65	4.56	4.65	4.78	4.79	4.52	4.53	4.67	4.69	4.55	4.79
05/23/19	4.67	4.65	4.62	4.52	4.64	4.63	4.55	4.67	4.80	4.77	4.52	4.66	4.64	4.67	4.51	4.78
05/24/19	4.66	4.63	4.75	4.51	4.62	4.62	4.52	4.70	4.82	4.75	4.49	4.66	4.67	4.69	4.52	4.76
05/25/19	4.65	4.61	4.75	4.53	4.62	4.59	4.49	4.68	4.84	4.72	4.45	4.67	4.66	4.70	4.59	4.79
05/26/19	4.63	4.62	4.73	4.50	4.62	4.58	4.51	4.65	4.84	4.74	4.53	4.66	4.70	4.66	4.73	4.79
05/27/19	4.62	4.67	4.74	4.50	4.63	4.61	4.54	4.66	4.82	4.75	4.71	4.65	4.71	4.66	4.71	4.78
05/28/19	4.63	4.62	4.71	4.50	4.59	4.60	4.51	4.67	4.79	4.71	4.69	4.66	4.82	4.69	4.72	4.76
05/29/19	4.64	4.58	4.69	4.50	4.54	4.60	4.50	4.66	4.79	4.70	4.69	4.65	4.92	4.68	4.71	4.77
05/30/19	4.62	4.58	4.70	4.47	4.53	4.60	4.49	4.61	4.80	4.72	4.66	4.63	4.88	4.66	4.68	4.73
05/31/19	4.61	4.51	4.66	4.44	4.52	4.55	4.43	4.60	4.79	4.70	4.64	4.62	4.87	4.65	4.70	4.69

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* Plant offline for maintenance event on 5/7/19.

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
05/01/19	4.77	4.63	5.01	5.26
05/02/19	4.68	4.60	4.99	4.97
05/03/19	4.69	4.63	5.08	5.01
05/04/19	4.76	4.61	5.12	5.25
05/05/19	4.74	4.61	5.05	5.29
05/06/19	4.72	4.59	5.02	5.06
05/07/19 *	N/A	N/A	N/A	N/A
05/08/19	4.75	4.72	5.03	5.21
05/09/19	4.75	4.85	5.03	5.21
05/10/19	4.67	4.81	4.98	5.10
05/11/19	4.66	4.82	5.02	5.05
05/12/19	4.65	4.87	5.09	5.34
05/13/19	4.63	4.85	5.04	5.36
05/14/19	4.68	4.87	5.04	5.15
05/15/19	4.70	4.83	4.92	5.24
05/16/19	4.69	4.80	4.99	5.20
05/17/19	4.62	4.74	4.99	5.27
05/18/19	4.61	4.72	4.96	5.30
05/19/19	4.61	4.71	5.02	5.07
05/20/19	4.66	4.69	5.04	5.15
05/21/19	4.83	4.70	4.96	5.32
05/22/19	4.76	4.70	4.95	5.06
05/23/19	4.73	4.70	4.98	5.04
05/24/19	4.71	4.71	5.03	5.29
05/25/19	4.73	4.70	5.04	5.05
05/26/19	4.66	4.69	5.04	5.18
05/27/19	4.67	4.71	4.96	5.30
05/28/19	4.66	4.71	5.00	5.12
05/29/19	4.66	4.66	5.08	5.15
05/30/19	4.72	4.65	5.06	5.24
05/31/19	4.84	4.60	4.97	5.14

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* Plant offline for maintenance event on 5/7/19.

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
05/01/19	0.07	0.08	0.09	0.10	0.11	0.12	0.08	0.10	0.07	0.11	0.06	0.09	0.11	0.12	0.10	0.11	0.06	0.06	0.08
05/02/19	0.06	0.07	0.10	0.11	0.11	0.12	0.08	0.09	0.06	0.08	0.07	0.08	0.12	0.13	0.10	0.11	0.05	0.06	0.08
05/03/19	0.07	0.08	0.10	0.11	0.11	0.12	0.08	0.08	0.07	0.09	0.08	0.09	0.08	0.13	0.10	0.11	0.07	0.08	0.08
05/04/19	0.08	0.09	0.11	0.12	0.11	0.11	0.08	0.08	0.07	0.10	0.09	0.10	0.06	0.08	0.11	0.11	0.08	0.08	0.09
05/05/19	0.08	0.09	0.11	0.11	0.11	0.12	0.07	0.08	0.08	0.09	0.10	0.10	0.07	0.08	0.11	0.11	0.08	0.09	0.09
05/06/19	0.08	0.09	0.11	0.11	0.11	0.11	0.06	0.07	0.08	0.09	0.10	0.11	0.07	0.08	0.11	0.12	0.08	0.10	0.09
05/07/19 *	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
05/08/19	0.08	0.12	0.15	0.23	0.18	0.30	0.08	0.18	0.10	0.15	0.12	0.15	0.10	0.14	0.11	0.14	0.08	0.12	0.09
05/09/19	0.07	0.08	0.09	0.10	0.10	0.10	0.06	0.06	0.07	0.10	0.09	0.11	0.07	0.14	0.09	0.10	0.07	0.07	0.08
05/10/19	0.06	0.08	0.11	0.11	0.10	0.12	0.06	0.07	0.05	0.05	0.07	0.08	0.05	0.07	0.09	0.10	0.07	0.08	0.07
05/11/19	0.08	0.08	0.11	0.12	0.10	0.12	0.06	0.07	0.06	0.09	0.08	0.09	0.06	0.08	0.10	0.10	0.08	0.08	0.08
05/12/19	0.09	0.10	0.12	0.13	0.10	0.11	0.06	0.07	0.07	0.07	0.09	0.16	0.07	0.08	0.10	0.10	0.09	0.09	0.09
05/13/19	0.09	0.09	0.12	0.13	0.10	0.10	0.06	0.07	0.07	0.07	0.10	0.13	0.08	0.11	0.10	0.10	0.09	0.10	0.09
05/14/19	0.09	0.09	0.12	0.13	0.10	0.10	0.06	0.07	0.06	0.10	0.08	0.11	0.07	0.08	0.10	0.10	0.08	0.09	0.08
05/15/19	0.08	0.09	0.12	0.12	0.10	0.10	0.06	0.07	0.05	0.05	0.06	0.06	0.07	0.08	0.10	0.10	0.08	0.08	0.08
05/16/19	0.08	0.08	0.11	0.12	0.09	0.10	0.06	0.06	0.04	0.05	0.05	0.06	0.07	0.08	0.10	0.10	0.07	0.08	0.08
05/17/19	0.07	0.09	0.11	0.12	0.09	0.10	0.06	0.06	0.04	0.05	0.06	0.06	0.07	0.09	0.10	0.10	0.07	0.08	0.07
05/18/19	0.09	0.09	0.12	0.12	0.10	0.10	0.06	0.07	0.05	0.06	0.06	0.07	0.07	0.08	0.11	0.11	0.06	0.07	0.08
05/19/19	0.09	0.10	0.12	0.12	0.10	0.10	0.06	0.07	0.05	0.07	0.06	0.07	0.07	0.08	0.10	0.11	0.06	0.07	0.08
05/20/19	0.09	0.10	0.12	0.12	0.10	0.10	0.06	0.07	0.05	0.06	0.07	0.07	0.07	0.07	0.10	0.10	0.06	0.07	0.08
05/21/19	0.09	0.10	0.12	0.12	0.10	0.10	0.06	0.07	0.05	0.10	0.07	0.11	0.07	0.07	0.10	0.10	0.07	0.07	0.08
05/22/19	0.09	0.10	0.12	0.12	0.10	0.10	0.06	0.07	0.04	0.06	0.06	0.06	0.07	0.08	0.10	0.10	0.06	0.07	0.08
05/23/19	0.09	0.10	0.11	0.12	0.09	0.10	0.06	0.07	0.04	0.05	0.06	0.07	0.07	0.08	0.09	0.10	0.06	0.07	0.08
05/24/19	0.09	0.10	0.11	0.12	0.10	0.10	0.06	0.07	0.04	0.05	0.07	0.08	0.06	0.07	0.09	0.09	0.06	0.06	0.08
05/25/19	0.10	0.10	0.12	0.12	0.10	0.10	0.06	0.07	0.05	0.07	0.08	0.09	0.07	0.07	0.09	0.10	0.06	0.06	0.08
05/26/19	0.10	0.12	0.11	0.12	0.10	0.10	0.06	0.07	0.06	0.07	0.09	0.09	0.07	0.09	0.09	0.10	0.05	0.06	0.08
05/27/19	0.10	0.10	0.11	0.12	0.10	0.10	0.06	0.10	0.06	0.07	0.10	0.10	0.07	0.08	0.09	0.10	0.04	0.05	0.08
05/28/19	0.10	0.10	0.12	0.12	0.10	0.10	0.06	0.07	0.05	0.10	0.08	0.11	0.08	0.08	0.10	0.12	0.05	0.05	0.08
05/29/19	0.08	0.10	0.11	0.12	0.10	0.12	0.07	0.08	0.04	0.05	0.07	0.08	0.07	0.09	0.10	0.11	0.06	0.07	0.08
05/30/19	0.07	0.09	0.11	0.12	0.11	0.12	0.07	0.08	0.03	0.06	0.07	0.08	0.07	0.08	0.10	0.11	0.07	0.08	0.08
05/31/19	0.08	0.09	0.11	0.11	0.10	0.11	0.06	0.07	0.04	0.06	0.08	0.08	0.06	0.07	0.10	0.11	0.07	0.08	0.08

Notes:

Effluent turbidity ntu limit 0.20 , values of 0.5 ntu require shutdown of cell.

* Plant offline for maintenance event on 5/7/19.

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
05/01/19	0.079	0.080	7.954	7.315	8.727	0.051	0.044	0.060	1,798	1,724	1,882	31	28	33	99.35	2.19	98.29	1.77
05/02/19	0.080	0.081	7.685	7.118	8.343	0.050	0.041	0.060	1,813	1,752	1,856	31	28	35	99.35	2.18	98.26	1.76
05/03/19	0.076	0.080	7.500	6.948	8.213	0.050	0.041	0.057	1,776	1,711	1,814	32	29	34	99.34	2.18	98.22	1.75
05/04/19	0.073	0.074	7.414	6.757	13.672	0.051	0.046	0.060	1,679	1,620	1,753	30	27	34	99.31	2.16	98.21	1.75
05/05/19	0.074	0.074	7.341	6.808	8.048	0.045	0.041	0.051	1,580	1,529	1,621	28	25	29	99.39	2.21	98.24	1.75
05/06/19	0.073	0.073	7.241	6.830	7.886	0.042	0.037	0.047	1,509	1,480	1,539	26	25	27	99.42	2.24	98.27	1.76
05/07/19 *	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
05/08/19	0.073	0.075	7.319	5.886	8.986	0.065	0.050	0.111	1,773	1,491	1,877	36	31	64	99.11	2.05	97.98	1.69
05/09/19	0.074	0.075	7.650	7.014	10.750	0.059	0.053	0.070	1,811	1,753	1,867	31	29	34	99.23	2.11	98.28	1.77
05/10/19	0.072	0.080	7.873	7.521	8.384	0.058	0.050	0.068	1,841	1,791	1,887	32	29	35	99.26	2.13	98.28	1.76
05/11/19	0.073	0.074	7.868	5.288	12.252	0.054	0.049	0.060	1,768	1,694	1,857	31	28	33	99.32	2.17	98.27	1.76
05/12/19	0.072	0.073	7.743	6.996	8.474	0.050	0.044	0.054	1,598	1,520	1,669	27	24	30	99.35	2.19	98.31	1.77
05/13/19	0.075	0.075	8.144	7.624	8.972	0.054	0.050	0.066	1,540	1,461	1,668	26	23	30	99.34	2.18	98.29	1.77
05/14/19	0.077	0.078	8.145	5.675	9.057	0.060	0.051	0.080	1,694	1,609	1,829	29	25	32	99.26	2.13	98.32	1.77
05/15/19	0.077	0.077	7.890	7.513	8.511	0.056	0.050	0.060	1,811	1,731	1,902	29	27	32	99.29	2.15	98.38	1.79
05/16/19	0.076	0.076	7.975	5.798	8.783	0.056	0.050	0.060	1,839	1,774	1,905	30	27	37	99.30	2.15	98.34	1.78
05/17/19	0.071	0.080	8.192	7.621	9.025	0.058	0.050	0.067	1,826	1,757	1,887	32	28	36	99.30	2.15	98.23	1.75
05/18/19	0.072	0.075	7.765	7.251	8.511	0.056	0.043	0.066	1,752	1,661	1,856	32	30	35	99.27	2.14	98.16	1.73
05/19/19	0.075	0.075	7.744	7.016	8.724	0.052	0.045	0.060	1,587	1,509	1,635	30	27	33	99.33	2.18	98.11	1.72
05/20/19	0.075	0.076	8.137	6.212	9.115	0.050	0.044	0.082	1,557	1,461	1,676	30	25	34	99.38	2.21	98.11	1.72
05/21/19	0.074	0.076	7.963	6.291	9.237	0.057	0.050	0.084	1,640	1,562	1,794	30	27	35	99.28	2.14	98.17	1.74
05/22/19	0.075	0.075	8.080	7.339	8.791	0.053	0.050	0.063	1,782	1,684	1,891	33	29	37	99.34	2.18	98.14	1.73
05/23/19	0.076	0.080	8.042	7.257	8.783	0.056	0.048	0.070	1,786	1,670	1,920	36	28	49	99.30	2.16	97.98	1.70
05/24/19	0.075	0.076	7.812	7.061	11.848	0.060	0.053	0.088	1,798	1,723	1,871	44	38	49	99.23	2.11	97.56	1.61
05/25/19	0.074	0.076	7.581	6.591	8.434	0.057	0.051	0.073	1,717	1,651	1,821	41	37	46	99.25	2.13	97.59	1.62
05/26/19	0.061	0.070	7.150	6.269	8.139	0.051	0.046	0.058	1,602	1,531	1,651	39	35	44	99.28	2.14	97.59	1.62
05/27/19	0.070	0.075	7.200	6.396	8.156	0.050	0.045	0.066	1,579	1,526	1,643	39	35	43	99.30	2.16	97.56	1.61
05/28/19	0.075	0.075	7.328	6.460	8.449	0.055	0.050	0.066	1,587	1,497	1,716	39	32	46	99.25	2.12	97.57	1.61
05/29/19	0.075	0.075	7.911	6.064	13.447	0.058	0.050	0.069	1,706	1,601	1,862	42	36	48	99.27	2.13	97.56	1.61
05/30/19	0.076	0.076	7.846	6.953	8.562	0.058	0.048	0.071	1,766	1,688	1,835	43	37	48	99.26	2.13	97.59	1.62
05/31/19	0.078	0.085	7.794	6.852	8.531	0.057	0.053	0.066	1,782	1,711	1,884	36	28	44	99.27	2.13	97.99	1.70

Notes:

* Plant offline for maintenance event on 5/7/19.

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
05/01/19	97.42	91.078	23,740.2	0.25	3.0	6
05/02/19	97.47	94.937	23,557.8	0.26	3.0	6
05/03/19	97.66	95.585	23,840.7	0.25	3.0	6
05/04/19	97.91	91.011	23,773.4	0.25	3.0	6
05/05/19	98.13	88.513	23,561.5	0.26	3.0	6
05/06/19	98.13	45.886	22,930.8	0.26	3.0	6
05/07/19 *	N/A	N/A	N/A	N/A	N/A	N/A
05/08/19	99.62	35.535	1,770.5	0.27	3.0	6
05/09/19	99.09	79.127	13,098.2	0.27	3.0	6
05/10/19	97.94	79.873	21,011.3	0.26	3.0	6
05/11/19	97.77	83.229	20,935.1	0.26	3.0	6
05/12/19	98.66	84.056	21,579.1	0.26	3.0	6
05/13/19	97.65	80.238	21,456.8	0.26	3.0	6
05/14/19	97.81	80.383	21,195.6	0.26	3.0	6
05/15/19	98.22	78.774	21,761.8	0.27	3.0	6
05/16/19	97.99	82.791	22,046.9	0.27	3.0	6
05/17/19	97.51	91.175	22,975.6	0.27	3.0	6
05/18/19	97.45	95.463	24,157.3	0.26	3.0	6
05/19/19	97.48	91.762	24,575.2	0.26	3.0	6
05/20/19	97.19	92.286	24,316.7	0.26	3.0	6
05/21/19	97.37	93.837	23,419.1	0.26	3.0	6
05/22/19	97.45	93.391	23,777.3	0.26	3.0	6
05/23/19	97.49	94.867	23,250.0	0.25	3.0	6
05/24/19	97.19	89.619	23,477.0	0.25	3.0	6
05/25/19	97.26	88.955	23,035.7	0.26	3.0	6
05/26/19	97.50	89.227	22,795.0	0.25	3.0	6
05/27/19	97.75	86.014	23,119.8	0.26	3.0	6
05/28/19	97.53	86.573	22,826.4	0.26	3.0	6
05/29/19	97.29	87.817	22,966.5	0.26	3.0	6
05/30/19	97.24	90.971	22,998.2	0.26	3.0	6
05/31/19	97.03	88.257	23,364.4	0.26	3.0	6

Notes:

Based on August 28, 2009 letter from California Department of Public Health (now DDW).

minimum UVT = 95%

* Plant offline for maintenance event on 5/7/19.

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
06/01/19	12.67	12.67	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/02/19	12.71	12.71	12.28	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/03/19	12.70	12.70	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/04/19	12.48	12.48	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/05/19	12.49	12.49	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/06/19	12.53	12.53	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/07/19	12.53	12.53	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/08/19	12.52	12.52	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/09/19	12.55	12.55	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/10/19	12.56	12.56	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/11/19	12.47	12.47	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/12/19	12.46	12.46	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/13/19	12.51	12.51	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/14/19	12.61	12.61	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/15/19	12.62	12.62	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/16/19	12.61	12.61	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/17/19	12.60	12.60	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/18/19	12.53	12.53	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/19/19	12.47	12.47	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/20/19	12.55	12.55	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/21/19	12.66	12.66	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/22/19	12.63	12.63	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/23/19	12.58	12.58	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/24/19	12.55	12.55	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/25/19	12.48	12.48	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/26/19	12.45	12.45	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/27/19	12.44	12.44	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/28/19	12.42	12.42	12.03	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/29/19	12.43	12.43	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
06/30/19	12.37	12.37	12.04	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*
06/01/19	0.00	4.43	2.24	6.00	0.00	12.67
06/02/19	0.00	4.43	2.28	6.00	0.00	12.71
06/03/19	0.00	4.45	2.24	6.00	0.00	12.70
06/04/19	0.00	4.42	2.06	6.00	0.00	12.48
06/05/19	0.00	4.39	2.10	6.00	0.00	12.49
06/06/19	0.00	4.40	2.13	6.00	0.00	12.53
06/07/19	0.00	4.41	2.12	6.00	0.00	12.53
06/08/19	0.00	4.41	2.12	6.00	0.00	12.52
06/09/19	0.00	4.41	2.15	6.00	0.00	12.55
06/10/19	0.00	4.40	2.16	6.00	0.00	12.56
06/11/19	0.00	4.37	2.10	6.00	0.00	12.47
06/12/19	0.00	4.35	2.11	6.00	0.00	12.46
06/13/19	0.00	4.37	2.14	6.00	0.00	12.51
06/14/19	0.00	4.45	2.16	6.00	0.00	12.61
06/15/19	0.00	4.44	2.18	6.00	0.00	12.62
06/16/19	0.00	4.42	2.18	6.00	0.00	12.61
06/17/19	0.00	4.43	2.17	6.00	0.00	12.60
06/18/19	0.00	4.41	2.12	6.00	0.00	12.53
06/19/19	0.00	4.38	2.08	6.00	0.00	12.47
06/20/19	0.00	4.45	2.10	6.00	0.00	12.55
06/21/19	0.00	4.47	2.19	6.00	0.00	12.66
06/22/19	0.00	4.45	2.18	6.00	0.00	12.63
06/23/19	0.00	4.46	2.12	6.00	0.00	12.58
06/24/19	0.00	4.44	2.11	6.00	0.00	12.55
06/25/19	0.00	4.43	2.05	6.00	0.00	12.48
06/26/19	0.00	4.40	2.05	6.00	0.00	12.45
06/27/19	0.00	4.39	2.05	6.00	0.00	12.44
06/28/19	0.00	4.39	2.03	6.00	0.00	12.42
06/29/19	0.00	4.38	2.05	6.00	0.00	12.43
06/30/19	0.00	4.34	2.04	6.00	0.00	12.37

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*
06/01/19	0.00	0.00	2.24	6.00	4.00	12.24
06/02/19	0.00	0.00	2.28	6.00	4.00	12.28
06/03/19	0.00	0.00	2.24	6.00	4.00	12.24
06/04/19	0.00	0.00	2.06	6.00	4.00	12.06
06/05/19	0.00	0.00	2.10	6.00	4.00	12.10
06/06/19	0.00	0.00	2.13	6.00	4.00	12.13
06/07/19	0.00	0.00	2.12	6.00	4.00	12.12
06/08/19	0.00	0.00	2.12	6.00	4.00	12.12
06/09/19	0.00	0.00	2.15	6.00	4.00	12.15
06/10/19	0.00	0.00	2.16	6.00	4.00	12.16
06/11/19	0.00	0.00	2.10	6.00	4.00	12.10
06/12/19	0.00	0.00	2.11	6.00	4.00	12.11
06/13/19	0.00	0.00	2.14	6.00	4.00	12.14
06/14/19	0.00	0.00	2.16	6.00	4.00	12.16
06/15/19	0.00	0.00	2.18	6.00	4.00	12.18
06/16/19	0.00	0.00	2.18	6.00	4.00	12.18
06/17/19	0.00	0.00	2.17	6.00	4.00	12.17
06/18/19	0.00	0.00	2.12	6.00	4.00	12.12
06/19/19	0.00	0.00	2.08	6.00	4.00	12.08
06/20/19	0.00	0.00	2.10	6.00	4.00	12.10
06/21/19	0.00	0.00	2.19	6.00	4.00	12.19
06/22/19	0.00	0.00	2.18	6.00	4.00	12.18
06/23/19	0.00	0.00	2.12	6.00	4.00	12.12
06/24/19	0.00	0.00	2.11	6.00	4.00	12.11
06/25/19	0.00	0.00	2.05	6.00	4.00	12.05
06/26/19	0.00	0.00	2.05	6.00	4.00	12.05
06/27/19	0.00	0.00	2.05	6.00	4.00	12.05
06/28/19	0.00	0.00	2.03	6.00	4.00	12.03
06/29/19	0.00	0.00	2.05	6.00	4.00	12.05
06/30/19	0.00	0.00	2.04	6.00	4.00	12.04

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	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
06/01/19	4.74	5.04	4.85	4.84	4.84	4.66	4.78	4.54	4.53	4.47	4.80	4.88	4.58	4.63	4.51	4.58
06/02/19	4.78	5.00	4.85	4.82	4.89	4.71	4.80	4.58	4.74	4.49	4.81	4.87	4.55	4.66	4.52	4.58
06/03/19	4.71	5.00	4.81	4.79	4.87	4.67	4.73	4.54	4.73	4.45	4.77	4.85	4.55	4.60	4.50	4.58
06/04/19	4.71	4.94	4.72	4.78	4.84	4.63	4.72	4.49	4.69	4.42	4.76	4.85	4.51	4.59	4.47	4.55
06/05/19	4.67	4.90	4.70	4.77	4.87	4.88	4.75	4.50	4.72	4.39	4.74	4.84	4.53	4.57	4.46	4.52
06/06/19	4.66	4.89	5.02	4.78	4.81	4.85	4.71	4.49	4.69	4.63	4.71	4.80	4.51	4.58	4.44	4.52
06/07/19	4.88	4.92	5.11	4.78	4.85	4.82	4.74	4.49	4.72	4.65	4.73	4.80	4.50	4.58	4.43	4.52
06/08/19	4.91	4.96	5.10	4.77	4.81	4.83	4.83	4.49	4.70	4.63	4.73	4.77	4.48	4.55	4.42	4.50
06/09/19	4.90	4.92	5.06	4.78	4.83	4.81	4.81	4.46	4.67	4.62	4.69	4.78	4.48	4.55	4.55	4.51
06/10/19	4.90	4.94	5.02	4.77	4.77	4.79	4.86	4.65	4.68	4.60	4.86	4.76	4.48	4.54	4.60	4.51
06/11/19	4.82	4.95	4.98	4.78	4.74	4.74	4.85	4.69	4.64	4.59	4.91	4.71	4.47	4.54	4.59	4.49
06/12/19	4.88	4.93	4.99	4.76	4.77	4.81	4.87	4.69	4.64	4.59	4.86	4.88	4.46	4.50	4.59	4.47
06/13/19	4.85	4.95	5.03	4.75	4.74	4.84	4.85	4.73	4.62	4.57	4.84	4.94	4.44	4.47	4.58	4.46
06/14/19	4.85	4.97	5.01	4.78	4.79	4.79	4.87	4.70	4.64	4.57	4.88	4.94	4.45	4.66	4.59	4.47
06/15/19	4.88	4.96	4.98	4.74	4.76	4.76	4.85	4.70	4.65	4.55	4.88	4.93	4.44	4.71	4.59	4.47
06/16/19	4.82	4.90	5.01	4.69	4.78	4.79	4.83	4.65	4.64	4.58	4.89	4.93	4.42	4.73	4.57	4.46
06/17/19	4.82	4.91	4.98	4.69	4.71	4.75	4.83	4.64	4.60	4.54	4.88	4.92	4.43	4.73	4.58	4.47
06/18/19	4.82	4.87	4.97	4.69	4.77	4.76	4.85	4.68	4.62	4.52	4.88	4.92	4.41	4.74	4.56	4.47
06/19/19	4.82	4.83	4.93	4.70	4.75	4.75	4.80	4.70	4.60	4.51	4.87	4.90	4.38	4.71	4.54	4.48
06/20/19	4.77	4.86	4.89	4.61	4.77	4.75	4.81	4.64	4.57	4.49	4.85	4.90	4.58	4.68	4.54	4.45
06/21/19	4.75	4.82	4.94	4.66	4.73	4.74	4.82	4.62	4.58	4.47	4.82	4.89	4.65	4.71	4.53	4.47
06/22/19	4.82	4.80	4.84	4.65	4.70	4.71	4.82	4.58	4.53	4.45	4.78	4.87	4.58	4.67	4.52	4.47
06/23/19	4.78	4.83	4.86	4.65	4.74	4.73	4.79	4.58	4.55	4.46	4.79	4.88	4.58	4.66	4.51	4.58
06/24/19	4.80	4.76	4.87	4.60	4.70	4.72	4.78	4.60	4.56	4.44	4.80	4.87	4.57	4.65	4.52	4.65
06/25/19	4.76	4.77	4.81	4.59	4.67	4.67	4.76	4.56	4.51	4.43	4.84	4.84	4.56	4.65	4.53	4.65
06/26/19	4.77	4.94	4.82	4.85	4.85	4.72	4.77	4.57	4.51	4.40	4.78	4.85	4.57	4.65	4.52	4.61
06/27/19	4.73	5.00	4.76	4.79	4.81	4.72	4.74	4.57	4.70	4.39	4.76	4.85	4.55	4.63	4.49	4.59
06/28/19	4.75	4.97	4.75	4.81	4.79	4.65	4.74	4.52	4.70	4.39	4.72	4.83	4.54	4.63	4.49	4.68
06/29/19	4.72	4.97	4.82	4.84	4.80	4.69	4.74	4.52	4.70	4.38	4.74	4.79	4.53	4.63	4.47	4.68
06/30/19	4.70	4.96	4.75	4.82	4.76	4.70	4.76	4.54	4.71	4.34	4.73	4.75	4.57	4.60	4.46	4.68

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
06/01/19	4.60	4.52	4.65	4.44	4.53	4.56	4.43	4.62	4.78	4.69	4.66	4.62	4.90	4.65	4.75	4.71
06/02/19	4.62	4.54	4.66	4.43	4.52	4.59	4.46	4.60	4.79	4.69	4.69	4.62	4.89	4.65	4.74	4.75
06/03/19	4.60	4.53	4.65	4.57	4.49	4.55	4.56	4.56	4.74	4.67	4.68	4.60	4.83	4.66	4.71	4.75
06/04/19	4.63	4.49	4.63	4.64	4.47	4.49	4.66	4.54	4.69	4.62	4.63	4.61	4.81	4.65	4.67	4.69
06/05/19	4.65	4.44	4.60	4.64	4.43	4.47	4.63	4.52	4.70	4.60	4.61	4.60	4.82	4.61	4.66	4.67
06/06/19	4.64	4.42	4.58	4.64	4.40	4.47	4.60	4.48	4.76	4.58	4.64	4.58	4.78	4.61	4.63	4.67
06/07/19	4.65	4.44	4.58	4.63	4.41	4.50	4.60	4.47	4.86	4.54	4.65	4.58	4.76	4.57	4.64	4.63
06/08/19	4.61	4.64	4.57	4.63	4.41	4.51	4.63	4.46	4.90	4.66	4.63	4.54	4.78	4.54	4.68	4.61
06/09/19	4.58	4.77	4.54	4.64	4.41	4.62	4.62	4.46	4.91	4.82	4.62	4.54	4.80	4.52	4.65	4.72
06/10/19	4.56	4.74	4.54	4.63	4.40	4.70	4.61	4.42	4.92	4.85	4.62	4.57	4.80	4.57	4.65	4.96
06/11/19	4.59	4.73	4.53	4.61	4.37	4.67	4.62	4.41	4.90	4.84	4.62	4.57	4.80	4.58	4.65	4.87
06/12/19	4.62	4.73	4.52	4.58	4.35	4.66	4.58	4.39	4.87	4.82	4.61	4.52	4.78	4.56	4.61	4.86
06/13/19	4.58	4.69	4.50	4.56	4.56	4.66	4.56	4.37	4.86	4.79	4.59	4.47	4.74	4.64	4.61	4.86
06/14/19	4.57	4.67	4.50	4.55	4.70	4.65	4.57	4.55	4.85	4.80	4.57	4.49	4.72	4.77	4.63	4.84
06/15/19	4.73	4.70	4.51	4.57	4.67	4.66	4.59	4.73	4.88	4.81	4.56	4.49	4.72	4.72	4.62	4.83
06/16/19	4.82	4.70	4.51	4.57	4.68	4.70	4.62	4.71	4.89	4.79	4.55	4.44	4.74	4.70	4.62	4.82
06/17/19	4.78	4.69	4.49	4.56	4.69	4.68	4.60	4.70	4.84	4.77	4.54	4.52	4.73	4.69	4.61	4.82
06/18/19	4.75	4.67	4.60	4.55	4.67	4.65	4.57	4.69	4.86	4.76	4.54	4.64	4.73	4.71	4.58	4.82
06/19/19	4.73	4.64	4.70	4.51	4.65	4.65	4.55	4.69	4.84	4.75	4.55	4.62	4.71	4.71	4.57	4.80
06/20/19	4.73	4.62	4.70	4.47	4.63	4.64	4.50	4.66	4.82	4.76	4.54	4.64	4.68	4.63	4.62	4.80
06/21/19	4.72	4.62	4.69	4.48	4.61	4.61	4.48	4.63	4.80	4.75	4.51	4.63	4.62	4.53	4.78	4.79
06/22/19	4.72	4.63	4.70	4.49	4.60	4.61	4.50	4.63	4.80	4.72	4.58	4.59	4.60	4.53	4.76	4.77
06/23/19	4.73	4.62	4.70	4.48	4.60	4.62	4.51	4.62	4.82	4.73	4.71	4.60	4.60	4.56	4.72	4.77
06/24/19	4.72	4.59	4.65	4.46	4.60	4.61	4.48	4.62	4.80	4.70	4.70	4.59	4.70	4.56	4.73	4.78
06/25/19	4.70	4.58	4.63	4.45	4.58	4.57	4.47	4.63	4.77	4.68	4.66	4.59	4.85	4.51	4.70	4.76
06/26/19	4.67	4.59	4.65	4.44	4.57	4.54	4.45	4.63	4.73	4.69	4.65	4.60	4.82	4.51	4.68	4.74
06/27/19	4.66	4.57	4.63	4.39	4.55	4.53	4.44	4.60	4.73	4.67	4.64	4.57	4.82	4.51	4.67	4.73
06/28/19	4.65	4.56	4.61	4.50	4.54	4.53	4.42	4.57	4.75	4.65	4.63	4.55	4.82	4.53	4.68	4.71
06/29/19	4.66	4.55	4.61	4.67	4.52	4.54	4.54	4.55	4.72	4.63	4.63	4.56	4.80	4.50	4.68	4.70
06/30/19	4.64	4.56	4.61	4.65	4.50	4.53	4.70	4.54	4.71	4.60	4.64	4.56	4.78	4.50	4.68	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

Date	E01 LRV	E02 LRV	E03 LRV	E04 LRV
06/01/19	4.78	4.63	5.05	5.05
06/02/19	4.72	4.63	5.04	5.11
06/03/19	4.77	4.71	5.08	5.10
06/04/19	4.73	4.82	5.12	5.12
06/05/19	4.69	4.81	5.04	5.28
06/06/19	4.68	4.83	4.98	5.16
06/07/19	4.70	4.81	5.03	5.21
06/08/19	4.74	4.82	*	5.29
06/09/19	4.75	4.84	*	5.15
06/10/19	4.74	4.83	5.15	5.21
06/11/19	4.72	4.80	5.06	5.23
06/12/19	4.72	4.80	5.11	5.05
06/13/19	4.67	4.80	5.08	5.16
06/14/19	4.68	4.79	5.08	5.30
06/15/19	4.71	4.79	5.09	5.26
06/16/19	4.72	4.78	5.06	5.33
06/17/19	4.79	4.78	5.08	5.61
06/18/19	4.79	4.77	5.08	5.33
06/19/19	4.77	4.74	5.07	5.28
06/20/19	4.77	4.71	5.08	5.45
06/21/19	4.79	4.73	5.18	5.33
06/22/19	4.77	4.71	5.10	5.24
06/23/19	4.71	4.68	5.12	5.19
06/24/19	4.72	4.69	5.18	5.23
06/25/19	4.72	4.69	5.15	5.29
06/26/19	4.77	4.69	5.21	5.30
06/27/19	4.75	4.65	5.35	5.25
06/28/19	4.76	4.61	5.14	5.25
06/29/19	4.70	4.58	5.14	5.06
06/30/19	4.69	4.72	5.21	5.11

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* Cell E03 was out of service on June 8 & June 9.

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
06/01/19	0.07	0.08	0.10	0.11	0.10	0.10	0.06	0.06	0.05	0.05	0.09	0.09	0.07	0.08	0.10	0.10	0.07	0.08	0.08
06/02/19	0.08	0.08	0.10	0.11	0.10	0.10	0.06	0.06	0.05	0.05	0.09	0.10	0.07	0.08	0.10	0.10	0.06	0.08	0.08
06/03/19	0.08	0.08	0.11	0.11	0.10	0.11	0.06	0.06	0.05	0.10	0.10	0.11	0.08	0.11	0.10	0.11	0.06	0.07	0.08
06/04/19	0.08	0.08	0.11	0.11	0.10	0.11	0.06	0.06	0.05	0.06	0.11	0.11	0.08	0.09	0.10	0.11	0.06	0.08	0.08
06/05/19	0.08	0.09	0.11	0.11	0.10	0.11	0.06	0.06	0.06	0.07	0.11	0.11	0.08	0.09	0.10	0.10	0.06	0.06	0.08
06/06/19	0.07	0.08	0.10	0.11	0.10	0.10	0.07	0.08	0.06	0.10	0.11	0.11	0.08	0.11	0.10	0.10	0.05	0.07	0.08
06/07/19	0.07	0.08	0.09	0.10	0.10	0.10	0.07	0.07	0.06	0.06	0.11	0.12	0.09	0.14	0.09	0.10	0.06	0.07	0.08
06/08/19	0.08	0.08	0.10	0.10	0.10	0.10	0.07	0.07	0.06	0.07	0.12	0.12	0.09	0.10	0.10	0.10	0.07	0.07	0.09
06/09/19	0.08	0.09	0.10	0.11	0.10	0.11	0.07	0.07	0.07	0.07	0.12	0.12	0.10	0.11	0.10	0.12	0.06	0.08	0.09
06/10/19	0.09	0.09	0.11	0.11	0.10	0.11	0.06	0.07	0.07	0.08	0.12	0.12	0.11	0.12	0.10	0.11	0.07	0.08	0.09
06/11/19	0.08	0.09	0.10	0.11	0.10	0.11	0.06	0.07	0.07	0.08	0.12	0.12	0.11	0.15	0.10	0.11	0.07	0.08	0.09
06/12/19	0.08	0.08	0.10	0.11	0.10	0.10	0.06	0.06	0.06	0.10	0.08	0.12	0.11	0.14	0.10	0.10	0.06	0.07	0.08
06/13/19	0.08	0.09	0.10	0.11	0.10	0.11	0.06	0.07	0.06	0.06	0.06	0.06	0.10	0.13	0.10	0.11	0.05	0.06	0.08
06/14/19	0.08	0.08	0.11	0.12	0.11	0.11	0.07	0.07	0.06	0.07	0.06	0.08	0.09	0.11	0.10	0.11	0.05	0.07	0.08
06/15/19	0.08	0.08	0.11	0.12	0.10	0.11	0.06	0.07	0.06	0.07	0.07	0.07	0.09	0.10	0.10	0.11	0.06	0.07	0.08
06/16/19	0.08	0.09	0.12	0.12	0.10	0.11	0.06	0.07	0.07	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.05	0.07	0.08
06/17/19	0.09	0.10	0.12	0.12	0.10	0.11	0.06	0.06	0.07	0.08	0.08	0.09	0.10	0.10	0.11	0.11	0.06	0.07	0.09
06/18/19	0.08	0.09	0.11	0.12	0.10	0.10	0.06	0.09	0.07	0.08	0.08	0.09	0.09	0.13	0.11	0.11	0.06	0.07	0.08
06/19/19	0.08	0.09	0.11	0.12	0.10	0.10	0.05	0.06	0.06	0.08	0.08	0.09	0.07	0.13	0.10	0.11	0.05	0.06	0.08
06/20/19	0.08	0.08	0.11	0.12	0.10	0.10	0.06	0.06	0.05	0.05	0.06	0.07	0.06	0.07	0.10	0.11	0.04	0.05	0.07
06/21/19	0.07	0.08	0.11	0.12	0.09	0.10	0.06	0.06	0.05	0.05	0.07	0.07	0.06	0.09	0.10	0.10	0.04	0.05	0.07
06/22/19	0.07	0.08	0.11	0.12	0.09	0.10	0.06	0.07	0.05	0.06	0.07	0.08	0.06	0.07	0.10	0.11	0.05	0.06	0.08
06/23/19	0.08	0.09	0.11	0.11	0.10	0.11	0.06	0.07	0.06	0.06	0.08	0.09	0.07	0.08	0.11	0.12	0.05	0.06	0.08
06/24/19	0.09	0.10	0.11	0.12	0.10	0.11	0.06	0.07	0.05	0.07	0.07	0.09	0.07	0.08	0.11	0.12	0.05	0.07	0.08
06/25/19	0.08	0.09	0.11	0.11	0.10	0.10	0.06	0.06	0.05	0.05	0.06	0.07	0.07	0.08	0.11	0.12	0.06	0.06	0.08
06/26/19	0.07	0.09	0.10	0.11	0.10	0.10	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.07	0.10	0.11	0.06	0.06	0.07
06/27/19	0.06	0.07	0.10	0.11	0.10	0.10	0.06	0.06	0.05	0.06	0.06	0.07	0.06	0.07	0.10	0.10	0.06	0.06	0.07
06/28/19	0.06	0.07	0.10	0.10	0.09	0.10	0.05	0.06	0.06	0.06	0.07	0.08	0.06	0.06	0.10	0.10	0.06	0.06	0.07
06/29/19	0.07	0.08	0.10	0.11	0.10	0.10	0.06	0.06	0.05	0.06	0.08	0.09	0.06	0.08	0.10	0.11	0.06	0.07	0.08
06/30/19	0.07	0.08	0.10	0.11	0.10	0.10	0.06	0.06	0.06	0.07	0.09	0.09	0.06	0.07	0.11	0.11	0.06	0.07	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
06/01/19	0.074	0.077	7.552	6.862	8.276	0.043	0.037	0.059	1,778	1,726	1,835	31	28	34	99.43	2.24	98.25	1.76
06/02/19	0.072	0.073	7.340	6.624	8.137	0.039	0.034	0.043	1,646	1,592	1,700	29	26	32	99.47	2.28	98.24	1.75
06/03/19	0.070	0.071	7.513	5.742	8.685	0.043	0.038	0.079	1,607	1,514	1,712	30	26	36	99.43	2.24	98.13	1.73
06/04/19	0.068	0.072	7.741	5.146	12.723	0.067	0.051	0.085	1,718	1,614	1,859	32	28	39	99.13	2.06	98.13	1.73
06/05/19	0.073	0.076	7.706	5.864	8.284	0.061	0.053	0.071	1,803	1,731	1,878	35	30	40	99.21	2.10	98.06	1.71
06/06/19	0.074	0.074	7.665	6.981	8.545	0.057	0.049	0.076	1,833	1,730	1,977	35	30	43	99.25	2.13	98.07	1.71
06/07/19	0.074	0.080	7.632	6.915	8.470	0.058	0.051	0.076	1,833	1,755	1,904	35	32	39	99.24	2.12	98.07	1.71
06/08/19	0.072	0.073	7.648	5.493	8.581	0.058	0.051	0.067	1,807	1,743	1,867	35	32	39	99.24	2.12	98.06	1.71
06/09/19	0.072	0.072	7.549	5.320	8.503	0.054	0.047	0.060	1,625	1,551	1,713	32	30	35	99.29	2.15	98.01	1.70
06/10/19	0.061	0.065	7.792	5.471	13.442	0.054	0.050	0.078	1,564	1,482	1,658	30	27	34	99.30	2.16	98.09	1.72
06/11/19	0.057	0.060	7.663	5.565	8.740	0.061	0.054	0.078	1,645	1,591	1,724	32	27	43	99.21	2.10	98.06	1.71
06/12/19	0.055	0.057	7.742	7.311	8.360	0.060	0.054	0.070	1,752	1,649	1,912	34	30	40	99.23	2.11	98.04	1.71
06/13/19	0.051	0.053	7.562	5.180	8.211	0.055	0.048	0.060	1,807	1,744	1,885	35	32	38	99.28	2.14	98.07	1.71
06/14/19	0.067	0.080	7.333	6.787	10.562	0.051	0.041	0.077	1,841	1,776	1,909	35	32	38	99.31	2.16	98.08	1.72
06/15/19	0.049	0.058	7.014	6.240	7.708	0.046	0.038	0.051	1,777	1,729	1,849	34	31	38	99.34	2.18	98.11	1.72
06/16/19	0.048	0.049	7.108	6.565	7.818	0.047	0.038	0.134	1,657	1,590	1,720	32	29	35	99.34	2.18	98.08	1.72
06/17/19	0.049	0.049	7.225	5.137	8.462	0.049	0.038	0.058	1,626	1,529	1,784	32	28	39	99.32	2.17	98.01	1.70
06/18/19	0.046	0.047	7.531	6.939	8.484	0.057	0.051	0.066	1,727	1,654	1,792	35	31	38	99.24	2.12	97.98	1.70
06/19/19	0.046	0.046	7.208	5.211	7.935	0.059	0.055	0.065	1,770	1,679	1,893	35	30	39	99.18	2.08	98.05	1.71
06/20/19	0.043	0.047	7.049	6.310	7.890	0.056	0.041	0.072	1,807	1,765	1,849	35	32	38	99.21	2.10	98.07	1.71
06/21/19	0.049	0.052	6.972	6.102	7.724	0.045	0.039	0.051	1,789	1,725	1,846	35	32	39	99.36	2.19	98.05	1.71
06/22/19	0.049	0.051	6.863	6.221	7.612	0.045	0.038	0.058	1,699	1,624	1,775	34	32	36	99.34	2.18	98.02	1.70
06/23/19	0.051	0.063	7.151	5.194	8.037	0.054	0.041	0.067	1,584	1,536	1,617	32	29	35	99.25	2.12	98.01	1.70
06/24/19	0.065	0.070	7.580	5.694	8.485	0.058	0.054	0.071	1,550	1,470	1,674	31	27	34	99.23	2.11	98.02	1.70
06/25/19	0.070	0.070	7.417	6.604	8.532	0.066	0.061	0.072	1,650	1,571	1,767	32	29	36	99.11	2.05	98.09	1.72
06/26/19	0.053	0.061	7.243	6.756	7.959	0.064	0.059	0.070	1,736	1,666	1,846	33	30	37	99.11	2.05	98.09	1.72
06/27/19	0.048	0.048	7.080	6.525	7.794	0.063	0.059	0.067	1,792	1,725	1,879	34	31	38	99.11	2.05	98.10	1.72
06/28/19	0.053	0.069	7.071	6.434	7.761	0.066	0.060	0.085	1,806	1,752	1,856	37	32	41	99.07	2.03	97.96	1.69
06/29/19	0.065	0.073	6.967	6.307	7.898	0.062	0.058	0.067	1,743	1,680	1,800	36	34	39	99.11	2.05	97.93	1.68
06/30/19	0.068	0.070	6.856	6.197	7.768	0.063	0.058	0.068	1,624	1,585	1,660	34	31	37	99.08	2.04	97.93	1.68

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	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
06/01/19	97.58	84.257	22,669.2	0.26	3.0	6
06/02/19	97.65	85.015	21,582.1	0.26	3.0	6
06/03/19	97.36	90.908	22,012.8	0.26	3.0	6
06/04/19	97.51	94.638	23,918.9	0.26	3.0	6
06/05/19	97.46	93.275	23,516.1	0.25	3.0	6
06/06/19	97.59	93.122	23,408.8	0.25	3.0	6
06/07/19	97.39	87.890	23,353.4	0.25	3.0	6
06/08/19	97.49	89.442	23,198.2	0.26	3.0	6
06/09/19	97.35	87.717	22,939.7	0.26	3.0	6
06/10/19	97.55	90.684	22,727.0	0.26	3.0	6
06/11/19	97.54	89.846	22,883.3	0.26	3.0	6
06/12/19	97.70	92.706	23,369.8	0.25	3.0	6
06/13/19	97.78	95.250	23,815.1	0.25	3.0	6
06/14/19	97.91	92.111	23,757.0	0.25	3.0	6
06/15/19	98.13	91.945	23,586.7	0.25	3.0	6
06/16/19	98.13	88.380	23,014.9	0.25	3.0	6
06/17/19	97.90	89.829	22,929.0	0.26	3.0	6
06/18/19	98.01	92.566	23,651.9	0.26	3.0	6
06/19/19	98.03	95.991	24,117.0	0.26	3.0	6
06/20/19	98.13	95.881	23,917.6	0.25	3.0	6
06/21/19	98.01	91.395	23,734.2	0.25	3.0	6
06/22/19	98.11	93.042	23,038.8	0.25	3.0	6
06/23/19	98.02	88.691	23,265.2	0.25	3.0	6
06/24/19	98.04	90.272	22,722.8	0.25	3.0	6
06/25/19	98.19	90.769	22,889.5	0.25	3.0	6
06/26/19	98.23	93.383	23,612.5	0.25	3.0	6
06/27/19	98.27	93.554	23,297.1	0.25	3.0	6
06/28/19	98.32	93.644	22,931.6	0.25	3.0	6
06/29/19	98.30	91.964	23,018.5	0.25	3.0	6
06/30/19	98.49	88.749	22,522.1	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
07/01/19	12.38	12.38	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/02/19	12.48	12.48	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/03/19	12.44	12.44	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/04/19	12.44	12.44	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/05/19	12.49	12.49	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/06/19	12.48	12.48	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/07/19	12.45	12.45	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/08/19	12.44	12.44	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/09/19	12.44	12.44	12.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/10/19	12.48	12.48	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/11/19	12.45	12.45	12.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/12/19	12.42	12.42	12.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/13/19	12.40	12.40	12.00	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/14/19	12.44	12.44	12.00	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/15/19	12.48	12.48	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/16/19	12.44	12.44	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/17/19	12.54	12.54	12.03	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/18/19	12.51	12.51	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/19/19	12.51	12.51	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/20/19	12.49	12.49	12.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/21/19	12.49	12.49	12.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/22/19	12.48	12.48	12.03	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/23/19	12.44	12.44	12.01	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/24/19	12.47	12.47	12.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/25/19	12.54	12.54	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/26/19	12.49	12.49	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/27/19	12.47	12.47	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/28/19	12.46	12.46	12.00	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/29/19	12.49	12.49	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/30/19	12.47	12.47	12.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
07/31/19	12.52	12.52	12.00	Y	Y	N	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*
07/01/19	0.00	4.30	2.07	6.00	0.00	12.38
07/02/19	0.00	4.43	2.06	6.00	0.00	12.48
07/03/19	0.00	4.39	2.05	6.00	0.00	12.44
07/04/19	0.00	4.39	2.05	6.00	0.00	12.44
07/05/19	0.00	4.43	2.06	6.00	0.00	12.49
07/06/19	0.00	4.42	2.07	6.00	0.00	12.48
07/07/19	0.00	4.38	2.07	6.00	0.00	12.45
07/08/19	0.00	4.37	2.07	6.00	0.00	12.44
07/09/19	0.00	4.42	2.02	6.00	0.00	12.44
07/10/19	0.00	4.43	2.05	6.00	0.00	12.48
07/11/19	0.00	4.43	2.02	6.00	0.00	12.45
07/12/19	0.00	4.40	2.02	6.00	0.00	12.42
07/13/19	0.00	4.40	2.00	6.00	0.00	12.40
07/14/19	0.00	4.44	2.00	6.00	0.00	12.44
07/15/19	0.00	4.42	2.05	6.00	0.00	12.48
07/16/19	0.00	4.40	2.04	6.00	0.00	12.44
07/17/19	0.00	4.51	2.03	6.00	0.00	12.54
07/18/19	0.00	4.48	2.04	6.00	0.00	12.51
07/19/19	0.00	4.46	2.04	6.00	0.00	12.51
07/20/19	0.00	4.47	2.02	6.00	0.00	12.49
07/21/19	0.00	4.47	2.02	6.00	0.00	12.49
07/22/19	0.00	4.45	2.03	6.00	0.00	12.48
07/23/19	0.00	4.42	2.01	6.00	0.00	12.44
07/24/19	0.00	4.45	2.02	6.00	0.00	12.47
07/25/19	0.00	4.44	2.11	6.00	0.00	12.54
07/26/19	0.00	4.43	2.06	6.00	0.00	12.49
07/27/19	0.00	4.42	2.05	6.00	0.00	12.47
07/28/19	0.00	4.46	2.00	6.00	0.00	12.46
07/29/19	0.00	4.45	2.04	6.00	0.00	12.49
07/30/19	0.00	4.45	2.02	6.00	0.00	12.47
07/31/19	0.00	4.52	2.00	6.00	0.00	12.52

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*
07/01/19	0.00	0.00	2.07	6.00	4.00	12.07
07/02/19	0.00	0.00	2.06	6.00	4.00	12.06
07/03/19	0.00	0.00	2.05	6.00	4.00	12.05
07/04/19	0.00	0.00	2.05	6.00	4.00	12.05
07/05/19	0.00	0.00	2.06	6.00	4.00	12.06
07/06/19	0.00	0.00	2.07	6.00	4.00	12.07
07/07/19	0.00	0.00	2.07	6.00	4.00	12.07
07/08/19	0.00	0.00	2.07	6.00	4.00	12.07
07/09/19	0.00	0.00	2.02	6.00	4.00	12.02
07/10/19	0.00	0.00	2.05	6.00	4.00	12.05
07/11/19	0.00	0.00	2.02	6.00	4.00	12.02
07/12/19	0.00	0.00	2.02	6.00	4.00	12.02
07/13/19	0.00	0.00	2.00	6.00	4.00	12.00
07/14/19	0.00	0.00	2.00	6.00	4.00	12.00
07/15/19	0.00	0.00	2.05	6.00	4.00	12.05
07/16/19	0.00	0.00	2.04	6.00	4.00	12.04
07/17/19	0.00	0.00	2.03	6.00	4.00	12.03
07/18/19	0.00	0.00	2.04	6.00	4.00	12.04
07/19/19	0.00	0.00	2.04	6.00	4.00	12.04
07/20/19	0.00	0.00	2.02	6.00	4.00	12.02
07/21/19	0.00	0.00	2.02	6.00	4.00	12.02
07/22/19	0.00	0.00	2.03	6.00	4.00	12.03
07/23/19	0.00	0.00	2.01	6.00	4.00	12.01
07/24/19	0.00	0.00	2.02	6.00	4.00	12.02
07/25/19	0.00	0.00	2.11	6.00	4.00	12.11
07/26/19	0.00	0.00	2.06	6.00	4.00	12.06
07/27/19	0.00	0.00	2.05	6.00	4.00	12.05
07/28/19	0.00	0.00	2.00	6.00	4.00	12.00
07/29/19	0.00	0.00	2.04	6.00	4.00	12.04
07/30/19	0.00	0.00	2.02	6.00	4.00	12.02
07/31/19	0.00	0.00	2.00	6.00	4.00	12.00

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
07/01/19	4.68	4.95	4.72	4.82	4.81	4.63	4.74	4.52	4.71	4.30	4.72	4.80	4.54	4.60	4.46	4.64
07/02/19	4.73	4.93	5.07	4.82	4.78	4.81	4.72	4.47	4.71	4.49	4.67	4.81	4.52	4.58	4.45	4.63
07/03/19	4.97	4.95	5.02	4.76	4.77	4.83	4.85	4.48	4.69	4.53	4.63	4.77	4.50	4.56	4.42	4.64
07/04/19	5.01	4.93	5.03	4.77	4.78	4.82	4.90	4.47	4.67	4.56	4.63	4.76	4.48	4.55	4.39	4.67
07/05/19	4.92	4.94	5.00	4.72	4.79	4.87	4.87	4.44	4.67	4.57	4.61	4.74	4.49	4.55	4.53	4.66
07/06/19	4.94	4.93	5.03	4.68	4.76	4.84	4.85	4.45	4.66	4.56	4.81	4.73	4.48	4.51	4.59	4.65
07/07/19	4.92	4.95	5.00	4.72	4.79	4.83	4.84	4.66	4.65	4.56	4.84	4.72	4.45	4.52	4.58	4.63
07/08/19	4.96	4.95	4.96	4.71	4.81	4.81	4.79	4.71	4.64	4.57	4.81	4.84	4.43	4.54	4.59	4.62
07/09/19	4.92	4.89	4.98	4.68	4.81	4.80	4.79	4.70	4.62	4.56	4.82	4.93	4.46	4.51	4.59	4.63
07/10/19	4.90	4.93	4.93	4.69	4.75	4.78	4.85	4.70	4.64	4.56	4.80	4.92	4.43	4.67	4.58	4.62
07/11/19	4.95	4.92	4.97	4.68	4.75	4.83	4.85	4.71	4.58	4.51	4.79	4.94	4.43	4.69	4.57	4.58
07/12/19	4.90	4.86	5.00	4.66	4.80	4.77	4.78	4.70	4.61	4.53	4.80	4.91	4.40	4.71	4.57	4.59
07/13/19	4.88	4.93	4.96	4.63	4.79	4.77	4.76	4.65	4.59	4.52	4.76	4.89	4.40	4.70	4.57	4.61
07/14/19	4.92	4.92	4.95	4.67	4.75	4.82	4.81	4.67	4.60	4.52	4.78	4.92	4.44	4.71	4.56	4.58
07/15/19	4.94	4.92	4.94	4.66	4.76	4.78	4.82	4.65	4.61	4.52	4.82	4.91	4.42	4.74	4.56	4.60
07/16/19	4.94	4.90	4.96	4.64	4.75	4.75	4.80	4.65	4.61	4.50	4.83	4.92	4.40	4.74	4.57	4.61
07/17/19	4.89	4.81	4.87	4.61	4.71	4.75	4.77	4.64	4.59	4.51	4.79	4.88	4.54	4.69	4.55	4.59
07/18/19	4.85	4.79	4.90	4.58	4.72	4.76	4.75	4.61	4.55	4.48	4.78	4.87	4.57	4.68	4.55	4.58
07/19/19	4.87	4.82	4.89	4.57	4.68	4.75	4.76	4.62	4.53	4.46	4.75	4.85	4.57	4.67	4.52	4.56
07/20/19	4.85	4.80	4.88	4.59	4.73	4.71	4.75	4.60	4.53	4.50	4.73	4.84	4.57	4.68	4.52	4.69
07/21/19	4.82	5.02	4.90	4.59	4.73	4.72	4.76	4.60	4.54	4.48	4.75	4.85	4.57	4.69	4.53	4.72
07/22/19	4.87	4.97	4.90	4.81	4.80	4.73	4.80	4.60	4.51	4.46	4.76	4.86	4.57	4.68	4.52	4.69
07/23/19	4.87	4.99	4.85	4.79	4.78	4.75	4.78	4.59	4.70	4.47	4.72	4.83	4.56	4.67	4.51	4.68
07/24/19	4.87	5.01	4.83	4.73	4.82	4.73	4.78	4.60	4.73	4.45	4.74	4.81	4.57	4.65	4.52	4.69
07/25/19	4.83	5.04	4.82	4.76	4.83	4.71	4.77	4.58	4.73	4.44	4.74	4.81	4.54	4.64	4.50	4.66
07/26/19	4.81	5.00	4.91	4.75	4.80	4.72	4.82	4.57	4.71	4.43	4.71	4.79	4.52	4.62	4.48	4.65
07/27/19	4.78	4.98	4.77	4.75	4.78	4.67	4.81	4.58	4.65	4.42	4.70	4.79	4.54	4.61	4.47	4.67
07/28/19	4.80	4.93	4.79	4.76	4.82	4.83	4.75	4.55	4.68	4.57	4.69	4.79	4.55	4.61	4.46	4.68
07/29/19	4.75	4.92	4.95	4.76	4.82	4.84	4.72	4.55	4.70	4.54	4.67	4.78	4.54	4.59	4.45	4.67
07/30/19	4.98	4.92	5.03	4.74	4.83	4.83	4.86	4.53	4.71	4.52	4.67	4.79	4.53	4.62	4.45	4.66
07/31/19	4.92	4.94	5.00	4.74	4.82	4.81	4.84	4.52	4.67	4.55	4.64	4.77	4.53	4.60	4.55	4.64

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
07/01/19	4.62	4.52	4.57	4.64	4.47	4.52	4.67	4.51	4.70	4.58	4.63	4.53	4.77	4.50	4.69	4.67
07/02/19	4.61	4.49	4.55	4.63	4.43	4.51	4.64	4.51	4.80	4.57	4.62	4.52	4.77	4.51	4.66	4.66
07/03/19	4.57	4.46	4.54	4.61	4.39	4.49	4.63	4.49	4.93	4.66	4.60	4.50	4.85	4.49	4.63	4.65
07/04/19	4.57	4.61	4.55	4.60	4.40	4.48	4.61	4.49	4.90	4.83	4.60	4.50	4.94	4.48	4.60	4.65
07/05/19	4.57	4.74	4.54	4.60	4.43	4.60	4.62	4.48	4.88	4.84	4.62	4.51	4.94	4.46	4.64	4.72
07/06/19	4.55	4.73	4.54	4.62	4.42	4.72	4.64	4.47	4.90	4.84	4.61	4.51	4.91	4.44	4.63	4.92
07/07/19	4.57	4.72	4.53	4.62	4.38	4.72	4.64	4.46	4.92	4.82	4.60	4.51	4.90	4.43	4.62	4.88
07/08/19	4.57	4.72	4.54	4.60	4.37	4.69	4.64	4.44	4.85	4.81	4.60	4.51	4.88	4.41	4.63	4.88
07/09/19	4.55	4.75	4.53	4.60	4.57	4.66	4.61	4.42	4.87	4.80	4.57	4.49	4.89	4.47	4.63	4.85
07/10/19	4.52	4.74	4.46	4.56	4.73	4.63	4.56	4.55	4.87	4.79	4.57	4.49	4.88	4.65	4.61	4.79
07/11/19	4.67	4.71	4.45	4.56	4.72	4.65	4.57	4.70	4.86	4.78	4.58	4.48	4.89	4.57	4.58	4.84
07/12/19	4.76	4.70	4.46	4.56	4.70	4.64	4.59	4.72	4.89	4.78	4.56	4.46	4.87	4.58	4.57	4.85
07/13/19	4.78	4.72	4.61	4.55	4.68	4.65	4.59	4.71	4.88	4.79	4.54	4.45	4.83	4.59	4.58	4.84
07/14/19	4.78	4.74	4.74	4.57	4.66	4.69	4.58	4.69	4.85	4.79	4.56	4.52	4.84	4.62	4.60	4.84
07/15/19	4.76	4.72	4.71	4.55	4.66	4.67	4.57	4.70	4.85	4.79	4.56	4.61	4.87	4.62	4.56	4.85
07/16/19	4.76	4.69	4.71	4.54	4.66	4.64	4.55	4.70	4.85	4.74	4.55	4.62	4.85	4.59	4.62	4.84
07/17/19	4.74	4.68	4.68	4.52	4.64	4.62	4.54	4.67	4.84	4.70	4.51	4.61	4.83	4.58	4.71	4.82
07/18/19	4.72	4.68	4.65	4.49	4.64	4.60	4.52	4.64	4.85	4.71	4.58	4.60	4.79	4.60	4.70	4.79
07/19/19	4.72	4.65	4.67	4.47	4.63	4.58	4.50	4.66	4.84	4.71	4.72	4.60	4.78	4.61	4.73	4.77
07/20/19	4.71	4.65	4.68	4.47	4.63	4.59	4.51	4.65	4.84	4.71	4.68	4.61	4.87	4.60	4.72	4.77
07/21/19	4.71	4.64	4.67	4.47	4.62	4.59	4.50	4.65	4.80	4.73	4.67	4.58	5.04	4.59	4.73	4.77
07/22/19	4.72	4.63	4.68	4.45	4.62	4.62	4.48	4.64	4.79	4.75	4.66	4.58	5.02	4.58	4.73	4.77
07/23/19	4.70	4.62	4.65	4.42	4.59	4.60	4.48	4.62	4.79	4.71	4.65	4.58	4.99	4.60	4.71	4.78
07/24/19	4.69	4.62	4.64	4.56	4.57	4.57	4.47	4.61	4.77	4.67	4.65	4.57	4.96	4.60	4.67	4.78
07/25/19	4.69	4.60	4.64	4.66	4.57	4.56	4.55	4.61	4.77	4.64	4.67	4.56	4.96	4.60	4.66	4.76
07/26/19	4.67	4.57	4.62	4.63	4.52	4.54	4.64	4.61	4.77	4.65	4.67	4.58	4.95	N/A *	4.68	4.74
07/27/19	4.65	4.57	4.62	4.63	4.51	4.53	4.64	4.61	4.74	4.65	4.63	4.55	4.95	N/A *	4.69	4.73
07/28/19	4.68	4.57	4.63	4.63	4.56	4.56	4.64	4.62	4.85	4.63	4.61	4.53	4.94	N/A *	4.67	4.72
07/29/19	4.67	4.55	4.61	4.63	4.55	4.56	4.62	4.61	4.95	4.62	4.62	4.54	4.93	N/A *	4.69	4.71
07/30/19	4.63	4.68	4.59	4.62	4.54	4.54	4.61	4.59	4.90	4.72	4.61	4.53	4.92	4.78	4.67	4.70
07/31/19	4.63	4.78	4.58	4.59	4.52	4.62	4.59	4.55	4.87	4.83	4.61	4.54	4.91	4.76	4.66	4.69

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

* Cell D06 out of service for a maintenance issue.

	MicroFiltration Process online monitoring results Log Removal Value			
	E01	**E02**	**E03**	**E04**
Date	LRV	LRV	LRV	LRV
07/01/19	4.69	4.90	5.11	5.17
07/02/19	4.69	4.87	5.14	5.08
07/03/19	4.73	4.85	5.15	5.00
07/04/19	4.77	4.77	5.13	5.16
07/05/19	4.73	4.79	5.11	5.33
07/06/19	4.74	4.82	5.22	5.41
07/07/19	4.72	4.84	5.15	5.15
07/08/19	4.74	4.81	5.12	5.17
07/09/19	4.74	4.74	5.04	5.13
07/10/19	4.77	4.74	5.02	5.18
07/11/19	4.72	4.76	5.14	5.19
07/12/19	4.72	4.79	5.11	5.19
07/13/19	4.83	4.77	5.17	5.25
07/14/19	4.82	4.78	5.13	5.33
07/15/19	4.78	4.78	5.19	5.18
07/16/19	4.81	4.74	5.12	5.19
07/17/19	4.77	4.73	5.11	5.25
07/18/19	4.71	4.69	5.15	5.20
07/19/19	4.71	4.72	5.17	5.20
07/20/19	4.73	4.70	5.10	5.09
07/21/19	4.76	4.70	5.11	5.18
07/22/19	4.76	4.72	5.16	5.23
07/23/19	4.76	4.71	5.10	5.30
07/24/19	4.77	4.70	5.14	5.54
07/25/19	4.77	4.66	5.13	5.22
07/26/19	4.77	4.71	5.18	5.13
07/27/19	4.76	4.87	5.17	5.15
07/28/19	4.69	4.84	5.14	5.07
07/29/19	4.73	4.88	5.12	5.24
07/30/19	4.82	4.82	5.14	5.23
07/31/19	4.76	4.81	5.16	5.21

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
07/01/19	0.07	0.08	0.10	0.11	0.10	0.10	0.06	0.06	0.05	0.07	0.09	0.10	0.07	0.12	0.11	0.11	0.06	0.07	0.08
07/02/19	0.07	0.09	0.10	0.11	0.10	0.10	0.06	0.06	0.06	0.07	0.07	0.10	0.07	0.11	0.11	0.11	0.06	0.07	0.08
07/03/19	0.08	0.10	0.10	0.11	0.10	0.11	0.06	0.07	0.05	0.06	0.06	0.07	0.07	0.08	0.11	0.11	0.06	0.07	0.08
07/04/19	0.07	0.08	0.11	0.12	0.11	0.12	0.06	0.07	0.05	0.06	0.07	0.07	0.08	0.14	0.10	0.11	0.06	0.06	0.08
07/05/19	0.08	0.09	0.10	0.11	0.10	0.11	0.06	0.07	0.05	0.06	0.07	0.08	0.08	0.12	0.10	0.11	0.06	0.07	0.08
07/06/19	0.08	0.09	0.10	0.11	0.10	0.11	0.05	0.06	0.06	0.07	0.08	0.09	0.09	0.09	0.11	0.11	0.07	0.07	0.08
07/07/19	0.08	0.09	0.10	0.11	0.09	0.10	0.05	0.06	0.05	0.06	0.09	0.10	0.09	0.14	0.11	0.11	0.07	0.07	0.08
07/08/19	0.08	0.09	0.10	0.11	0.09	0.10	0.05	0.06	0.06	0.07	0.09	0.10	0.11	0.14	0.11	0.11	0.07	0.07	0.08
07/09/19	0.08	0.08	0.10	0.12	0.09	0.10	0.05	0.06	0.05	0.06	0.09	0.10	0.11	0.14	0.11	0.11	0.07	0.07	0.08
07/10/19	0.05	0.08	0.10	0.12	0.10	0.11	0.06	0.07	0.04	0.05	0.10	0.11	0.11	0.13	0.11	0.11	0.07	0.07	0.08
07/11/19	0.06	0.09	0.11	0.12	0.10	0.10	0.06	0.07	0.06	0.07	0.11	0.11	0.11	0.16	0.11	0.11	0.06	0.07	0.09
07/12/19	0.07	0.08	0.09	0.11	0.10	0.10	0.05	0.06	0.06	0.07	0.11	0.11	0.11	0.17	0.11	0.11	0.06	0.07	0.08
07/13/19	0.07	0.08	0.04	0.05	0.09	0.10	0.05	0.06	0.06	0.07	0.11	0.11	0.12	0.18	0.11	0.12	0.07	0.08	0.08
07/14/19	0.07	0.08	0.04	0.04	0.09	0.10	0.05	0.06	0.05	0.06	0.11	0.12	0.12	0.17	0.11	0.12	0.07	0.08	0.08
07/15/19	0.07	0.08	0.04	0.04	0.09	0.10	0.05	0.06	0.06	0.07	0.11	0.12	0.12	0.19	0.11	0.12	0.07	0.08	0.08
07/16/19	0.08	0.08	0.04	0.05	0.09	0.10	0.06	0.06	0.06	0.07	0.08	0.12	0.12	0.16	0.12	0.12	0.08	0.08	0.08
07/17/19	0.07	0.08	0.03	0.04	0.09	0.10	0.05	0.06	0.05	0.06	0.06	0.06	0.09	0.14	0.11	0.12	0.07	0.08	0.07
07/18/19	0.07	0.08	0.03	0.04	0.08	0.10	0.05	0.06	0.05	0.06	0.06	0.07	0.06	0.07	0.10	0.10	0.06	0.06	0.06
07/19/19	0.07	0.09	0.04	0.04	0.09	0.10	0.05	0.06	0.06	0.06	0.06	0.07	0.05	0.09	0.10	0.10	0.06	0.06	0.06
07/20/19	0.08	0.09	0.04	0.04	0.09	0.10	0.05	0.05	0.06	0.07	0.07	0.08	0.06	0.08	0.10	0.10	0.06	0.06	0.07
07/21/19	0.08	0.09	0.04	0.05	0.09	0.10	0.04	0.06	0.06	0.07	0.08	0.09	0.07	0.11	0.10	0.10	0.05	0.06	0.07
07/22/19	0.08	0.09	0.04	0.05	0.09	0.10	0.05	0.05	0.07	0.07	0.09	0.10	0.07	0.10	0.10	0.11	0.06	0.07	0.07
07/23/19	0.08	0.09	0.04	0.04	0.09	0.10	0.05	0.05	0.07	0.07	0.09	0.10	0.08	0.10	0.10	0.10	0.06	0.07	0.07
07/24/19	0.08	0.08	0.04	0.04	0.09	0.10	0.05	0.05	0.06	0.08	0.07	0.10	0.07	0.10	0.10	0.10	0.06	0.07	0.07
07/25/19	0.08	0.09	0.04	0.04	0.09	0.10	0.05	0.05	0.06	0.07	0.06	0.07	0.05	0.09	0.06	0.11	0.06	0.07	0.06
07/26/19	0.07	0.08	0.04	0.04	0.09	0.10	0.05	0.05	0.06	0.07	0.06	0.07	0.06	0.08	0.08	0.08	0.07	0.08	0.06
07/27/19	0.07	0.08	0.04	0.05	0.10	0.10	0.05	0.05	0.05	0.06	0.07	0.08	0.06	0.08	0.08	0.09	0.07	0.08	0.07
07/28/19	0.07	0.09	0.04	0.05	0.10	0.10	0.05	0.05	0.05	0.07	0.08	0.09	0.07	0.08	0.09	0.09	0.07	0.09	0.07
07/29/19	0.08	0.09	0.04	0.05	0.10	0.10	0.05	0.06	0.07	0.08	0.08	0.09	0.08	0.13	0.09	0.12	0.07	0.11	0.07
07/30/19	0.07	0.08	0.04	0.05	0.09	0.10	0.05	0.05	0.06	0.08	0.08	0.11	0.09	0.10	0.09	0.10	0.07	0.08	0.07
07/31/19	0.07	0.08	0.04	0.05	0.09	0.10	0.04	0.05	0.07	0.08	0.08	0.09	0.07	0.10	0.09	0.10	0.07	0.07	0.07

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
07/01/19	0.050	0.057	7.398	6.010	8.203	0.062	0.043*	0.071	1,666	1,564	1,837	35	30	42	99.16	2.07	97.91	1.68
07/02/19	0.066	0.070	7.727	5.196	8.575	0.068	0.061	0.075	1,842	1,731	1,970	38	33	43	99.12	2.06	97.95	1.69
07/03/19	0.069	0.070	7.356	6.864	8.368	0.066	0.050	0.085	1,905	1,837	1,966	40	36	43	99.10	2.05	97.92	1.68
07/04/19	0.069	0.069	7.084	4.846	13.491	0.064	0.055	0.076	1,838	1,787	1,915	39	36	45	99.10	2.05	97.90	1.68
07/05/19	0.069	0.069	6.721	6.090	7.683	0.058	0.053	0.062	1,700	1,601	1,765	37	33	41	99.14	2.06	97.84	1.67
07/06/19	0.067	0.068	7.027	6.350	7.683	0.060	0.056	0.064	1,653	1,588	1,717	35	33	39	99.14	2.07	97.86	1.67
07/07/19	0.069	0.070	6.934	6.309	7.665	0.059	0.051	0.067	1,614	1,574	1,653	33	31	37	99.14	2.07	97.93	1.68
07/08/19	0.071	0.072	7.180	5.457	8.010	0.061	0.056	0.073	1,588	1,506	1,713	33	30	38	99.15	2.07	97.93	1.68
07/09/19	0.071	0.072	7.191	5.755	8.336	0.069	0.060	0.082	1,672	1,621	1,751	34	32	38	99.04	2.02	97.94	1.69
07/10/19	0.071	0.071	7.530	5.312	8.441	0.067	0.062	0.071	1,747	1,668	1,859	35	32	40	99.11	2.05	97.99	1.70
07/11/19	0.070	0.070	7.255	6.518	7.926	0.069	0.061	0.079	1,824	1,774	1,886	38	34	43	99.05	2.02	97.94	1.69
07/12/19	0.060	0.073	7.192	6.522	7.904	0.069	0.064	0.078	1,838	1,791	1,909	37	34	41	99.04	2.02	97.97	1.69
07/13/19	0.059	0.061	7.212	6.477	7.821	0.072	0.063	0.088	1,841	1,803	1,886	38	35	40	99.00	2.00	97.96	1.69
07/14/19	0.059	0.060	7.018	4.816	8.034	0.070	0.058	0.086	1,732	1,653	1,798	37	35	39	99.01	2.00	97.88	1.67
07/15/19	0.060	0.060	7.425	4.895	8.440	0.065	0.059	0.075	1,646	1,570	1,757	34	30	38	99.12	2.05	97.95	1.69
07/16/19	0.059	0.060	7.660	4.914	8.507	0.069	0.062	0.079	1,719	1,640	1,814	34	31	38	99.10	2.04	98.00	1.70
07/17/19	0.059	0.060	7.571	4.706	8.246	0.071	0.065	0.081	1,795	1,708	1,911	37	33	43	99.07	2.03	97.95	1.69
07/18/19	0.059	0.061	7.549	5.261	8.273	0.069	0.064	0.082	1,848	1,759	1,955	38	33	42	99.08	2.04	97.97	1.69
07/19/19	0.059	0.061	7.293	6.426	8.233	0.066	0.062	0.071	1,848	1,781	1,915	38	34	43	99.10	2.04	97.93	1.68
07/20/19	0.060	0.060	7.150	5.413	12.693	0.068	0.064	0.075	1,834	1,779	1,889	39	36	43	99.05	2.02	97.87	1.67
07/21/19	0.059	0.060	6.800	6.090	8.927	0.066	0.056	0.077	1,703	1,654	1,755	35	33	38	99.04	2.02	97.93	1.68
07/22/19	0.058	0.060	6.971	5.559	8.103	0.065	0.058	0.219	1,628	1,543	1,750	33	30	40	99.07	2.03	97.95	1.69
07/23/19	0.060	0.060	7.363	6.472	8.209	0.071	0.062	0.083	1,679	1,610	1,758	36	33	40	99.03	2.01	97.84	1.66
07/24/19	0.060	0.061	7.464	6.266	8.532	0.071	0.065	0.081	1,719	1,650	1,805	37	33	42	99.05	2.02	97.84	1.66
07/25/19	0.056	0.059	7.705	6.309	8.557	0.061	0.051	0.074	1,775	1,709	1,867	40	35	47	99.21	2.11	97.77	1.65
07/26/19	0.052	0.060	6.447	5.696	8.514	0.056	0.054	0.062	1,781	1,706	1,852	39	34	44	99.13	2.06	97.80	1.66
07/27/19	0.061	0.063	5.962	5.502	10.976	0.054	0.048	0.059	1,731	1,680	1,788	39	36	43	99.10	2.05	97.75	1.65
07/28/19	0.063	0.063	5.776	5.391	6.368	0.057	0.046	0.520**	1,615	1,536	1,692	38	35	43	99.01	2.00	97.62	1.62
07/29/19	0.063	0.063	6.651	5.318	8.352	0.061	0.046	0.078	1,605	1,515	1,736	38	33	45	99.08	2.04	97.63	1.63
07/30/19	0.058	0.062	7.337	5.561	8.129	0.071	0.066	0.079	1,724	1,632	1,832	39	35	43	99.04	2.02	97.74	1.65
07/31/19	0.058	0.059	7.310	6.076	8.110	0.074	0.067	0.082	1,792	1,707	1,904	41	35	49	98.99	2.00	97.73	1.64

Notes:

* Value from backup analyzer due to primary analyzer error.

** Momentary spike in TOC value caused by bringing online RO unit B02 after a membrane cleaning.

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
07/01/19	98.37	89.588	22,546.5	0.25	3.0	6
07/02/19	98.24	92.629	23,317.1	0.25	3.0	6
07/03/19	98.16	84.922	23,145.2	0.25	3.0	6
07/04/19	98.32	82.810	20,881.2	0.25	3.0	6
07/05/19	97.99	86.908	21,364.9	0.25	3.0	6
07/06/19	98.03	87.191	21,970.0	0.25	3.0	6
07/07/19	98.22	88.303	21,798.8	0.25	3.0	6
07/08/19	98.02	87.049	22,073.6	0.25	3.0	6
07/09/19	98.24	90.122	21,983.7	0.25	3.0	6
07/10/19	97.93	94.349	22,357.6	0.25	3.0	6
07/11/19	98.07	92.129	22,596.5	0.24	3.0	6
07/12/19	97.96	94.761	22,620.1	0.24	3.0	6
07/13/19	98.04	91.236	22,478.7	0.24	3.0	6
07/14/19	98.45	91.975	22,297.4	0.24	3.0	6
07/15/19	98.21	90.478	22,406.8	0.24	3.0	6
07/16/19	97.98	92.919	22,410.1	0.25	3.0	6
07/17/19	98.00	94.760	22,677.8	0.24	3.0	6
07/18/19	97.98	94.697	22,932.7	0.24	3.0	6
07/19/19	97.97	91.290	22,577.7	0.24	3.0	6
07/20/19	97.89	89.548	22,493.2	0.25	3.0	6
07/21/19	98.20	91.068	22,383.2	0.25	3.0	6
07/22/19	97.65	89.387	22,659.9	0.25	3.0	6
07/23/19	97.73	93.100	22,245.9	0.25	3.0	6
07/24/19	98.07	94.468	22,195.7	0.24	3.0	6
07/25/19	97.75	91.054	22,393.8	0.24	3.0	6
07/26/19	97.76	92.114	22,079.6	0.24	3.0	6
07/27/19	97.69	96.634	22,893.0	0.24	3.0	6
07/28/19	97.83	87.936	23,690.9	0.25	3.0	6
07/29/19	98.13	88.996	21,981.6	0.25	3.0	6
07/30/19	98.02	92.478	21,892.9	0.25	3.0	6
07/31/19	97.88	93.231	22,597.6	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
08/01/19	12.47	12.47	12.99	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/02/19	12.38	12.38	12.90	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/03/19	12.37	12.37	12.90	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/04/19	12.43	12.43	12.94	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/05/19	12.45	12.45	12.98	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/06/19	12.44	12.44	12.99	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/07/19	12.42	12.42	12.96	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/08/19	12.45	12.45	12.99	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/09/19	12.45	12.45	12.99	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/10/19	12.46	12.46	12.99	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/11/19	12.45	12.45	13.00	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/12/19	12.52	12.52	13.00	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/13/19	12.49	12.49	12.97	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/14/19	12.45	12.45	12.96	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/15/19	12.47	12.47	12.99	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/16/19	12.46	12.46	12.99	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/17/19	12.49	12.49	13.00	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/18/19	12.55	12.55	13.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/19/19	12.58	12.58	13.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/20/19	12.49	12.49	13.01	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/21/19	12.51	12.51	13.03	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/22/19	12.50	12.50	13.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/23/19	12.61	12.61	13.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/24/19	12.52	12.52	13.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/25/19	12.55	12.55	13.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/26/19	12.58	12.58	13.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/27/19	12.54	12.54	13.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/28/19	12.52	12.52	13.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/29/19	12.59	12.59	13.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/30/19	12.56	12.56	13.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
08/31/19	12.59	12.59	13.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0

Notes:

1. Two additional log virus credit taken for two months of travel time beyond the project's primary 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*
08/01/19	0.00	4.48	1.99	6.00	0.00	12.47
08/02/19	0.00	4.48	1.90	6.00	0.00	12.38
08/03/19	0.00	4.47	1.90	6.00	0.00	12.37
08/04/19	0.00	4.48	1.94	6.00	0.00	12.43
08/05/19	0.00	4.46	1.98	6.00	0.00	12.45
08/06/19	0.00	4.45	1.99	6.00	0.00	12.44
08/07/19	0.00	4.45	1.96	6.00	0.00	12.42
08/08/19	0.00	4.46	1.99	6.00	0.00	12.45
08/09/19	0.00	4.47	1.99	6.00	0.00	12.45
08/10/19	0.00	4.47	1.99	6.00	0.00	12.46
08/11/19	0.00	4.45	2.00	6.00	0.00	12.45
08/12/19	0.00	4.52	2.00	6.00	0.00	12.52
08/13/19	0.00	4.52	1.97	6.00	0.00	12.49
08/14/19	0.00	4.49	1.96	6.00	0.00	12.45
08/15/19	0.00	4.49	1.99	6.00	0.00	12.47
08/16/19	0.00	4.47	1.99	6.00	0.00	12.46
08/17/19	0.00	4.48	2.00	6.00	0.00	12.49
08/18/19	0.00	4.49	2.06	6.00	0.00	12.55
08/19/19	0.00	4.49	2.09	6.00	0.00	12.58
08/20/19	0.00	4.48	2.01	6.00	0.00	12.49
08/21/19	0.00	4.48	2.03	6.00	0.00	12.51
08/22/19	0.00	4.45	2.05	6.00	0.00	12.50
08/23/19	0.00	4.50	2.12	6.00	0.00	12.61
08/24/19	0.00	4.48	2.04	6.00	0.00	12.52
08/25/19	0.00	4.48	2.06	6.00	0.00	12.55
08/26/19	0.00	4.51	2.06	6.00	0.00	12.58
08/27/19	0.00	4.50	2.04	6.00	0.00	12.54
08/28/19	0.00	4.50	2.02	6.00	0.00	12.52
08/29/19	0.00	4.54	2.05	6.00	0.00	12.59
08/30/19	0.00	4.52	2.04	6.00	0.00	12.56
08/31/19	0.00	4.54	2.05	6.00	0.00	12.59

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*
08/01/19	0.00	0.00	1.99	6.00	5.00	12.99
08/02/19	0.00	0.00	1.90	6.00	5.00	12.90
08/03/19	0.00	0.00	1.90	6.00	5.00	12.90
08/04/19	0.00	0.00	1.94	6.00	5.00	12.94
08/05/19	0.00	0.00	1.98	6.00	5.00	12.98
08/06/19	0.00	0.00	1.99	6.00	5.00	12.99
08/07/19	0.00	0.00	1.96	6.00	5.00	12.96
08/08/19	0.00	0.00	1.99	6.00	5.00	12.99
08/09/19	0.00	0.00	1.99	6.00	5.00	12.99
08/10/19	0.00	0.00	1.99	6.00	5.00	12.99
08/11/19	0.00	0.00	2.00	6.00	5.00	13.00
08/12/19	0.00	0.00	2.00	6.00	5.00	13.00
08/13/19	0.00	0.00	1.97	6.00	5.00	12.97
08/14/19	0.00	0.00	1.96	6.00	5.00	12.96
08/15/19	0.00	0.00	1.99	6.00	5.00	12.99
08/16/19	0.00	0.00	1.99	6.00	5.00	12.99
08/17/19	0.00	0.00	2.00	6.00	5.00	13.00
08/18/19	0.00	0.00	2.06	6.00	5.00	13.06
08/19/19	0.00	0.00	2.09	6.00	5.00	13.09
08/20/19	0.00	0.00	2.01	6.00	5.00	13.01
08/21/19	0.00	0.00	2.03	6.00	5.00	13.03
08/22/19	0.00	0.00	2.05	6.00	5.00	13.05
08/23/19	0.00	0.00	2.12	6.00	5.00	13.12
08/24/19	0.00	0.00	2.04	6.00	5.00	13.04
08/25/19	0.00	0.00	2.06	6.00	5.00	13.06
08/26/19	0.00	0.00	2.06	6.00	5.00	13.06
08/27/19	0.00	0.00	2.04	6.00	5.00	13.04
08/28/19	0.00	0.00	2.02	6.00	5.00	13.02
08/29/19	0.00	0.00	2.05	6.00	5.00	13.05
08/30/19	0.00	0.00	2.04	6.00	5.00	13.04
08/31/19	0.00	0.00	2.05	6.00	5.00	13.05

Notes:

1. Two additional log virus credit taken for two months of travel time beyond the project's primary 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	MicroFiltration Process online monitoring results Log Removal Value															
	A01	A02	A03	A04	A05	A06	A07	A08	B01	B02	B03	B04	B05	B06	B07	B08
	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
08/01/19	4.90	4.97	4.99	4.71	4.79	4.80	4.82	4.48	4.64	4.54	4.81	4.75	4.49	4.55	4.58	4.64
08/02/19	4.90	4.87	5.00	4.71	4.80	4.78	4.80	4.70	4.61	4.56	4.85	4.76	4.48	4.57	4.59	4.63
08/03/19	4.91	4.98	5.02	4.73	4.81	4.83	4.86	4.64	4.64	4.55	4.85	4.88	4.48	4.57	4.57	4.65
08/04/19	4.95	4.93	5.02	4.72	4.80	4.84	4.86	4.65	4.68	4.54	4.84	4.89	4.48	4.57	4.57	4.62
08/05/19	4.89	4.91	4.99	4.68	4.79	4.81	4.85	4.68	4.65	4.52	4.89	4.85	4.46	4.67	4.56	4.61
08/06/19	4.92	4.94	4.96	4.70	4.75	4.81	4.84	4.68	4.65	4.54	4.89	4.85	4.45	4.72	4.57	4.61
08/07/19	4.92	4.91	5.00	4.71	4.76	4.79	4.80	4.69	4.62	4.52	4.90	4.85	4.45	4.69	4.56	4.61
08/08/19	4.93	4.96	4.99	4.70	4.77	4.78	4.82	4.64	4.62	4.54	4.87	4.84	4.46	4.70	4.54	4.63
08/09/19	4.93	4.90	4.99	4.67	4.72	4.78	4.83	4.65	4.62	4.53	4.89	4.85	4.47	4.70	4.54	4.62
08/10/19	4.91	4.90	4.99	4.69	4.73	4.78	4.83	4.63	4.59	4.52	4.86	4.81	4.47	4.69	4.53	4.61
08/11/19	4.92	4.91	5.00	4.69	4.76	4.77	4.81	4.62	4.59	4.52	4.86	4.84	4.45	4.71	4.54	4.61
08/12/19	4.89	4.91	4.96	4.69	4.81	4.75	4.79	4.64	4.60	4.52	4.87	4.86	4.57	4.72	4.53	4.59
08/13/19	4.88	4.89	4.95	4.69	4.79	4.76	4.83	4.63	4.59	4.52	4.88	4.84	4.60	4.69	4.52	4.59
08/14/19	4.91	4.86	4.90	4.65	4.75	4.72	4.80	4.61	4.58	4.49	4.86	4.83	4.54	4.67	4.53	4.58
08/15/19	4.81	4.89	4.91	4.61	4.73	4.72	4.79	4.64	4.56	4.49	4.85	4.78	4.58	4.65	4.54	4.65
08/16/19	4.86	5.00	4.85	4.62	4.75	4.69	4.81	4.62	4.56	4.48	4.85	4.80	4.59	4.65	4.51	4.71
08/17/19	4.84	5.04	4.89	4.83	4.83	4.71	4.77	4.61	4.74	4.48	4.81	4.78	4.56	4.66	4.51	4.71
08/18/19	4.91	4.99	4.95	4.80	4.86	4.73	4.79	4.61	4.76	4.49	4.82	4.77	4.57	4.68	4.50	4.71
08/19/19	4.87	4.98	4.92	4.82	4.82	4.74	4.80	4.62	4.74	4.49	4.83	4.78	4.57	4.68	4.51	4.71
08/20/19	4.86	5.03	4.89	4.80	4.81	4.71	4.81	4.57	4.72	4.48	4.83	4.76	4.56	4.65	4.50	4.71
08/21/19	4.83	4.99	4.88	4.79	4.82	4.70	4.79	4.53	4.70	4.48	4.82	4.76	4.63	4.67	4.51	4.72
08/22/19	4.84	5.04	4.92	4.82	4.83	4.73	4.80	4.60	4.66	4.45	4.81	4.75	4.67	4.66	4.51	4.73
08/23/19	4.84	4.94	4.90	4.77	4.82	4.90	4.81	4.60	4.68	4.55	4.82	4.75	4.64	4.63	4.50	4.70
08/24/19	4.85	5.00	4.84	4.76	4.81	4.77	4.77	4.59	4.68	4.57	4.82	4.74	4.60	4.63	4.48	4.69
08/25/19	5.02	4.96	4.97	4.74	4.83	4.77	4.90	4.53	4.67	4.54	4.79	4.73	4.60	4.61	4.48	4.69
08/26/19	4.96	4.95	4.97	4.75	4.83	4.78	4.88	4.51	4.66	4.53	4.80	4.72	4.58	4.60	4.58	4.66
08/27/19	4.95	4.97	5.00	4.76	4.82	4.78	4.87	4.50	4.67	4.54	4.89	4.68	4.59	4.62	4.60	4.65
08/28/19	4.95	4.97	5.00	4.79	4.81	4.81	4.85	4.53	4.66	4.56	4.89	4.84	4.61	4.62	4.57	4.65
08/29/19	4.95	4.96	4.93	4.70	4.79	4.75	4.84	4.62	4.63	4.56	4.87	4.84	4.57	4.60	4.57	4.63
08/30/19	4.96	4.91	5.00	4.69	4.78	4.80	4.85	4.65	4.62	4.52	4.88	4.81	4.55	4.59	4.57	4.62
08/31/19	4.90	4.91	4.95	4.68	4.78	4.77	4.81	4.64	4.62	4.54	4.86	4.82	4.59	4.67	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	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
08/01/19	4.61	4.72	4.57	4.58	4.49	4.65	4.56	4.55	4.91	4.79	4.60	4.59	4.94	4.74	4.65	4.79
08/02/19	4.62	4.71	4.57	4.58	4.50	4.64	4.58	4.54	4.91	4.79	4.61	4.57	4.92	4.75	4.64	4.81
08/03/19	4.62	4.71	4.56	4.58	4.47	4.65	4.60	4.52	4.88	4.80	4.60	4.57	4.93	4.72	4.65	4.83
08/04/19	4.61	4.72	4.55	4.58	4.59	4.65	4.57	4.52	4.89	4.79	4.60	4.57	4.91	4.71	4.63	4.85
08/05/19	4.59	4.71	4.56	4.58	4.69	4.64	4.59	4.63	4.88	4.78	4.59	4.54	4.91	4.69	4.62	4.82
08/06/19	4.59	4.70	4.56	4.56	4.65	4.64	4.59	4.75	4.89	4.78	4.59	4.53	4.91	4.67	4.61	4.83
08/07/19	4.68	4.71	4.54	4.55	4.67	4.64	4.56	4.72	4.87	4.77	4.59	4.53	4.86	4.65	4.60	4.83
08/08/19	4.74	4.70	4.63	4.56	4.67	4.63	4.57	4.68	4.88	4.76	4.58	4.51	4.85	4.64	4.61	4.81
08/09/19	4.77	4.68	4.69	4.58	4.65	4.63	4.58	4.69	4.89	4.76	4.59	4.56	4.91	4.72	4.62	4.83
08/10/19	4.75	4.66	4.71	4.57	4.64	4.62	4.57	4.69	4.86	4.77	4.58	4.67	4.89	4.86	4.64	4.84
08/11/19	4.74	4.68	4.73	4.56	4.63	4.63	4.59	4.69	4.87	4.76	4.57	4.69	4.90	4.80	4.70	4.82
08/12/19	4.74	4.71	4.73	4.55	4.63	4.64	4.58	4.69	4.84	4.75	4.57	4.67	4.90	4.78	4.83	4.80
08/13/19	4.73	4.69	4.70	4.55	4.62	4.63	4.56	4.67	4.84	4.76	4.61	4.66	4.88	4.78	4.77	4.80
08/14/19	4.73	4.66	4.67	4.53	4.61	4.62	4.54	4.66	4.83	4.75	4.70	4.64	4.86	4.77	4.73	4.80
08/15/19	4.71	4.63	4.65	4.51	4.60	4.61	4.53	4.64	4.80	4.72	4.68	4.63	4.82	4.74	4.70	4.80
08/16/19	4.69	4.63	4.63	4.47	4.59	4.61	4.52	4.64	4.79	4.71	4.68	4.64	4.85	4.71	4.70	4.79
08/17/19	4.70	4.66	4.65	4.49	4.59	4.60	4.53	4.66	4.82	4.69	4.66	4.63	4.98	4.73	4.71	4.79
08/18/19	4.71	4.65	4.67	4.52	4.58	4.62	4.54	4.66	4.83	4.69	4.67	4.65	5.03	4.73	4.72	4.80
08/19/19	4.71	4.66	4.67	4.60	4.57	4.61	4.63	4.65	4.83	4.73	4.66	4.64	5.01	4.73	4.75	4.78
08/20/19	4.70	4.65	4.67	4.65	4.56	4.58	4.71	4.63	4.81	4.73	4.66	4.64	4.99	4.75	4.74	4.77
08/21/19	4.70	4.62	4.65	4.64	4.56	4.60	4.69	4.62	4.79	4.71	4.66	4.64	4.96	4.73	4.71	4.76
08/22/19	4.70	4.62	4.63	4.63	4.56	4.59	4.73	4.61	4.78	4.69	4.64	4.63	4.94	4.72	4.70	4.77
08/23/19	4.67	4.59	4.62	4.61	4.54	4.55	4.75	4.58	4.89	4.66	4.63	4.60	4.91	4.71	4.68	4.71
08/24/19	4.67	4.58	4.62	4.61	4.53	4.55	4.73	4.59	4.97	4.66	4.63	4.58	4.95	4.70	4.68	4.72
08/25/19	4.68	4.72	4.62	4.64	4.53	4.67	4.72	4.60	4.93	4.71	4.62	4.59	4.93	4.70	4.67	4.73
08/26/19	4.67	4.79	4.62	4.64	4.52	4.73	4.72	4.58	4.92	4.81	4.63	4.58	4.92	4.71	4.66	4.77
08/27/19	4.66	4.75	4.60	4.61	4.51	4.66	4.74	4.57	4.88	4.82	4.62	4.58	4.93	4.71	4.64	4.93
08/28/19	4.63	4.75	4.57	4.57	4.50	4.63	4.76	4.54	4.85	4.80	4.60	4.58	4.89	4.71	4.66	4.87
08/29/19	4.60	4.75	4.56	4.54	4.69	4.66	4.75	4.54	4.85	4.77	4.58	4.56	4.86	4.67	4.65	4.85
08/30/19	4.61	4.73	4.58	4.56	4.81	4.66	4.76	4.73	4.85	4.76	4.59	4.55	4.88	4.67	4.67	4.85
08/31/19	4.63	4.72	4.59	4.60	4.75	4.67	4.77	4.84	4.90	4.77	4.58	4.55	4.91	4.67	4.68	4.84

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
08/01/19	4.72	4.83	5.07	5.28
08/02/19	4.77	4.83	5.16	5.22
08/03/19	4.76	4.84	5.12	5.09
08/04/19	4.74	4.81	5.18	5.21
08/05/19	4.73	4.79	5.16	5.23
08/06/19	4.70	4.77	5.26	5.37
08/07/19	4.74	4.76	5.22	5.37
08/08/19	4.83	4.77	5.28	5.20
08/09/19	4.79	4.78	5.18	5.12
08/10/19	4.73	4.77	5.19	5.12
08/11/19	4.75	4.75	5.15	5.15
08/12/19	4.73	4.78	5.13	5.26
08/13/19	4.77	4.79	5.14	5.37
08/14/19	4.72	4.76	5.21	5.38
08/15/19	4.70	4.71	5.15	5.18
08/16/19	4.71	4.67	5.18	5.35
08/17/19	4.76	4.67	5.18	5.25
08/18/19	4.78	4.69	5.13	5.20
08/19/19	4.78	4.73	5.15	5.25
08/20/19	4.73	4.71	5.21	5.19
08/21/19	4.73	4.73	5.26	5.10
08/22/19	4.74	4.90	5.15	5.17
08/23/19	4.73	4.86	5.12	5.36
08/24/19	4.77	4.83	5.25	5.31
08/25/19	4.80	4.80	5.24	5.39
08/26/19	4.78	4.83	5.27	5.24
08/27/19	4.79	4.82	5.26	5.16
08/28/19	4.73	4.83	5.24	5.26
08/29/19	4.75	4.85	5.20	5.24
08/30/19	4.73	4.82	5.21	5.38
08/31/19	4.68	4.82	5.17	5.37

Notes:

Giardia and Crypto LRV based on USEPA Membrane Filtration Guidance Manual and sensitive at less than 3 micron.

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
08/01/19	0.07	0.08	0.04	0.05	0.09	0.10	0.04	0.05	0.08	0.08	0.08	0.09	0.08	0.11	0.09	0.10	0.07	0.07	0.07
08/02/19	0.07	0.08	0.04	0.04	0.09	0.10	0.04	0.05	0.08	0.08	0.08	0.10	0.07	0.09	0.10	0.11	0.07	0.07	0.07
08/03/19	0.08	0.09	0.04	0.05	0.09	0.10	0.04	0.05	0.08	0.09	0.08	0.10	0.08	0.09	0.10	0.10	0.07	0.08	0.07
08/04/19	0.08	0.09	0.04	0.04	0.09	0.10	0.04	0.05	0.08	0.09	0.09	0.10	0.08	0.09	0.10	0.11	0.07	0.08	0.08
08/05/19	0.08	0.13	0.04	0.04	0.10	0.10	0.04	0.05	0.08	0.09	0.09	0.10	0.08	0.14	0.10	0.11	0.07	0.07	0.08
08/06/19	0.07	0.09	0.04	0.04	0.10	0.10	0.04	0.05	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.11	0.07	0.07	0.08
08/07/19	0.08	0.09	0.04	0.04	0.10	0.10	0.05	0.05	0.08	0.09	0.08	0.10	0.10	0.12	0.10	0.11	0.07	0.07	0.07
08/08/19	0.07	0.09	0.04	0.06	0.10	0.10	0.04	0.05	0.07	0.08	0.06	0.07	0.10	0.12	0.10	0.10	0.07	0.07	0.07
08/09/19	0.07	0.09	0.04	0.05	0.10	0.10	0.04	0.04	0.08	0.08	0.07	0.08	0.10	0.15	0.10	0.10	0.07	0.07	0.07
08/10/19	0.08	0.09	0.04	0.05	0.09	0.10	0.03	0.04	0.08	0.09	0.08	0.08	0.10	0.12	0.10	0.14	0.07	0.07	0.07
08/11/19	0.08	0.09	0.04	0.05	0.09	0.10	0.03	0.04	0.09	0.09	0.08	0.10	0.11	0.12	0.10	0.11	0.07	0.08	0.08
08/12/19	0.08	0.09	0.04	0.04	0.09	0.10	0.03	0.04	0.09	0.10	0.09	0.10	0.11	0.12	0.11	0.13	0.07	0.07	0.08
08/13/19	0.08	0.09	0.04	0.04	0.09	0.10	0.03	0.04	0.10	0.11	0.10	0.10	0.11	0.15	0.10	0.11	0.07	0.07	0.08
08/14/19	0.08	0.09	0.04	0.04	0.09	0.10	0.04	0.06	0.07	0.11	0.07	0.10	0.09	0.13	0.10	0.11	0.06	0.07	0.07
08/15/19	0.08	0.09	0.04	0.04	0.09	0.10	0.04	0.06	0.06	0.06	0.05	0.06	0.07	0.09	0.10	0.11	0.05	0.06	0.06
08/16/19	0.08	0.09	0.04	0.05	0.09	0.09	0.04	0.05	0.06	0.17	0.05	0.07	0.08	0.09	0.09	0.10	0.06	0.09	0.06
08/17/19	0.08	0.09	0.04	0.05	0.08	0.10	0.04	0.04	0.07	0.07	0.06	0.06	0.08	0.09	0.10	0.10	0.06	0.06	0.07
08/18/19	0.08	0.10	0.04	0.04	0.08	0.09	0.03	0.04	0.07	0.07	0.06	0.06	0.08	0.10	0.10	0.10	0.06	0.06	0.06
08/19/19	0.08	0.10	0.04	0.05	0.08	0.09	0.04	0.05	0.07	0.08	0.06	0.07	0.07	0.10	0.10	0.10	0.06	0.06	0.07
08/20/19	0.08	0.11	0.04	0.04	0.08	0.09	0.04	0.05	0.06	0.23	0.06	0.10	0.07	0.09	0.10	0.10	0.05	0.06	0.06
08/21/19	0.08	0.09	0.04	0.04	0.08	0.09	0.04	0.04	0.06	0.07	0.05	0.06	0.07	0.09	0.10	0.10	0.05	0.06	0.06
08/22/19	0.08	0.09	0.04	0.07	0.08	0.09	0.04	0.05	0.07	0.12	0.05	0.05	0.07	0.11	0.10	0.17	0.05	0.06	0.06
08/23/19	0.07	0.09	0.04	0.04	0.09	0.11	0.07	0.11	0.06	0.07	0.05	0.06	0.08	0.11	0.10	0.11	0.05	0.06	0.07
08/24/19	0.07	0.08	0.04	0.04	0.10	0.11	0.11	0.12	0.07	0.11	0.05	0.07	0.07	0.09	0.09	0.10	0.05	0.06	0.07
08/25/19	0.08	0.09	0.04	0.04	0.10	0.10	0.11	0.11	0.07	0.09	0.06	0.08	0.07	0.10	0.09	0.10	0.05	0.06	0.07
08/26/19	0.07	0.08	0.04	0.04	0.09	0.10	0.10	0.11	0.07	0.08	0.06	0.08	0.07	0.08	0.09	0.10	0.06	0.06	0.07
08/27/19	0.07	0.08	0.03	0.04	0.09	0.10	0.09	0.10	0.07	0.10	0.07	0.09	0.11	0.18	0.09	0.12	0.06	0.07	0.08
08/28/19	0.07	0.08	0.04	0.04	0.09	0.10	0.10	0.10	0.07	0.09	0.07	0.11	0.10	0.18	0.09	0.10	0.06	0.06	0.08
08/29/19	0.07	0.07	0.04	0.04	0.09	0.09	0.09	0.10	0.07	0.07	0.06	0.07	0.09	0.13	0.09	0.10	0.06	0.07	0.07
08/30/19	0.07	0.07	0.03	0.04	0.08	0.09	0.09	0.10	0.07	0.08	0.07	0.08	0.10	0.14	0.09	0.10	0.06	0.07	0.08
08/31/19	0.07	0.10	0.04	0.04	0.08	0.09	0.09	0.10	0.08	0.16	0.08	0.09	0.10	0.14	0.09	0.10	0.07	0.07	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
08/01/19	0.059	0.060	7.114	5.999	7.867	0.072	0.067	0.082	1,806	1,738	1,879	41	37	44	98.98	1.99	97.72	1.64
08/02/19	0.059	0.060	5.857	5.420	6.359	0.073	0.067	0.083	1,825	1,746	1,923	44	39	51	98.75	1.90	97.62	1.62
08/03/19	0.058	0.060	5.723	5.316	6.986	0.073	0.064	0.082	1,769	1,686	1,880	43	40	47	98.73	1.90	97.59	1.62
08/04/19	0.060	0.060	5.570	5.255	6.539	0.064	0.060	0.069	1,583	1,505	1,661	37	32	43	98.86	1.94	97.64	1.63
08/05/19	0.060	0.062	6.421	5.231	7.887	0.067	0.062	0.078	1,562	1,473	1,677	38	33	45	98.96	1.98	97.58	1.62
08/06/19	0.064	0.065	7.043	6.065	7.945	0.072	0.067	0.080	1,687	1,596	1,800	40	35	46	98.97	1.99	97.65	1.63
08/07/19	0.065	0.066	7.046	6.331	7.762	0.076	0.071	0.084	1,774	1,696	1,876	43	37	50	98.92	1.96	97.58	1.62
08/08/19	0.065	0.066	7.098	6.409	7.810	0.073	0.067	0.081	1,804	1,730	1,877	44	39	50	98.97	1.99	97.56	1.61
08/09/19	0.065	0.066	7.024	6.358	7.793	0.073	0.069	0.078	1,788	1,717	1,868	42	38	46	98.97	1.99	97.65	1.63
08/10/19	0.066	0.066	6.914	5.457	7.793	0.071	0.064	0.077	1,740	1,662	1,825	41	38	45	98.97	1.99	97.66	1.63
08/11/19	0.065	0.066	6.572	5.954	7.285	0.065	0.059	0.073	1,584	1,513	1,638	37	34	41	99.00	2.00	97.67	1.63
08/12/19	0.065	0.065	6.456	5.684	7.338	0.064	0.049	0.076	1,537	1,456	1,670	36	32	41	99.01	2.00	97.69	1.64
08/13/19	0.065	0.065	6.459	5.494	7.606	0.069	0.063	0.078	1,654	1,575	1,748	38	33	43	98.93	1.97	97.72	1.64
08/14/19	0.066	0.066	6.228	5.527	7.606	0.069	0.060	0.077	1,723	1,659	1,793	40	35	46	98.89	1.96	97.68	1.63
08/15/19	0.066	0.066	5.717	5.317	6.394	0.059	0.050	0.075	1,756	1,694	1,811	41	38	45	98.97	1.99	97.64	1.63
08/16/19	0.066	0.067	5.756	5.412	6.386	0.059	0.055	0.065	1,733	1,676	1,783	40	36	43	98.98	1.99	97.72	1.64
08/17/19	0.066	0.066	5.764	5.349	9.232	0.057	0.049	0.067	1,688	1,632	1,745	41	38	43	99.01	2.00	97.58	1.62
08/18/19	0.066	0.066	5.995	5.181	8.027	0.053	0.044	0.061	1,562	1,500	1,616	37	34	41	99.12	2.06	97.62	1.62
08/19/19	0.066	0.066	7.482	6.609	8.266	0.061	0.056	0.075	1,543	1,473	1,664	37	33	41	99.19	2.09	97.63	1.63
08/20/19	0.068	0.069	7.335	6.710	8.266	0.072	0.066	0.077	1,641	1,550	1,763	38	34	44	99.02	2.01	97.70	1.64
08/21/19	0.067	0.068	7.448	6.007	8.228	0.070	0.064	0.078	1,733	1,657	1,829	41	37	48	99.07	2.03	97.61	1.62
08/22/19	0.067	0.067	7.536	6.984	8.346	0.066	0.061	0.076	1,759	1,692	1,822	42	39	46	99.12	2.05	97.60	1.62
08/23/19	0.067	0.077	7.475	6.943	8.245	0.057	0.051	0.069	1,785	1,731	1,845	40	35	45	99.24	2.12	97.74	1.65
08/24/19	0.051	0.058	7.429	6.556	8.028	0.068	0.060	0.081	1,735	1,686	1,788	40	37	43	99.08	2.04	97.72	1.64
08/25/19	0.063	0.068	7.193	6.458	8.496	0.062	0.054	0.075	1,604	1,540	1,674	37	34	39	99.13	2.06	97.71	1.64
08/26/19	0.068	0.074	7.264	6.511	8.135	0.063	0.057	0.075	1,549	1,482	1,627	36	33	40	99.13	2.06	97.71	1.64
08/27/19	0.078	0.083	7.401	6.570	8.224	0.068	0.062	0.078	1,654	1,574	1,789	38	34	45	99.08	2.04	97.70	1.64
08/28/19	0.084	0.084	7.721	7.124	8.754	0.074	0.060	0.100	1,805	1,708	1,935	42	35	48	99.05	2.02	97.69	1.64
08/29/19	0.084	0.084	7.463	6.828	8.094	0.066	0.062	0.112	1,847	1,784	1,912	42	38	48	99.11	2.05	97.70	1.64
08/30/19	0.081	0.085	7.382	6.803	8.046	0.068	0.061	0.082	1,820	1,738	1,889	41	37	46	99.08	2.04	97.76	1.65
08/31/19	0.076	0.077	7.367	6.763	7.978	0.066	0.060	0.072	1,772	1,708	1,838	41	39	45	99.11	2.05	97.68	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

Date	UltraViolet / AOP Process online monitoring results					
	UVT % avg	FLOW MG	POWER kW	EED kWh/kgal	Peroxide Dose mg/l	Log Removal
08/01/19	97.99	94.294	21,803.5	0.24	3.0	6
08/02/19	97.96	94.485	22,900.5	0.24	3.0	6
08/03/19	97.93	92.683	22,446.4	0.24	3.0	6
08/04/19	97.96	95.516	22,583.7	0.24	3.0	6
08/05/19	97.85	90.768	23,022.6	0.24	3.0	6
08/06/19	97.99	93.364	22,155.3	0.24	3.0	6
08/07/19	97.89	92.100	22,596.5	0.24	3.0	6
08/08/19	97.92	86.411	22,675.8	0.25	3.0	6
08/09/19	97.72	90.502	22,083.5	0.25	3.0	6
08/10/19	97.89	91.025	22,579.3	0.25	3.0	6
08/11/19	97.93	90.120	22,447.5	0.25	3.0	6
08/12/19	97.74	90.738	22,336.4	0.25	3.0	6
08/13/19	97.81	93.066	22,546.2	0.25	3.0	6
08/14/19	97.80	91.530	22,602.2	0.24	3.0	6
08/15/19	97.84	90.988	22,827.6	0.25	3.0	6
08/16/19	97.74	92.623	22,173.0	0.24	3.0	6
08/17/19	97.87	86.648	22,979.1	0.24	3.0	6
08/18/19	98.09	86.682	21,712.1	0.25	3.0	6
08/19/19	97.87	87.091	21,344.3	0.25	3.0	6
08/20/19	97.85	90.189	21,435.4	0.25	3.0	6
08/21/19	97.95	86.194	22,630.9	0.25	3.0	6
08/22/19	97.97	89.538	21,867.7	0.25	3.0	6
08/23/19	97.92	92.596	22,281.5	0.25	3.0	6
08/24/19	98.01	92.493	23,322.2	0.25	3.0	6
08/25/19	98.16	89.864	23,294.6	0.25	3.0	6
08/26/19	98.07	93.135	22,470.4	0.25	3.0	6
08/27/19	97.98	92.901	22,892.8	0.25	3.0	6
08/28/19	97.75	93.553	22,900.0	0.25	3.0	6
08/29/19	97.52	92.592	23,057.9	0.25	3.0	6
08/30/19	97.10	93.535	22,935.5	0.25	3.0	6
08/31/19	97.47	89.148	22,906.8	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
09/01/19	12.59	12.59	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/02/19	12.62	12.62	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/03/19	12.63	12.63	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/04/19	12.61	12.61	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/05/19	12.59	12.59	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/06/19	12.60	12.60	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/07/19	12.64	12.64	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/08/19	12.62	12.62	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/09/19	12.59	12.59	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/10/19	12.57	12.57	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/11/19	12.55	12.55	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/12/19	12.54	12.54	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/13/19	12.52	12.52	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/14/19	12.52	12.52	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/15/19	12.55	12.55	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/16/19	12.53	12.53	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/17/19	12.51	12.51	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/18/19	12.54	12.54	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/19/19	12.53	12.53	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/20/19	12.51	12.51	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/21/19	12.57	12.57	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/22/19	12.57	12.57	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/23/19	12.60	12.60	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/24/19	12.56	12.56	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/25/19	12.44	12.44	12.00 *	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/26/19	12.47	12.47	12.01	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/27/19	12.51	12.51	12.03	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/28/19	12.52	12.52	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/29/19	12.58	12.58	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
09/30/19	12.57	12.57	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.

* See note on pg. 3 regarding virus LRV for 9/25

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*
09/01/19	0.00	4.53	2.06	6.00	0.00	12.59
09/02/19	0.00	4.52	2.09	6.00	0.00	12.62
09/03/19	0.00	4.54	2.09	6.00	0.00	12.63
09/04/19	0.00	4.54	2.06	6.00	0.00	12.61
09/05/19	0.00	4.50	2.09	6.00	0.00	12.59
09/06/19	0.00	4.49	2.11	6.00	0.00	12.60
09/07/19	0.00	4.50	2.14	6.00	0.00	12.64
09/08/19	0.00	4.47	2.15	6.00	0.00	12.62
09/09/19	0.00	4.48	2.10	6.00	0.00	12.59
09/10/19	0.00	4.49	2.08	6.00	0.00	12.57
09/11/19	0.00	4.48	2.07	6.00	0.00	12.55
09/12/19	0.00	4.47	2.07	6.00	0.00	12.54
09/13/19	0.00	4.45	2.06	6.00	0.00	12.52
09/14/19	0.00	4.45	2.08	6.00	0.00	12.52
09/15/19	0.00	4.45	2.10	6.00	0.00	12.55
09/16/19	0.00	4.44	2.10	6.00	0.00	12.53
09/17/19	0.00	4.46	2.05	6.00	0.00	12.51
09/18/19	0.00	4.48	2.06	6.00	0.00	12.54
09/19/19	0.00	4.46	2.06	6.00	0.00	12.53
09/20/19	0.00	4.45	2.06	6.00	0.00	12.51
09/21/19	0.00	4.50	2.07	6.00	0.00	12.57
09/22/19	0.00	4.50	2.07	6.00	0.00	12.57
09/23/19	0.00	4.49	2.11	6.00	0.00	12.60
09/24/19	0.00	4.50	2.06	6.00	0.00	12.56
09/25/19	0.00	4.47	1.98 *	6.00	0.00	12.44
09/26/19	0.00	4.46	2.01	6.00	0.00	12.47
09/27/19	0.00	4.48	2.03	6.00	0.00	12.51
09/28/19	0.00	4.48	2.05	6.00	0.00	12.52
09/29/19	0.00	4.50	2.08	6.00	0.00	12.58
09/30/19	0.00	4.48	2.10	6.00	0.00	12.57

Notes:

* LRV less than 2 due to a short term increase in permeate value when a RO unit put into service after a cleaning.

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*
09/01/19	0.00	0.00	2.06	6.00	4.00	12.06
09/02/19	0.00	0.00	2.09	6.00	4.00	12.09
09/03/19	0.00	0.00	2.09	6.00	4.00	12.09
09/04/19	0.00	0.00	2.06	6.00	4.00	12.06
09/05/19	0.00	0.00	2.09	6.00	4.00	12.09
09/06/19	0.00	0.00	2.11	6.00	4.00	12.11
09/07/19	0.00	0.00	2.14	6.00	4.00	12.14
09/08/19	0.00	0.00	2.15	6.00	4.00	12.15
09/09/19	0.00	0.00	2.10	6.00	4.00	12.10
09/10/19	0.00	0.00	2.08	6.00	4.00	12.08
09/11/19	0.00	0.00	2.07	6.00	4.00	12.07
09/12/19	0.00	0.00	2.07	6.00	4.00	12.07
09/13/19	0.00	0.00	2.06	6.00	4.00	12.06
09/14/19	0.00	0.00	2.08	6.00	4.00	12.08
09/15/19	0.00	0.00	2.10	6.00	4.00	12.10
09/16/19	0.00	0.00	2.10	6.00	4.00	12.10
09/17/19	0.00	0.00	2.05	6.00	4.00	12.05
09/18/19	0.00	0.00	2.06	6.00	4.00	12.06
09/19/19	0.00	0.00	2.06	6.00	4.00	12.06
09/20/19	0.00	0.00	2.06	6.00	4.00	12.06
09/21/19	0.00	0.00	2.07	6.00	4.00	12.07
09/22/19	0.00	0.00	2.07	6.00	4.00	12.07
09/23/19	0.00	0.00	2.11	6.00	4.00	12.11
09/24/19	0.00	0.00	2.06	6.00	4.00	12.06
09/25/19	0.00	0.00	1.98 *	6.00	4.02	12.00
09/26/19	0.00	0.00	2.01	6.00	4.00	12.01
09/27/19	0.00	0.00	2.03	6.00	4.00	12.03
09/28/19	0.00	0.00	2.05	6.00	4.00	12.05
09/29/19	0.00	0.00	2.08	6.00	4.00	12.08
09/30/19	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.

* LRV less than 2 due to a short term increase in permeate value when a RO unit put into service after a cleaning.

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															
	A01	**A02**	**A03**	**A04**	**A05**	**A06**	**A07**	**A08**	**B01**	**B02**	**B03**	**B04**	**B05**	**B06**	**B07**	**B08**
	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV	LRV
09/01/19	4.94	4.93	4.98	4.71	4.78	4.75	4.84	4.67	4.65	4.53	4.86	4.84	4.58	4.73	4.55	4.64
09/02/19	4.87	4.96	4.94	4.71	4.79	4.75	4.83	4.64	4.63	4.52	4.88	4.82	4.56	4.74	4.56	4.65
09/03/19	4.92	4.92	4.97	4.68	4.78	4.76	4.85	4.65	4.63	4.54	4.85	4.80	4.56	4.72	4.56	4.65
09/04/19	4.91	4.93	4.97	4.68	4.79	4.75	4.82	4.65	4.60	4.54	4.89	4.81	4.56	4.71	4.55	4.60
09/05/19	4.91	4.92	4.99	4.64	4.76	4.72	4.83	4.62	4.58	4.50	4.84	4.78	4.52	4.69	4.54	4.59
09/06/19	4.91	4.92	4.98	4.65	4.75	4.73	4.82	4.63	4.61	4.49	4.83	4.77	4.51	4.68	4.53	4.59
09/07/19	4.88	4.93	4.97	4.65	4.74	4.74	4.81	4.60	4.62	4.50	4.84	4.78	4.61	4.70	4.54	4.59
09/08/19	4.90	4.83	4.91	4.65	4.72	4.71	4.84	4.60	4.59	4.47	4.85	4.78	4.64	4.69	4.55	4.57
09/09/19	4.91	4.88	4.95	4.64	4.74	4.73	4.80	4.59	4.59	4.48	4.84	4.76	4.66	4.67	4.52	4.57
09/10/19	4.88	5.08	4.93	4.65	4.76	4.70	4.82	4.62	4.55	4.49	4.85	4.77	4.63	4.66	4.53	4.64
09/11/19	4.88	5.02	4.95	4.65	4.84	4.73	4.80	4.57	4.57	4.48	4.84	4.77	4.64	4.67	4.52	4.67
09/12/19	4.85	5.03	4.89	4.77	4.79	4.69	4.79	4.56	4.67	4.47	4.82	4.75	4.64	4.65	4.50	4.66
09/13/19	4.85	5.05	4.84	4.75	4.79	4.68	4.78	4.56	4.71	4.45	4.82	4.76	4.64	4.64	4.50	4.65
09/14/19	4.90	4.99	4.89	4.69	4.78	4.70	4.77	4.56	4.71	4.45	4.83	4.75	4.65	4.65	4.51	4.68
09/15/19	4.82	5.04	4.84	4.68	4.73	4.69	4.77	4.55	4.69	4.45	4.81	4.73	4.63	4.64	4.51	4.66
09/16/19	4.78	4.96	4.86	4.71	4.77	4.66	4.75	4.54	4.67	4.44	4.82	4.70	4.61	4.62	4.48	4.63
09/17/19	4.82	4.96	4.84	4.67	4.76	4.67	4.75	4.54	4.65	4.58	4.80	4.71	4.59	4.63	4.46	4.63
09/18/19	4.86	4.99	4.81	4.72	4.75	4.79	4.75	4.49	4.66	4.56	4.80	4.69	4.60	4.60	4.48	4.61
09/19/19	4.78	4.98	4.83	4.67	4.78	4.76	4.74	4.51	4.66	4.54	4.78	4.69	4.57	4.59	4.46	4.60
09/20/19	4.94	4.91	5.06	4.66	4.75	4.77	4.85	4.51	4.61	4.54	4.77	4.66	4.54	4.56	4.45	4.59
09/21/19	4.91	4.89	5.01	4.67	4.75	4.75	4.84	4.50	4.62	4.51	4.75	4.67	4.56	4.56	4.54	4.58
09/22/19	4.91	4.91	5.02	4.66	4.75	4.79	4.80	4.50	4.64	4.53	4.89	4.66	4.58	4.57	4.56	4.59
09/23/19	4.92	4.92	4.99	4.65	4.75	4.77	4.83	4.49	4.63	4.53	4.93	4.79	4.56	4.59	4.55	4.58
09/24/19	4.96	4.90	4.97	4.64	4.75	4.75	4.81	4.60	4.62	4.52	4.89	4.80	4.53	4.59	4.55	4.58
09/25/19	4.92	4.90	4.92	4.65	4.77	4.74	4.82	4.65	4.61	4.51	4.87	4.80	4.50	4.58	4.55	4.58
09/26/19	4.93	4.87	4.97	4.64	4.76	4.72	4.77	4.64	4.58	4.48	4.84	4.78	4.48	4.65	4.53	4.55
09/27/19	4.87	4.86	4.96	4.64	4.76	4.71	4.80	4.59	4.55	4.52	4.87	4.80	4.49	4.70	4.52	4.56
09/28/19	4.86	4.88	4.96	4.65	4.73	4.72	4.77	4.62	4.58	4.55	4.86	4.81	4.50	4.72	4.53	4.55
09/29/19	4.84	4.87	4.97	4.60	4.75	4.71	4.81	4.64	4.56	4.57	4.87	4.80	4.50	4.73	4.52	4.55
09/30/19	4.86	4.84	4.89	4.62	4.70	4.72	4.76	4.61	4.53	4.55	4.87	4.79	4.48	4.68	4.52	4.53

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
09/01/19	4.62	4.72	4.58	4.61	4.76	4.66	4.77	4.77	4.89	4.79	4.59	4.55	4.92	4.68	4.66	4.82
09/02/19	4.76	4.73	4.73	4.64	4.76	4.68	4.78	4.78	4.88	4.78	4.60	4.53	4.90	4.68	4.65	4.81
09/03/19	4.79	4.70	4.79	4.60	4.76	4.68	4.76	4.77	4.87	4.78	4.59	4.59	4.92	4.67	4.62	4.81
09/04/19	4.75	4.69	4.73	4.55	4.72	4.63	4.73	4.71	4.82	4.77	4.56	4.70	4.90	4.70	4.63	4.85
09/05/19	4.72	4.67	4.70	4.56	4.65	4.61	4.71	4.69	4.79	4.74	4.55	4.64	4.87	4.77	4.63	4.80
09/06/19	4.71	4.66	4.69	4.59	4.63	4.60	4.69	4.69	4.81	4.74	4.55	4.64	4.85	4.74	4.64	4.79
09/07/19	4.73	4.66	4.68	4.61	4.68	4.62	4.71	4.70	4.83	4.74	4.55	4.64	4.87	4.76	4.77	4.81
09/08/19	4.73	4.67	4.68	4.58	4.73	4.63	4.71	4.71	4.83	4.75	4.55	4.65	4.89	4.75	4.74	4.82
09/09/19	4.74	4.63	4.70	4.56	4.72	4.62	4.68	4.72	4.83	4.73	4.59	4.64	4.85	4.74	4.72	4.78
09/10/19	4.69	4.63	4.68	4.55	4.70	4.60	4.68	4.68	4.81	4.72	4.66	4.62	4.82	4.71	4.68	4.76
09/11/19	4.69	4.63	4.64	4.55	4.68	4.58	4.67	4.64	4.80	4.70	4.65	4.60	4.87	4.72	4.68	4.76
09/12/19	4.70	4.61	4.63	4.56	4.66	4.57	4.65	4.65	4.81	4.69	4.63	4.59	4.97	4.72	4.66	4.77
09/13/19	4.67	4.61	4.62	4.59	4.67	4.57	4.65	4.66	4.80	4.70	4.62	4.59	4.96	4.71	4.67	4.76
09/14/19	4.68	4.60	4.62	4.61	4.62	4.57	4.67	4.65	4.78	4.69	4.62	4.59	4.95	4.72	4.69	4.74
09/15/19	4.68	4.61	4.62	4.68	4.62	4.58	4.66	4.62	4.77	4.67	4.62	4.57	4.95	4.70	4.66	4.72
09/16/19	4.67	4.59	4.60	4.70	4.61	4.57	4.71	4.60	4.76	4.64	4.61	4.55	4.94	4.66	4.64	4.74
09/17/19	4.65	4.57	4.61	4.70	4.58	4.53	4.76	4.58	4.75	4.63	4.61	4.55	4.91	4.67	4.67	4.73
09/18/19	4.63	4.54	4.58	4.71	4.60	4.50	4.74	4.57	4.80	4.61	4.59	4.52	4.91	4.67	4.66	4.74
09/19/19	4.62	4.52	4.57	4.75	4.59	4.48	4.73	4.57	4.87	4.60	4.57	4.51	4.88	4.65	4.65	4.69
09/20/19	4.60	4.67	4.54	4.73	4.55	4.56	4.73	4.55	4.84	4.67	4.58	4.52	4.92	4.66	4.61	4.68
09/21/19	4.61	4.75	4.54	4.73	4.52	4.64	4.74	4.55	4.85	4.79	4.57	4.53	4.88	4.68	4.62	4.76
09/22/19	4.62	4.70	4.58	4.76	4.52	4.65	4.73	4.55	4.88	4.81	4.56	4.53	4.88	4.65	4.64	4.91
09/23/19	4.60	4.69	4.54	4.74	4.53	4.65	4.71	4.54	4.87	4.77	4.57	4.53	4.91	4.64	4.63	4.87
09/24/19	4.59	4.67	4.51	4.75	4.67	4.63	4.69	4.52	4.85	4.75	4.56	4.50	4.86	4.65	4.60	4.84
09/25/19	4.59	4.68	4.52	4.78	4.76	4.63	4.68	4.64	4.84	4.73	4.54	4.47	4.85	4.64	4.58	4.83
09/26/19	4.57	4.67	4.52	4.76	4.77	4.63	4.69	4.77	4.83	4.72	4.55	4.46	4.86	4.63	4.59	4.82
09/27/19	4.55	4.65	4.51	4.75	4.77	4.61	4.68	4.75	4.82	4.73	4.56	4.48	4.86	4.60	4.60	4.83
09/28/19	4.71	4.65	4.64	4.74	4.73	4.60	4.69	4.74	4.82	4.74	4.56	4.48	4.85	4.57	4.56	4.82
09/29/19	4.78	4.68	4.72	4.73	4.71	4.61	4.70	4.75	4.86	4.74	4.58	4.56	4.85	4.59	4.54	4.81
09/30/19	4.75	4.65	4.69	4.71	4.71	4.60	4.67	4.71	4.83	4.71	4.58	4.67	4.82	4.67	4.54	4.81

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
09/01/19	4.72	4.82	5.16	5.14
09/02/19	4.75	4.79	5.24	5.17
09/03/19	4.79	4.76	5.30	5.30
09/04/19	4.79	4.73	5.37	5.23
09/05/19	4.75	4.80	5.22	5.14
09/06/19	4.73	4.76	5.21	5.28
09/07/19	4.72	4.76	5.20	5.26
09/08/19	4.68	4.75	5.24	5.20
09/09/19	4.70	4.78	5.14	5.34
09/10/19	4.72	4.77	5.28	5.13
09/11/19	4.74	4.75	5.26	5.05
09/12/19	4.75	4.73	5.24	5.25
09/13/19	4.71	4.71	5.22	5.18
09/14/19	4.72	4.73	5.14	5.13
09/15/19	4.69	4.70	5.18	5.23
09/16/19	4.67	4.66	5.35	5.29
09/17/19	4.73	4.73	5.22	5.26
09/18/19	4.73	4.82	5.12	5.25
09/19/19	4.70	4.81	5.23	5.16
09/20/19	4.78	4.79	5.25	5.20
09/21/19	4.68	4.77	5.19	5.29
09/22/19	4.68	4.80	5.22	5.17
09/23/19	4.67	4.79	5.14	5.19
09/24/19	4.72	4.78	5.16	5.10
09/25/19	4.73	4.76	5.17	5.18
09/26/19	4.70	4.78	5.24	5.17
09/27/19	4.68	4.73	5.21	5.29
09/28/19	4.69	4.69	5.27	5.27
09/29/19	4.75	4.70	5.16	5.28
09/30/19	4.75	4.72	5.20	5.22

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
09/01/19	0.07	0.10	0.03	0.04	0.09	0.09	0.10	0.11	0.08	0.10	0.09	0.10	0.11	0.13	0.09	0.10	0.07	0.08	0.08
09/02/19	0.07	0.08	0.04	0.04	0.09	0.10	0.10	0.11	0.09	0.10	0.10	0.11	0.11	0.18	0.10	0.10	0.07	0.08	0.09
09/03/19	0.07	0.08	0.04	0.04	0.09	0.10	0.10	0.11	0.10	0.10	0.11	0.11	0.13	0.20	0.10	0.10	0.07	0.08	0.09
09/04/19	0.07	0.08	0.04	0.04	0.09	0.10	0.10	0.10	0.10	0.21	0.11	0.12	0.13	0.22	0.10	0.11	0.07	0.10	0.09
09/05/19	0.06	0.08	0.04	0.04	0.09	0.10	0.10	0.11	0.10	0.11	0.11	0.12	0.13	0.18	0.10	0.11	0.07	0.08	0.09
09/06/19	0.06	0.07	0.04	0.05	0.09	0.10	0.10	0.11	0.10	0.11	0.12	0.12	0.12	0.21	0.10	0.11	0.07	0.08	0.09
09/07/19	0.07	0.07	0.04	0.04	0.09	0.09	0.10	0.11	0.11	0.12	0.11	0.12	0.10	0.21	0.10	0.10	0.07	0.08	0.09
09/08/19	0.07	0.08	0.04	0.04	0.09	0.09	0.09	0.10	0.11	0.11	0.12	0.13	0.10	0.18	0.10	0.11	0.06	0.07	0.09
09/09/19	0.08	0.08	0.04	0.04	0.09	0.10	0.10	0.10	0.11	0.18	0.12	0.13	0.12	0.17	0.10	0.10	0.07	0.08	0.09
09/10/19	0.08	0.08	0.04	0.04	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13	0.11	0.16	0.10	0.10	0.07	0.08	0.09
09/11/19	0.08	0.08	0.04	0.05	0.09	0.09	0.10	0.10	0.11	0.13	0.11	0.12	0.10	0.15	0.10	0.11	0.07	0.08	0.09
09/12/19	0.08	0.08	0.04	0.04	0.09	0.10	0.10	0.11	0.09	0.12	0.09	0.11	0.08	0.13	0.10	0.10	0.06	0.07	0.08
09/13/19	0.08	0.08	0.03	0.04	0.09	0.10	0.10	0.10	0.07	0.08	0.08	0.10	0.08	0.08	0.09	0.10	0.06	0.06	0.08
09/14/19	0.08	0.08	0.03	0.04	0.09	0.09	0.10	0.10	0.08	0.09	0.08	0.13	0.08	0.08	0.10	0.10	0.06	0.07	0.08
09/15/19	0.08	0.09	0.03	0.04	0.09	0.09	0.10	0.10	0.08	0.09	0.09	0.10	0.08	0.10	0.10	0.10	0.06	0.07	0.08
09/16/19	0.08	0.10	0.03	0.04	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.10	0.08	0.10	0.10	0.10	0.06	0.07	0.08
09/17/19	0.08	0.09	0.03	0.04	0.09	0.10	0.10	0.10	0.08	0.10	0.09	0.11	0.11	0.13	0.10	0.10	0.06	0.07	0.08
09/18/19	0.07	0.09	0.03	0.04	0.10	0.10	0.10	0.11	0.07	0.08	0.07	0.08	0.10	0.14	0.10	0.10	0.06	0.07	0.08
09/19/19	0.07	0.08	0.03	0.04	0.09	0.10	0.10	0.11	0.07	0.08	0.08	0.09	0.12	0.14	0.10	0.10	0.06	0.07	0.08
09/20/19	0.07	0.09	0.03	0.04	0.09	0.09	0.10	0.10	0.07	0.09	0.09	0.09	0.11	0.16	0.09	0.10	0.06	0.07	0.08
09/21/19	0.08	0.10	0.03	0.04	0.09	0.10	0.10	0.11	0.08	0.10	0.10	0.10	0.10	0.14	0.10	0.11	0.06	0.06	0.08
09/22/19	0.09	0.09	0.03	0.04	0.09	0.10	0.10	0.10	0.09	0.09	0.10	0.11	0.11	0.15	0.10	0.10	0.06	0.07	0.08
09/23/19	0.09	0.10	0.03	0.04	0.09	0.10	0.10	0.10	0.09	0.10	0.11	0.16	0.11	0.15	0.10	0.10	0.06	0.06	0.09
09/24/19	0.09	0.10	0.03	0.04	0.09	0.10	0.10	0.10	0.09	0.10	0.11	0.12	0.11	0.14	0.09	0.10	0.05	0.06	0.08
09/25/19	0.08	0.09	0.04	0.05	0.10	0.11	0.11	0.12	0.07	0.10	0.09	0.12	0.10	0.14	0.09	0.10	0.05	0.06	0.08
09/26/19	0.07	0.08	0.04	0.06	0.10	0.10	0.11	0.11	0.05	0.06	0.07	0.07	0.07	0.10	0.09	0.10	0.05	0.05	0.07
09/27/19	0.07	0.08	0.04	0.05	0.10	0.10	0.10	0.11	0.05	0.06	0.07	0.08	0.08	0.11	0.09	0.10	0.05	0.05	0.07
09/28/19	0.07	0.08	0.04	0.05	0.09	0.10	0.10	0.10	0.06	0.06	0.08	0.08	0.08	0.10	0.09	0.09	0.05	0.06	0.07
09/29/19	0.07	0.08	0.04	0.05	0.09	0.09	0.09	0.10	0.06	0.07	0.08	0.09	0.08	0.11	0.09	0.09	0.05	0.06	0.07
09/30/19	0.07	0.08	0.04	0.05	0.09	0.10	0.09	0.10	0.06	0.07	0.09	0.10	0.08	0.11	0.09	0.15	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
09/01/19	0.079	0.080	7.132	6.617	7.911	0.062	0.052	0.075	1,638	1,589	1,682	38	35	41	99.13	2.06	97.71	1.64
09/02/19	0.080	0.080	7.168	5.571	8.273	0.058	0.054	0.064	1,556	1,502	1,602	36	34	40	99.19	2.09	97.66	1.63
09/03/19	0.078	0.079	7.360	5.669	8.268	0.059	0.056	0.072	1,547	1,463	1,684	35	31	41	99.19	2.09	97.76	1.65
09/04/19	0.078	0.079	7.689	6.810	9.528	0.067	0.058	0.097	1,696	1,600	1,812	39	34	50	99.13	2.06	97.70	1.64
09/05/19	0.078	0.078	7.560	5.882	8.316	0.061	0.056	0.070	1,745	1,685	1,826	39	35	44	99.19	2.09	97.78	1.65
09/06/19	0.077	0.079	7.521	5.573	8.353	0.058	0.050	0.070	1,780	1,729	1,823	40	37	43	99.23	2.11	97.76	1.65
09/07/19	0.075	0.077	7.520	6.213	8.140	0.054	0.047	0.061	1,726	1,673	1,813	39	36	41	99.28	2.14	97.76	1.65
09/08/19	0.078	0.078	7.345	6.249	8.235	0.052	0.043	0.187	1,596	1,524	1,655	36	32	40	99.29	2.15	97.76	1.65
09/09/19	0.079	0.079	7.588	6.500	8.509	0.060	0.051	0.070	1,527	1,441	1,635	39	34	44	99.21	2.10	97.48	1.60
09/10/19	0.081	0.083	7.608	6.500	8.620	0.063	0.058	0.073	1,626	1,555	1,730	36	31	41	99.17	2.08	97.80	1.66
09/11/19	0.083	0.087	7.547	5.370	8.259	0.064	0.057	0.074	1,704	1,626	1,803	40	36	44	99.15	2.07	97.65	1.63
09/12/19	0.085	0.085	7.503	5.578	8.317	0.064	0.054	0.071	1,748	1,692	1,794	41	37	46	99.15	2.07	97.66	1.63
09/13/19	0.079	0.085	7.440	6.065	9.065	0.064	0.061	0.071	1,728	1,681	1,778	41	36	48	99.13	2.06	97.63	1.62
09/14/19	0.071	0.075	7.463	6.809	8.178	0.062	0.056	0.070	1,698	1,641	1,764	41	37	45	99.16	2.08	97.60	1.62
09/15/19	0.077	0.079	7.260	6.008	8.149	0.058	0.053	0.062	1,588	1,528	1,624	38	35	42	99.20	2.10	97.59	1.62
09/16/19	0.077	0.078	7.447	6.626	8.442	0.060	0.051	0.075	1,533	1,456	1,633	37	33	44	99.20	2.10	97.59	1.62
09/17/19	0.078	0.078	7.487	5.456	8.590	0.067	0.061	0.075	1,621	1,544	1,740	38	33	45	99.11	2.05	97.64	1.63
09/18/19	0.078	0.078	7.636	5.613	8.478	0.066	0.058	0.075	1,710	1,652	1,756	41	36	45	99.13	2.06	97.59	1.62
09/19/19	0.077	0.077	7.471	6.904	8.198	0.065	0.059	0.087	1,711	1,666	1,789	42	39	46	99.14	2.06	97.55	1.61
09/20/19	0.074	0.077	7.441	5.820	8.311	0.064	0.058	0.083	1,727	1,686	1,794	40	36	45	99.14	2.06	97.66	1.63
09/21/19	0.076	0.079	7.555	6.751	8.300	0.064	0.057	0.072	1,682	1,629	1,737	41	38	46	99.15	2.07	97.55	1.61
09/22/19	0.080	0.081	7.281	5.919	8.247	0.062	0.057	0.068	1,586	1,540	1,644	39	36	42	99.15	2.07	97.54	1.61
09/23/19	0.081	0.081	7.493	6.873	10.187	0.058	0.053	0.065	1,535	1,457	1,635	36	32	42	99.22	2.11	97.64	1.63
09/24/19	0.079	0.080	7.392	5.629	8.317	0.064	0.058	0.072	1,625	1,560	1,722	38	34	42	99.13	2.06	97.66	1.63
09/25/19	0.079	0.080	7.571	5.868	8.449	0.080	0.065	0.558	1,673	1,607	1,746	39	35	45	98.95	1.98 *	97.65	1.63
09/26/19	0.079	0.079	7.503	5.648	8.476	0.074	0.064	0.084	1,700	1,639	1,782	41	36	46	99.02	2.01	97.59	1.62
09/27/19	0.079	0.080	7.490	6.798	8.186	0.069	0.062	0.077	1,689	1,629	1,751	40	37	44	99.07	2.03	97.61	1.62
09/28/19	0.079	0.079	7.412	5.709	8.270	0.066	0.055	0.086	1,669	1,607	1,747	40	37	43	99.11	2.05	97.61	1.62
09/29/19	0.079	0.079	7.207	6.624	8.029	0.060	0.051	0.070	1,598	1,540	1,677	38	36	41	99.17	2.08	97.61	1.62
09/30/19	0.078	0.078	7.367	6.642	8.411	0.059	0.054	0.083	1,530	1,453	1,657	36	33	41	99.20	2.10	97.63	1.62

Notes:

* LRV less than 2 due to a short term increase in permeate value when a RO unit put into service after a cleaning.

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
09/01/19	98.04	90.259	22,443.4	0.25	3.0	6
09/02/19	97.95	87.686	22,688.6	0.25	3.0	6
09/03/19	97.80	91.027	21,905.3	0.25	3.0	6
09/04/19	97.79	77.037	22,778.0	0.25	3.0	6
09/05/19	97.63	95.194	20,715.2	0.25	3.0	6
09/06/19	97.60	93.576	23,106.7	0.24	3.0	6
09/07/19	97.82	91.642	22,749.0	0.24	3.0	6
09/08/19	97.91	90.247	22,753.9	0.25	3.0	6
09/09/19	97.56	89.202	22,221.8	0.25	3.0	6
09/10/19	97.60	91.867	22,042.0	0.25	3.0	6
09/11/19	97.76	91.060	22,790.9	0.25	3.0	6
09/12/19	98.05	92.967	22,740.8	0.25	3.0	6
09/13/19	97.73	91.321	22,688.3	0.25	3.0	6
09/14/19	97.95	90.525	22,688.2	0.25	3.0	6
09/15/19	98.05	90.527	22,712.0	0.25	3.0	6
09/16/19	97.75	89.173	22,474.3	0.25	3.0	6
09/17/19	97.88	92.354	22,417.5	0.25	3.0	6
09/18/19	97.89	92.834	22,983.0	0.25	3.0	6
09/19/19	97.62	92.140	22,946.9	0.25	3.0	6
09/20/19	97.71	92.363	22,943.6	0.25	3.0	6
09/21/19	97.56	89.970	22,836.0	0.25	3.0	6
09/22/19	97.81	89.461	22,657.2	0.25	3.0	6
09/23/19	97.75	92.534	22,859.9	0.25	3.0	6
09/24/19	97.42	93.276	23,103.9	0.25	3.0	6
09/25/19	97.51	92.409	23,100.3	0.25	3.0	6
09/26/19	97.34	91.453	22,641.3	0.25	3.0	6
09/27/19	97.16	92.286	23,118.2	0.25	3.0	6
09/28/19	97.75	89.205	22,859.1	0.25	3.0	6
09/29/19	97.71	89.937	22,735.5	0.25	3.0	6
09/30/19	97.45	90.821	22,958.3	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
10/01/19	12.52	12.52	12.05	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/02/19	12.48	12.48	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/03/19	12.52	12.52	12.04	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/04/19	12.55	12.55	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/05/19	12.58	12.58	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/06/19	12.60	12.60	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/07/19	12.56	12.56	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/08/19	12.52	12.52	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/09/19	12.52	12.52	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/10/19	12.57	12.57	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/11/19	12.60	12.60	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/12/19	12.61	12.61	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/13/19	12.64	12.64	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/14/19	12.56	12.56	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/15/19	12.48	12.48	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/16/19	12.47	12.47	12.07	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/17/19	12.54	12.54	12.06	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/18/19	12.56	12.56	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/19/19	12.53	12.53	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/20/19	12.53	12.53	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/21/19	12.53	12.53	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/22/19	12.48	12.48	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/23/19	12.47	12.47	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/24/19	12.39	12.39	12.02	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/25/19	12.50	12.50	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/26/19	12.58	12.58	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/27/19	12.60	12.60	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/28/19	12.59	12.59	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/29/19	12.51	12.51	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/30/19	12.49	12.49	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
10/31/19	12.49	12.49	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

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*
10/01/19	0.00	4.47	2.05	6.00	0.00	12.52
10/02/19	0.00	4.44	2.04	6.00	0.00	12.48
10/03/19	0.00	4.49	2.04	6.00	0.00	12.52
10/04/19	0.00	4.49	2.06	6.00	0.00	12.55
10/05/19	0.00	4.51	2.07	6.00	0.00	12.58
10/06/19	0.00	4.51	2.09	6.00	0.00	12.60
10/07/19	0.00	4.47	2.09	6.00	0.00	12.56
10/08/19	0.00	4.46	2.06	6.00	0.00	12.52
10/09/19	0.00	4.46	2.06	6.00	0.00	12.52
10/10/19	0.00	4.45	2.12	6.00	0.00	12.57
10/11/19	0.00	4.44	2.15	6.00	0.00	12.60
10/12/19	0.00	4.45	2.16	6.00	0.00	12.61
10/13/19	0.00	4.43	2.21	6.00	0.00	12.64
10/14/19	0.00	4.41	2.15	6.00	0.00	12.56
10/15/19	0.00	4.39	2.09	6.00	0.00	12.48
10/16/19	0.00	4.40	2.07	6.00	0.00	12.47
10/17/19	0.00	4.48	2.06	6.00	0.00	12.54
10/18/19	0.00	4.47	2.09	6.00	0.00	12.56
10/19/19	0.00	4.44	2.10	6.00	0.00	12.53
10/20/19	0.00	4.41	2.12	6.00	0.00	12.53
10/21/19	0.00	4.41	2.12	6.00	0.00	12.53
10/22/19	0.00	4.40	2.08	6.00	0.00	12.48
10/23/19	0.00	4.39	2.08	6.00	0.00	12.47
10/24/19	0.00	4.37	2.02	6.00	0.00	12.39
10/25/19	0.00	4.40	2.10	6.00	0.00	12.50
10/26/19	0.00	4.41	2.17	6.00	0.00	12.58
10/27/19	0.00	4.39	2.21	6.00	0.00	12.60
10/28/19	0.00	4.38	2.21	6.00	0.00	12.59
10/29/19	0.00	4.38	2.13	6.00	0.00	12.51
10/30/19	0.00	4.37	2.11	6.00	0.00	12.49
10/31/19	0.00	4.36	2.13	6.00	0.00	12.49

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
10/01/19	0.00	0.00	2.05	6.00	4.00	12.05
10/02/19	0.00	0.00	2.04	6.00	4.00	12.04
10/03/19	0.00	0.00	2.04	6.00	4.00	12.04
10/04/19	0.00	0.00	2.06	6.00	4.00	12.06
10/05/19	0.00	0.00	2.07	6.00	4.00	12.07
10/06/19	0.00	0.00	2.09	6.00	4.00	12.09
10/07/19	0.00	0.00	2.09	6.00	4.00	12.09
10/08/19	0.00	0.00	2.06	6.00	4.00	12.06
10/09/19	0.00	0.00	2.06	6.00	4.00	12.06
10/10/19	0.00	0.00	2.12	6.00	4.00	12.12
10/11/19	0.00	0.00	2.15	6.00	4.00	12.15
10/12/19	0.00	0.00	2.16	6.00	4.00	12.16
10/13/19	0.00	0.00	2.21	6.00	4.00	12.21
10/14/19	0.00	0.00	2.15	6.00	4.00	12.15
10/15/19	0.00	0.00	2.09	6.00	4.00	12.09
10/16/19	0.00	0.00	2.07	6.00	4.00	12.07
10/17/19	0.00	0.00	2.06	6.00	4.00	12.06
10/18/19	0.00	0.00	2.09	6.00	4.00	12.09
10/19/19	0.00	0.00	2.10	6.00	4.00	12.10
10/20/19	0.00	0.00	2.12	6.00	4.00	12.12
10/21/19	0.00	0.00	2.12	6.00	4.00	12.12
10/22/19	0.00	0.00	2.08	6.00	4.00	12.08
10/23/19	0.00	0.00	2.08	6.00	4.00	12.08
10/24/19	0.00	0.00	2.02	6.00	4.00	12.02
10/25/19	0.00	0.00	2.10	6.00	4.00	12.10
10/26/19	0.00	0.00	2.17	6.00	4.00	12.17
10/27/19	0.00	0.00	2.21	6.00	4.00	12.21
10/28/19	0.00	0.00	2.21	6.00	4.00	12.21
10/29/19	0.00	0.00	2.13	6.00	4.00	12.13
10/30/19	0.00	0.00	2.11	6.00	4.00	12.11
10/31/19	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
10/01/19	4.86	4.82	4.89	4.58	4.69	4.70	4.79	4.59	4.56	4.56	4.84	4.78	4.47	4.68	4.51	4.54
10/02/19	4.86	4.83	4.92	4.59	4.71	4.67	4.77	4.59	4.52	4.57	4.82	4.79	4.44	4.70	4.50	4.52
10/03/19	4.83	4.83	4.90	4.55	4.70	4.67	4.78	4.61	4.49	4.54	4.80	4.78	4.59	4.65	4.50	4.51
10/04/19	4.85	4.81	4.92	4.61	4.68	4.70	4.79	4.62	4.55	4.54	4.81	4.78	4.63	4.67	4.49	4.52
10/05/19	4.88	4.81	4.89	4.59	4.68	4.69	4.82	4.60	4.55	4.56	4.81	4.76	4.65	4.70	4.51	4.52
10/06/19	4.85	4.79	4.88	4.56	4.77	4.68	4.82	4.60	4.52	4.54	4.83	4.76	4.62	4.67	4.51	4.61
10/07/19	4.84	4.92	4.85	4.54	4.77	4.70	4.78	4.59	4.49	4.50	4.81	4.74	4.60	4.67	4.47	4.63
10/08/19	4.82	4.97	4.87	4.78	4.75	4.66	4.78	4.57	4.65	4.50	4.79	4.75	4.60	4.66	4.46	4.61
10/09/19	4.81	4.96	4.88	4.76	4.78	4.64	4.76	4.56	4.69	4.52	4.81	4.76	4.60	4.62	4.46	4.60
10/10/19	4.75	4.93	4.84	4.74	4.76	4.62	4.75	4.55	4.68	4.51	4.80	4.72	4.58	4.62	4.45	4.58
10/11/19	4.80	4.91	4.82	4.66	4.74	4.65	4.80	4.55	4.61	4.50	4.78	4.72	4.57	4.61	4.44	4.58
10/12/19	4.83	4.95	4.84	4.69	4.73	4.62	4.76	4.50	4.66	4.48	4.78	4.72	4.57	4.61	4.45	4.60
10/13/19	4.79	4.88	4.78	4.70	4.74	4.63	4.75	4.49	4.67	4.51	4.79	4.73	4.57	4.61	4.43	4.61
10/14/19	4.78	4.87	4.76	4.62	4.74	4.79	4.74	4.50	4.65	4.68	4.79	4.70	4.54	4.60	4.41	4.59
10/15/19	4.76	4.90	4.77	4.64	4.71	4.71	4.69	4.48	4.65	4.65	4.76	4.68	4.53	4.59	4.39	4.57
10/16/19	4.74	4.88	4.75	4.64	4.72	4.73	4.67	4.44	4.62	4.65	4.77	4.68	4.52	4.58	4.40	4.57
10/17/19	4.86	4.89	4.94	4.64	4.68	4.69	4.88	4.48	4.57	4.64	4.74	4.67	4.52	4.55	4.51	4.56
10/18/19	4.89	4.91	4.94	4.66	4.69	4.69	4.80	4.47	4.56	4.63	4.85	4.66	4.52	4.51	4.56	4.55
10/19/19	4.84	4.83	4.95	4.58	4.62	4.72	4.77	4.44	4.58	4.62	4.81	4.79	4.52	4.53	4.51	4.57
10/20/19	4.83	4.86	4.98	4.60	4.61	4.68	4.79	4.41	4.59	4.63	4.81	4.79	4.50	4.53	4.50	4.56
10/21/19	4.83	4.86	4.86	4.57	4.59	4.67	4.75	4.51	4.55	4.62	4.82	4.75	4.49	4.48	4.50	4.54
10/22/19	4.84	4.84	4.91	4.58	4.62	4.68	4.80	4.63	4.53	4.57	4.84	4.73	4.51	4.67	4.51	4.53
10/23/19	4.80	4.79	4.91	4.57	4.58	4.67	4.73	4.64	4.54	4.58	4.82	4.72	4.47	4.70	4.47	4.52
10/24/19	4.77	4.80	4.89	4.58	4.61	4.62	4.75	4.62	4.52	4.59	4.84	4.71	4.43	4.66	4.45	4.50
10/25/19	4.81	4.80	4.90	4.57	4.68	4.67	4.74	4.60	4.51	4.59	4.80	4.74	4.43	4.67	4.46	4.50
10/26/19	4.83	4.80	4.91	4.51	4.68	4.68	4.76	4.59	4.50	4.56	4.79	4.73	4.41	4.66	4.46	4.49
10/27/19	4.79	4.73	4.87	4.51	4.67	4.62	4.72	4.61	4.51	4.57	4.81	4.74	4.39	4.64	4.47	4.46
10/28/19	4.80	4.75	4.86	4.53	4.63	4.64	4.70	4.62	4.46	4.51	4.76	4.74	4.38	4.60	4.45	4.43
10/29/19	4.79	4.65	4.81	4.46	4.57	4.61	4.72	4.53	4.41	4.51	4.74	4.69	4.56	4.57	4.40	4.43
10/30/19	4.77	4.64	4.70	4.41	4.52	4.60	4.72	4.54	4.39	4.50	4.73	4.66	4.59	4.58	4.38	4.40
10/31/19	4.76	4.67	4.78	4.38	4.51	4.57	4.70	4.51	4.38	4.50	4.73	4.65	4.56	4.57	4.38	4.36

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
10/01/19	4.76	4.66	4.71	4.71	4.72	4.61	4.68	4.69	4.83	4.70	4.54	4.62	4.83	4.73	4.53	4.80
10/02/19	4.74	4.66	4.71	4.71	4.73	4.64	4.71	4.74	4.81	4.69	4.50	4.59	4.78	4.68	4.59	4.82
10/03/19	4.73	4.65	4.70	4.71	4.74	4.63	4.73	4.77	4.82	4.69	4.49	4.61	4.76	4.69	4.74	4.83
10/04/19	4.72	4.62	4.68	4.69	4.72	4.59	4.69	4.73	4.84	4.71	4.50	4.62	4.79	4.68	4.71	4.78
10/05/19	4.72	4.62	4.66	4.68	4.69	4.58	4.66	4.72	4.77	4.70	4.55	4.60	4.77	4.69	4.70	4.77
10/06/19	4.74	4.64	4.69	4.71	4.71	4.59	4.68	4.73	4.78	4.69	4.64	4.62	4.76	4.68	4.68	4.75
10/07/19	4.72	4.62	4.67	4.70	4.70	4.59	4.66	4.70	4.79	4.68	4.64	4.60	4.83	4.69	4.66	4.79
10/08/19	4.67	4.59	4.63	4.66	4.69	4.57	4.61	4.67	4.75	4.65	4.64	4.58	4.95	4.67	4.67	4.75
10/09/19	4.65	4.58	4.62	4.63	4.68	4.55	4.60	4.67	4.73	4.64	4.61	4.58	4.94	4.67	4.65	4.72
10/10/19	4.64	4.55	4.58	4.60	4.65	4.53	4.57	4.64	4.72	4.63	4.58	4.56	4.90	4.64	4.65	4.70
10/11/19	4.63	4.56	4.56	4.60	4.62	4.51	4.68	4.63	4.71	4.59	4.57	4.55	4.90	4.64	4.64	4.71
10/12/19	4.64	4.56	4.58	4.71	4.63	4.52	4.79	4.64	4.73	4.59	4.59	4.56	4.92	4.66	4.65	4.69
10/13/19	4.63	4.55	4.60	4.77	4.60	4.52	4.74	4.61	4.73	4.58	4.55	4.55	4.89	4.66	4.63	4.71
10/14/19	4.62	4.54	4.59	4.76	4.60	4.49	4.75	4.59	4.83	4.55	4.55	4.54	4.87	4.65	4.63	4.70
10/15/19	4.59	4.54	4.57	4.73	4.60	4.49	4.72	4.57	4.91	4.52	4.57	4.52	4.85	4.64	4.62	4.67
10/16/19	4.59	4.50	4.54	4.73	4.57	4.55	4.69	4.58	4.81	4.62	4.56	4.51	4.82	4.62	4.58	4.65
10/17/19	4.59	4.62	4.52	4.72	4.55	4.65	4.66	4.57	4.80	4.72	4.54	4.49	4.81	4.62	4.59	4.73
10/18/19	4.59	4.67	4.52	4.71	4.54	4.70	4.67	4.54	4.82	4.69	4.54	4.47	4.82	4.60	4.56	4.86
10/19/19	4.56	4.65	4.50	4.71	4.50	4.67	4.67	4.52	4.82	4.69	4.52	4.46	4.81	4.61	4.57	4.75
10/20/19	4.55	4.70	4.48	4.72	4.66	4.64	4.64	4.50	4.79	4.70	4.50	4.45	4.82	4.60	4.55	4.79
10/21/19	4.52	4.68	4.48	4.70	4.84	4.62	4.64	4.65	4.75	4.70	4.51	4.41	4.83	4.57	4.57	4.75
10/22/19	4.50	4.64	4.49	4.69	4.76	4.61	4.65	4.78	4.80	4.65	4.50	4.40	4.80	4.57	4.55	4.77
10/23/19	4.51	4.60	4.47	4.67	4.73	4.59	4.66	4.73	4.85	4.62	4.50	4.39	4.80	4.57	4.54	4.80
10/24/19	4.47	4.59	4.59	4.65	4.69	4.57	4.63	4.71	4.82	4.65	4.45	4.37	4.80	4.56	4.51	4.78
10/25/19	4.61	4.60	4.65	4.65	4.66	4.58	4.60	4.70	4.77	4.65	4.43	4.40	4.75	4.52	4.50	4.73
10/26/19	4.67	4.59	4.63	4.63	4.67	4.55	4.61	4.68	4.77	4.62	4.45	4.49	4.73	4.51	4.48	4.71
10/27/19	4.67	4.57	4.63	4.60	4.67	4.52	4.61	4.66	4.75	4.56	4.42	4.60	4.76	4.56	4.46	4.72
10/28/19	4.64	4.55	4.61	4.56	4.65	4.50	4.59	4.64	4.73	4.59	4.40	4.58	4.73	4.67	4.43	4.71
10/29/19	4.63	4.50	4.60	4.53	4.64	4.47	4.54	4.61	4.74	4.64	4.38	4.56	4.70	4.65	4.51	4.69
10/30/19	4.62	4.46	4.58	4.50	4.65	4.47	4.48	4.59	4.71	4.62	4.37	4.54	4.66	4.61	4.66	4.63
10/31/19	4.61	4.47	4.55	4.46	4.68	4.47	4.47	4.59	4.66	4.57	4.45	4.55	4.63	4.64	4.63	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

Date	MicroFiltration Process online monitoring results Log Removal Value			
	E01 LRV	**E02** LRV	**E03** LRV	**E04** LRV
10/01/19	4.70	4.71	5.13	5.16
10/02/19	4.66	4.70	5.21	5.18
10/03/19	4.68	4.68	5.19	5.18
10/04/19	4.68	4.68	5.16	5.27
10/05/19	4.69	4.69	5.17	5.20
10/06/19	4.68	4.67	5.07	5.20
10/07/19	4.69	4.69	5.06	5.22
10/08/19	4.71	4.69	5.16	5.16
10/09/19	4.72	4.66	5.18	5.13
10/10/19	4.68	4.60	5.18	5.19
10/11/19	4.72	4.61	5.19	5.18
10/12/19	4.71	4.60	5.18	5.12
10/13/19	4.68	4.68	5.14	5.37
10/14/19	4.65	4.79	5.09	5.16
10/15/19	4.70	4.79	5.15	5.10
10/16/19	4.81	4.77	5.22	5.16
10/17/19	4.72	4.74	5.29	5.18
10/18/19	4.69	4.74	5.15	5.24
10/19/19	4.66	4.71	5.01	5.17
10/20/19	4.66	4.71	5.07	5.01
10/21/19	4.65	4.68	5.06	5.19
10/22/19	4.65	4.71	5.08	5.24
10/23/19	4.60	4.71	5.11	5.01
10/24/19	4.64	4.65	5.05	4.84
10/25/19	4.81	4.68	4.98	5.13
10/26/19	4.69	4.68	5.04	5.11
10/27/19	4.66	4.64	5.10	5.10
10/28/19	4.67	4.65	5.09	4.96
10/29/19	4.66	4.59	5.16	4.93
10/30/19	4.63	4.58	5.20	4.92
10/31/19	4.63	4.55	5.29	5.03

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
10/01/19	0.07	0.09	0.04	0.05	0.09	0.10	0.10	0.10	0.08	0.10	0.09	0.11	0.08	0.11	0.09	0.10	0.05	0.06	0.08
10/02/19	0.05	0.08	0.05	0.06	0.10	0.11	0.10	0.11	0.07	0.08	0.07	0.09	0.08	0.11	0.09	0.10	0.06	0.08	0.08
10/03/19	0.05	0.06	0.04	0.05	0.10	0.10	0.10	0.11	0.07	0.08	0.08	0.09	0.08	0.12	0.09	0.10	0.07	0.08	0.08
10/04/19	0.05	0.06	0.04	0.05	0.09	0.10	0.10	0.11	0.08	0.09	0.09	0.10	0.07	0.09	0.09	0.10	0.07	0.07	0.08
10/05/19	0.06	0.07	0.05	0.06	0.09	0.10	0.10	0.11	0.09	0.09	0.10	0.10	0.08	0.11	0.09	0.10	0.07	0.07	0.08
10/06/19	0.07	0.07	0.05	0.06	0.09	0.10	0.10	0.10	0.09	0.09	0.10	0.11	0.09	0.14	0.09	0.10	0.07	0.08	0.08
10/07/19	0.07	0.08	0.05	0.05	0.09	0.10	0.10	0.10	0.09	0.10	0.11	0.11	0.09	0.14	0.09	0.10	0.07	0.08	0.08
10/08/19	0.07	0.08	0.04	0.05	0.09	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.09	0.13	0.09	0.10	0.07	0.07	0.08
10/09/19	0.07	0.08	0.05	0.05	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.13	0.09	0.11	0.09	0.10	0.07	0.07	0.08
10/10/19	0.07	0.08	0.04	0.05	0.09	0.10	0.10	0.11	0.08	0.10	0.09	0.11	0.08	0.11	0.09	0.10	0.06	0.07	0.08
10/11/19	0.07	0.07	0.04	0.05	0.10	0.10	0.10	0.11	0.07	0.08	0.08	0.08	0.06	0.07	0.09	0.09	0.07	0.08	0.07
10/12/19	0.07	0.08	0.05	0.05	0.09	0.10	0.10	0.11	0.08	0.09	0.08	0.09	0.07	0.10	0.08	0.09	0.07	0.08	0.08
10/13/19	0.08	0.09	0.05	0.05	0.09	0.10	0.10	0.10	0.09	0.09	0.09	0.10	0.07	0.09	0.08	0.09	0.07	0.08	0.08
10/14/19	0.08	0.09	0.05	0.05	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.10	0.09	0.13	0.09	0.10	0.07	0.08	0.08
10/15/19	0.08	0.09	0.05	0.05	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.12	0.09	0.13	0.09	0.10	0.07	0.08	0.08
10/16/19	0.07	0.08	0.05	0.05	0.09	0.10	0.10	0.11	0.10	0.10	0.10	0.11	0.10	0.12	0.09	0.10	0.07	0.08	0.08
10/17/19	0.07	0.08	0.05	0.07	0.09	0.09	0.10	0.13	0.10	0.12	0.10	0.13	0.10	0.12	0.08	0.10	0.07	0.08	0.08
10/18/19	0.07	0.08	0.05	0.06	0.10	0.11	0.10	0.11	0.09	0.11	0.09	0.11	0.08	0.11	0.09	0.10	0.07	0.08	0.08
10/19/19	0.06	0.07	0.06	0.07	0.10	0.11	0.11	0.11	0.08	0.09	0.08	0.08	0.06	0.07	0.08	0.10	0.07	0.08	0.08
10/20/19	0.06	0.08	0.06	0.07	0.10	0.10	0.10	0.11	0.08	0.10	0.08	0.09	0.07	0.08	0.08	0.09	0.07	0.08	0.08
10/21/19	0.06	0.07	0.06	0.07	0.09	0.10	0.10	0.11	0.09	0.10	0.09	0.10	0.07	0.08	0.08	0.09	0.07	0.08	0.08
10/22/19	0.07	0.07	0.05	0.06	0.09	0.10	0.09	0.11	0.09	0.10	0.09	0.11	0.08	0.09	0.07	0.09	0.07	0.07	0.08
10/23/19	0.07	0.08	0.05	0.08	0.09	0.10	0.09	0.10	0.10	0.11	0.09	0.11	0.08	0.10	0.07	0.09	0.07	0.08	0.08
10/24/19	0.07	0.09	0.05	0.06	0.09	0.10	0.10	0.10	0.10	0.13	0.10	0.12	0.09	0.11	0.07	0.08	0.07	0.15	0.08
10/25/19	0.07	0.08	0.05	0.06	0.09	0.10	0.10	0.10	0.10	0.11	0.10	0.12	0.09	0.14	0.07	0.08	0.06	0.07	0.08
10/26/19	0.07	0.09	0.05	0.07	0.09	0.10	0.10	0.11	0.11	0.12	0.11	0.12	0.10	0.11	0.08	0.09	0.07	0.08	0.09
10/27/19	0.08	0.10	0.05	0.07	0.10	0.12	0.11	0.11	0.11	0.13	0.11	0.12	0.10	0.11	0.08	0.11	0.07	0.08	0.09
10/28/19	0.08	0.10	0.06	0.06	0.10	0.11	0.10	0.14	0.11	0.13	0.11	0.11	0.11	0.12	0.08	0.10	0.07	0.08	0.09
10/29/19	0.08	0.09	0.06	0.06	0.10	0.11	0.10	0.11	0.12	0.13	0.11	0.11	0.10	0.13	0.08	0.09	0.07	0.07	0.09
10/30/19	0.06	0.08	0.05	0.06	0.09	0.10	0.10	0.11	0.11	0.13	0.10	0.11	0.10	0.12	0.07	0.08	0.07	0.07	0.08
10/31/19	0.05	0.06	0.06	0.11	0.09	0.10	0.10	0.10	0.10	0.12	0.09	0.11	0.07	0.11	0.07	0.09	0.06	0.07	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
10/01/19	0.078	0.078	7.448	6.756	8.560	0.067	0.058	0.082	1,602	1,532	1,709	38	33	42	99.10	2.05	97.64	1.63
10/02/19	0.079	0.080	7.486	6.059	8.317	0.068	0.056	0.082	1,691	1,631	1,741	41	38	46	99.09	2.04	97.55	1.61
10/03/19	0.079	0.080	7.466	6.748	8.196	0.068	0.058	0.090	1,670	1,606	1,761	40	34	44	99.08	2.04	97.60	1.62
10/04/19	0.068	0.080	7.398	6.763	8.196	0.065	0.057	0.077	1,692	1,663	1,743	41	37	46	99.12	2.06	97.56	1.61
10/05/19	0.064	0.066	7.325	6.615	8.084	0.062	0.055	0.077	1,643	1,594	1,693	40	37	43	99.15	2.07	97.58	1.62
10/06/19	0.067	0.070	7.176	6.515	8.024	0.059	0.053	0.067	1,563	1,511	1,609	38	35	41	99.18	2.09	97.59	1.62
10/07/19	0.070	0.070	7.447	5.879	8.413	0.060	0.056	0.072	1,516	1,440	1,608	36	32	42	99.19	2.09	97.61	1.62
10/08/19	0.069	0.069	7.486	5.741	9.679	0.065	0.056	0.075	1,594	1,548	1,664	38	34	42	99.13	2.06	97.62	1.62
10/09/19	0.068	0.069	7.695	5.724	8.343	0.067	0.057	0.075	1,674	1,613	1,770	40	36	45	99.13	2.06	97.62	1.62
10/10/19	0.068	0.069	7.563	6.876	8.392	0.057	0.049	0.072	1,714	1,656	1,793	41	37	46	99.25	2.12	97.61	1.62
10/11/19	0.069	0.069	7.400	5.662	8.180	0.052	0.047	0.057	1,698	1,636	1,769	39	35	43	99.30	2.15	97.67	1.63
10/12/19	0.070	0.070	7.527	6.830	8.317	0.052	0.045	0.114	1,656	1,598	1,712	38	34	42	99.31	2.16	97.72	1.64
10/13/19	0.069	0.070	7.395	6.610	8.308	0.046	0.041	0.053	1,582	1,537	1,630	34	32	38	99.38	2.21	97.82	1.66
10/14/19	0.068	0.069	7.568	6.217	8.616	0.054	0.043	0.069	1,533	1,434	1,681	34	29	42	99.29	2.15	97.76	1.65
10/15/19	0.068	0.068	7.675	5.841	8.616	0.063	0.056	0.069	1,606	1,562	1,669	37	32	41	99.19	2.09	97.71	1.64
10/16/19	0.068	0.068	7.621	5.941	8.432	0.064	0.059	0.110	1,666	1,594	1,762	39	34	44	99.15	2.07	97.67	1.63
10/17/19	0.067	0.067	7.841	5.941	8.575	0.068	0.060	0.082	1,702	1,634	1,779	39	35	44	99.13	2.06	97.70	1.64
10/18/19	0.059	0.070	7.870	6.883	8.568	0.064	0.057	0.073	1,712	1,660	1,755	40	36	44	99.18	2.09	97.67	1.63
10/19/19	0.058	0.061	7.830	6.685	8.560	0.063	0.055	0.072	1,681	1,624	1,740	39	36	42	99.20	2.10	97.69	1.64
10/20/19	0.060	0.062	7.708	7.072	9.583	0.059	0.051	0.102	1,609	1,550	1,685	38	34	42	99.24	2.12	97.65	1.63
10/21/19	0.064	0.065	7.555	6.992	8.412	0.057	0.052	0.067	1,567	1,490	1,664	36	31	40	99.24	2.12	97.73	1.64
10/22/19	0.063	0.064	7.766	6.244	8.561	0.064	0.058	0.074	1,667	1,599	1,770	39	34	45	99.17	2.08	97.64	1.63
10/23/19	0.066	0.073	7.791	7.269	8.644	0.064	0.059	0.071	1,729	1,662	1,791	41	37	45	99.18	2.08	97.62	1.62
10/24/19	0.077	0.079	7.979	7.177	10.385	0.077	0.064	0.112	1,719	1,646	1,780	40	36	44	99.04	2.02	97.65	1.63
10/25/19	0.077	0.078	7.720	7.097	8.466	0.061	0.057	0.072	1,734	1,642	1,807	40	36	43	99.21	2.10	97.72	1.64
10/26/19	0.077	0.078	7.702	6.890	8.497	0.052	0.044	0.166	1,719	1,668	1,774	39	36	42	99.32	2.17	97.74	1.65
10/27/19	0.076	0.077	8.032	7.552	8.690	0.050	0.043	0.056	1,658	1,592	1,739	36	33	41	99.38	2.21	97.80	1.66
10/28/19	0.075	0.080	7.983	7.477	10.770	0.049	0.042	0.064	1,622	1,545	1,709	36	32	39	99.38	2.21	97.80	1.66
10/29/19	0.081	0.083	7.944	6.309	8.730	0.059	0.054	0.067	1,669	1,596	1,793	35	32	40	99.26	2.13	97.90	1.68
10/30/19	0.081	0.082	7.867	7.227	8.705	0.060	0.051	0.070	1,715	1,646	1,794	35	32	39	99.23	2.11	97.94	1.69
10/31/19	0.079	0.080	7.716	7.054	8.520	0.058	0.051	0.069	1,725	1,649	1,786	36	32	40	99.25	2.13	97.93	1.68

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

	UltraViolet / AOP Process online monitoring results					
	UVT %	FLOW	POWER	EED	Peroxide Dose	Log
Date	avg	MG	kW	kWh/kgal	mg/l	Removal
10/01/19	97.53	87.331	22,465.0	0.26	3.0	6
10/02/19	97.73	72.854	22,384.7	0.26	3.0	6
10/03/19	97.75	90.110	19,254.8	0.26	3.0	6
10/04/19	97.43	92.001	23,001.4	0.25	3.0	6
10/05/19	97.84	91.237	23,502.3	0.25	3.0	6
10/06/19	97.65	88.668	22,946.7	0.26	3.0	6
10/07/19	97.23	89.745	22,739.4	0.25	3.0	6
10/08/19	97.50	90.829	22,926.1	0.26	3.0	6
10/09/19	97.49	91.572	22,884.7	0.26	3.0	6
10/10/19	97.50	92.096	23,145.0	0.25	3.0	6
10/11/19	97.13	91.294	23,386.0	0.25	3.0	6
10/12/19	97.35	87.256	23,254.4	0.26	3.0	6
10/13/19	97.60	91.322	23,010.7	0.26	3.0	6
10/14/19	97.47	91.077	23,534.0	0.26	3.0	6
10/15/19	97.36	93.313	23,524.6	0.26	3.0	6
10/16/19	97.22	90.902	23,583.3	0.25	3.0	6
10/17/19	97.35	93.993	23,971.7	0.26	3.0	6
10/18/19	97.20	92.656	23,705.9	0.25	3.0	6
10/19/19	97.31	91.516	23,560.9	0.26	3.0	6
10/20/19	97.56	88.981	23,613.8	0.26	3.0	6
10/21/19	97.82	92.657	23,371.2	0.26	3.0	6
10/22/19	97.62	91.165	23,624.1	0.26	3.0	6
10/23/19	97.68	92.568	23,708.7	0.26	3.0	6
10/24/19	97.67	93.058	24,006.1	0.26	3.0	6
10/25/19	97.87	91.276	23,605.7	0.26	3.0	6
10/26/19	98.02	89.203	23,350.0	0.26	3.0	6
10/27/19	98.06	92.059	22,996.3	0.26	3.0	6
10/28/19	98.03	91.501	23,995.6	0.26	3.0	6
10/29/19	98.09	97.588	24,634.2	0.26	3.0	6
10/30/19	98.11	95.179	25,042.2	0.25	3.0	6
10/31/19	98.11	94.533	23,977.1	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
11/01/19	12.47	12.47	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/02/19	12.46	12.46	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/03/19	12.50	12.50	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/04/19	12.49	12.49	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/05/19	12.44	12.44	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/06/19	12.44	12.44	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/07/19	12.42	12.42	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/08/19	12.37	12.37	12.08	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/09/19	12.35	12.35	12.09	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/10/19	12.37	12.37	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/11/19	12.39	12.39	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/12/19	12.33	12.33	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/13/19	12.26	12.26	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/14/19	12.46	12.46	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/15/19	12.50	12.50	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/16/19	12.47	12.47	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/17/19	12.54	12.54	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/18/19	12.54	12.54	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/19/19	12.41	12.41	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/20/19	12.38	12.38	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/21/19	12.50	12.50	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/22/19	12.45	12.45	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/23/19	12.45	12.45	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/24/19	12.46	12.46	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/25/19	12.42	12.42	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/26/19	12.40	12.40	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/27/19	12.50	12.50	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/28/19	12.49	12.49	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/29/19	12.41	12.41	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
11/30/19	12.44	12.44	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*
11/01/19	0.00	4.36	2.11	6.00	0.00	12.47
11/02/19	0.00	4.35	2.11	6.00	0.00	12.46
11/03/19	0.00	4.35	2.15	6.00	0.00	12.50
11/04/19	0.00	4.34	2.15	6.00	0.00	12.49
11/05/19	0.00	4.34	2.11	6.00	0.00	12.44
11/06/19	0.00	4.34	2.10	6.00	0.00	12.44
11/07/19	0.00	4.32	2.10	6.00	0.00	12.42
11/08/19	0.00	4.29	2.08	6.00	0.00	12.37
11/09/19	0.00	4.26	2.09	6.00	0.00	12.35
11/10/19	0.00	4.25	2.12	6.00	0.00	12.37
11/11/19	0.00	4.25	2.14	6.00	0.00	12.39
11/12/19	0.00	4.22	2.10	6.00	0.00	12.33
11/13/19	0.00	4.14	2.12	6.00	0.00	12.26
11/14/19	0.00	4.30	2.17	6.00	0.00	12.46
11/15/19	0.00	4.28	2.22	6.00	0.00	12.50
11/16/19	0.00	4.27	2.21	6.00	0.00	12.47
11/17/19	0.00	4.28	2.26	6.00	0.00	12.54
11/18/19	0.00	4.30	2.24	6.00	0.00	12.54
11/19/19	0.00	4.27	2.14	6.00	0.00	12.41
11/20/19	0.00	4.26	2.12	6.00	0.00	12.38
11/21/19	0.00	4.35	2.14	6.00	0.00	12.50
11/22/19	0.00	4.31	2.14	6.00	0.00	12.45
11/23/19	0.00	4.30	2.15	6.00	0.00	12.45
11/24/19	0.00	4.30	2.16	6.00	0.00	12.46
11/25/19	0.00	4.27	2.15	6.00	0.00	12.42
11/26/19	0.00	4.25	2.15	6.00	0.00	12.40
11/27/19	0.00	4.37	2.13	6.00	0.00	12.50
11/28/19	0.00	4.35	2.14	6.00	0.00	12.49
11/29/19	0.00	4.31	2.10	6.00	0.00	12.41
11/30/19	0.00	4.31	2.13	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*
11/01/19	0.00	0.00	2.11	6.00	4.00	12.11
11/02/19	0.00	0.00	2.11	6.00	4.00	12.11
11/03/19	0.00	0.00	2.15	6.00	4.00	12.15
11/04/19	0.00	0.00	2.15	6.00	4.00	12.15
11/05/19	0.00	0.00	2.11	6.00	4.00	12.11
11/06/19	0.00	0.00	2.10	6.00	4.00	12.10
11/07/19	0.00	0.00	2.10	6.00	4.00	12.10
11/08/19	0.00	0.00	2.08	6.00	4.00	12.08
11/09/19	0.00	0.00	2.09	6.00	4.00	12.09
11/10/19	0.00	0.00	2.12	6.00	4.00	12.12
11/11/19	0.00	0.00	2.14	6.00	4.00	12.14
11/12/19	0.00	0.00	2.10	6.00	4.00	12.10
11/13/19	0.00	0.00	2.12	6.00	4.00	12.12
11/14/19	0.00	0.00	2.17	6.00	4.00	12.17
11/15/19	0.00	0.00	2.22	6.00	4.00	12.22
11/16/19	0.00	0.00	2.21	6.00	4.00	12.21
11/17/19	0.00	0.00	2.26	6.00	4.00	12.26
11/18/19	0.00	0.00	2.24	6.00	4.00	12.24
11/19/19	0.00	0.00	2.14	6.00	4.00	12.14
11/20/19	0.00	0.00	2.12	6.00	4.00	12.12
11/21/19	0.00	0.00	2.14	6.00	4.00	12.14
11/22/19	0.00	0.00	2.14	6.00	4.00	12.14
11/23/19	0.00	0.00	2.15	6.00	4.00	12.15
11/24/19	0.00	0.00	2.16	6.00	4.00	12.16
11/25/19	0.00	0.00	2.15	6.00	4.00	12.15
11/26/19	0.00	0.00	2.15	6.00	4.00	12.15
11/27/19	0.00	0.00	2.13	6.00	4.00	12.13
11/28/19	0.00	0.00	2.14	6.00	4.00	12.14
11/29/19	0.00	0.00	2.10	6.00	4.00	12.10
11/30/19	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
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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
11/01/19	4.71	4.64	4.76	4.38	4.67	4.57	4.65	4.47	4.36	4.47	4.71	4.65	4.56	4.54	4.38	4.51
11/02/19	4.71	4.83	4.72	4.35	4.66	4.56	4.63	4.48	4.37	4.46	4.69	4.65	4.55	4.55	4.36	4.62
11/03/19	4.68	4.90	4.69	4.67	4.72	4.57	4.64	4.49	4.58	4.44	4.66	4.66	4.55	4.54	4.35	4.63
11/04/19	4.64	4.86	4.69	4.62	4.73	4.53	4.59	4.48	4.62	4.41	4.66	4.63	4.53	4.52	4.34	4.60
11/05/19	4.59	4.86	4.68	4.58	4.70	4.49	4.62	4.45	4.62	4.39	4.65	4.61	4.54	4.49	4.34	4.58
11/06/19	4.66	4.84	4.68	4.58	4.69	4.48	4.63	4.45	4.62	4.38	4.65	4.60	4.54	4.48	4.34	4.57
11/07/19	4.57	4.82	4.62	4.56	4.71	4.47	4.56	4.42	4.59	4.36	4.61	4.58	4.50	4.46	4.32	4.58
11/08/19	4.60	4.81	4.58	4.61	4.77	4.42	4.51	4.38	4.57	4.33	4.56	4.54	4.48	4.42	4.29	4.55
11/09/19	4.58	4.84	4.56	4.63	4.71	4.42	4.51	4.38	4.55	4.32	4.54	4.54	4.51	4.44	4.26	4.56
11/10/19	4.59	4.81	4.55	4.61	4.67	4.66	4.50	4.37	4.55	4.57	4.55	4.53	4.48	4.44	4.25	4.56
11/11/19	4.58	4.74	4.51	4.61	4.68	4.69	4.49	4.34	4.56	4.62	4.54	4.49	4.47	4.39	4.25	4.54
11/12/19	4.84	4.77	4.90	4.55	4.70	4.71	4.46	4.31	4.53	4.60	4.54	4.47	4.43	4.36	4.22	4.52
11/13/19	4.90	4.77	4.89	4.60	4.71	4.68	4.57	4.32	4.22	4.27	4.30	4.62	4.23	4.14	4.33	4.29
11/14/19	4.80	4.84	4.94	4.59	4.62	4.68	4.66	4.30	4.41	4.50	4.60	4.74	4.49	4.46	4.44	4.46
11/15/19	4.77	4.76	4.95	4.53	4.61	4.61	4.69	4.58	4.55	4.56	4.69	4.72	4.60	4.59	4.47	4.59
11/16/19	4.84	4.74	4.89	4.54	4.63	4.67	4.71	4.57	4.59	4.55	4.69	4.72	4.56	4.55	4.48	4.58
11/17/19	4.80	4.70	4.91	4.49	4.67	4.61	4.65	4.58	4.58	4.54	4.65	4.72	4.54	4.54	4.48	4.57
11/18/19	4.77	4.72	4.86	4.50	4.64	4.62	4.67	4.61	4.56	4.53	4.66	4.72	4.54	4.55	4.46	4.57
11/19/19	4.82	4.70	4.90	4.47	4.60	4.61	4.67	4.56	4.57	4.54	4.65	4.72	4.54	4.52	4.45	4.56
11/20/19	4.83	4.70	4.89	4.50	4.61	4.64	4.68	4.55	4.58	4.52	4.65	4.72	4.52	4.53	4.42	4.57
11/21/19	4.76	4.66	4.81	4.48	4.57	4.59	4.61	4.50	4.55	4.49	4.62	4.70	4.51	4.48	4.43	4.54
11/22/19	4.77	4.62	4.87	4.43	4.57	4.58	4.65	4.51	4.50	4.50	4.57	4.68	4.47	4.45	4.42	4.50
11/23/19	4.74	4.54	4.84	4.36	4.54	4.58	4.62	4.48	4.51	4.45	4.57	4.67	4.46	4.43	4.42	4.50
11/24/19	4.72	4.61	4.79	4.32	4.48	4.54	4.62	4.52	4.48	4.46	4.55	4.68	4.48	4.44	4.40	4.49
11/25/19	4.70	4.57	4.72	4.31	4.49	4.54	4.60	4.52	4.50	4.43	4.54	4.68	4.47	4.40	4.38	4.48
11/26/19	4.75	4.53	4.72	4.62	4.48	4.55	4.54	4.50	4.46	4.41	4.55	4.63	4.44	4.38	4.38	4.49
11/27/19	4.72	4.52	4.74	4.66	4.64	4.55	4.53	4.50	4.47	4.38	4.51	4.63	4.42	4.39	4.37	4.47
11/28/19	4.66	4.86	4.73	4.61	4.65	4.51	4.58	4.47	4.41	4.37	4.46	4.59	4.39	4.35	4.35	4.43
11/29/19	4.66	4.85	4.66	4.64	4.69	4.50	4.56	4.45	4.41	4.35	4.43	4.60	4.36	4.31	4.34	4.43
11/30/19	4.66	4.74	4.66	4.57	4.68	4.46	4.57	4.43	4.36	4.36	4.41	4.57	4.36	4.31	4.32	4.42

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
11/01/19	4.62	4.45	4.55	4.46	4.66	4.45	4.46	4.58	4.62	4.51	4.60	4.52	4.59	4.63	4.57	4.65
11/02/19	4.62	4.42	4.55	4.46	4.63	4.43	4.42	4.56	4.65	4.53	4.54	4.48	4.75	4.63	4.61	4.62
11/03/19	4.61	4.43	4.53	4.44	4.63	4.43	4.45	4.55	4.63	4.54	4.57	4.51	4.96	4.62	4.62	4.61
11/04/19	4.59	4.43	4.51	4.43	4.63	4.43	4.45	4.53	4.58	4.49	4.56	4.54	4.86	4.60	4.57	4.60
11/05/19	4.56	4.39	4.47	4.39	4.57	4.40	4.39	4.50	4.54	4.49	4.53	4.54	4.85	4.60	4.57	4.58
11/06/19	4.54	4.37	4.45	4.36	4.52	4.39	4.36	4.48	4.49	4.49	4.54	4.51	4.82	4.61	4.56	4.56
11/07/19	4.49	4.36	4.43	4.53	4.55	4.32	4.72	4.43	4.48	4.44	4.53	4.48	4.82	4.59	4.57	4.55
11/08/19	4.46	4.31	4.40	4.68	4.52	4.30	4.68	4.39	4.47	4.40	4.53	4.48	4.81	4.56	4.56	4.54
11/09/19	4.47	4.51	4.40	4.68	4.50	4.30	4.64	4.35	4.47	4.41	4.52	4.45	4.86	4.58	4.52	4.52
11/10/19	4.47	4.62	4.40	4.68	4.50	4.29	4.65	4.34	4.63	4.40	4.52	4.45	4.84	4.55	4.51	4.48
11/11/19	4.46	4.62	4.35	4.66	4.48	4.48	4.64	4.33	4.78	4.51	4.51	4.43	4.82	4.53	4.50	4.45
11/12/19	4.46	4.54	4.26	4.50	4.44	4.53	4.59	4.43	4.71	4.68	4.50	4.40	4.78	4.52	4.47	4.38
11/13/19	4.42	4.55	4.26	4.50	4.43	4.51	4.60	4.67	4.72	4.68	4.47	4.39	4.75	4.49	4.44	4.50
11/14/19	4.41	4.57	4.30	4.60	4.42	4.65	4.65	4.66	4.75	4.64	4.43	4.37	4.74	4.46	4.43	4.71
11/15/19	4.39	4.54	4.28	4.59	4.39	4.60	4.59	4.59	4.71	4.64	4.42	4.35	4.73	4.44	4.45	4.69
11/16/19	4.39	4.54	4.27	4.59	4.59	4.56	4.57	4.58	4.71	4.67	4.44	4.36	4.70	4.43	4.44	4.72
11/17/19	4.34	4.54	4.28	4.61	4.77	4.61	4.58	4.61	4.73	4.67	4.41	4.33	4.71	4.44	4.44	4.67
11/18/19	4.30	4.50	4.46	4.57	4.68	4.59	4.56	4.62	4.70	4.66	4.40	4.30	4.70	4.41	4.39	4.68
11/19/19	4.28	4.51	4.58	4.54	4.66	4.57	4.53	4.58	4.67	4.65	4.38	4.27	4.70	4.41	4.39	4.67
11/20/19	4.49	4.51	4.58	4.51	4.68	4.57	4.52	4.54	4.67	4.63	4.35	4.26	4.67	4.40	4.39	4.68
11/21/19	4.66	4.50	4.57	4.51	4.66	4.59	4.52	4.52	4.68	4.60	4.35	4.36	4.62	4.38	4.37	4.68
11/22/19	4.61	4.48	4.55	4.49	4.64	4.61	4.50	4.54	4.65	4.57	4.31	4.55	4.61	4.46	4.34	4.66
11/23/19	4.62	4.45	4.55	4.49	4.63	4.58	4.49	4.54	4.64	4.55	4.30	4.52	4.60	4.64	4.30	4.63
11/24/19	4.62	4.43	4.52	4.49	4.61	4.56	4.48	4.52	4.63	4.55	4.30	4.52	4.58	4.56	4.40	4.63
11/25/19	4.62	4.45	4.55	4.49	4.60	4.58	4.46	4.51	4.61	4.52	4.27	4.53	4.55	4.56	4.64	4.62
11/26/19	4.60	4.43	4.50	4.46	4.56	4.55	4.45	4.51	4.55	4.50	4.25	4.55	4.52	4.56	4.58	4.58
11/27/19	4.56	4.39	4.48	4.40	4.54	4.53	4.41	4.47	4.57	4.51	4.38	4.53	4.54	4.58	4.57	4.58
11/28/19	4.56	4.36	4.48	4.57	4.54	4.55	4.38	4.45	4.59	4.49	4.58	4.50	4.50	4.57	4.58	4.57
11/29/19	4.56	4.33	4.45	4.69	4.52	4.53	4.38	4.43	4.54	4.47	4.56	4.49	4.59	4.54	4.54	4.54
11/30/19	4.51	4.53	4.45	4.67	4.50	4.52	4.39	4.43	4.55	4.44	4.55	4.49	4.75	4.55	4.55	4.56

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
11/01/19	4.58	4.50	5.09	4.98
11/02/19	4.63	4.51	5.13	5.11
11/03/19	4.72	4.53	5.13	5.04
11/04/19	4.65	4.49	5.15	5.16
11/05/19	4.65	4.44	5.21	5.00
11/06/19	4.67	4.40	5.22	5.16
11/07/19	4.64	4.39	5.16	5.09
11/08/19	4.60	4.47	5.18	5.11
11/09/19	4.58	4.71	5.12	5.10
11/10/19	4.55	4.70	5.23	5.09
11/11/19	4.57	4.66	5.25	5.07
11/12/19	4.64	4.63	5.13	5.11
11/13/19	4.64	4.69	5.24	5.03
11/14/19	4.63	4.68	5.22	4.96
11/15/19	4.60	4.62	5.32	5.13
11/16/19	4.53	4.62	5.26	5.26
11/17/19	4.54	4.62	5.25	5.21
11/18/19	4.57	4.64	5.23	5.06
11/19/19	4.79	4.67	5.25	5.01
11/20/19	4.72	4.65	5.31	5.00
11/21/19	4.68	4.61	5.45	5.05
11/22/19	4.67	4.60	5.27	5.08
11/23/19	4.66	4.57	5.16	5.14
11/24/19	4.63	4.57	5.21	4.87
11/25/19	4.61	4.56	5.26	4.92
11/26/19	4.52	4.56	5.11	5.09
11/27/19	4.54	4.54	5.18	4.89
11/28/19	4.69	4.49	5.18	4.82
11/29/19	4.63	4.47	5.21	5.16
11/30/19	4.63	4.47	5.24	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 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
11/01/19	0.06	0.07	0.06	0.09	0.09	0.09	0.09	0.10	0.09	0.10	0.08	0.10	0.06	0.07	0.07	0.08	0.07	0.07	0.07
11/02/19	0.06	0.08	0.06	0.07	0.09	0.10	0.09	0.10	0.09	0.10	0.08	0.09	0.07	0.09	0.07	0.08	0.07	0.08	0.08
11/03/19	0.06	0.07	0.06	0.07	0.09	0.10	0.10	0.11	0.10	0.11	0.09	0.10	0.08	0.09	0.08	0.09	0.07	0.08	0.08
11/04/19	0.06	0.08	0.06	0.06	0.10	0.10	0.11	0.11	0.10	0.11	0.09	0.11	0.09	0.15	0.08	0.09	0.07	0.07	0.08
11/05/19	0.06	0.09	0.05	0.07	0.09	0.10	0.10	0.11	0.10	0.12	0.10	0.12	0.09	0.13	0.08	0.09	0.07	0.07	0.08
11/06/19	0.06	0.07	0.05	0.08	0.09	0.11	0.10	0.12	0.11	0.13	0.10	0.12	0.10	0.12	0.08	0.09	0.07	0.09	0.08
11/07/19	0.06	0.07	0.06	0.07	0.10	0.11	0.10	0.12	0.12	0.14	0.11	0.12	0.10	0.12	0.08	0.10	0.07	0.09	0.09
11/08/19	0.06	0.09	0.05	0.06	0.10	0.10	0.10	0.11	0.10	0.12	0.09	0.11	0.10	0.15	0.08	0.09	0.07	0.08	0.08
11/09/19	0.06	0.07	0.05	0.07	0.10	0.11	0.11	0.12	0.08	0.09	0.06	0.07	0.08	0.11	0.08	0.08	0.06	0.08	0.08
11/10/19	0.06	0.07	0.05	0.08	0.10	0.11	0.10	0.11	0.08	0.09	0.07	0.08	0.08	0.10	0.08	0.09	0.06	0.07	0.08
11/11/19	0.08	0.10	0.05	0.06	0.09	0.10	0.10	0.10	0.09	0.09	0.07	0.07	0.08	0.09	0.07	0.08	0.06	0.07	0.08
11/12/19	0.08	0.10	0.05	0.06	0.09	0.10	0.10	0.10	0.09	0.10	0.07	0.16	0.08	0.10	0.07	0.08	0.06	0.07	0.08
11/13/19	0.07	0.09	0.05	0.09	0.10	0.10	0.10	0.11	0.08	0.10	0.06	0.08	0.08	0.10	0.07	0.08	0.06	0.07	0.07
11/14/19	0.07	0.08	0.05	0.07	0.10	0.10	0.10	0.12	0.06	0.07	0.05	0.06	0.08	0.11	0.06	0.08	0.07	0.08	0.07
11/15/19	0.07	0.08	0.06	0.12	0.10	0.10	0.09	0.10	0.06	0.07	0.06	0.07	0.07	0.08	0.05	0.06	0.08	0.08	0.07
11/16/19	0.08	0.09	0.05	0.06	0.09	0.10	0.09	0.09	0.06	0.07	0.06	0.07	0.07	0.09	0.05	0.06	0.08	0.08	0.07
11/17/19	0.08	0.10	0.06	0.07	0.09	0.10	0.09	0.10	0.07	0.07	0.06	0.07	0.08	0.10	0.06	0.07	0.08	0.09	0.07
11/18/19	0.09	0.10	0.06	0.07	0.09	0.10	0.10	0.10	0.07	0.09	0.07	0.08	0.08	0.10	0.06	0.07	0.08	0.09	0.08
11/19/19	0.08	0.09	0.06	0.07	0.09	0.10	0.10	0.10	0.08	0.09	0.07	0.08	0.07	0.09	0.06	0.07	0.08	0.09	0.08
11/20/19	0.08	0.10	0.06	0.08	0.09	0.11	0.10	0.12	0.08	0.10	0.07	0.08	0.07	0.09	0.06	0.08	0.07	0.10	0.07
11/21/19	0.08	0.11	0.06	0.08	0.10	0.11	0.11	0.12	0.08	0.10	0.07	0.08	0.08	0.09	0.06	0.08	0.07	0.11	0.08
11/22/19	0.08	0.08	0.05	0.06	0.09	0.09	0.09	0.10	0.08	0.09	0.06	0.07	0.07	0.08	0.06	0.06	0.07	0.07	0.07
11/23/19	0.08	0.09	0.05	0.06	0.09	0.09	0.09	0.09	0.08	0.09	0.07	0.08	0.07	0.08	0.06	0.06	0.07	0.07	0.07
11/24/19	0.08	0.09	0.05	0.06	0.09	0.09	0.09	0.09	0.09	0.10	0.08	0.08	0.07	0.09	0.06	0.06	0.07	0.07	0.07
11/25/19	0.09	0.12	0.06	0.10	0.10	0.13	0.10	0.13	0.10	0.14	0.08	0.11	0.08	0.13	0.06	0.09	0.07	0.11	0.08
11/26/19	0.09	0.12	0.07	0.09	0.10	0.13	0.10	0.13	0.11	0.14	0.09	0.11	0.08	0.11	0.07	0.09	0.08	0.11	0.09
11/27/19	0.08	0.10	0.06	0.08	0.09	0.11	0.10	0.11	0.11	0.13	0.09	0.10	0.08	0.09	0.06	0.08	0.07	0.09	0.08
11/28/19	0.08	0.10	0.05	0.06	0.09	0.09	0.09	0.10	0.10	0.11	0.09	0.10	0.08	0.09	0.06	0.06	0.06	0.07	0.08
11/29/19	0.06	0.08	0.05	0.06	0.08	0.09	0.09	0.09	0.10	0.10	0.09	0.10	0.07	0.08	0.06	0.07	0.05	0.06	0.07
11/30/19	0.06	0.08	0.05	0.06	0.08	0.09	0.09	0.09	0.10	0.11	0.10	0.10	0.08	0.09	0.07	0.07	0.06	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)
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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
11/01/19	0.078	0.083	7.697	5.968	8.515	0.060	0.054	0.072	1,708	1,639	1,762	36	32	39	99.22	2.11	97.92	1.68
11/02/19	0.071	0.073	7.871	7.156	8.557	0.061	0.056	0.072	1,650	1,589	1,710	35	32	38	99.23	2.11	97.89	1.68
11/03/19	0.069	0.073	7.760	5.689	8.613	0.055	0.050	0.060	1,589	1,530	1,646	33	30	37	99.29	2.15	97.94	1.69
11/04/19	0.070	0.073	7.772	7.055	8.889	0.055	0.050	0.069	1,559	1,464	1,686	32	29	37	99.29	2.15	97.95	1.69
11/05/19	0.066	0.068	7.857	7.188	8.889	0.061	0.056	0.075	1,651	1,580	1,709	34	31	38	99.22	2.11	97.95	1.69
11/06/19	0.065	0.066	7.713	6.074	8.633	0.061	0.056	0.068	1,667	1,605	1,744	34	31	38	99.21	2.10	97.96	1.69
11/07/19	0.065	0.066	7.740	7.057	8.669	0.061	0.056	0.071	1,702	1,657	1,744	35	32	38	99.21	2.10	97.94	1.69
11/08/19	0.067	0.067	7.582	5.511	8.494	0.063	0.056	0.075	1,703	1,660	1,739	35	32	38	99.17	2.08	97.95	1.69
11/09/19	0.066	0.067	7.705	6.073	8.459	0.063	0.056	0.074	1,665	1,603	1,734	35	33	39	99.18	2.09	97.91	1.68
11/10/19	0.068	0.068	7.798	7.126	8.417	0.060	0.052	0.067	1,602	1,542	1,671	33	31	37	99.23	2.12	97.94	1.69
11/11/19	0.067	0.069	7.757	5.690	8.816	0.057	0.051	0.071	1,583	1,517	1,661	33	30	37	99.27	2.14	97.94	1.69
11/12/19	0.067	0.068	7.986	7.453	8.841	0.063	0.056	0.074	1,630	1,566	1,703	34	30	38	99.21	2.10	97.92	1.68
11/13/19	0.067	0.067	7.646	7.156	8.424	0.059	0.049	0.071	1,685	1,634	1,749	35	32	38	99.23	2.12	97.91	1.68
11/14/19	0.067	0.067	7.608	6.936	8.679	0.052	0.043	0.062	1,696	1,634	1,773	34	31	37	99.32	2.17	97.99	1.70
11/15/19	0.064	0.067	7.629	6.980	8.454	0.046	0.041	0.052	1,679	1,614	1,743	33	30	37	99.40	2.22	98.02	1.70
11/16/19	0.062	0.064	7.454	6.786	8.188	0.046	0.042	0.054	1,659	1,600	1,714	34	31	38	99.38	2.21	97.96	1.69
11/17/19	0.060	0.061	7.621	6.050	8.257	0.042	0.038	0.045	1,603	1,531	1,680	33	30	37	99.45	2.26	97.97	1.69
11/18/19	0.058	0.060	7.807	7.079	11.185	0.045	0.009	0.066	1,579	1,498	1,683	32	29	36	99.43	2.24	97.99	1.70
11/19/19	0.060	0.062	7.885	7.184	8.784	0.057	0.051	0.065	1,674	1,594	1,764	34	30	38	99.28	2.14	97.99	1.70
11/20/19	0.065	0.071	7.941	7.301	8.560	0.061	0.047	0.115	1,725	1,664	1,818	34	31	37	99.24	2.12	98.03	1.70
11/21/19	0.071	0.073	7.740	7.125	8.532	0.056	0.051	0.067	1,732	1,667	1,801	34	31	38	99.28	2.14	98.02	1.70
11/22/19	0.070	0.071	7.619	7.065	8.431	0.055	0.050	0.067	1,742	1,707	1,794	34	32	37	99.27	2.14	98.05	1.71
11/23/19	0.071	0.072	7.522	6.896	8.239	0.053	0.048	0.060	1,685	1,626	1,746	32	30	35	99.29	2.15	98.08	1.72
11/24/19	0.073	0.073	7.280	6.536	7.941	0.050	0.046	0.058	1,630	1,581	1,688	31	29	35	99.31	2.16	98.09	1.72
11/25/19	0.072	0.073	7.238	6.515	7.977	0.051	0.046	0.061	1,612	1,542	1,688	31	28	34	99.30	2.15	98.09	1.72
11/26/19	0.071	0.072	7.356	6.657	8.043	0.052	0.048	0.058	1,670	1,603	1,756	31	28	34	99.29	2.15	98.17	1.74
11/27/19	0.061	0.071	7.549	6.831	8.217	0.056	0.051	0.062	1,701	1,640	1,769	32	29	36	99.25	2.13	98.10	1.72
11/28/19	0.059	0.061	7.569	7.055	8.340	0.054	0.051	0.058	1,627	1,451	1,750	29	25	34	99.28	2.14	98.20	1.74
11/29/19	0.065	0.065	6.786	6.190	7.845	0.054	0.054	0.054	1,477	1,364	1,614	26	22	32	99.20	2.10	98.24	1.75
11/30/19	0.064	0.065	7.258	6.381	8.134	0.054	0.054	0.054	1,611	1,516	1,726	30	27	33	99.26	2.13	98.14	1.73

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
11/01/19	98.21	94.130	24,024.3	0.25	3.0	6
11/02/19	98.34	93.885	24,136.3	0.26	3.0	6
11/03/19	98.36	95.317	24,172.5	0.26	3.0	6
11/04/19	98.27	98.006	25,665.4	0.26	3.0	6
11/05/19	98.31	96.525	25,537.8	0.26	3.0	6
11/06/19	98.34	98.495	25,452.3	0.26	3.0	6
11/07/19	98.04	98.161	25,620.5	0.26	3.0	6
11/08/19	98.05	98.139	25,472.9	0.26	3.0	6
11/09/19	97.90	95.416	25,544.9	0.26	3.0	6
11/10/19	97.93	96.647	24,810.6	0.26	3.0	6
11/11/19	98.02	95.493	24,733.9	0.26	3.0	6
11/12/19	98.17	89.101	24,382.0	0.26	3.0	6
11/13/19	98.39	84.688	23,187.3	0.27	3.0	6
11/14/19	98.39	97.406	24,940.9	0.26	3.0	6
11/15/19	98.31	99.744	24,971.7	0.26	3.0	6
11/16/19	98.17	94.006	26,052.1	0.26	3.0	6
11/17/19	98.07	97.333	24,661.9	0.26	3.0	6
11/18/19	98.12	99.682	25,607.9	0.26	3.0	6
11/19/19	97.99	97.099	26,176.3	0.26	3.0	6
11/20/19	98.21	96.224	25,382.6	0.26	3.0	6
11/21/19	98.20	98.799	24,914.2	0.26	3.0	6
11/22/19	98.16	98.585	26,050.4	0.26	3.0	6
11/23/19	98.15	97.827	25,966.6	0.26	3.0	6
11/24/19	98.30	97.622	25,865.7	0.26	3.0	6
11/25/19	98.50	93.806	25,586.4	0.26	3.0	6
11/26/19	98.45	94.449	24,950.9	0.26	3.0	6
11/27/19	98.21	97.330	24,229.3	0.26	3.0	6
11/28/19	98.20	99.460	25,267.9	0.26	3.0	6
11/29/19	98.18	95.090	25,724.6	0.26	3.0	6
11/30/19	97.67	94.254	24,827.5	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				
							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
12/01/19	12.42	12.42	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/02/19	12.37	12.37	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/03/19	12.35	12.35	12.14	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/04/19	12.42	12.42	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/05/19	12.49	12.49	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/06/19	12.46	12.46	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/07/19	12.40	12.40	12.23	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/08/19	12.43	12.43	12.26	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/09/19	12.46	12.46	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/10/19	12.42	12.42	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/11/19	12.39	12.39	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/12/19	12.40	12.40	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/13/19	12.45	12.45	12.19	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/14/19	12.39	12.39	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/15/19	12.45	12.45	12.25	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/16/19	12.44	12.44	12.24	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/17/19	12.38	12.38	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/18/19	12.39	12.39	12.13	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/19/19	12.40	12.40	12.12	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/20/19	12.39	12.39	12.10	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/21/19	12.45	12.45	12.11	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/22/19	12.50	12.50	12.15	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/23/19	12.52	12.52	12.20	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/24/19	12.50	12.50	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/25/19	12.49	12.49	12.16	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/26/19	12.50	12.50	12.22	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/27/19	12.44	12.44	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/28/19	12.40	12.40	12.17	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/29/19	12.38	12.38	12.18	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/30/19	12.43	12.43	12.21	Y	Y	Y	0.0	0.0	0.0	0.0	0.0
12/31/19	12.44	12.44	12.20	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*
12/01/19	0.00	4.29	2.13	6.00	0.00	12.42
12/02/19	0.00	4.23	2.14	6.00	0.00	12.37
12/03/19	0.00	4.21	2.14	6.00	0.00	12.35
12/04/19	0.00	4.24	2.18	6.00	0.00	12.42
12/05/19	0.00	4.27	2.22	6.00	0.00	12.49
12/06/19	0.00	4.26	2.20	6.00	0.00	12.46
12/07/19	0.00	4.18	2.23	6.00	0.00	12.40
12/08/19	0.00	4.17	2.26	6.00	0.00	12.43
12/09/19	0.00	4.25	2.21	6.00	0.00	12.46
12/10/19	0.00	4.30	2.13	6.00	0.00	12.42
12/11/19	0.00	4.27	2.11	6.00	0.00	12.39
12/12/19	0.00	4.25	2.15	6.00	0.00	12.40
12/13/19	0.00	4.26	2.19	6.00	0.00	12.45
12/14/19	0.00	4.20	2.18	6.00	0.00	12.39
12/15/19	0.00	4.20	2.25	6.00	0.00	12.45
12/16/19	0.00	4.20	2.24	6.00	0.00	12.44
12/17/19	0.00	4.20	2.18	6.00	0.00	12.38
12/18/19	0.00	4.26	2.13	6.00	0.00	12.39
12/19/19	0.00	4.28	2.12	6.00	0.00	12.40
12/20/19	0.00	4.28	2.10	6.00	0.00	12.39
12/21/19	0.00	4.34	2.11	6.00	0.00	12.45
12/22/19	0.00	4.35	2.15	6.00	0.00	12.50
12/23/19	0.00	4.32	2.20	6.00	0.00	12.52
12/24/19	0.00	4.32	2.18	6.00	0.00	12.50
12/25/19	0.00	4.34	2.16	6.00	0.00	12.49
12/26/19	0.00	4.28	2.22	6.00	0.00	12.50
12/27/19	0.00	4.26	2.18	6.00	0.00	12.44
12/28/19	0.00	4.23	2.17	6.00	0.00	12.40
12/29/19	0.00	4.20	2.18	6.00	0.00	12.38
12/30/19	0.00	4.23	2.21	6.00	0.00	12.43
12/31/19	0.00	4.24	2.20	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*
12/01/19	0.00	0.00	2.13	6.00	4.00	12.13
12/02/19	0.00	0.00	2.14	6.00	4.00	12.14
12/03/19	0.00	0.00	2.14	6.00	4.00	12.14
12/04/19	0.00	0.00	2.18	6.00	4.00	12.18
12/05/19	0.00	0.00	2.22	6.00	4.00	12.22
12/06/19	0.00	0.00	2.20	6.00	4.00	12.20
12/07/19	0.00	0.00	2.23	6.00	4.00	12.23
12/08/19	0.00	0.00	2.26	6.00	4.00	12.26
12/09/19	0.00	0.00	2.21	6.00	4.00	12.21
12/10/19	0.00	0.00	2.13	6.00	4.00	12.13
12/11/19	0.00	0.00	2.11	6.00	4.00	12.11
12/12/19	0.00	0.00	2.15	6.00	4.00	12.15
12/13/19	0.00	0.00	2.19	6.00	4.00	12.19
12/14/19	0.00	0.00	2.18	6.00	4.00	12.18
12/15/19	0.00	0.00	2.25	6.00	4.00	12.25
12/16/19	0.00	0.00	2.24	6.00	4.00	12.24
12/17/19	0.00	0.00	2.18	6.00	4.00	12.18
12/18/19	0.00	0.00	2.13	6.00	4.00	12.13
12/19/19	0.00	0.00	2.12	6.00	4.00	12.12
12/20/19	0.00	0.00	2.10	6.00	4.00	12.10
12/21/19	0.00	0.00	2.11	6.00	4.00	12.11
12/22/19	0.00	0.00	2.15	6.00	4.00	12.15
12/23/19	0.00	0.00	2.20	6.00	4.00	12.20
12/24/19	0.00	0.00	2.18	6.00	4.00	12.18
12/25/19	0.00	0.00	2.16	6.00	4.00	12.16
12/26/19	0.00	0.00	2.22	6.00	4.00	12.22
12/27/19	0.00	0.00	2.18	6.00	4.00	12.18
12/28/19	0.00	0.00	2.17	6.00	4.00	12.17
12/29/19	0.00	0.00	2.18	6.00	4.00	12.18
12/30/19	0.00	0.00	2.21	6.00	4.00	12.21
12/31/19	0.00	0.00	2.20	6.00	4.00	12.20

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
12/01/19	4.60	4.77	4.62	4.57	4.68	4.45	4.57	4.40	4.36	4.33	4.41	4.57	4.36	4.29	4.32	4.40
12/02/19	4.56	4.78	4.56	4.58	4.61	4.43	4.56	4.38	4.35	4.32	4.71	4.55	4.32	4.23	4.30	4.38
12/03/19	4.60	4.81	4.58	4.56	4.64	4.41	4.53	4.41	4.32	4.29	4.79	4.53	4.30	4.21	4.31	4.34
12/04/19	4.56	4.77	4.59	4.52	4.66	4.38	4.54	4.40	4.32	4.50	4.76	4.52	4.27	4.46	4.32	4.34
12/05/19	4.58	4.76	4.56	4.53	4.66	4.41	4.55	4.35	4.27	4.58	4.73	4.49	4.47	4.62	4.32	4.29
12/06/19	4.53	4.73	4.88	4.50	4.66	4.67	4.53	4.34	4.26	4.58	4.72	4.45	4.60	4.56	4.28	4.28
12/07/19	4.53	4.73	4.86	4.45	4.62	4.58	4.49	4.49	4.18	4.54	4.71	4.42	4.56	4.49	4.26	4.27
12/08/19	4.83	4.73	4.86	4.43	4.60	4.61	4.48	4.51	4.17	4.56	4.68	4.43	4.51	4.47	4.24	4.27
12/09/19	4.77	4.74	4.86	4.41	4.62	4.59	4.50	4.53	4.51	4.55	4.71	4.38	4.52	4.49	4.29	4.25
12/10/19	4.74	4.74	4.82	4.40	4.58	4.59	4.63	4.52	4.52	4.49	4.72	4.62	4.51	4.46	4.31	4.44
12/11/19	4.80	4.77	4.76	4.47	4.59	4.60	4.70	4.53	4.50	4.49	4.68	4.69	4.49	4.45	4.45	4.55
12/12/19	4.79	4.64	4.75	4.35	4.58	4.57	4.66	4.48	4.51	4.50	4.68	4.71	4.49	4.41	4.54	4.53
12/13/19	4.70	4.71	4.79	4.39	4.57	4.60	4.68	4.48	4.49	4.49	4.66	4.69	4.46	4.40	4.57	4.52
12/14/19	4.77	4.66	4.73	4.35	4.56	4.54	4.70	4.47	4.43	4.49	4.64	4.65	4.45	4.44	4.58	4.50
12/15/19	4.78	4.73	4.73	4.74	4.56	4.53	4.70	4.47	4.46	4.50	4.65	4.66	4.46	4.45	4.55	4.51
12/16/19	4.71	4.68	4.72	4.61	4.52	4.52	4.66	4.46	4.43	4.49	4.66	4.67	4.42	4.40	4.55	4.52
12/17/19	4.73	4.65	4.73	4.67	4.49	4.58	4.67	4.50	4.42	4.45	4.60	4.64	4.38	4.40	4.53	4.49
12/18/19	4.71	4.61	4.72	4.60	4.48	4.57	4.61	4.49	4.40	4.40	4.60	4.58	4.40	4.36	4.49	4.45
12/19/19	4.73	4.61	4.70	4.59	4.50	4.56	4.62	4.51	4.39	4.35	4.57	4.60	4.38	4.31	4.50	4.41
12/20/19	4.74	4.62	4.70	4.59	4.51	4.55	4.63	4.51	4.39	4.34	4.56	4.61	4.38	4.30	4.51	4.40
12/21/19	4.81	4.76	4.84	4.71	4.55	4.61	4.65	4.53	4.49	4.47	4.63	4.68	4.48	4.36	4.60	4.53
12/22/19	4.81	4.69	4.77	4.67	4.51	4.59	4.63	4.50	4.48	4.43	4.64	4.65	4.42	4.38	4.55	4.49
12/23/19	4.68	4.55	4.68	4.64	4.49	4.56	4.63	4.48	4.44	4.42	4.63	4.63	4.39	4.37	4.53	4.45
12/24/19	4.66	4.58	4.67	4.56	4.64	4.52	4.60	4.45	4.40	4.38	4.61	4.71	4.36	4.34	4.52	4.42
12/25/19	4.62	4.57	4.64	4.58	4.67	4.52	4.59	4.47	4.40	4.36	4.59	4.74	4.34	4.34	4.53	4.43
12/26/19	4.64	4.92	4.64	4.60	4.67	4.57	4.60	4.45	4.36	4.36	4.53	4.70	4.29	4.30	4.50	4.39
12/27/19	4.65	4.83	4.60	4.50	4.66	4.50	4.57	4.49	4.33	4.32	4.53	4.65	4.30	4.26	4.48	4.37
12/28/19	4.65	4.90	4.61	4.48	4.67	4.44	4.59	4.51	4.31	4.31	4.53	4.62	4.33	4.23	4.45	4.38
12/29/19	4.63	4.85	4.59	4.43	4.64	4.42	4.58	4.51	4.32	4.32	4.47	4.61	4.28	4.20	4.46	4.39
12/30/19	4.59	4.86	4.55	4.37	4.57	4.47	4.57	4.49	4.25	4.25	4.45	4.58	4.23	4.43	4.43	4.35
12/31/19	4.53	4.83	4.50	4.33	4.59	4.45	4.53	4.48	4.27	4.49	4.69	4.56	4.24	4.55	4.42	4.33

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															
	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
12/01/19	4.52	4.61	4.43	4.66	4.46	4.51	4.57	4.38	4.55	4.44	4.54	4.48	4.74	4.56	4.52	4.54
12/02/19	4.52	4.56	4.41	4.65	4.43	4.46	4.70	4.32	4.54	4.42	4.54	4.48	4.73	4.54	4.52	4.50
12/03/19	4.49	4.53	4.38	4.62	4.40	4.41	4.59	4.30	4.50	4.37	4.51	4.46	4.75	4.54	4.54	4.49
12/04/19	4.47	4.50	4.32	4.57	4.34	4.37	4.56	4.24	4.47	4.34	4.49	4.42	4.77	4.48	4.53	4.44
12/05/19	4.46	4.52	4.29	4.59	4.33	4.37	4.60	4.46	4.43	4.33	4.51	4.40	4.75	4.47	4.52	4.42
12/06/19	4.44	4.49	4.26	4.57	4.54	4.34	4.59	4.68	4.53	4.28	4.48	4.39	4.75	4.50	4.51	4.40
12/07/19	4.40	4.45	4.44	4.54	4.67	4.42	4.56	4.61	4.71	4.41	4.46	4.39	4.76	4.51	4.47	4.37
12/08/19	4.37	4.44	4.56	4.50	4.65	4.64	4.54	4.59	4.75	4.63	4.48	4.32	4.74	4.47	4.45	4.38
12/09/19	4.31	4.44	4.54	4.48	4.63	4.57	4.51	4.60	4.70	4.64	4.44	4.28	4.71	4.44	4.44	4.45
12/10/19	4.30	4.39	4.53	4.49	4.60	4.50	4.46	4.59	4.66	4.63	4.42	4.31	4.73	4.44	4.46	4.70
12/11/19	4.27	4.41	4.50	4.46	4.57	4.54	4.47	4.55	4.68	4.63	4.39	4.30	4.65	4.40	4.40	4.70
12/12/19	4.25	4.40	4.47	4.43	4.52	4.53	4.46	4.51	4.67	4.61	4.36	4.27	4.66	4.33	4.40	4.65
12/13/19	4.50	4.36	4.44	4.41	4.51	4.48	4.44	4.51	4.63	4.57	4.38	4.26	4.69	4.32	4.38	4.62
12/14/19	4.60	4.32	4.43	4.54	4.51	4.47	4.44	4.49	4.65	4.53	4.37	4.20	4.62	4.34	4.37	4.69
12/15/19	4.60	4.31	4.46	4.62	4.51	4.48	4.43	4.48	4.69	4.54	4.36	4.20	4.62	4.30	4.35	4.69
12/16/19	4.57	4.31	4.42	4.62	4.47	4.48	4.40	4.47	4.67	4.56	4.35	4.20	4.64	4.29	4.32	4.66
12/17/19	4.54	4.51	4.37	4.59	4.41	4.47	4.38	4.45	4.63	4.55	4.32	4.20	4.60	4.31	4.31	4.60
12/18/19	4.52	4.58	4.32	4.56	4.36	4.44	4.38	4.41	4.61	4.51	4.30	4.34	4.55	4.26	4.32	4.61
12/19/19	4.49	4.54	4.30	4.57	4.34	4.43	4.50	4.37	4.58	4.51	4.28	4.53	4.55	4.38	4.32	4.59
12/20/19	4.49	4.55	4.30	4.57	4.34	4.44	4.64	4.36	4.61	4.59	4.28	4.56	4.59	4.68	4.37	4.70
12/21/19	4.63	4.63	4.48	4.66	4.44	4.57	4.76	4.42	4.67	4.62	4.34	4.59	4.65	4.64	4.37	4.73
12/22/19	4.57	4.59	4.46	4.62	4.44	4.49	4.71	4.44	4.65	4.57	4.35	4.54	4.64	4.58	4.46	4.70
12/23/19	4.52	4.49	4.36	4.53	4.39	4.44	4.60	4.40	4.61	4.51	4.32	4.47	4.59	4.54	4.61	4.62
12/24/19	4.51	4.45	4.32	4.51	4.38	4.43	4.54	4.36	4.57	4.49	4.40	4.48	4.53	4.56	4.53	4.63
12/25/19	4.50	4.48	4.35	4.54	4.39	4.44	4.59	4.36	4.54	4.52	4.56	4.49	4.49	4.55	4.52	4.59
12/26/19	4.49	4.42	4.28	4.54	4.56	4.42	4.61	4.33	4.55	4.51	4.53	4.48	4.51	4.56	4.55	4.58
12/27/19	4.48	4.38	4.42	4.50	4.65	4.52	4.55	4.50	4.51	4.46	4.50	4.45	4.59	4.49	4.51	4.54
12/28/19	4.45	4.41	4.54	4.46	4.59	4.62	4.52	4.66	4.45	4.44	4.49	4.45	4.70	4.43	4.51	4.48
12/29/19	4.41	4.36	4.51	4.43	4.55	4.54	4.51	4.60	4.44	4.40	4.50	4.40	4.65	4.46	4.46	4.52
12/30/19	4.38	4.33	4.46	4.41	4.53	4.51	4.48	4.56	4.41	4.37	4.46	4.40	4.66	4.48	4.44	4.46
12/31/19	4.32	4.33	4.42	4.38	4.52	4.46	4.46	4.53	4.37	4.38	4.43	4.44	4.70	4.45	4.45	4.41

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
12/01/19	4.55	4.45	5.04	5.00
12/02/19	4.54	4.42	5.11	5.20
12/03/19	4.58	4.42	5.04	5.03
12/04/19	4.55	4.51	5.20	4.83
12/05/19	4.73	4.73	5.15	4.75
12/06/19	4.62	4.66	5.21	4.91
12/07/19	4.61	4.67	5.25	4.86
12/08/19	4.63	4.64	5.13	4.87
12/09/19	4.57	4.63	5.10	5.14
12/10/19	4.59	4.60	5.02	4.93
12/11/19	4.50	4.58	5.12	4.86
12/12/19	4.53	4.64	5.03	4.93
12/13/19	4.67	4.62	5.04	4.90
12/14/19	4.65	4.58	5.17	5.12
12/15/19	4.62	4.57	5.16	5.04
12/16/19	4.62	4.63	5.18	4.78
12/17/19	4.65	4.60	5.13	5.03
12/18/19	4.60	4.57	5.10	4.98
12/19/19	4.61	4.56	5.15	5.00
12/20/19	4.58	4.60	5.10	4.90
12/21/19	4.59	4.64	5.20	5.09
12/22/19	4.63	4.59	5.17	5.06
12/23/19	4.70	4.52	5.06	4.97
12/24/19	4.66	4.50	4.99	4.84
12/25/19	4.60	4.47	5.00	4.92
12/26/19	4.59	4.48	4.97	4.98
12/27/19	4.58	4.48	4.99	4.94
12/28/19	4.61	4.43	5.00	5.01
12/29/19	4.56	4.39	5.03	5.15
12/30/19	4.55	4.35	5.11	4.96
12/31/19	4.58	4.45	4.96	4.78

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
12/01/19	0.07	0.07	0.05	0.06	0.08	0.09	0.09	0.09	0.11	0.12	0.10	0.11	0.08	0.09	0.07	0.07	0.06	0.06	0.08
12/02/19	0.06	0.07	0.05	0.06	0.09	0.09	0.09	0.09	0.11	0.11	0.10	0.10	0.09	0.09	0.07	0.08	0.06	0.06	0.08
12/03/19	0.06	0.08	0.06	0.11	0.09	0.09	0.09	0.10	0.11	0.11	0.09	0.10	0.09	0.09	0.08	0.08	0.06	0.06	0.08
12/04/19	0.07	0.08	0.05	0.06	0.08	0.09	0.09	0.09	0.11	0.12	0.07	0.09	0.09	0.10	0.07	0.09	0.06	0.06	0.08
12/05/19	0.07	0.08	0.05	0.06	0.08	0.09	0.09	0.09	0.11	0.13	0.07	0.09	0.10	0.13	0.08	0.08	0.05	0.06	0.08
12/06/19	0.06	0.07	0.05	0.06	0.08	0.09	0.09	0.09	0.11	0.12	0.07	0.09	0.11	0.12	0.08	0.08	0.06	0.07	0.08
12/07/19	0.07	0.08	0.05	0.06	0.08	0.09	0.09	0.09	0.12	0.12	0.09	0.10	0.11	0.14	0.08	0.08	0.05	0.06	0.08
12/08/19	0.07	0.08	0.05	0.06	0.08	0.09	0.09	0.09	0.11	0.12	0.09	0.10	0.12	0.15	0.08	0.08	0.06	0.06	0.08
12/09/19	0.07	0.08	0.05	0.06	0.09	0.09	0.09	0.09	0.12	0.12	0.10	0.10	0.12	0.15	0.08	0.08	0.06	0.06	0.08
12/10/19	0.07	0.09	0.05	0.06	0.08	0.09	0.09	0.09	0.11	0.12	0.10	0.10	0.13	0.16	0.08	0.08	0.06	0.06	0.09
12/11/19	0.06	0.09	0.05	0.06	0.08	0.09	0.07	0.09	0.10	0.12	0.07	0.10	0.13	0.16	0.08	0.08	0.06	0.06	0.08
12/12/19	0.07	0.07	0.05	0.06	0.08	0.08	0.07	0.07	0.09	0.09	0.06	0.07	0.11	0.16	0.07	0.08	0.05	0.07	0.07
12/13/19	0.07	0.09	0.06	0.06	0.08	0.08	0.06	0.07	0.09	0.10	0.07	0.07	0.10	0.13	0.08	0.08	0.04	0.05	0.07
12/14/19	0.07	0.08	0.06	0.07	0.08	0.08	0.06	0.07	0.10	0.10	0.07	0.08	0.11	0.13	0.08	0.09	0.05	0.05	0.07
12/15/19	0.07	0.09	0.06	0.06	0.08	0.09	0.07	0.07	0.10	0.10	0.07	0.08	0.11	0.15	0.08	0.08	0.05	0.05	0.08
12/16/19	0.07	0.08	0.06	0.07	0.08	0.09	0.07	0.08	0.10	0.11	0.08	0.09	0.11	0.15	0.08	0.09	0.05	0.06	0.08
12/17/19	0.06	0.08	0.05	0.07	0.09	0.10	0.09	0.10	0.08	0.11	0.06	0.09	0.08	0.12	0.07	0.09	0.05	0.07	0.07
12/18/19	0.06	0.07	0.04	0.05	0.10	0.10	0.10	0.10	0.06	0.06	0.04	0.06	0.06	0.08	0.06	0.07	0.06	0.07	0.06
12/19/19	0.06	0.07	0.04	0.05	0.09	0.10	0.09	0.10	0.06	0.06	0.04	0.06	0.06	0.07	0.06	0.07	0.05	0.07	0.06
12/20/19	0.07	0.08	0.06	0.09	0.10	0.14	0.09	0.10	0.09	0.13	0.07	0.09	0.06	0.09	0.06	0.07	0.06	0.06	0.06
12/21/19	0.07	0.15	0.06	0.07	0.09	0.11	0.09	0.11	0.07	0.14	0.06	0.09	0.06	0.07	0.07	0.07	0.06	0.07	0.07
12/22/19	0.07	0.08	0.06	0.06	0.09	0.09	0.09	0.09	0.07	0.08	0.07	0.07	0.07	0.08	0.07	0.07	0.06	0.07	0.07
12/23/19	0.07	0.08	0.06	0.06	0.09	0.09	0.09	0.10	0.08	0.08	0.07	0.08	0.07	0.08	0.07	0.07	0.06	0.07	0.07
12/24/19	0.07	0.08	0.05	0.06	0.08	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.07	0.08	0.07	0.08	0.06	0.07	0.07
12/25/19	0.07	0.07	0.06	0.06	0.08	0.09	0.09	0.09	0.08	0.09	0.08	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.07
12/26/19	0.07	0.11	0.06	0.07	0.09	0.09	0.09	0.10	0.09	0.09	0.09	0.09	0.08	0.09	0.07	0.07	0.06	0.07	0.08
12/27/19	0.07	0.08	0.06	0.06	0.09	0.09	0.09	0.10	0.09	0.10	0.09	0.09	0.09	0.10	0.07	0.08	0.06	0.07	0.08
12/28/19	0.07	0.07	0.06	0.06	0.09	0.09	0.09	0.10	0.10	0.11	0.09	0.09	0.09	0.10	0.07	0.08	0.06	0.07	0.08
12/29/19	0.07	0.07	0.06	0.06	0.09	0.09	0.09	0.10	0.10	0.11	0.09	0.10	0.10	0.11	0.07	0.08	0.07	0.07	0.08
12/30/19	0.07	0.08	0.06	0.07	0.09	0.09	0.09	0.10	0.11	0.11	0.10	0.10	0.10	0.11	0.08	0.08	0.07	0.08	0.08
12/31/19	0.07	0.08	0.05	0.06	0.09	0.09	0.10	0.11	0.08	0.11	0.07	0.10	0.07	0.11	0.07	0.08	0.06	0.07	0.07

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
12/01/19	0.061	0.062	7.327	5.787	8.183	0.054	0.054	0.054	1,618	1,567	1,687	30	28	34	99.26	2.13	98.13	1.73
12/02/19	0.061	0.061	7.397	6.624	8.318	0.054	0.054	0.054	1,578	1,513	1,650	29	27	32	99.27	2.14	98.15	1.73
12/03/19	0.060	0.061	7.416	6.764	8.373	0.054	0.054	0.054	1,658	1,578	1,794	30	27	34	99.27	2.14	98.18	1.74
12/04/19	0.062	0.063	7.276	6.818	8.012	0.048	0.039	0.072	1,666	1,584	1,760	31	27	49	99.34	2.18	98.13	1.73
12/05/19	0.063	0.063	7.278	6.559	7.987	0.044	0.041	0.051	1,618	1,523	1,758	28	25	32	99.39	2.22	98.30	1.77
12/06/19	0.063	0.066	7.325	5.478	7.997	0.046	0.043	0.053	1,687	1,627	1,738	30	27	33	99.38	2.20	98.24	1.75
12/07/19	0.063	0.065	7.542	6.774	8.465	0.045	0.039	0.050	1,677	1,635	1,732	30	28	33	99.41	2.23	98.22	1.75
12/08/19	0.063	0.063	7.852	7.071	9.233	0.043	0.036	0.053	1,630	1,578	1,713	29	27	34	99.45	2.26	98.20	1.74
12/09/19	0.063	0.063	7.667	6.990	8.415	0.048	0.040	0.059	1,584	1,515	1,682	28	25	31	99.38	2.21	98.25	1.76
12/10/19	0.062	0.062	7.651	6.746	8.587	0.057	0.051	0.064	1,660	1,578	1,794	28	26	33	99.25	2.13	98.29	1.77
12/11/19	0.062	0.062	7.608	6.845	8.520	0.058	0.053	0.067	1,714	1,643	1,781	31	27	36	99.23	2.11	98.21	1.75
12/12/19	0.062	0.062	7.506	6.717	8.360	0.054	0.042	0.125	1,714	1,643	1,781	31	27	36	99.29	2.15	98.21	1.75
12/13/19	0.062	0.062	7.608	6.296	8.415	0.049	0.044	0.055	1,700	1,638	1,751	32	29	35	99.36	2.19	98.14	1.73
12/14/19	0.062	0.062	7.811	6.773	8.677	0.051	0.043	0.060	1,691	1,646	1,735	32	30	36	99.34	2.18	98.10	1.72
12/15/19	0.062	0.063	7.593	6.834	8.562	0.042	0.036	0.049	1,631	1,588	1,701	30	28	33	99.44	2.25	98.15	1.73
12/16/19	0.063	0.063	7.433	6.544	8.234	0.043	0.038	0.047	1,595	1,500	1,720	29	27	33	99.42	2.24	98.18	1.74
12/17/19	0.062	0.063	7.615	6.763	8.575	0.050	0.045	0.059	1,677	1,597	1,758	30	27	33	99.34	2.18	98.21	1.75
12/18/19	0.062	0.062	7.826	6.888	8.586	0.058	0.051	0.065	1,712	1,654	1,788	30	28	33	99.26	2.13	98.22	1.75
12/19/19	0.062	0.062	7.764	6.954	12.995	0.059	0.055	0.062	1,715	1,665	1,763	31	28	34	99.25	2.12	98.20	1.75
12/20/19	0.061	0.062	7.916	7.342	8.480	0.062	0.056	0.070	1,661	1,612	1,731	31	28	33	99.21	2.10	98.15	1.73
12/21/19	0.062	0.062	7.990	6.735	8.652	0.062	0.056	0.068	1,674	1,646	1,720	32	28	42	99.22	2.11	98.06	1.71
12/22/19	0.062	0.062	7.765	6.960	8.607	0.055	0.046	0.064	1,611	1,558	1,655	31	29	39	99.30	2.15	98.08	1.72
12/23/19	0.063	0.063	7.877	6.952	9.298	0.050	0.043	0.059	1,525	1,480	1,621	27	25	31	99.37	2.20	98.23	1.75
12/24/19	0.063	0.063	8.138	7.123	9.320	0.054	0.047	0.064	1,602	1,524	1,738	28	25	32	99.33	2.18	98.28	1.76
12/25/19	0.062	0.062	7.263	6.701	8.515	0.050	0.038	0.060	1,619	1,557	1,696	30	27	34	99.31	2.16	98.16	1.74
12/26/19	0.061	0.061	6.798	5.391	7.914	0.041	0.034	0.048	1,419	1,262	1,638	24	19	32	99.40	2.22	98.33	1.78
12/27/19	0.059	0.061	7.615	6.687	8.515	0.050	0.045	0.057	1,623	1,478	1,804	27	23	32	99.34	2.18	98.35	1.78
12/28/19	0.056	0.057	7.864	6.966	8.661	0.053	0.046	0.062	1,715	1,652	1,796	29	27	32	99.32	2.17	98.30	1.77
12/29/19	0.057	0.058	7.632	6.729	8.623	0.051	0.044	0.059	1,664	1,618	1,739	29	27	31	99.34	2.18	98.28	1.77
12/30/19	0.058	0.058	7.690	6.796	8.678	0.048	0.043	0.059	1,655	1,591	1,752	29	27	31	99.38	2.21	98.27	1.76
12/31/19	0.058	0.058	7.877	7.104	11.901	0.050	0.046	0.055	1,698	1,636	1,788	29	27	32	99.37	2.20	98.29	1.77

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
12/01/19	97.79	93.934	24,293.8	0.26	3.0	6
12/02/19	97.78	97.663	24,523.6	0.26	3.0	6
12/03/19	97.76	99.780	25,520.9	0.26	3.0	6
12/04/19	98.01	83.047	25,880.3	0.26	3.0	6
12/05/19	98.17	99.535	23,123.2	0.26	3.0	6
12/06/19	97.66	96.141	26,029.8	0.26	3.0	6
12/07/19	97.31	96.586	25,293.6	0.26	3.0	6
12/08/19	97.45	96.725	25,088.9	0.26	3.0	6
12/09/19	97.40	94.968	25,360.7	0.26	3.0	6
12/10/19	97.44	99.470	25,375.5	0.26	3.0	6
12/11/19	97.21	97.494	26,272.2	0.26	3.0	6
12/12/19	97.31	98.599	25,573.7	0.26	3.0	6
12/13/19	97.31	97.920	25,814.7	0.26	3.0	6
12/14/19	97.47	96.138	25,617.7	0.26	3.0	6
12/15/19	97.45	96.098	25,234.5	0.26	3.0	6
12/16/19	97.45	99.896	25,124.3	0.26	3.0	6
12/17/19	97.38	99.827	26,246.6	0.26	3.0	6
12/18/19	97.33	98.940	26,312.7	0.26	3.0	6
12/19/19	97.34	61.284	24,346.4	0.26	3.0	6
12/20/19	97.39	19.345	13,943.7	0.27	3.0	6
12/21/19	97.03	28.324	6,435.8	0.33	3.0	6
12/22/19	96.96	95.905	13,204.4	0.30	3.0	6
12/23/19	96.68	99.947	24,961.1	0.26	3.0	6
12/24/19	97.11	99.906	26,060.1	0.26	3.0	6
12/25/19	97.15	92.884	26,140.3	0.26	3.0	6
12/26/19	96.89	98.662	24,840.3	0.27	3.0	6
12/27/19	97.22	99.915	26,152.0	0.26	3.0	6
12/28/19	97.19	99.935	26,457.5	0.26	3.0	6
12/29/19	97.22	99.913	26,391.6	0.26	3.0	6
12/30/19	97.12	99.938	26,351.6	0.26	3.0	6
12/31/19	97.26	95.043	26,347.7	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

Appendix G

Groundwater Quality Data at the Talbert Barrier

Orange County Water District
Groundwater Replenishment System
2019 Annual Report

GWRS 2019 Quarterly Sampling Dates

OCWD Water Quality Department

TALBERT BARRIER - GROUNDWATER

Monitoring Well	Qtr 1	Qtr 2	Qtr 3	Qtr 4
OCWD-M10/1-4	01/21/2019	04/15/2019	07/22/2019	10/21/2019
OCWD-M11/1-4	02/07/2019	04/17/2019	07/24/2019	11/05/2019
OCWD-M19/3	01/09/2019	04/03/2019	07/11/2019	10/10/2019
OCWD-M45/1-5	01/07/2019	05/07/2019	07/09/2019	10/08/2019
OCWD-M46/2-5	01/23/2019	04/02/2019	08/06/2019	10/07/2019
OCWD-M46A/1	01/23/2019	04/02/2019	08/06/2019	10/07/2019
OCWD-M47/1-5	01/22/2019	04/16/2019	07/23/2019	10/22/2019

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 2019 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**	**Reduced[3,4,5,6]**	**Q - Year**	**Comprehensive**	**Reduced[3,4,5,6]**
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]Reduced: Annual cyanide, selected SOC's and radionuclide

[6]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 2019 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	1.6 - 14.8	1.4 - 9.9	ND - 7.3	1.7 - 12.6
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 2.7	ND - 2.7	ND - 3.4	ND - 3.1
Barium (Ba), ug/L	OCWD	1000	7 - 62.4	6.8 - 111	7.9 - 141	9.4 - 138
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 - 0.75	0.31 - 0.71	0.29 - 0.66	0.27 - 0.65
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 - 1.5	ND - 2.3	ND - 1.9
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 1.47	ND - 1.07	ND - 1.29	ND - 1.05
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.004 - 0.014	Not Required	Not Required	Not Required
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND - 1.6	ND - 2	ND - 1.7
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 - 0.1	ND	ND	ND
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	149 - 614	156 - 918	170 - 1130	175 - 1090
Iron (Fe), ug/L	OCWD	300	ND - 45.9	ND - 24	ND - 33.2	ND - 9.2
Manganese (Mn), ug/L	OCWD	50	1.8 - 41.2	1.9 - 36.1	2.9 - 36.2	15401
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	2 - 39.8	2.3 - 37	2.7 - 38.9	2.8 - 38.9
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND - 1	ND - 1	ND - 32	ND - 2
Total Dissolved Solids (TDS), mg/L	OCWD	500	82 - 354	88 - 580	130 - 732	96 - 694
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.2	ND - 0.3	ND - 0.2	ND - 0.2
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	1.7 - 2.9	ND	ND - 1	1.2 - 2.5
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.17 - 0.25	0.16 - 0.26	0.14 - 0.25	0.12 - 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 - 4.7	ND - 3.9	ND - 4	ND - 3.9
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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 < MCL	ND < NL	ND < NL	ND < NL
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND	ND	ND	ND
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND

OCWD-M10/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/21/2019	11:50	1,4-Dioxane (14DIOX)	1.7	ug/L	1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/21/2019	11:50	Carbamazepine (CBMAZP)	1.2	ng/L	1

Year 2019, Quarter 2

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/15/2019	9:55	1,4-Dioxane (14DIOX)	1.5	ug/L	1

Year 2019, Quarter 3

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/22/2019	9:15	1,4-Dioxane (14DIOX)	1.4	ug/L	1

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/21/2019	11:50	1,4-Dioxane (14DIOX)	1.5	ug/L	1

OCWD-M10/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: ***551.1***

Sample Date & Time		*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
1/21/2019	10:30	Chloroform (CHCl3)	0.1	ug/L	0.1
1/21/2019	10:30	Total Trihalomethanes (TTHMs)	0.1	ug/L	0.1

OCWD-M10/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/21/2019 11:10	1,4-Dioxane (14DIOX)	6.8	ug/L	1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/21/2019 11:10	Primidone (PRIMDN)	1.6	ng/L	1

Year 2019, Quarter 2

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
4/15/2019 10:25	1,4-Dioxane (14DIOX)	6.4	ug/L	1

Year 2019, Quarter 3

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/22/2019 10:05	1,4-Dioxane (14DIOX)	6.4	ug/L	1

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/21/2019 10:25	1,4-Dioxane (14DIOX)	6.7	ug/L	1

OCWD-M10/4
Organic Detections by Method

Year 2019, Quarter 1

METHOD: CEC

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/21/2019	9:45	Carbamazepine (CBMAZP)	1.4	ng/L	1
1/21/2019	9:45	Gemfibrozil (GMFIBZ)	1.7	ng/L	1
1/21/2019	9:45	N,N-diethyl-m-toluamide (DEET)	3.0	ng/L	1

Year 2019, Quarter 3

METHOD: 14DIOX

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/22/2019	9:30	1,4-Dioxane (14DIOX)	1.0	ug/L	1

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/21/2019	9:40	1,4-Dioxane (14DIOX)	1.5	ug/L	1

Summary of All 2019 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	ND - 5.6	1.9 - 5.4	ND - 4.5	ND - 2.5
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 2.6	ND - 2.4	ND - 2.4	ND - 2.5
Barium (Ba), ug/L	OCWD	1000	13.1 - 102	15.1 - 116	14 - 110	11.2 - 94.6
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 - 1	ND - 1.4
Fluoride (F), mg/L	OCWD	2	0.35 - 0.75	0.35 - 0.8	0.35 - 0.7	0.34 - 0.66
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.91	ND - 0.96	ND - 0.95	ND - 0.83
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND - 1	ND - 1.2	ND - 1.3	ND - 1.1
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	1.2 - 2.25	1.2 - 2.19	1.29 - 2.05	1.24 - 1.99
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.006	Not Required	Not Required	Not Required
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 2.5	ND - 2.7	ND - 2.9	ND - 3.7
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	ND - 0.7	ND - 0.7	ND - 0.7
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	162 - 709	167 - 778	170 - 787	170 - 755
Iron (Fe), ug/L	OCWD	300	ND - 5.9	ND	ND	ND
Manganese (Mn), ug/L	OCWD	50	ND - 1.4	ND	ND - 1.1	ND
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND	ND	ND - 1.2	ND - 1.1
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	90 - 426	144 - 520	98 - 500	108 - 466
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.4	ND	ND	ND
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	0.16 - 0.25	0.16 - 0.27	0.16 - 0.26	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	2.1 - 3.7	1.6 - 3.4	1.8 - 3.5	1.7 - 3.5
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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 < MCL	ND < NL	ND < NL	ND < NL
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
537	PFAS Compounds		ND	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	Not Reported	ND	ND	ND

OCWD-M11/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2019	9:55	1,4-Dioxane (14DIOX)	1.0	ug/L	1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2019	9:55	Chloroform (CHCl3)	0.8	ug/L	0.5
2/7/2019	9:55	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2019	9:55	Bromodichloromethane (CHBrCl)	0.2	ug/L	0.1
2/7/2019	9:55	Chloroform (CHCl3)	0.7	ug/L	0.1
2/7/2019	9:55	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/17/2019	10:25	Chloroform (CHCl3)	0.7	ug/L	0.5
4/17/2019	10:25	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2019, Quarter 3

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/24/2019	9:30	1,4-Dioxane (14DIOX)	1.5	ug/L	1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/24/2019	9:30	Chloroform (CHCl3)	0.7	ug/L	0.5
7/24/2019	9:30	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

OCWD-M11/1
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2019	12:25	1,4-Dioxane (14DIOX)	1.6	ug/L	1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2019	12:25	Chloroform (CHCl3)	0.7	ug/L	0.5
11/5/2019	12:25	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

OCWD-M11/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/7/2019 11:40	Chloroform (CHCl3)	TR	ug/L	0.5
2/7/2019 11:40	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/7/2019 11:40	Chloroform (CHCl3)	0.3	ug/L	0.1
2/7/2019 11:40	Total Trihalomethanes (TTHMs)	0.3	ug/L	0.1

Year 2019, Quarter 2

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
4/17/2019 9:50	1,4-Dioxane (14DIOX)	1.0	ug/L	1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
4/17/2019 9:50	Chloroform (CHCl3)	TR	ug/L	0.5
4/17/2019 9:50	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2019, Quarter 3

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/24/2019 10:50	1,4-Dioxane (14DIOX)	1.2	ug/L	1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/24/2019 10:50	Chloroform (CHCl3)	TR	ug/L	0.5
7/24/2019 10:50	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

OCWD-M11/2
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2019	11:55	1,4-Dioxane (14DIOX)	1.4	ug/L	1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/5/2019	11:55	Chloroform (CHCl3)	TR	ug/L	0.5
11/5/2019	11:55	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

OCWD-M11/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/7/2019 11:00	Methylene Chloride (CH2Cl2)	0.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/7/2019 11:00	Chloroform (CHCl3)	0.1	ug/L	0.1
2/7/2019 11:00	Total Trihalomethanes (TTHMs)	0.1	ug/L	0.1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/7/2019 11:00	Sulfamethoxazole (SULTHZ)	1.5	ng/L	1

OCWD-M11/4
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2019	10:30	1,4-Dioxane (14DIOX)	1.2	ug/L	1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2019	10:30	Chloroform (CHCl3)	1.0	ug/L	0.5
2/7/2019	10:30	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2019	10:30	Bromodichloromethane (CHBrCl)	0.2	ug/L	0.1
2/7/2019	10:30	Chloroform (CHCl3)	0.8	ug/L	0.1
2/7/2019	10:30	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/7/2019	10:30	Sulfamethoxazole (SULTHZ)	1.9	ng/L	1

Year 2019, Quarter 2

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/17/2019	9:55	1,4-Dioxane (14DIOX)	1.3	ug/L	1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/17/2019	9:55	Chloroform (CHCl3)	0.5	ug/L	0.5
4/17/2019	9:55	Total Trihalomethanes (TTHMs)	0.5	ug/L	0.5

OCWD-M11/4
Organic Detections by Method

Year 2019, Quarter 3

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/24/2019 10:15	1,4-Dioxane (14DIOX)	1.3	ug/L	1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/24/2019 10:15	Chloroform (CHCl3)	0.7	ug/L	0.5
7/24/2019 10:15	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/5/2019 11:15	1,4-Dioxane (14DIOX)	1.3	ug/L	1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/5/2019 11:15	Chloroform (CHCl3)	0.6	ug/L	0.5
11/5/2019 11:15	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

Summary of All 2019 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	4.2	6.3	3.3	7.3
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND	1.3	1.5	1.8
Barium (Ba), ug/L	OCWD	1000	22.4	14.6	15	10.8
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	1.1	ND	1.5
Fluoride (F), mg/L	OCWD	2	ND	ND	ND	0.11
Hexavalent Chromium (CrVI), ug/L	OCWD	10	0.25	0.25	0.34	0.31
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	1.58	1.38	1.33	1.35
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND	Not Required	Not Required	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	1.4 - 1.8	1.6	1.6	2.6
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	173	127	133	107
Iron (Fe), ug/L	OCWD	300	6.4	ND	ND	ND
Manganese (Mn), ug/L	OCWD	50	1.3	1.7	1.5	1.9
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	89	64	76	76
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.1	0.2	0.1	0.1
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND	1.8	ND	ND
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.25	0.24	0.25	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	2.7	2.9	3.3	4.1
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND < NL

OCWD-M19/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/9/2019	9:55	Chloroform (CHCl3)	1.8	ug/L	0.5
1/9/2019	9:55	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

METHOD: 551.1

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/9/2019	9:55	Chloroform (CHCl3)	1.4	ug/L	0.1
1/9/2019	9:55	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.1

METHOD: CEC

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/9/2019	9:55	Sulfamethoxazole (SULTHZ)	1.3	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
4/3/2019	9:55	Chloroform (CHCl3)	1.6	ug/L	0.5
4/3/2019	9:55	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/11/2019	9:55	Chloroform (CHCl3)	1.6	ug/L	0.5
7/11/2019	9:55	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

OCWD-M19/3
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/10/2019 10:05	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
10/10/2019 10:05	Chloroform (CHCl3)	2.6	ug/L	0.5
10/10/2019 10:05	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
10/10/2019 10:05	Total Trihalomethanes (TTHMs)	2.6	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/10/2019 10:05	n-Nitrosodimethylamine (NDMA)	2.5	ng/L	2

Summary of All 2019 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 - 10.3	ND - 64.6	ND - 14.9	1.3 - 11.6
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 2.3	ND - 3.4	ND - 3.6	ND - 3.6
Barium (Ba), ug/L	OCWD	1000	6.4 - 60.9	11.8 - 59.6	10.2 - 58.8	10.7 - 60.2
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	0.31 - 0.9	0.32 - 0.86	0.31 - 0.84	0.33 - 0.9
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 - 1.6	ND - 1.9	ND - 2.2	ND - 2
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 1.9	ND - 2.21	ND - 2.34	ND - 2.4
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.117	Not Required	Not Required	Not Required
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 2.1	ND - 2.6	ND - 2.5	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	ND - 0.3	ND - 0.9	ND - 0.7	ND - 0.9
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND - 160	ND - 120	ND - 140	ND - 110
Electrical Conductivity (EC), um/cm	OCWD	900	193 - 1090	172 - 1110	175 - 1110	177 - 1120
Iron (Fe), ug/L	OCWD	300	ND - 60.8	ND - 390	ND - 206	ND - 178
Manganese (Mn), ug/L	OCWD	50	ND - 11.4	ND - 30.3	1.3 - 23.7	1.1 - 19.4
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	1.5 - 11.3	1.2 - 29.1	1.3 - 23.3	ND - 19.8
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND - 2	ND - 32	ND - 1	ND - 2
Total Dissolved Solids (TDS), mg/L	OCWD	500	125 - 680	102 - 716	120 - 750	114 - 758
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.2	0.1 - 0.7	ND - 0.5	ND - 0.5
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND - 1.7	ND - 3	ND - 2.1	ND - 3
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.1 - 0.32	0.11 - 0.31	0.11 - 0.31	0.11 - 0.3
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 - 3.4	ND - 6.3	ND - 4.7	ND - 5
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND - 0.2	ND - 0.2
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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 < MCL	ND < NL	ND < NL	ND < NL
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	Not Required	Not Required	Not Required
537RV1.1	PFAS Compounds	OCWD	Not Required	Not Required	Not Required	ND - Detections
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND

OCWD-M45/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/24/2019	10:35	Tetrachloroethene (PCE)	TR	ug/L	0.5
1/24/2019	10:35	Trichloroethene (TCE)	TR	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/24/2019	10:35	Tetrachloroethene (PCE)	0.2	ug/L	0.1
1/24/2019	10:35	Trichloroethene (TCE)	0.4	ug/L	0.1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/7/2019	9:05	Tetrachloroethene (PCE)	TR	ug/L	0.5
5/7/2019	9:05	Trichloroethene (TCE)	TR	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
7/9/2019	10:10	Methyl tert-butyl ether (MTBE)	0.2	ug/L	0.2
7/9/2019	10:10	Tetrachloroethene (PCE)	TR	ug/L	0.5
7/9/2019	10:10	Trichloroethene (TCE)	TR	ug/L	0.5

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/8/2019	9:50	Methyl tert-butyl ether (MTBE)	0.2	ug/L	0.2
10/8/2019	9:50	Tetrachloroethene (PCE)	TR	ug/L	0.5
10/8/2019	9:50	Trichloroethene (TCE)	TR	ug/L	0.5

OCWD-M45/1
Organic Detections by Method

Year 2019, Quarter 4

METHOD: ***537RV1.1***

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
10/8/2019	9:50	Perfluoro hexane sulfonic acid (PFHxS)	6.0	ng/L	4

OCWD-M45/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/7/2019 10:55	Chloroform (CHCl3)	TR	ug/L	0.5
1/7/2019 10:55	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/7/2019 10:55	Chloroform (CHCl3)	0.3	ug/L	0.1
1/7/2019 10:55	Total Trihalomethanes (TTHMs)	0.3	ug/L	0.1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/7/2019 10:55	Sulfamethoxazole (SULTHZ)	1.0	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
5/7/2019 10:25	Chloroform (CHCl3)	0.5	ug/L	0.5
5/7/2019 10:25	Total Trihalomethanes (TTHMs)	0.5	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/9/2019 11:20	Chloroform (CHCl3)	0.7	ug/L	0.5
7/9/2019 11:20	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

OCWD-M45/2
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/8/2019	11:05	Chloroform (CHCl3)	0.9	ug/L	0.5
10/8/2019	11:05	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

OCWD-M45/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/7/2019 11:40	1,4-Dioxane (14DIOX)	5.5	ug/L	1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/7/2019 11:40	Gemfibrozil (GMFIBZ)	7.3	ng/L	1
1/7/2019 11:40	N,N-diethyl-m-toluamide (DEET)	1.7	ng/L	1
1/7/2019 11:40	Primidone (PRIMDN)	1.9	ng/L	1

Year 2019, Quarter 2

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
5/7/2019 10:45	1,4-Dioxane (14DIOX)	3.5	ug/L	1

Year 2019, Quarter 3

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/9/2019 13:15	1,4-Dioxane (14DIOX)	7.2	ug/L	1

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
10/8/2019 11:15	1,4-Dioxane (14DIOX)	3.8	ug/L	1

OCWD-M45/4
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/7/2019	10:40	1,4-Dioxane (14DIOX)	1.9	ug/L	1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/7/2019	10:40	Gemfibrozil (GMFIBZ)	1.5	ng/L	1

OCWD-M45/5
Organic Detections by Method

Year 2019, Quarter 2

METHOD: ***524.2***

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
5/7/2019	9:50	Chloroform (CHCl3)	0.9	ug/L	0.5
5/7/2019	9:50	Methylene Chloride (CH2Cl2)	1.5	ug/L	0.5
5/7/2019	9:50	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

Year 2019, Quarter 3

METHOD: ***524.2***

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
7/9/2019	10:30	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
7/9/2019	10:40	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

Summary of All 2019 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	6.3 - 18.1	44155	8.4 - 18	5.7 - 16.8
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 4.5	ND - 4.2	ND - 4.5	ND - 4.7
Barium (Ba), ug/L	OCWD	1000	4.2 - 19.4	4.1 - 18.3	4.8 - 18.6	4.7 - 15.6
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	ND - 0.76	0.12 - 0.79	ND - 0.74	ND - 0.73
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.34	ND - 0.3	ND - 0.28	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 - 1.39	ND - 1.3	ND - 1.19	ND - 1.25
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.004	Not Required	Not Required	ND - 0.003
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 1.5	ND - 1.5	ND - 1.3	ND - 1.6
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 - 1.7	ND - 2.8	ND - 1.5	ND - 1.9
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND - 50	ND - 50	ND - 50	ND - 50
Electrical Conductivity (EC), um/cm	OCWD	900	118 - 368	114 - 374	122 - 379	125 - 376
Iron (Fe), ug/L	OCWD	300	ND - 22.9	11 - 23.7	5.2 - 24	ND - 22
Manganese (Mn), ug/L	OCWD	50	ND - 5.3	ND - 5.1	ND - 5.5	ND - 5.5
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 5.3	ND - 5.1	ND - 5.5	ND - 5.5
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND - 4	ND - 130	ND - 2	ND - 4
Total Dissolved Solids (TDS), mg/L	OCWD	500	64 - 216	73.5 - 200	78 - 240	82 - 234
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.1 - 0.2	0.5 - 0.7	0.1 - 0.6	ND - 0.2
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND - 2	ND - 2.4	1.2 - 2.6	ND - 2.5
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.11 - 0.25	0.12 - 0.25	0.11 - 0.26	0.12 - 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 - 10.4	ND - 9.9	ND - 9.6	1.4 - 9.7
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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 < MCL	ND < NL	ND < NL	ND < NL
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
537	PFAS Compounds	OCWD	ND	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < NL

OCWD-M46A/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2019	9:55	Chloroform (CHCl3)	1.7	ug/L	0.5
1/23/2019	9:55	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2019	9:55	Chloroform (CHCl3)	1.4	ug/L	0.2
1/23/2019	9:55	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2019	9:55	n-Nitrosodimethylamine (NDMA)	3.5	ng/L	2

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/2/2019	9:00	Chloroform (CHCl3)	2.8	ug/L	0.5
4/2/2019	9:00	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/2/2019	9:00	n-Nitrosodimethylamine (NDMA)	3.3	ng/L	2

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/6/2019	10:45	Chloroform (CHCl3)	1.3	ug/L	0.5
8/6/2019	10:45	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

OCWD-M46A/1
Organic Detections by Method

Year 2019, Quarter 3

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/6/2019	10:45	n-Nitrosodimethylamine (NDMA)	3.1	ng/L	2

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/7/2019	9:55	Chloroform (CHCl3)	1.8	ug/L	0.5
10/7/2019	9:55	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/7/2019	9:55	n-Nitrosodimethylamine (NDMA)	2.2	ng/L	2

OCWD-M46/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2019	12:15	Chloroform (CHCl3)	1.3	ug/L	0.5
1/23/2019	12:15	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2019	12:15	Bromodichloromethane (CHBrCl)	0.2	ug/L	0.1
1/23/2019	12:15	Chloroform (CHCl3)	1.3	ug/L	0.1
1/23/2019	12:15	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/2/2019	10:50	Chloroform (CHCl3)	1.4	ug/L	0.5
4/2/2019	10:50	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/6/2019	9:10	Chloroform (CHCl3)	1.5	ug/L	0.5
8/6/2019	9:10	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.5

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/7/2019	10:40	Chloroform (CHCl3)	1.9	ug/L	0.5
10/7/2019	10:40	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
10/7/2019	10:40	Total Trihalomethanes (TTHMs)	1.9	ug/L	0.5

OCWD-M46/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2019	12:00	Chloroform (CHCl3)	0.2	ug/L	0.1
1/23/2019	12:00	Total Trihalomethanes (TTHMs)	0.2	ug/L	0.1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/2/2019	10:35	Chloroform (CHCl3)	TR	ug/L	0.5
4/2/2019	10:35	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/7/2019	11:40	Chloroform (CHCl3)	TR	ug/L	0.5
10/7/2019	11:40	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

OCWD-M46/5
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
1/23/2019	10:50	1,4-Dioxane (14DIOX)	1.0	ug/L	1

Year 2019, Quarter 2

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
4/2/2019	9:40	1,4-Dioxane (14DIOX)	1.9	ug/L	1

Year 2019, Quarter 3

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/6/2019	9:40	1,4-Dioxane (14DIOX)	2.5	ug/L	1

Year 2019, Quarter 4

METHOD: 14DIOX

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
10/7/2019	10:25	1,4-Dioxane (14DIOX)	2.6	ug/L	1

Summary of All 2019 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	2.4 - 20.4	3.4 - 45.9	2.3 - 17.4	2.9 - 39.9
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 8.8	ND - 8.6	ND - 7.9	ND - 7.7
Barium (Ba), ug/L	OCWD	1000	4.1 - 35.9	3.6 - 34.5	4 - 33.7	4.6 - 35.5
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	0.3 - 0.9	0.31 - 0.9	0.31 - 0.89	0.3 - 0.86
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.26	ND - 0.29	ND - 0.27	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 - 1.53	ND - 1.52	ND - 1.36	ND - 1.13
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.008	Not Required	Not Required	Not Required
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 - 1.7	ND - 1.9	ND - 1.5	ND - 1.4
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND - 80	ND - 100	ND - 100	ND - 90
Electrical Conductivity (EC), um/cm	OCWD	900	193 - 355	190 - 358	191 - 360	188 - 358
Iron (Fe), ug/L	OCWD	300	7.1 - 61.2	7.4 - 71.4	7 - 52.5	6.3 - 65.3
Manganese (Mn), ug/L	OCWD	50	ND - 23.4	ND - 20.3	ND - 18.7	1.5 - 18.6
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 21.5	ND - 19.2	ND - 19.3	ND - 17.5
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND - 2	ND	ND - 2	ND - 8
Total Dissolved Solids (TDS), mg/L	OCWD	500	100 - 202	102 - 200	104 - 228	138 - 238
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND - 0.6	ND - 1	ND - 0.5	ND - 0.7
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	1.4 - 3	ND - 1.9	ND	ND - 2.2
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	ND - 0.24	ND - 0.23	ND - 0.24	ND - 0.23
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 - 4.1	ND - 2.8	ND - 3.7	ND - 3.9
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	ND	ND	ND

OCWD-M47/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: CEC

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
1/22/2019	9:45	Carbamazepine (CBMAZP)	1.4	ng/L	1

OCWD-M47/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/22/2019 10:40	Chloroform (CHCl3)	1.7	ug/L	0.5
1/22/2019 10:40	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/22/2019 10:40	Bromodichloromethane (CHBrCl)	0.2	ug/L	0.1
1/22/2019 10:40	Chloroform (CHCl3)	1.3	ug/L	0.1
1/22/2019 10:40	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
1/22/2019 10:40	Sulfamethoxazole (SULTHZ)	1.1	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
4/16/2019 10:15	Chloroform (CHCl3)	1.9	ug/L	0.5
4/16/2019 10:15	Total Trihalomethanes (TTHMs)	1.9	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
7/23/2019 10:55	Chloroform (CHCl3)	1.5	ug/L	0.5
7/23/2019 10:55	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.5

OCWD-M47/2
Organic Detections by Method

Year 2019, Quarter 4

METHOD: ***524.2***

Sample Date & Time	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
10/22/2019 10:15	Chloroform (CHCl3)	1.4	ug/L	0.5
10/22/2019 10:15	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.5

Appendix H

Talbert Barrier Monitoring Well
Groundwater Quality Data
1,4-Dioxane, NDMA and Selected Constituents

Orange County Water District
Groundwater Replenishment System
2019 Annual Report

TABLE H-1
MONITORING WELL OCWD-M10
1,4-dioxane and NDMA Concentrations, 2015- 2019

M10/1 *Talbert, Alpha-III Aquifers* *Perforations: 80-160 ft bgs*			**M10/2** *Beta-I,II Aquifers* *Perforations: 175-195 ft bgs*			**M10/3** *Beta-III Aquifer* *Perforations: 215-240 ft bgs*			**M10/4** *Lambda, Omicron, Upper Rho Aquifers* *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)
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
1/21/2019	1.7	<2	1/21/2019	<1	<2	1/21/2019	6.8	<2	1/21/2019	<1	<2
4/15/2019	1.5	<2	4/15/2019	<1	<2	4/15/2019	6.4	<2	4/15/2019	<1	<2
7/22/2019	1.4	<2	7/22/2019	<1	<2	7/22/2019	6.4	<2	7/22/2019	1	<2
10/21/2019	1.5	<2	10/21/2019	<1	<2	10/21/2019	6.7	<2	10/21/2019	1.5	<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, 2015-2019

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)
1/28/2015	<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
2/7/2019	1	na	2/7/2019	<1	na	2/7/2019	<1	na	2/7/2019	1.2	na
4/17/2019	<1	<2	4/17/2019	1	<2	4/17/2019	<1	<2	4/17/2019	1.3	<2
7/24/2019	1.5	<2	7/24/2019	1.2	<2	7/24/2019	<1	<2	7/24/2019	1.3	<2
11/5/2019	1.6	<2	11/5/2019	1.4	<2	11/5/2019	<1	<2	11/5/2019	1.3	<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, 2015 - 2019

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)
04/08/15	<1	<2	04/08/15	<1	<2	01/13/15	1.5	<2
10/07/15	<1	na	10/07/15	<1	na	04/08/15	<1	<2
04/06/16	<1	na	04/06/16	<1	na	07/29/15	<1	<2
10/05/16	<1	na	10/05/16	<1	na	10/07/15	<1	<2
02/23/17	<1	na	02/23/17	<1	na	01/12/16	<1	<2
10/04/17	<1	na	10/04/17	<1	na	04/06/16	<1	<2
04/11/18	<1	na	04/11/18	<1	na	07/12/16	<1	2.7
10/10/18	<1	na	10/10/18	<1	na	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
						01/09/19	<1	<2
						04/03/19	<1	<2
						07/11/19	<1	<2
						10/10/19	<1	2.5

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, 2015 - 2019

M45/1
Alpha-III, Beta-I,II Perforations 195-205 ft bgs

Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/12/15	<1	<2
04/06/15	<1	<2
07/01/15	<1	<2
10/05/15	<1	<2
01/11/16	<1	<2
04/05/16	<1	<2
07/11/16	<1	<2
10/04/16	<1	<2
1/10/17	<1	<2
4/4/17	<1	<2
7/11/17	<1	<2
10/3/17	<1	<2
1/10/18	<1	<2
4/10/18	<1	<2
7/10/18	<1	<2
10/9/18	<1	<2
1/24/19	<1	<2
5/7/19	<1	<2
7/9/19	<1	<2
10/8/19	<1	<2

M45/2
Beta-III Aquifer Perforations 250-260 ft bgs

Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/12/15	1.1	<2
04/06/15	<1	<2
07/01/15	<1	<2
10/05/15	<1	<2
01/11/16	<1	<2
04/05/16	<1	<2
07/11/16	<1	<2
10/04/16	<1	<2
01/10/17	<1	<2
04/04/17	<1	<2
07/11/17	<1	<2
10/03/17	<1	<2
01/10/18	<1	<2
04/10/18	<1	<2
07/10/18	<1	<2
10/09/18	<1	<2
01/07/19	<1	<2
05/07/19	<1	<2
07/09/19	<1	<2
10/08/19	<1	<2

M45/3
Omicron Aquifer Perforations 335-345 ft bgs

Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/12/15	13.5	<2
04/06/15	15.2	<2
07/01/15	14.5	<2
10/05/15	12.6	<2
01/11/16	10.9	<2
04/05/16	14.9	<2
04/13/16	9.8	na
07/11/16	14.5	<2
10/04/16	11.5	<2
01/10/17	10.3	<2
04/04/17	9.1	<2
07/11/17	7.7	<2
10/03/17	5.5	<2
01/10/18	6.7	<2
04/10/18	4.9	<2
07/10/18	3.7	<2
10/09/18	5.1	<2
01/07/19	5.5	<2
05/07/19	3.5	<2
07/09/19	7.2	<2
10/08/19	3.8	<2

M45/4
Upper Rho Aquifer Perforations 380-390 ft bgs

Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/12/15	4.1	<2
04/06/15	5.2	<2
07/01/15	1.5	<2
10/05/15	4.4	<2
10/19/15	2.8	<2
01/12/16	1.7	<2
04/05/16	<1	<2
04/13/16	1.6	na
07/11/16	3	<2
10/04/16	3	<2
01/10/17	<1	<2
04/04/17	<1	<2
07/11/17	1.3	<2
07/19/17	1.1	na
10/03/17	<1	<2
01/10/18	2.4	<2
04/10/18	1.8	<2
07/10/18	1.6	<2
10/09/18	1.2	<2
01/07/19	1.9	<2
05/07/19	<1	<2
07/09/19	<1	<2
10/08/19	<1	<2

M45/5
Main Aquifer Perforations 780-790 ft bgs

Date	1,4-dioxane (ug/L)	NDMA (ng/L)
01/12/15	<1	<2
04/06/15	<1	<2
07/01/15	<1	<2
10/05/15	<1	<2
01/11/16	<1	<2
04/05/16	<1	<2
07/11/16	<1	<2
10/04/16	<1	<2
01/10/17	<1	<2
04/04/17	<1	<2
07/11/17	<1	<2
10/03/17	<1	<2
01/10/18	<1	<2
04/10/18	<1	<2
07/10/18	<1	<2
10/09/18	<1	<2
01/07/19	<1	<2
05/07/19	<1	<2
07/09/19	<1	<2
10/08/19	<1	<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, 2015 - 2019

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)
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
01/23/19	<1	3.5	05/07/18	<1	<2	01/23/19	<1	<2	01/23/19	<1	<2	01/23/19	1	<2
04/02/19	<1	3.3	08/07/18	<1	<2	04/02/19	<1	<2	04/02/19	<1	<2	04/02/19	1.9	<2
08/06/19	<1	3.1	10/08/18	<1	<2	08/06/19	<1	<2	08/06/19	<1	<2	08/06/19	2.5	<2
10/07/19	<1	2.2	01/23/19	<1	<2	10/07/19	<1	<2	10/07/19	<1	<2	10/07/19	2.6	<2
			04/02/19	<1	<2									
			08/06/19	<1	<2									
			10/07/19	<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
2015 - 2019

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)
01/27/15	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
01/22/19	<1	<2	01/22/19	<1	<2	01/22/19	<1	<2
04/16/19	<1	<2	04/16/19	<1	<2	04/16/19	<1	<2
07/23/19	<1	<2	07/23/19	<1	<2	07/23/19	<1	<2
10/22/19	<1	<2	10/22/19	<1	<2	10/22/19	<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)
01/27/15	<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
01/22/19	<1	<2	01/22/19	<1	<2
04/16/19	<1	<2	04/16/19	<1	<2
07/23/19	<1	<2	07/23/19	<1	<2
10/22/19	<1	<2	10/22/19	<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
2015 - 2019

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-III Perforations 80-160 ft bgs	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
	01/21/19	0.167	45.0	354	213	<0.2	0.004	1.14	0.14
	04/15/19	0.210	53.6	414	268	na	na	1.00	0.29
	07/22/19	0.246	61.3	474	288	na	na	1.17	0.39
	10/21/19	0.237	59.4	464	255	na	na	0.89	0.29
M10/2 Beta-I,II Perforations 175-195 ft bgs	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
	01/21/19	0.108	30.3	238	149	<0.2	0.005	1.47	0.11
	04/15/19	0.320	79.9	580	380	na	na	1.07	0.36
	07/22/19	0.420	99.7	732	490	na	na	1.29	0.53
	10/21/19	0.407	97.5	694	418	na	na	1.05	0.45
M10/3 Beta-III Perforations 215-240 ft bgs	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
	01/21/19	0.166	53.4	342	174	<0.2	0.014	0.15	0.20
	04/15/19	0.160	54.6	358	189	na	na	0.16	0.33
	07/22/19	0.140	47.5	326	147	na	na	<0.1	0.34
	10/21/19	0.144	46.2	274	145	na	na	<0.1	0.29

TABLE H-7
MONITORING WELL OCWD-M10
General Water Quality Data
2015 - 2019

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, Upper Rho Perforations 280-305 ft bgs	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
	01/21/19	0.020	8.1	82	31.3	0.3	0.007	<0.1	0.16
	04/15/19	0.020	8.5	88	34.0	na	na	<0.1	0.19
	07/22/19	0.026	10.7	130	36.5	na	na	<0.1	0.21
	10/21/19	0.029	9.9	96	33.7	na	na	<0.1	0.17

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
2015 - 2019

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)
M11/1 Talbert Perforations 60-110 ft bgs	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
	10/21/15	0.025	11.8	170	82.9	<0.2	<0.007	7.3	0.13
	01/27/16	0.023	11.4	172	80.9	<0.2	<0.002	1.6	0.2
	04/20/16	0.029	12.5	146	80.4	<0.2	<0.002	1.7	0.15
	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	69.4	<0.2	<0.002	1.3	0.11
	01/25/17	0.020	134	134	68.6	<0.2	<0.002	1.3	0.1
	04/19/17	0.021	130	130	72.8	<0.2	<0.002	1.3	0.12
	07/26/17	0.022	154	154	66.8	<0.2	<0.002	1.3	0.11
	10/18/17	0.021	156	156	88.8	<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	98.5	na	na	1.04	0.11
	10/24/18	0.082	23.8	166	130	<0.2	0.002	1.19	0.14
	02/07/19	0.091	28.3	226	136	<0.2	0.004	1.2	0.14
	04/17/19	0.096	29.5	232	153	na	na	1.2	0.22
	07/24/19	0.130	40.0	290	185	na	na	1.29	0.19
	11/05/19	0.132	42.4	304	169	na	na	1.24	0.20
M11/2 Talbert, Alpha-III Perforations 125-155 ft bgs	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
	07/28/15	0.026	11.7	122	61.4	<0.2	<0.007	11.4	0.11
	10/21/15	0.017	10.9	122	49.9	<0.2	<0.007	11.6	0.06
	01/27/16	0.036	13.6	128	60.1	<0.2	0.003	2.64	0.1
	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
	02/07/19	0.222	56.3	426	271	<0.2	0.005	1.70	0.27
	04/17/19	0.250	62.7	520	308	na	na	1.37	0.35
	07/24/19	0.252	64.6	500	323	na	na	1.66	0.32
	11/05/19	0.226	61.1	466	315	na	na	1.63	0.46
M11/3 Beta-I, -II, -III Perforations 170-225 ft bgs	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
	10/21/15	0.013	9.5	88	27.8	<0.2	<0.007	13.2	0.07
	01/27/16	0.022	10.3	94	28	<0.2	<0.002	2.97	0.16
	04/20/16	0.018	10.6	89	29.6	<0.2	<0.002	3.07	0.09
	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
	02/07/19	0.028	10.3	90	33.9	<0.2	<0.002	2.25	0.07
	04/17/19	0.028	10.7	144	39.8	na	na	2.19	0.14
	07/24/19	0.030	10.7	98	40.8	na	na	2.05	0.10
	11/05/19	0.029	10.0	108	39.3	na	na	1.99	0.09

TABLE H-8
MONITORING WELL OCWD-M11
General Water Quality Data
2015 - 2019

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	01/28/15	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
	02/07/19	0.047	15.6	126	46.5	<0.2	0.006	1.45	0.10
	04/17/19	0.046	16.2	152	58.3	na	na	1.63	0.18
	07/24/19	0.039	14.3	122	53.1	na	na	1.69	0.13
	11/05/19	0.032	12.7	130	50.8	na	na	1.70	0.12

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
2015 - 2019

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	04/08/15	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 130-195 ft bgs	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	01/13/15	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
	01/09/19	0.025	9.1	89	59.6	<0.2	<0.002	1.58	0.08
	04/03/19	0.017	6.1	64	41.0	na	na	1.38	0.09
	07/11/19	0.018	6.7	76	42.8	na	na	1.33	0.11
	10/10/19	0.017	6.6	76	31.2	na	<0.002	1.35	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
2015 - 2019 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)
	01/12/15	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
M45/1	07/11/16	0.384	92.3	678	433	<0.2	0.103	1.64	0.4
Alpha-III, Beta-I,II	10/04/16	0.362	85.7	644	437	<0.2	0.075	1.55	0.35
Perforations	01/10/17	0.379	87.7	514	462	<0.2	0.103	1.45	0.39
195-205 ft bgs	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
	01/24/19	0.394	92.2	680	453	0.2	0.117	1.71	0.57
	05/07/19	0.407	92.1	716	473	na	na	2.21	0.44
	07/09/19	0.417	92.8	750	511	na	na	2.34	0.48
	10/08/19	0.409	93.0	758	480	na	na	2.4	0.42
	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
M45/2	10/04/16	0.032	12.5	122	47	<0.2	0.043	2.48	0.11
Beta-III	01/10/17	0.033	13.0	116	46.8	<0.2	0.046	2.31	0.11
Perforations	04/04/17	0.029	12.3	110	46.4	<0.2	0.048	2.47	0.1
250-260 ft bgs	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
	01/24/19	0.045	14.1	131	60.4	<0.2	0.038	1.9	0.12
	05/07/19	0.053	16.1	142	65.8	na	na	1.87	0.16
	07/09/19	0.048	17.2	156	73.9	na	na	1.77	0.14
	10/08/19	0.049	16.0	154	71.1	na	na	1.66	0.11
	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
M45/3	10/04/16	0.129	42.4	298	110	<0.2	<0.002	<0.1	0.31
Omicron	01/10/17	0.116	39.1	272	105	<0.2	<0.002	<0.1	0.28
Perforations	04/04/17	0.122	43.5	292	112	<0.2	<0.002	<0.1	0.33
335-345 ft bgs	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
	01/24/19	0.068	24.6	212	75.6	<0.2	<0.002	<0.1	0.18
	05/07/19	0.049	18.7	182	57.7	na	na	<0.1	0.33
	07/09/19	0.095	31.9	246	92.8	na	na	<0.1	0.31
	10/08/19	0.041	18.6	194	56.9	na	na	<0.1	0.22

TABLE H-10
MONITORING WELL OCWD-M45
2015 - 2019 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	01/12/15	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
	01/24/19	0.028	10.4	125	44.8	0.5	<0.002	<0.1	0.16
	05/07/19	0.018	8.3	102	40.5	na	na	<0.1	0.86
	07/09/19	0.021	8.7	120	45.3	na	na	<0.1	2.43
	10/08/19	0.020	9.2	114	42.2	na	na	<0.1	0.23
M45/5 Main Perforations 780-790 ft bgs	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
	01/24/19	0.154	13.7	272	31.1	0.8	0.008	<0.1	7.15
	05/07/19	0.161	15.0	304	37.4	na	na	<0.1	8.90
	07/09/19	0.155	14.1	306	34.8	na	na	<0.1	7.28
	10/08/19	0.157	14.3	316	31.5	na	na	<0.1	7.37

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
2015 - 2019

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	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
	01/23/19	0.014	6.5	80	44.6	<0.2	<0.002	1.39	0.09
	04/02/19	0.016	5.9	75	41.0	na	na	1.30	0.12
	08/06/19	0.014	5.5	90	43.0	na	na	1.13	0.12
	10/07/19	0.013	6.1	82	40.6	na	<0.002	1.12	0.06
M46/2 Upper Rho Perforations 420-430 ft bgs	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
	01/23/19	0.013	5.6	64	32.3	<0.2	<0.002	1.16	<0.05
	04/02/19	0.015	5.4	74	32.1	na	na	1.04	0.08
	08/06/19	0.018	6.1	78	37.0	na	na	1.19	0.09
	10/07/19	0.017	6.9	96	40.0	na	<0.002	1.25	0.06

TABLE H-11
MONITORING WELL OCWD-M46
General Water Quality Data
2015 - 2019

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)
	02/09/15	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
M46/3	08/09/16	0.029	12.5	154	41.1	<0.2	<0.002	0.22	0.21
Lower Rho	11/01/16	0.027	12.1	168	40.8	<0.2	<0.002	0.2	0.13
Perforations	02/07/17	0.025	11.7	146	39.3	<0.2	0.004	0.2	0.23
515-535 ft bgs	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
	01/23/19	0.024	11.5	120	37.3	<0.2	0.003	0.26	0.07
	04/02/19	0.023	11	132	34.6	na	na	0.27	0.13
	08/06/19	0.023	10.7	124	33.9	na	na	0.25	0.26
	10/07/19	0.023	11.2	144	32.3	na	<0.002	0.25	0.11
	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
M46/4	11/01/16	0.057	15.6	214	17	<0.2	<0.002	<0.1	1.07
Main	02/07/17	0.056	15.4	222	17	0.2	0.002	0.11	1.13
Perforations	05/02/17	0.06	16.1	214	16.4	<0.2	0.003	<0.1	1.04
640-660 ft bgs	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
	01/23/19	0.056	14.6	200	15.8	0.3	0.003	<0.1	0.92
	04/02/19	0.057	14.4	176	16.7	na	na	<0.1	1.11
	08/06/19	0.054	14.4	218	16.3	na	na	<0.1	0.97
	10/07/19	0.052	14.5	234	15	na	0.002	<0.1	1.18

TABLE H-11
MONITORING WELL OCWD-M46
General Water Quality Data
2015 - 2019

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	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
	01/23/19	0.051	1.91	216	13.4	0.5	0.004	<0.1	1.91
	04/02/19	0.056	1.93	200	14.5	na	na	<0.1	1.93
	08/06/19	0.06	1.64	240	14.3	na	na	<0.1	1.64
	10/07/19	0.06	2.05	218	12.7	na	0.003	<0.1	2.05

Notes: OCWD-M46 is located approximately 900 feet northeast of the nearest injection well site (I-26).
na = not analyzed

TABLE H-12
MONITORING WELL OCWD-M47
2015 - 2019 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)
M47/1 Beta-III Perforations 355-375 ft bgs	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
	07/01/15	0.020	10.5	152	47.7	<0.2	<0.007	0.5	0.19
	10/20/15	0.016	9.5	156	43.8	<0.2	<0.007	<0.4	0.15
	02/09/16	0.022	9.1	148	40.3	<0.2	<0.002	<0.1	0.16
	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
	1/22/19	0.027	12.4	110	40.3	<0.2	<0.002	<0.1	0.1
	4/16/19	0.025	12.1	106	39.2	na	na	<0.1	0.15
	7/23/19	0.025	11.7	126	39.4	na	na	<0.1	0.15
	10/22/19	0.023	9.3	138	36	na	na	<0.1	0.19
M47/2 Upper Rho Perforations 470-480 ft bgs	01/27/15	na	19.3	188	89.6	<0.2	0.026	9.1	0.21
	04/21/15	0.037	16.4	162	77	<0.2	0.02	10	0.18
	07/01/15	0.039	15.6	150	73.7	<0.2	0.023	10	0.19
	10/20/15	0.029	14.7	162	70	<0.2	0.049	10.1	0.14
	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
	1/22/19	0.026	10.7	100	55.9	<0.2	0.006	1.53	0.08
	4/16/19	0.024	10.2	102	55.9	na	na	1.52	0.10
	7/23/19	0.026	10.2	104	56	na	na	1.36	0.13
	10/22/19	0.027	8.8	140	52.6	na	na	1.13	0.12

TABLE H-12
MONITORING WELL OCWD-M47
2015 - 2019 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	01/27/15	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
	1/22/19	0.038	13.6	184	65.1	0.2	<0.002	<0.1	<0.05
	4/16/19	0.035	13.7	176	66.6	na	na	<0.1	0.1
	7/23/19	0.037	13.7	212	66	na	na	<0.1	0.12
	10/22/19	0.037	12.5	210	63.8	na	na	<0.1	0.07
M47/4 Main Perforations 745-765 ft bgs	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
	1/22/19	0.039	12.4	192	23.2	0.2	0.005	<0.1	0.74
	4/16/19	0.038	12.4	194	23.6	na	na	<0.1	0.98
	7/23/19	0.038	12.5	228	23.6	na	na	<0.1	0.91
	10/22/19	0.041	11.3	212	23.7	na	na	<0.1	0.86

TABLE H-12
MONITORING WELL OCWD-M47
2015 - 2019 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)
M47/5 Main Perforations 940-960 ft bgs	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
	10/20/15	0.052	12.8	250	11.4	0.4	<0.007	<0.4	2.45
	02/09/16	0.059	12.3	230	11.2	0.3	0.005	<0.1	3.2
	04/19/16	0.054	12.9	222	11.3	0.3	0.005	<0.1	2.76
	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
	1/22/19	0.058	12.8	202	11.6	0.3	0.008	<0.1	2.89
	4/16/19	0.056	12.8	200	12	na	na	<0.1	3.24
	7/23/19	0.06	12.9	222	11.9	na	na	<0.1	2.91
	10/22/19	0.06	11.5	238	10.6	na	na	<0.1	2.54

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
2019 Annual Report

GWRS 2019 Quarterly Sampling Dates
OCWD Water Quality Department
ANAHEIM FOREBAY - GROUNDWATER

Monitoring Well	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AM-7/1	02/20/2019	05/21/2019	08/19/2019	11/26/2019
AM-8/1	02/20/2019	05/21/2019	08/19/2019	11/26/2019
AM-10/1	02/20/2019	05/21/2019	08/19/2019	11/19/2019
AMD-10/1-5	02/04/2019	05/08/2019	08/07/2019	11/04/2019
AMD-12/1-5	02/19/2019	05/20/2019	08/20/2019	11/18/2019
OCWD-KB1/1	02/04/2019	05/06/2019	08/07/2019	11/04/2019

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 2019 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

Notes for Appendix I 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	Reduced[3,4,5,6]	Q - Year	Comprehensive	Reduced[3,4,5,6]
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]Reduced: Annual cyanide, selected SOC's and radionuclide

[6]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 2019 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	2.6	4	1.9	ND
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	1.8	2.3	3	2.5
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	1.3	2.0 - 3.0	2.7 - 3.5	2.3
Barium (Ba), ug/L	OCWD	1000	71.6	52.8	44	34.7
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	0.12	0.14	0.17	0.14
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	1.2	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	0.36	0.51 - 0.72	0.7 - 0.71	0.96
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.005	0.004 - 0.006	0.003	Not Reported
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	1	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	1.5 - 2.1	1.7	1.3	0.8
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	5	5	3	ND
Electrical Conductivity (EC), um/cm	OCWD	900	830	459 - 667	381 - 562	572
Iron (Fe), ug/L	OCWD	300	226.0	186	100	122
Manganese (Mn), ug/L	OCWD	50	11.9	8.7	4.5	4.5
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	11.5	5.5 - 9.3	3.5 - 4.4	5
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	2	2	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	460	268 - 400	218 - 322	328
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	1.1	1	0.4	0.6
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	2	1.7	1.2	1.2
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.16	0.17	0.17	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	3.3	3.2	4.6	4.0
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD/ WeckLab	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD/ WeckLab	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	ND	Not Required	Not Required	Not Required
508	Chlorinated Pesticides	WeckLab	ND	Not Required	Not Required	Not Required
515.3	Chlorinated Acids	WeckLab	ND	Not Required	Not Required	Not Required
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	Not Required	Not Required	Not Required

AM-7/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2019	10:45	Chloroform (CHCl3)	2.1	ug/L	0.5
2/20/2019	10:45	Total Trihalomethanes (TTHMs)	2.1	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2019	10:45	Chloroform (CHCl3)	1.5	ug/L	0.2
2/20/2019	10:45	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2019	10:45	Sulfamethoxazole (SULTHZ)	1.4	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/21/2019	10:35	Chloroform (CHCl3)	1.7	ug/L	0.5
5/21/2019	10:35	Total Trihalomethanes (TTHMs)	1.7	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/19/2019	10:55	Chloroform (CHCl3)	1.3	ug/L	0.5
8/19/2019	10:55	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

AM-7/1
Organic Detections by Method

Year 2019, Quarter 4

METHOD: ***524.2***

Sample Date &	*Time*	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/26/2019	10:00	Chloroform (CHCl3)	0.8	ug/L	0.5
11/26/2019	10:00	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

Summary of All 2019 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	1.1	1.8	1.3	ND
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND	1	1.1	ND
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	ND	ND - 1	ND	
Barium (Ba), ug/L	OCWD	1000	63.6	65.6	56.4	47
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	0.24	0.24	0.23	0.22
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	1.3	ND	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	0.35	0.36 - 0.41	0.65	0.62
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.016	0.022		
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	1	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 - 1.4	1.5	1	1.3
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	5	5	5	3
Electrical Conductivity (EC), um/cm	OCWD	900	672	662 - 735	617	557
Iron (Fe), ug/L	OCWD	300	856	451	442	39.7
Manganese (Mn), ug/L	OCWD	50	18.6	13.6	10.6	8.2
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	16.2	11.9 - 15.1	9.6	8
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	4	32	4
Total Dissolved Solids (TDS), mg/L	OCWD	500	376	390 - 446	356	334
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	1.7	1.4	1.2	0.8
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	1.3	1.6	1.3	1.2
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.16	0.15	0.14	0.14
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	2.2	1.4	2.4	2.1
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD / WeckLab	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD/ WeckLab	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	ND	Not Required	Not Required	Not Required
508	Chlorinated Pesticides	WeckLab	ND	Not Required	Not Required	Not Required
515.3	Chlorinated Acids	WeckLab	ND	Not Required	Not Required	Not Required
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
537.1	PFAS Compounds	OCWD	Not Required	Not Required	Not Required	ND - Detection
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	Not Required	Not Required	Not Required

AM-8/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2019	9:50	Chloroform (CHCl3)	1.4	ug/L	0.5
2/20/2019	9:50	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2019	9:50	Chloroform (CHCl3)	1.1	ug/L	0.1
2/20/2019	9:50	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/20/2019	9:50	Simazine (SIMAZ)	0.0090	ug/L	0.005
2/20/2019	9:50	Sucralose (SUCRAL)	110	ng/L	100
2/20/2019	9:50	Sulfamethoxazole (SULTHZ)	2.8	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/21/2019	10:00	Chloroform (CHCl3)	1.5	ug/L	0.5
5/21/2019	10:00	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/19/2019	10:15	Chloroform (CHCl3)	1.0	ug/L	0.5
8/19/2019	10:15	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

AM-8/1
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/19/2019	10:00	Chloroform (CHCl3)	1.3	ug/L	0.5
11/19/2019	10:00	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

METHOD: 537.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/19/2019	10:00	Perfluoro butane sulfonic acid (PFBS)	2.2	ng/L	2
11/19/2019	10:00	Perfluoro octane sulfonic acid (PFOS)	2.2	ng/L	2

METHOD: UNKWQAN

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/19/2019	10:00	PFOA + PFOS (PFOAOS)	2.2	ng/L	2

Summary of All 2019 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	3.3	16.2	4.1	ND
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	1.4	1.6	1.5	1.5
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	1.8	2	1.8	1.5
Barium (Ba), ug/L	OCWD	1000	8.5	8	9.3	8.4
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	ND
Fluoride (F), mg/L	OCWD	2	0.23	0.22	0.2	0.17
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	1.06	0.95	1.12	1.18
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.004	Not Reported	Not Reported	Not Reported
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 - 1.3	1.8	2	2.7
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	ND	ND	ND	ND
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	110	105	112	114
Iron (Fe), ug/L	OCWD	300	120.0	191	134	15
Manganese (Mn), ug/L	OCWD	50	3.1	4	3.4	2.1
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	1.8	2	1.8	1.9
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	1	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	58	55	32	73
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.2	0.8	0.3	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	0.25	0.2	0.23	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	4.1	3.7	4.2	4.1
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD/ WeckLab	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD/ WeckLab	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	ND	Not Required	Not Required	Not Required
508	Chlorinated Pesticides	WeckLab	ND	Not Required	Not Required	Not Required
515.3	Chlorinated Acids	WeckLab	ND	Not Required	Not Required	Not Required
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	Not Required	Not Required	Not Required

AM-10/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/20/2019 10:00	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
2/20/2019 10:00	Chloroform (CHCl3)	1.1	ug/L	0.5
2/20/2019 10:00	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/20/2019 10:00	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.1
2/20/2019 10:00	Chloroform (CHCl3)	0.9	ug/L	0.1
2/20/2019 10:00	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/20/2019 10:00	Diuron (DIURON)	0.0080	ug/L	0.005
2/20/2019 10:00	Simazine (SIMAZ)	0.0100	ug/L	0.005

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
5/21/2019 11:15	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
5/21/2019 11:15	Chloroform (CHCl3)	1.2	ug/L	0.5
5/21/2019 11:15	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
8/19/2019 9:25	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
8/19/2019 9:25	Chloroform (CHCl3)	1.2	ug/L	0.5
8/19/2019 9:25	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.5

AM-10/1
Organic Detections by Method

Year 2019, Quarter 4

METHOD: ***524.2***

Sample Date &	*Time*	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/26/2019	10:40	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
11/26/2019	10:40	Chloroform (CHCl3)	1.6	ug/L	0.5
11/26/2019	10:40	Total Trihalomethanes (TTHMs)	2.7	ug/L	0.5

Summary of All 2019 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 - 5.3	ND - 24.7	ND - 3.2	ND - 23
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 1.6	ND - 5.9	ND - 3.1	ND - 3.7
Arsenic (dissolved)* (As-DIS), ug/L	OCWD	N/A	1.5 - 1.9	ND - 6.1	1.8 - 4	1.5 - 4.1
Barium (Ba), ug/L	OCWD	1000	48.6 - 83.3	5.7 - 89.1	15.1 - 92.9	10.8 - 88.6
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 - 2.5	ND	ND	ND
Fluoride (F), mg/L	OCWD	2	ND - 0.5	0.16 - 0.56	ND - 0.58	ND - 0.55
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 - 3.5	ND - 1.7	ND - 1.8	ND - 1.3
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	0.36 - 0.78	0.36 - 0.94	0.23 - 1.05	0.12 - 0.92
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	0.009 - 0.147	0.013 - 0.046	0.013 - 0.043	Not Reported
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND - 1.4	ND - 1.5	ND - 1.4
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 - 2	0.25 - 1.8	ND - 1.2	ND - 2.2
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND - 30	ND - 20	43903	ND - 15
Electrical Conductivity (EC), um/cm	OCWD	900	577 - 959	126 - 926	188 - 955	190 - 937
Iron (Fe), ug/L	OCWD	300	147 - 1080	55.6 - 792	16.1 - 564	52.2 - 585
Manganese (Mn), ug/L	OCWD	50	11.5 - 51.9	2.4 - 50.8	2.9 - 49.7	6.7 - 39
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	10.6 - 59.5	ND - 49.7	1.7 - 47	6.1 - 45.4
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND - 4	ND - 4	43846	ND - 2
Total Dissolved Solids (TDS), mg/L	OCWD	500	330 - 578	80 - 598	96 - 584	132 - 602
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.4 - 4.1	0.4 - 3.9	0.2 - 1.2	0.2 - 1.8
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND - 3.6	ND - 2.1	1.1 - 2.1	ND - 2
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.15 - 0.21	0.15 - 0.2	0.17 - 0.22	0.16 - 0.22
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 - 2.4	ND - 6.2	ND - 4.3	ND - 3.1
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD / WeckLab	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD/ WeckLab	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	ND	Not Required	Not Required	Not Required
508	Chlorinated Pesticides	WeckLab	ND	Not Required	Not Required	Not Required
515.3	Chlorinated Acids	WeckLab	ND	Not Required	Not Required	Not Required
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
537RV1.1	PFAS Compounds	OCWD	Not Required	Not Required	Not Required	ND - Detections
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	Not Required	ND	Not Required	Not Required

AMD-10/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/4/2019	9:55	Chloroform (CHCl3)	2.0	ug/L	0.5
2/4/2019	9:55	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/4/2019	9:55	Chloroform (CHCl3)	1.4	ug/L	0.2
2/4/2019	9:55	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/8/2019	10:15	Chloroform (CHCl3)	0.8	ug/L	0.5
5/8/2019	10:15	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/7/2019	9:55	Chloroform (CHCl3)	0.7	ug/L	0.5
8/7/2019	9:55	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/4/2019	10:05	Chloroform (CHCl3)	2.2	ug/L	0.5
11/4/2019	10:05	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5

AMD-10/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 11:00	Chloroform (CHCl3)	1.5	ug/L	0.5
2/4/2019 11:00	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 11:00	Chloroform (CHCl3)	1.3	ug/L	0.1
2/4/2019 11:00	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 11:00	Sulfamethoxazole (SULTHZ)	1.6	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
5/8/2019 11:25	Chloroform (CHCl3)	1.8	ug/L	0.5
5/8/2019 11:25	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
8/7/2019 12:55	Chloroform (CHCl3)	1.2	ug/L	0.5
8/7/2019 12:55	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5

AMD-10/2
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/4/2019	12:40	Chloroform (CHCl3)	1.0	ug/L	0.5
11/4/2019	12:40	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

AMD-10/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 12:10	Chloroform (CHCl3)	0.5	ug/L	0.5
2/4/2019 12:10	Total Trihalomethanes (TTHMs)	0.5	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 12:10	Chloroform (CHCl3)	0.5	ug/L	0.1
2/4/2019 12:10	Total Trihalomethanes (TTHMs)	0.5	ug/L	0.1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 12:10	Atrazine (ATRAZ)	0.0010	ug/L	0.001
2/4/2019 12:10	Carbamazepine (CBMAZP)	5.6	ng/L	1
2/4/2019 12:10	Diuron (DIURON)	0.0050	ug/L	0.005
2/4/2019 12:10	Primidone (PRIMDN)	3.3	ng/L	1
2/4/2019 12:10	Simazine (SIMAZ)	0.0090	ug/L	0.005
2/4/2019 12:10	Sucralose (SUCRAL)	1210	ng/L	100
2/4/2019 12:10	Sulfamethoxazole (SULTHZ)	19.3	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
5/8/2019 12:50	Chloroform (CHCl3)	0.7	ug/L	0.5
5/8/2019 12:50	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
8/7/2019 12:45	Chloroform (CHCl3)	0.6	ug/L	0.5
8/7/2019 12:45	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

AMD-10/3
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/4/2019	12:15	Chloroform (CHCl3)	0.7	ug/L	0.5
11/4/2019	12:15	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

METHOD: 537RV1.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/4/2019	12:15	Perfluoro butane sulfonic acid (PFBS)	8.8	ng/L	4
11/4/2019	12:15	Perfluoro hexane sulfonic acid (PFHxS)	4.4	ng/L	4
11/4/2019	12:15	Perfluoro octane sulfonic acid (PFOS)	10.1	ng/L	4
11/4/2019	12:15	Perfluoro octanoic acid (PFOA)	4.2	ng/L	4
11/4/2019	12:15	Perfluorohexanoic acid (PFHxA)	5.4	ng/L	4

METHOD: UNKWQAN

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/4/2019	12:15	PFOA + PFOS (PFOAOS)	14.3	ng/L	4

AMD-10/4
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 12:45	Chloroform (CHCl3)	0.6	ug/L	0.5
2/4/2019 12:45	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 12:45	Chloroform (CHCl3)	0.5	ug/L	0.1
2/4/2019 12:45	Total Trihalomethanes (TTHMs)	0.5	ug/L	0.1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/4/2019 12:45	Atrazine (ATRAZ)	0.0010	ug/L	0.001
2/4/2019 12:45	Carbamazepine (CBMAZP)	7.1	ng/L	1
2/4/2019 12:45	Diuron (DIURON)	0.0050	ug/L	0.005
2/4/2019 12:45	Primidone (PRIMDN)	3.7	ng/L	1
2/4/2019 12:45	Simazine (SIMAZ)	0.0280	ug/L	0.005
2/4/2019 12:45	Sucralose (SUCRAL)	856	ng/L	100
2/4/2019 12:45	Sulfamethoxazole (SULTHZ)	23.1	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
5/8/2019 13:30	Chloroform (CHCl3)	TR	ug/L	0.5
5/8/2019 13:30	Total Trihalomethanes (TTHMs)	TR	ug/L	0.5

Year 2019, Quarter 4

METHOD: 537RV1.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/4/2019 11:45	Perfluoro octane sulfonic acid (PFOS)	11.4	ng/L	4
11/4/2019 11:45	Perfluoro octanoic acid (PFOA)	9.2	ng/L	4
11/4/2019 11:45	Perfluorohexanoic acid (PFHxA)	9.0	ng/L	4

AMD-10/4
Organic Detections by Method

Year 2019, Quarter 4

METHOD: UNKWQAN

Sample Date &	*Time*	*Parameter*	*Result*	*Units*	*Reportable Detection Limit*
11/4/2019	11:45	PFOA + PFOS (PFOAOS)	20.6	ng/L	4

AMD-10/5
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/4/2019	11:05	Chloroform (CHCl3)	1.1	ug/L	0.5
2/4/2019	11:05	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/4/2019	11:05	Chloroform (CHCl3)	0.8	ug/L	0.1
2/4/2019	11:05	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/4/2019	11:05	Atrazine (ATRAZ)	0.0020	ug/L	0.001
2/4/2019	11:05	Carbamazepine (CBMAZP)	3.8	ng/L	1
2/4/2019	11:05	Diuron (DIURON)	0.0080	ug/L	0.005
2/4/2019	11:05	Primidone (PRIMDN)	2.7	ng/L	1
2/4/2019	11:05	Simazine (SIMAZ)	0.0470	ug/L	0.005
2/4/2019	11:05	Sucralose (SUCRAL)	398	ng/L	100
2/4/2019	11:05	Sulfamethoxazole (SULTHZ)	18.2	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/8/2019	11:35	Chloroform (CHCl3)	0.9	ug/L	0.5
5/8/2019	11:35	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/7/2019	11:25	Chloroform (CHCl3)	0.7	ug/L	0.5
8/7/2019	11:25	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

AMD-10/5
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/4/2019 11:05	Chloroform (CHCl3)	0.8	ug/L	0.5
11/4/2019 11:05	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

METHOD: 537RV1.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/4/2019 11:05	Perfluoro butane sulfonic acid (PFBS)	6.0	ng/L	4
11/4/2019 11:05	Perfluoro heptanoic acid (PFHpA)	4.5	ng/L	4
11/4/2019 11:05	Perfluoro hexane sulfonic acid (PFHxS)	4.1	ng/L	4
11/4/2019 11:05	Perfluoro octane sulfonic acid (PFOS)	9.9	ng/L	4
11/4/2019 11:05	Perfluoro octanoic acid (PFOA)	9.7	ng/L	4
11/4/2019 11:05	Perfluorohexanoic acid (PFHxA)	10.7	ng/L	4

METHOD: UNKWQAN

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/4/2019 11:05	PFOA + PFOS (PFOAOS)	19.6	ng/L	4

Summary of All 2019 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 - 8.9	1.2 - 4.9	ND - 4.7	ND
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 1.2	ND - 3.8	ND - 7.9	ND - 6
Arsenic (dissolved)* (As-DIS), ug/L	OCWD	N/A	1 - 1.6	1.1 - 5.4	ND - 7.7	ND - 6.4
Barium (Ba), ug/L	OCWD	1000	19.3 - 89.5	18.5 - 85.8	5.9 - 82.5	8 - 79.6
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 - 3	ND	ND - 1.1
Fluoride (F), mg/L	OCWD	2	ND - 0.68	0.16 - 0.64	0.25 - 0.59	0.21 - 0.59
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.29	ND - 0.44	ND - 0.43	ND - 0.34
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND - 4.1	1.3 - 3.7	ND - 4	ND - 4.8
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	0.26 - 1.2	0.56 - 1.01	0.62 - 0.97	0.37 - 1.02
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND	ND	ND	Not Reported
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND	ND - 1.2	ND - 1.1	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 - 2.6	ND - 1.6	ND - 1.3	ND - 1.3
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	ND	ND	ND	Not Required
Total Coliform (Mult. Tube Fermentation) (TCOLIM), MPN	OCWD	N/A	ND	ND	ND	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	275 - 955	215 - 956	144 - 954	183 - 916
Iron (Fe), ug/L	OCWD	300	ND - 14.1	ND - 19.8	ND	ND - 14.2
Manganese (Mn), ug/L	OCWD	50	ND - 1.6	ND - 3.6	ND - 1.2	ND - 1.7
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND	ND - 3.2	ND - 1.4	ND - 1.7
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND - 1	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	142 - 580	128 - 592	72 - 600	112 - 578
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.2 - 0.3	ND - 0.2	ND	ND - 0.1
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	ND - 2.7	1.2 - 2.4	ND - 1.8	ND - 2
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.15 - 0.24	0.18 - 0.23	0.18 - 0.23	0.17 - 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	2.9 - 3.7	2.1 - 4.5	2.6 - 8.7	2.2 - 7.9
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD / WeclkLab	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD/ WeckLab	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	ND	Not Required	Not Required	Not Required
508	Chlorinated Pesticides	WeckLab	ND	Not Required	Not Required	Not Required
515.3	Chlorinated Acids	WeckLab	ND	Not Required	Not Required	Not Required
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
537.1	PFAS Compounds	OCWD	Not Required	Not Required	Not Required	ND - Detections
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND	Not Required	Not Required	Not Required

AMD-12/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	10:30	Chloroform (CHCl3)	2.6	ug/L	0.5
2/19/2019	10:30	Total Trihalomethanes (TTHMs)	2.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	10:30	Chloroform (CHCl3)	1.9	ug/L	0.2
2/19/2019	10:30	Total Trihalomethanes (TTHMs)	1.9	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	10:30	Sulfamethoxazole (SULTHZ)	1.5	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/20/2019	9:50	Chloroform (CHCl3)	1.4	ug/L	0.5
5/20/2019	9:50	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/20/2019	10:00	Chloroform (CHCl3)	0.8	ug/L	0.5
8/20/2019	10:00	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

AMD-12/1
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019	10:00	Chloroform (CHCl3)	1.0	ug/L	0.5
11/18/2019	10:00	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

AMD-12/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	11:25	Chloroform (CHCl3)	1.1	ug/L	0.5
2/19/2019	11:25	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	11:25	Chloroform (CHCl3)	0.9	ug/L	0.1
2/19/2019	11:25	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	11:25	Simazine (SIMAZ)	0.0090	ug/L	0.005
2/19/2019	11:25	Sulfamethoxazole (SULTHZ)	1.0	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/20/2019	10:40	Chloroform (CHCl3)	1.6	ug/L	0.5
5/20/2019	10:40	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/20/2019	10:50	Chloroform (CHCl3)	1.3	ug/L	0.5
8/20/2019	10:50	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

AMD-12/2
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019	10:55	Chloroform (CHCl3)	1.3	ug/L	0.5
11/18/2019	10:55	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.5

AMD-12/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	12:25	Chloroform (CHCl3)	0.6	ug/L	0.5
2/19/2019	12:25	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	12:25	Chloroform (CHCl3)	0.5	ug/L	0.1
2/19/2019	12:25	Total Trihalomethanes (TTHMs)	0.5	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/19/2019	12:25	Carbamazepine (CBMAZP)	2.2	ng/L	1
2/19/2019	12:25	Diuron (DIURON)	0.0050	ug/L	0.005
2/19/2019	12:25	Simazine (SIMAZ)	0.0200	ug/L	0.005
2/19/2019	12:25	Sucralose (SUCRAL)	136	ng/L	100
2/19/2019	12:25	Sulfamethoxazole (SULTHZ)	6.6	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/20/2019	11:35	Chloroform (CHCl3)	0.7	ug/L	0.5
5/20/2019	11:35	Total Trihalomethanes (TTHMs)	0.7	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/20/2019	11:50	Chloroform (CHCl3)	0.8	ug/L	0.5
8/20/2019	11:50	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

AMD-12/3
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 12:10	Chloroform (CHCl3)	0.9	ug/L	0.5
11/18/2019 12:10	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

METHOD: 537.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 12:10	Perfluoro butane sulfonic acid (PFBS)	4.2	ng/L	2
11/18/2019 12:10	Perfluoro hexane sulfonic acid (PFHxS)	2.7	ng/L	2
11/18/2019 12:10	Perfluoro octane sulfonic acid (PFOS)	4.9	ng/L	2
11/18/2019 12:10	Perfluoro octanoic acid (PFOA)	4.4	ng/L	2
11/18/2019 12:10	Perfluorohexanoic acid (PFHxA)	4.0	ng/L	2

METHOD: UNKWQAN

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 12:10	PFOA + PFOS (PFOAOS)	9.3	ng/L	2

AMD-12/3
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 12:10	Chloroform (CHCl3)	0.9	ug/L	0.5
11/18/2019 12:10	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

METHOD: 537.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 12:10	Perfluoro butane sulfonic acid (PFBS)	4.2	ng/L	2
11/18/2019 12:10	Perfluoro hexane sulfonic acid (PFHxS)	2.7	ng/L	2
11/18/2019 12:10	Perfluoro octane sulfonic acid (PFOS)	4.9	ng/L	2
11/18/2019 12:10	Perfluoro octanoic acid (PFOA)	4.4	ng/L	2
11/18/2019 12:10	Perfluorohexanoic acid (PFHxA)	4.0	ng/L	2

METHOD: UNKWQAN

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 12:10	PFOA + PFOS (PFOAOS)	9.3	ng/L	2

AMD-12/4
Organic Detections by Method

Year 2019, Quarter 1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/19/2019 12:10	Atrazine (ATRAZ)	0.0010	ug/L	0.001
2/19/2019 12:10	Carbamazepine (CBMAZP)	12.6	ng/L	1
2/19/2019 12:10	Diuron (DIURON)	0.0100	ug/L	0.005
2/19/2019 12:10	Primidone (PRIMDN)	4.3	ng/L	1
2/19/2019 12:10	Simazine (SIMAZ)	0.0460	ug/L	0.005
2/19/2019 12:10	Sucralose (SUCRAL)	1190	ng/L	100
2/19/2019 12:10	Sulfamethoxazole (SULTHZ)	17.0	ng/L	1

Year 2019, Quarter 4

METHOD: 537.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 12:05	Perfluoro butane sulfonic acid (PFBS)	4.2	ng/L	2
11/18/2019 12:05	Perfluoro hexane sulfonic acid (PFHxS)	3.4	ng/L	2
11/18/2019 12:05	Perfluoro octane sulfonic acid (PFOS)	7.1	ng/L	2
11/18/2019 12:05	Perfluoro octanoic acid (PFOA)	4.6	ng/L	2
11/18/2019 12:05	Perfluorohexanoic acid (PFHxA)	4.2	ng/L	2

METHOD: UNKWQAN

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 12:05	PFOA + PFOS (PFOAOS)	11.7	ng/L	2

AMD-12/5
Organic Detections by Method

Year 2019, Quarter 1

METHOD: CEC

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
2/19/2019 11:05	Atrazine (ATRAZ)	0.0030	ug/L	0.001
2/19/2019 11:05	Carbamazepine (CBMAZP)	17.8	ng/L	1
2/19/2019 11:05	Primidone (PRIMDN)	5.9	ng/L	1
2/19/2019 11:05	Simazine (SIMAZ)	0.118	ug/L	0.005
2/19/2019 11:05	Sucralose (SUCRAL)	1740	ng/L	100
2/19/2019 11:05	Sulfamethoxazole (SULTHZ)	23.0	ng/L	1

Year 2019, Quarter 4

METHOD: 537.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 10:50	Perfluoro butane sulfonic acid (PFBS)	5.0	ng/L	2
11/18/2019 10:50	Perfluoro heptanoic acid (PFHpA)	2.4	ng/L	2
11/18/2019 10:50	Perfluoro hexane sulfonic acid (PFHxS)	4.4	ng/L	2
11/18/2019 10:50	Perfluoro octane sulfonic acid (PFOS)	7.3	ng/L	2
11/18/2019 10:50	Perfluoro octanoic acid (PFOA)	7.7	ng/L	2
11/18/2019 10:50	Perfluorohexanoic acid (PFHxA)	5.4	ng/L	2

METHOD: UNKWQAN

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
11/18/2019 10:50	PFOA + PFOS (PFOAOS)	15	ng/L	2

Summary of All 2019 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	1.1	4.6	13.5	1.7
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	ND	1.3	3	ND
Arsenic (dissolved)* (As-DIS), ug/L	OCWD	N/A	ND	1.2	2.9	ND
Barium (Ba), ug/L	OCWD	1000	58.7	13.4	4.2	56.2
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	0.24	0.53	0.63	0.15
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	1.4
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	0.47	1.25	1.23	ND
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND	Not Reported	Not Reported	Not Reported
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 - 1.5	0.6	1	2.8
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	3	ND
Electrical Conductivity (EC), um/cm	OCWD	900	881	301	**130**	**952**
Iron (Fe), ug/L	OCWD	300	6.6	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	514	168	72	606
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	ND	0.1	0.3	ND
Action Level Chemicals						
Copper (Cu), ug/L	OCWD	1300	3.3	1.7	1.4	2.2
Lead (Pb), ug/L	OCWD	15	ND	ND	ND	ND
CDPH Unregulated Chemicals						
Boron (B), mg/L	OCWD	N/A	0.13	0.18	0.22	0.14
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	2.1	3.2	5.2	2.6
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD / WeckLab	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD/ WeckLab	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	ND	Not Required	Not Required	Not Required
508	Chlorinated Pesticides	WeckLab	ND	Not Required	Not Required	Not Required
515.3	Chlorinated Acids	WeckLab	ND	Not Required	Not Required	Not Required
524.2	Volatile Organic Compounds (VOCs)	OCWD	ND < MCL	ND < MCL	ND < MCL	ND < MCL
525.2	Semi-Volatile Organic Compounds (SOCs)	OCWD	ND	Not Required	Not Required	Not Required
537RV1.1	PFAS Compounds	OCWD	Not Required	Not Required	Not Required	ND
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	ND - Detections	Not Required	Not Required	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	Not Required	ND	Not Required	Not Required

OCWD-KB1/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/4/2019	9:45	Chloroform (CHCl3)	1.5	ug/L	0.5
2/4/2019	9:45	Total Trihalomethanes (TTHMs)	1.5	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/4/2019	9:45	Chloroform (CHCl3)	1.1	ug/L	0.1
2/4/2019	9:45	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.1

METHOD: CEC

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
2/4/2019	9:45	Sucralose (SUCRAL)	868	ng/L	100
2/4/2019	9:45	Sulfamethoxazole (SULTHZ)	4.4	ng/L	1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
5/6/2019	10:05	Chloroform (CHCl3)	0.6	ug/L	0.5
5/6/2019	10:05	Total Trihalomethanes (TTHMs)	0.6	ug/L	0.5

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
8/7/2019	10:25	Chloroform (CHCl3)	1.0	ug/L	0.5
8/7/2019	10:25	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

OCWD-KB1/1
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
11/4/2019	11:35	Chloroform (CHCl3)	2.8	ug/L	0.5
11/4/2019	11:35	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5

Appendix J

Anaheim Forebay Monitoring Well
Groundwater Quality
1,4-Dioxane, NDMA and Selected Constituents

Orange County Water District
Groundwater Replenishment System
2019 Annual Report

TABLE J-1
OCWD MONITORING WELL AM-7
1,4-dioxane and NDMA Concentrations
2015 - 2019

AM-7/1 *Shallow Aquifer* *Perforations: 210-225 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
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
2/20/2019	<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
2015 - 2019

AM-8/1 *Shallow Aquifer* *Perforations: 268-285 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
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
2/20/2019	<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
2015 - 2019

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)
02/11/15	<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
02/04/19	<1	na	02/04/19	<1	na	02/04/19	<1	na
05/08/19	na	<2	05/08/19	na	<2	05/08/19	na	<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)
02/11/15	<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
02/04/19	<1	na	02/04/19	<1	na
05/08/19	na	<2	05/08/19	na	<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
2015 - 2019

AMD-12/1 *Principal Aquifer* *Perforations: 330-350 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)
02/24/15	<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
02/19/19	<1	<2	02/19/19	<1	<2	02/19/19	<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)
02/24/15	<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
02/19/19	<1	<2	02/19/19	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-5
OCWD MONITORING WELL AM-10
1,4-dioxane and NDMA Concentrations
2015 - 2019

AM-10/1 *Shallow Aquifer* *Perforations: 217-235 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
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
02/20/19	<1	<2

Notes: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-6
OCWD MONITORING WELL KB1
1,4-dioxane and NDMA Concentrations
2015 - 2019

KB1 *Shallow Aquifer* *Perforations: 180-200 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
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
02/04/19	<1	na
05/06/19	na	<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
2015 - 2019 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	01/20/15	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
	02/20/19	0.056	75.0	460	252	<0.2	0.005	0.36	0.54
	04/11/19	na	58.7	400	na	na	0.006	0.51	0.45
	05/21/19	0.045	56.4	372	184	na	na	0.57	0.43
	06/11/19	na	36.8	268	na	na	0.004	0.72	0.29
	07/15/19	na	29.3	218	na	na	0.003	0.71	0.25
	08/19/19	0.042	47.2	322	166	na	na	0.7	0.37
	11/26/19	0.019	54.6	328	135	na	na	0.96	0.4

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

BGT Note: For Bromide, used Method 300.1B to be consistent. For Total Hardness, used Total Hardness (as CaCO3)…not diss
GWRS-RawWQ_2019_Item4_working

TABLE J-8
OCWD MONITORING WELL AM-8
2015 - 2019 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	01/20/15	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
	02/20/19	0.068	64.0	376	219	<0.2	0.016	0.35	0.42
	04/10/19	na	69.0	446	na	na	0.022	0.36	0.52
	05/21/19	0.062	61.4	390	212	na	na	0.41	0.49
	08/19/19	0.073	59.8	356	179	na	na	0.65	0.45
	11/19/19	0.054	50.7	334	156	na	na	0.62	0.32

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-9
OCWD MONITORING WELL AMD-10
2015 - 2019 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	02/11/15	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
	02/04/19	0.037	46	330	144	<0.2	0.009	0.74	0.3
	04/10/19	na	6.8	80	na	na	0.013	0.94	0.11
	05/08/19	0.016	6.5	84	17.6	na	na	0.91	0.09
	06/11/19	na	9.8	82.5	na	na	0.013	0.92	0.12
	07/15/19	na	17.1	96	na	na	0.013	0.86	0.15
	08/07/19	0.040	26.5	126	46.7	na	na	1.05	0.19
	11/04/19	0.041	48.6	286	124	na	na	0.62	0.37

TABLE J-9
OCWD MONITORING WELL AMD-10
2015 - 2019 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	02/11/15	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
	02/04/19	0.045	51.5	366	205	<0.2	0.042	0.78	0.32
	04/10/19	na	59.6	382	na	na	0.046	0.64	0.4
	05/08/19	0.047	55.5	390	229	na	na	0.7	0.36
	06/11/19	na	40.8	342	na	na	0.04	0.87	0.28
	07/15/19	na	34.0	258	na	na	0.043	0.84	0.22
	08/07/19	0.035	32.6	234	151	na	na	0.93	0.2
	11/04/19	0.021	10.9	132	57.2	na	na	0.92	0.1
AMD-10/3 Principal Perforations 550-570 ft bgs	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
	02/04/19	0.094	78.4	422	190	<0.2	0.043	0.64	0.53
	04/10/19	na	na	na	na	na	na	na	na
	05/08/19	0.087	90.4	598	254	na	na	0.36	0.75
	06/11/19	na	na	na	na	na	na	na	na
	07/15/19	na	na	na	na	na	na	na	na
	08/07/19	0.079	91.4	584	279	na	na	0.34	0.73
	11/04/19	0.099	99.1	602	287	na	na	0.71	0.7

TABLE J-9
OCWD MONITORING WELL AMD-10
2015 - 2019 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	02/11/15		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
	02/04/19	0.093	76.5	490	226	<0.2	0.097	0.61	0.4
	04/10/19	na	na	na	na	na	na	na	na
	05/08/19	0.091	59.2	384	166	na	na	0.45	0.49
	06/11/19	na	na	na	na	na	na	na	na
	07/15/19	na	na	na	na	na	na	na	na
	08/07/19	0.086	58.8	398	155	na	na	0.23	0.54
	11/04/19	0.083	68	438	171	na	na	0.12	0.61
AMD-10/5 Principal Perforations 934-954 ft bgs	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
	02/10/16	0.172	93.9	548	258	<0.2	0.268	0.91	0.43
	05/04/16	0.17	94.5	550	252	<0.2	0.264	0.89	0.43
	08/10/16	0.176	93.4	574	258	<0.2	0.277	0.7	0.44
	11/02/16	0.145	93.0	618	254	<0.2	0.269	0.65	0.45
	02/08/17	0.145	93.2	564	265	<0.2	0.259	0.65	0.46
	05/03/17	0.141	92.9	568	263	<0.2	0.227	0.65	0.46
	08/09/17	0.129	93.0	598	262	<0.2	0.187	0.54	0.46
	11/01/17	0.127	94.3	544	273	<0.2	0.192	0.49	0.47
	02/07/18	0.122	99.2	612	284	<0.2	0.221	0.48	0.47
	04/16/18	na	na	na	na	na	na	na	na
	05/08/18	0.123	94.8	520	275	na	na	0.41	0.46
	06/11/18	na	na	na	na	na	na	na	na
	08/08/18	0.099	93.5	608	255	na	na	0.21	0.47
	10/15/18	na	na	na	na	na	na	na	na
	11/05/18	0.094	95.6	614	295	<0.2	0.145	0.32	0.49
	02/04/19	0.099	94.1	578	276	<0.2	0.147	0.36	0.36
	04/10/19	na	na	na	na	na	na	na	na
	05/08/19	0.099	87.2	576	270	na	na	0.48	0.48
	06/11/19	na	na	na	na	na	na	na	na
	07/15/19	na	na	na	na	na	na	na	na
	08/07/19	0.095	82.9	566	254	na	na	0.47	0.46
	11/04/19	0.088	79.0	562	243	na	na	0.41	0.46

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-10
OCWD MONITORING WELL AMD-12
2015 - 2019 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 330-350 ft bgs	01/20/15	na	36.8	290	na	na	<0.007	7.5	0.37
	02/24/15	0.029	25.4	198	84.4	<0.2	<0.007	8.5	0.20
	03/16/15	na	29.9	198	na	na	<0.007	8.4	0.24
	04/14/15	na	31.6	192	na	na	<0.007	8.8	0.22
	05/20/15	0.04	26.8	188	61.2	<0.2	<0.007	8.9	0.20
	06/23/15	na	20.7	150	na	na	<0.007	10	0.18
	07/21/15	na	16.5	126	na	na	0.007	11.2	0.14
	08/12/15	0.023	15.5	102	32.3	<0.2	<0.007	11.3	0.13
	09/16/15	na	14.2	124	na	na	<0.007	10.4	0.13
	10/13/15	na	12.9	98	na	na	<0.007	10.2	0.09
	11/17/15	0.022	13.4	112	27.3	<0.2	<0.007	10.2	0.08
	12/08/15	na	13	98	na	na	<0.007	10.3	0.17
	02/23/16	0.029	34.1	210	79.3	<0.2	<0.002	1.59	0.23
	04/20/16	na	18.2	160	na	na	<0.002	1.92	0.14
	05/17/16	0.024	11.7	115	33.3	<0.2	<0.002	1.76	0.09
	06/20/16	na	27.7	168	na	na	<0.002	1.3	0.21
	08/23/16	0.07	81.1	538	296	<0.2	<0.002	0.47	0.62
	10/10/16	na	60.9	452	na	na	<0.002	0.78	0.48
	11/15/16	0.036	41.5	358	163	<0.2	<0.002	1.19	0.33
	12/12/16	na	36.3	286	na	na	<0.002	1.34	0.26
	02/22/17	0.024	22.5	182	72	<0.2	<0.002	1.63	0.2
	04/11/17	na	23.2	152	na	na	<0.002	1.53	0.15
	05/16/17	0.054	40.4	234	74.2	<0.2	<0.002	1.47	0.29
	06/20/17	na	44	238	na	na	<0.002	1.52	0.39
	08/22/17	0.029	16.5	138	42.6	<0.2	<0.002	1.28	0.18
	10/03/17	na	20	130	na	na	<0.002	0.68	0.34
	11/15/17	0.059	26.9	174	59.2	<0.2	<0.002	0.40	0.1
	12/13/17	na	45.4	256	na	na	<0.002	0.26	0.39
	02/20/18	0.056	56.3	350	191	<0.2	<0.002	0.54	0.49
	04/18/18	na	20.8	154	na	na	<0.002	0.99	0.20
	05/22/18	0.021	9.4	114	41	na	na	1.02	0.17
	06/14/18	na	6.7	84	na	na	<0.002	1.01	0.06
	08/21/18	0.059	69.2	418	228	na	na	0.36	0.46
	10/15/18	na	92.7	586	na	na	<0.002	0.28	0.65
	11/06/18	0.069	92.4	626	342	<0.2	<0.002	0.27	0.67
	12/11/18	na	87.1	568	na	na	0.004	0.22	0.67
	02/19/19	0.065	91.2	570	310	<0.2	<0.002	0.26	0.53
	05/20/19	0.019	16	190	61.7	na	na	0.99	0.27
	06/11/19	na	9.9	128	na	na	<0.002	1.01	0.13
	07/15/19	na	7.6	72	na	na	<0.002	0.88	0.11
	08/20/19	0.019	9	120	17.4	na	na	0.97	0.13
	11/18/19	0.024	12.9	112	25	na	na	1.02	0.10
AMD-12/2 Principal Perforations 490-520 ft bgs	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
	02/20/18	0.016	9.4	102	38	<0.2	<0.002	1.40	0.20
	04/18/18	na	na	na	na	na	na	na	na
	05/22/18	0.027	12.3	104	36.1	na	na	1.22	0.14
	06/14/18	na	na	na	na	na	na	na	na
	08/21/18	0.021	11.4	98	44	na	na	1.13	0.13
	10/15/18	na	na	na	na	na	na	na	na
	11/06/18	0.02	10.3	120	38.6	<0.2	0.003	1.10	0.11
	02/19/19	0.026	25.1	142	75.1	<0.2	<0.002	1.20	0.15
	05/20/19	0.034	39.6	248	129	na	na	0.98	0.31
	06/11/19	na	na	na	na	na	na	na	na
	07/15/19	na	na	na	na	na	na	na	na
	08/20/19	0.036	40.9	296	136	na	na	0.91	0.29
	11/18/19	0.027	26.7	208	118	na	na	0.85	0.17

TABLE J-10
OCWD MONITORING WELL AMD-12
2015 - 2019 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)
	02/24/15	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
AMD-12/3	08/22/17	0.068	74.6	520	225	<0.2	<0.002	0.94	0.56
Principal	11/15/17	0.064	77.2	516	236	<0.2	<0.002	0.71	0.37
Perforations	02/20/18	0.076	79.7	484	235	<0.2	<0.002	0.86	0.55
595-615 ft bgs	04/18/18	na	na	na	na	na	na	na	na
	05/22/18	0.096	65.3	432	181	na	na	1.15	0.47
	06/14/18	na	na	na	na	na	na	na	na
	08/21/18	0.069	41.7	314	142	na	na	1.06	0.36
	10/15/18	na	na	na	na	na	na	na	na
	11/06/18	0.064	36.1	284	102	<0.2	0.003	1.00	0.35
	02/19/19	0.055	34.4	242	91.2	<0.2	<0.002	0.86	0.26
	05/20/19	0.065	53.1	334	126	na	na	0.85	0.39
	06/11/19	na	na	na	na	na	na	na	na
	07/15/19	na	na	na	na	na	na	na	na
	08/20/19	0.073	68.5	412	163	na	na	0.70	0.52
	11/18/19	0.071	80.5	472	217	na	na	0.41	0.48
	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
AMD-12/4	08/22/17	0.099	91.2	580	254	<0.2	<0.002	0.69	0.83
Principal	11/15/17	0.096	92	584	269	<0.2	<0.002	0.81	0.67
Perforations	02/20/18	0.09	92.1	578	281	<0.2	<0.002	0.62	0.83
725-745 ft bgs	04/18/18	na	na	na	na	na	na	na	na
	05/22/18	0.106	93	598	260	na	na	0.60	0.79
	06/14/18	na	na	na	na	na	na	na	na
	08/21/18	0.091	85.5	548	273	na	na	0.82	0.72
	10/15/18	na	na	na	na	na	na	na	na
	11/06/18	0.093	77.4	532	236	<0.2	0.003	1.01	0.74
	02/19/19	0.086	58.9	398	173	<0.2	<0.002	0.84	0.55
	05/20/19	0.076	53.3	340	148	na	na	0.67	0.58
	06/11/19	na	na	na	na	na	na	na	na
	07/15/19	na	na	na	na	na	na	na	na
	08/20/19	0.079	59.1	382	135	na	na	0.62	0.67
	11/18/19	0.078	73	412	170	na	na	0.37	0.57

TABLE J-10
OCWD MONITORING WELL AMD-12
2015 - 2019 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-12/5 Principal Perforations 940-960 ft bgs	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
	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
	02/20/18	0.124	92.5	560	263	<0.2	<0.002	0.63	0.69
	04/18/18	na	na	na	na	na	na	na	na
	05/22/18	0.134	93.5	552	244	na	na	0.59	0.60
	06/14/18	na	na	na	na	na	na	na	na
	08/21/18	0.112	92.7	570	276	na	na	0.59	0.60
	10/15/18	na	na	na	na	na	na	na	na
	11/06/18	0.112	94.9	263	269	<0.2	0.002	0.62	0.70
	02/19/19	0.107	97	580	278	<0.2	<0.002	0.61	0.57
	05/20/19	0.1	96.8	592	284	na	na	0.56	0.69
	06/11/19	na	na	na	na	na	na	na	na
	07/15/19	na	na	na	na	na	na	na	na
	08/20/19	0.099	93.5	600	263	na	na	0.63	0.75
	11/18/19	0.091	91.6	578	251	na	na	0.46	0.62

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-12
OCWD MONITORING WELL AM-10
2015 - 2019 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-10/1 Shallow Perforations 217-235 ft bgs	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
	2/20/2019	0.012	5.3	58	33.1	<0.2	0.004	1.06	<0.05
	5/21/2019	0.014	5.3	55	33.5	na	na	0.95	0.08
	8/19/2019	0.015	5.9	32	36.5	na	na	1.12	0.08
	11/26/2019	0.064	5	73	29.8	na	na	1.18	<0.05

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE J-13
OCWD MONITORING WELL KB1
2015 - 2019 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	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
	2/4/2019	0.072	85.5	514	254	<0.2	<0.002	0.47	0.78
	5/6/2019	0.04	25.4	168	62	na	na	1.25	0.54
	8/7/2019	0.017	5.9	72	16	na	na	1.23	0.28
	11/4/2019	0.063	92.6	606	270	na	na	0.01	0.97

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
2019 Annual Report

GWRS 2019 Quarterly Sampling Dates

OCWD Water Quality Department

MID-BASIN INJECTION (MBI) PROJECT

GROUNDWATER

Monitoring Well	Qtr 1	Qtr 2	Qtr 3	Qtr 4
SAR-10/1-4	03/20/2019	06/18/2019	09/04/2019	12/04/2019
SAR-11/1-3	03/20/2019	06/17/2019	09/04/2019	12/04/2019

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 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. The multi-depth nested wells are 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 2019 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

► NS: Not sampled

Summary of All 2019 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	11.6 - 106	8.7 - 43	8.5 - 44.2	10.1 - 139
Antimony (Sb), ug/L	OCWD	6	ND	ND - 1	ND	ND
Arsenic (As), ug/L	OCWD	10	ND - 6	ND - 5.3	ND - 4.9	ND - 5
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	ND - 5.8	ND - 5.1	ND - 4.6	ND - 4.6
Barium (Ba), ug/L	OCWD	1000	11.1 - 27.6	12 - 31	11.6 - 30.4	11.7 - 25.4
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 - 1.2	ND - 2.5	ND - 1.2	ND
Fluoride (F), mg/L	OCWD	2	ND - 0.11	ND	ND	ND
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.38	ND - 3.42	ND - 0.32	ND - 0.49
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND	ND - 1.6	ND - 1.7	ND - 1.1
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 0.95	ND - 1.16	ND - 1.25	ND - 1.08
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.004	Not Reported	Not Reported	Not Reported
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 1.1	ND - 1.1	ND - 1.3	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 - 2.4	ND - 4.7	ND - 2.4
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	101 - 137	110 - 139	113 - 143	101 - 143
Iron (Fe), ug/L	OCWD	300	ND - 56.3	ND - 24.1	ND - 46.6	ND - 70.7
Manganese (Mn), ug/L	OCWD	50	ND - 4.2	ND - 4.5	ND - 4.2	ND - 4.6
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 4.4	ND - 4.6	ND - 4.2	ND - 4
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND - 2	ND - 1	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	53 - 78	64 - 80	52 - 76	40 - 92
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.2 - 2	ND - 3.2	ND - 2.9	ND - 3.8
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	0.2 - 0.24	0.21 - 0.26	0.24 - 0.28	0.21 - 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 - 3.8	ND - 4.2	ND - 4	ND - 4.6
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	ND	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	Not Required	Not Required	ND	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < NL

SAR-10/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2019 10:55	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
3/20/2019 10:55	Chloroform (CHCl3)	1.1	ug/L	0.5
3/20/2019 10:55	Total Trihalomethanes (TTHMs)	1.1	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2019 10:55	Bromodichloromethane (CHBrCl)	0.4	ug/L	0.1
3/20/2019 10:55	Chloroform (CHCl3)	0.9	ug/L	0.1
3/20/2019 10:55	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2019 10:55	n-Nitrosodimethylamine (NDMA)	4.2	ng/L	2

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
6/18/2019 12:00	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
6/18/2019 12:00	Chloroform (CHCl3)	1.2	ug/L	0.5
6/18/2019 12:00	Total Trihalomethanes (TTHMs)	1.2	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
6/18/2019 12:00	n-Nitrosodimethylamine (NDMA)	3.7	ng/L	2

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
9/4/2019 11:30	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5

SAR-10/1
Organic Detections by Method

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
9/4/2019 11:30	Chloroform (CHCl3)	1.8	ug/L	0.5
9/4/2019 11:30	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
9/4/2019 11:30	n-Nitrosodimethylamine (NDMA)	4.2	ng/L	2

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
12/4/2019 12:05	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
12/4/2019 12:05	Chloroform (CHCl3)	1.2	ug/L	0.5
12/4/2019 12:05	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
12/4/2019 12:05	n-Nitrosodimethylamine (NDMA)	4.6	ng/L	2

SAR-10/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	9:20	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.5
3/20/2019	9:20	Chloroform (CHCl3)	1.1	ug/L	0.5
3/20/2019	9:20	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5
3/20/2019	9:20	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	9:20	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.1
3/20/2019	9:20	Chloroform (CHCl3)	1.0	ug/L	0.1
3/20/2019	9:20	Dibromochloromethane (CHBr2C)	0.1	ug/L	0.1
3/20/2019	9:20	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	9:20	n-Nitrosodimethylamine (NDMA)	5.5	ng/L	2

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2019	10:10	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
6/18/2019	10:10	Chloroform (CHCl3)	1.4	ug/L	0.5
6/18/2019	10:10	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2019	10:10	n-Nitrosodimethylamine (NDMA)	4.9	ng/L	2

SAR-10/2
Organic Detections by Method

Year 2019, Quarter 3

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
9/4/2019	9:50	Bromodichloromethane (CHBrCl)	1.7	ug/L	0.5
9/4/2019	9:50	Chloroform (CHCl3)	2.3	ug/L	0.5
9/4/2019	9:50	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
9/4/2019	9:50	Total Trihalomethanes (TTHMs)	4.0	ug/L	0.5

METHOD: NDMA-LOW

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
9/4/2019	9:50	n-Nitrosodimethylamine (NDMA)	4.9	ng/L	2

Year 2019, Quarter 4

METHOD: 524.2

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
12/4/2019	12:10	Bromodichloromethane (CHBrCl)	1.0	ug/L	0.5
12/4/2019	12:10	Chloroform (CHCl3)	1.4	ug/L	0.5
12/4/2019	12:10	Total Trihalomethanes (TTHMs)	2.4	ug/L	0.5

METHOD: NDMA-LOW

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
12/4/2019	12:10	n-Nitrosodimethylamine (NDMA)	4.2	ng/L	2

SAR-10/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	10:45	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2019	11:20	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2019	11:20	n-Nitrosodimethylamine (NDMA)	2.3	ng/L	2

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/4/2019	10:55	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/4/2019	10:55	n-Nitrosodimethylamine (NDMA)	2.8	ng/L	2

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/4/2019	13:15	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

SAR-10/3
Organic Detections by Method

Year 2019, Quarter 4

METHOD: ***NDMA-LOW***

Sample Date &	Time	Parameter	Result	Units	Reportable Detection Limit
12/4/2019	13:15	n-Nitrosodimethylamine (NDMA)	2.0	ng/L	2

SAR-10/4
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	9:50	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.5
3/20/2019	9:50	Chloroform (CHCl3)	1.0	ug/L	0.5
3/20/2019	9:50	Total Trihalomethanes (TTHMs)	1.6	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	9:50	Bromodichloromethane (CHBrCl)	0.4	ug/L	0.2
3/20/2019	9:50	Chloroform (CHCl3)	0.8	ug/L	0.2
3/20/2019	9:50	Total Trihalomethanes (TTHMs)	1.3	ug/L	0.2

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	9:50	n-Nitrosodimethylamine (NDMA)	2.8	ng/L	2

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2019	10:35	Bromodichloromethane (CHBrCl)	0.9	ug/L	0.5
6/18/2019	10:35	Chloroform (CHCl3)	1.5	ug/L	0.5
6/18/2019	10:35	Total Trihalomethanes (TTHMs)	2.4	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/18/2019	10:35	n-Nitrosodimethylamine (NDMA)	4.2	ng/L	2

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/4/2019	10:15	Bromodichloromethane (CHBrCl)	2.1	ug/L	0.5

SAR-10/4
Organic Detections by Method

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/4/2019	10:15	Chloroform (CHCl3)	2.6	ug/L	0.5
9/4/2019	10:15	Dibromochloromethane (CHBr2C)	TR	ug/L	0.5
9/4/2019	10:15	Total Trihalomethanes (TTHMs)	4.7	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/4/2019	10:15	n-Nitrosodimethylamine (NDMA)	6.3	ng/L	2

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/4/2019	11:00	Bromodichloromethane (CHBrCl)	0.8	ug/L	0.5
12/4/2019	11:00	Chloroform (CHCl3)	1.2	ug/L	0.5
12/4/2019	11:00	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.5

Summary of All 2019 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	9.1 - 17	3.6 - 7.7	2.1 - 6.9	5.4 - 7.5
Antimony (Sb), ug/L	OCWD	6	ND	ND	ND	ND
Arsenic (As), ug/L	OCWD	10	2.2 - 4.1	2.8 - 4.5	2.5 - 4.1	2.3 - 3.9
Arsenic (dissolved) (As-DIS), ug/L	OCWD	N/A	2.2 - 4.2	2.8 - 4.3	2.2 - 3.8	2.1 - 3.7
Barium (Ba), ug/L	OCWD	1000	16.9 - 31.5	17.5 - 30.9	15.4 - 30.5	14.5 - 27.4
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 - 10	ND - 6.8	ND - 1.6	ND - 1.9
Fluoride (F), mg/L	OCWD	2	ND - 0.56	0.13 - 0.56	0.14 - 0.54	ND - 0.54
Hexavalent Chromium (CrVI), ug/L	OCWD	10	ND - 0.28	ND - 0.27	ND - 0.24	ND - 0.27
Mercury (Hg), ug/L	OCWD	2	ND	ND	ND	ND
Nickel (Ni), ug/L	OCWD	100	ND - 2	1.2 - 2.5	1.3 - 1.4	ND
Nitrate Nitrogen (NO3-N), mg/L	OCWD	10	ND - 1.28	ND - 1.06	ND - 1.04	ND - 1.11
Nitrite Nitrogen (NO2-N), mg/L	OCWD	1	ND - 0.003	Not Reported	Not Reported	Not Reported
Perchlorate (CLO4), ug/L	OCWD	6	ND	ND	ND	ND
Selenium (Se), ug/L	OCWD	50	ND - 3.3	ND - 3.1	ND - 3.7	ND - 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 - 2.4	ND - 1.8	ND - 2.2	ND - 2.8
Primary Drinking Water Standards - Biological						
Total Coliform (Colilert - MPN/100mL) (TCOLIQ), MPN	OCWD	N/A	Not Required	Not Required	Not Required	Not Required
Secondary Drinking Water Standards						
Apparent Color (unfiltered) (APCOLR), UNITS	OCWD	15	ND	ND	ND	ND
Electrical Conductivity (EC), um/cm	OCWD	900	120 - 241	122 - 233	128 - 253	130 - 208
Iron (Fe), ug/L	OCWD	300	14.1 - 65.7	11.9 - 73.7	8.8 - 10.1	ND - 7.5
Manganese (Mn), ug/L	OCWD	50	ND - 7.5	ND - 6.8	ND - 6.4	ND - 7.9
Manganese (dissolved)* (Mn-DIS), ug/L	OCWD	N/A	ND - 7	ND - 6.5	ND - 6	ND - 6.9
Threshold Odor Number (Median) (ODOR), TON	OCWD	3	ND	ND	ND	ND
Total Dissolved Solids (TDS), mg/L	OCWD	500	74 - 138	58 - 138	54 - 146	80 - 130
Other Constituents	OCWD	Varies	ND < SMCL	ND < SMCL	ND < SMCL	ND < SMCL
Turbidity (TURB), NTU	OCWD	5	0.2 - 0.7	0.2 - 0.6	0.2	0.1 - 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	0.16 - 0.25	0.17 - 0.23	0.15 - 0.21	0.17 - 0.22
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 - 11.4	ND - 11	ND - 10.2	ND - 9.6
EPA Unregulated Chemicals						
2,4-Dinitrotoluene (24DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
2,6-Dinitrotoluene (26DNT), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
4,4'-DDE (DDE), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Acetochlor (ACETOC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
DCPA-Dacthal (DCPA), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
EPTC (EPTC), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required
Methyl tert-butyl ether (MTBE), ug/L	OCWD	5**	ND	ND	ND	ND
Molinate (MOLINT), ug/L	OCWD	20***	ND	Not Required	Not Required	Not Required
Terbacil (TRBACL), ug/L	OCWD	N/A	ND	Not Required	Not Required	Not Required

* MCL based on total not dissolved; ** CA Secondary MCL; *** CA Primary MCL

Summary of 2019 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	ND	Not Required	Not Required	Not Required
551.1	Disinfection Byproducts (DBPs) - Haloacetonitriles	OCWD	ND < MCL	Not Required	Not Required	Not Required
CEC	Chemicals of Emerging Concern	OCWD	Not Required	Not Required	ND	Not Required
NDMA-LOW	NDMA-LOW Analytical Procedure	OCWD	ND < NL	ND < NL	ND < NL	ND < NL

SAR-11/1
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	9:30	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.5
3/20/2019	9:30	Chloroform (CHCl3)	1.2	ug/L	0.5
3/20/2019	9:30	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

METHOD: 551.1

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	9:30	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.1
3/20/2019	9:30	Chloroform (CHCl3)	1.0	ug/L	0.1
3/20/2019	9:30	Total Trihalomethanes (TTHMs)	1.4	ug/L	0.1

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/17/2019	11:35	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
6/17/2019	11:35	Chloroform (CHCl3)	1.0	ug/L	0.5
6/17/2019	11:35	Total Trihalomethanes (TTHMs)	1.0	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
6/17/2019	11:35	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
9/4/2019	10:40	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
9/4/2019	10:40	Chloroform (CHCl3)	0.9	ug/L	0.5
9/4/2019	10:40	Total Trihalomethanes (TTHMs)	0.9	ug/L	0.5

SAR-11/1
Organic Detections by Method

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/4/2019	13:40	Bromodichloromethane (CHBrCl)	TR	ug/L	0.5
12/4/2019	13:40	Chloroform (CHCl3)	0.8	ug/L	0.5
12/4/2019	13:40	Total Trihalomethanes (TTHMs)	0.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
12/4/2019	13:40	n-Nitrosodimethylamine (NDMA)	2.1	ng/L	2

SAR-11/2
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2019 10:20	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
3/20/2019 10:20	Chloroform (CHCl3)	1.7	ug/L	0.5
3/20/2019 10:20	Total Trihalomethanes (TTHMs)	2.4	ug/L	0.5

METHOD: 551.1

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2019 10:20	Bromodichloromethane (CHBrCl)	0.6	ug/L	0.1
3/20/2019 10:20	Chloroform (CHCl3)	1.2	ug/L	0.2
3/20/2019 10:20	Dibromochloromethane (CHBr2C)	0.1	ug/L	0.1
3/20/2019 10:20	Total Trihalomethanes (TTHMs)	2.0	ug/L	0.1

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
3/20/2019 10:20	n-Nitrosodimethylamine (NDMA)	4.2	ng/L	2

Year 2019, Quarter 2

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
6/17/2019 10:50	Bromodichloromethane (CHBrCl)	0.5	ug/L	0.5
6/17/2019 10:50	Chloroform (CHCl3)	1.2	ug/L	0.5
6/17/2019 10:50	Total Trihalomethanes (TTHMs)	1.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
6/17/2019 10:50	n-Nitrosodimethylamine (NDMA)	3.7	ng/L	2

SAR-11/2
Organic Detections by Method

Year 2019, Quarter 3

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
9/4/2019 11:45	Bromodichloromethane (CHBrCl)	0.7	ug/L	0.5
9/4/2019 11:45	Chloroform (CHCl3)	1.5	ug/L	0.5
9/4/2019 11:45	Total Trihalomethanes (TTHMs)	2.2	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
9/4/2019 11:45	n-Nitrosodimethylamine (NDMA)	3.5	ng/L	2

Year 2019, Quarter 4

METHOD: 524.2

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
12/4/2019 12:35	Bromodichloromethane (CHBrCl)	1.1	ug/L	0.5
12/4/2019 12:35	Chloroform (CHCl3)	1.7	ug/L	0.5
12/4/2019 12:35	Total Trihalomethanes (TTHMs)	2.8	ug/L	0.5

METHOD: NDMA-LOW

Sample Date & Time	Parameter	Result	Units	Reportable Detection Limit
12/4/2019 12:35	n-Nitrosodimethylamine (NDMA)	3.7	ng/L	2

SAR-11/3
Organic Detections by Method

Year 2019, Quarter 1

METHOD: 524.2

Sample Date & Time		Parameter	Result	Units	Reportable Detection Limit
3/20/2019	11:10	Methylene Chloride (CH2Cl2)	TR	ug/L	0.5

Appendix L

Mid-Basin Injection Area Monitoring Well Groundwater Quality

1,4-Dioxane, NDMA and Selected Constituents

Orange County Water District
Groundwater Replenishment System
2019 Annual Report

TABLE L-1
OCWD MONITORING WELL SAR-10
1,4-dioxane and NDMA Concentrations
2015- 2019

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)
3/23/2015	<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
3/20/2019	<1	4.2	3/20/2019	<1	5.5	3/20/2019	<1	<2
6/18/2019	<1	3.7	6/18/2019	<1	4.9	6/18/2019	<1	2.3
9/4/2019	<1	4.2	9/4/2019	<1	4.9	9/4/2019	<1	2.8
12/4/2019	<1	4.6	12/4/2019	<1	4.2	12/4/2019	<1	2

TABLE L-1
OCWD MONITORING WELL SAR-10
1,4-dioxane and NDMA Concentrations
2015- 2019

SAR-10/4 *Main Aquifer* *Perforations: 1,100-1,115 ft bgs*		
Date	1,4-dioxane (ug/L)	NDMA (ng/L)
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
3/20/2019	<1	2.8
6/18/2019	<1	4.2
9/4/2019	<1	6.3
12/4/2019	<1	<2

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
2015 - 2019

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)
3/24/2015	<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
3/20/2019	<1	<2	3/20/2019	<1	4.2	3/20/2019	<1	<2
6/17/2019	<1	2.1	6/17/2019	<1	3.7	6/17/2019	<1	<2
9/4/2019	<1	<2	9/4/2019	<1	3.5	9/4/2019	<1	<2
12/4/2019	<1	2.1	12/4/2019	<1	3.7	12/4/2019	<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
2015 - 2019 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	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
	3/20/2019	0.014	5.1	5.2	68	47.8	<0.2	0.004	0.74	0.07
	6/18/2019	0.014	5.6	6.1	74	51.6	na	na	0.78	0.1
	9/4/2019	0.016	6.4	6.3	66	49.8	na	na	0.83	0.11
	12/4/2019	0.016	5.4	5.3	92	46.7	na	na	0.76	0.15

TABLE L-3
OCWD MONITORING WELL SAR-10
2015 - 2019 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	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
	3/20/2019	0.014	4.7	0.7	56	40.6	<0.2	0.003	0.95	0.11
	6/18/2019	<0.01	5.6	0.6	64	44.2	na	na	1.16	0.06
	9/4/2019	0.019	6.3	0.6	64	39.6	na	na	1.25	0.08
	12/4/2019	0.017	4.6	0.6	40	34.2	na	an	0.99	0.01

TABLE L-3
OCWD MONITORING WELL SAR-10
2015 - 2019 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	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
	3/20/2019	0.011	4.9	10.9	78	49.6	<0.2	0.002	<0.1	0.12
	6/18/2019	0.012	4.8	11	80	52.4	na	na	<0.1	0.11
	9/4/2019	0.013	5.5	11.3	76	52.5	na	na	<0.1	0.15
	12/4/2019	0.018	5.8	11.4	74	42.8	na	na	<0.1	0.16

TABLE L-3
OCWD MONITORING WELL SAR-10
2015 - 2019 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	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
	3/20/2019	0.012	4.1	3.2	53	38.6	<0.2	<0.002	0.90	0.07
	6/18/2019	0.014	5.4	3.9	64	41.8	na	na	1.07	0.08
	9/4/2019	0.023	6.9	4.8	52	41.5	na	na	1.21	0.13
	12/4/2019	0.015	4.6	3.6	53	33.5	na	na	1.08	0.06

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed

TABLE L-4
OCWD MONITORING WELL SAR-11
2015 - 2019 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	3/24/2015	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
	3/20/2019	0.021	8.3	12.9	138	73.3	<0.2	<0.002	0.87	0.07
	6/17/2019	0.019	8.1	12.7	138	73.6	na	na	0.8	0.08
	9/4/2019	0.019	8.6	14.7	146	75.4	na	na	0.67	0.11
	12/4/2019	0.020	7.1	9.7	130	59.4	na	na	0.82	0.07

TABLE L-4
OCWD MONITORING WELL SAR-11
2015 - 2019 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	3/24/2015	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
	3/20/2019	0.012	5.7	1	90	53.2	<0.2	0.003	1.28	0.07
	6/17/2019	0.013	5	0.9	76	52.6	na	na	1.06	0.07
	9/4/2019	0.013	5.1	1	66	50.6	na	na	1.04	0.10
	12/4/2019	0.016	5.3	1.1	92	37.2	na	na	1.11	0.06

TABLE L-4
OCWD MONITORING WELL SAR-11
2015 - 2019 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)
	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
SAR-11/3	12/15/15	na	11.2	10.7	132	na	na	<0.002	<0.1	0.13
Main	12/29/15	na	11.1	9.4	138	na	na	<0.002	<0.1	0.14
Perforations	01/20/16	na	10.8	8.7	106	na	na	<0.002	<0.1	0.15
1,100-1,110 ft bgs	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
	3/20/2019	0.011	4.9	8	74	34.9	<0.2	0.002	<0.1	0.08
	6/17/2019	0.014	5.1	8.6	58	33	na	na	<0.1	0.09
	9/4/2019	0.012	5.6	9.2	54	32.4	na	na	<0.1	0.18
	12/4/2019	0.018	6	10	80	33.2	na	na	<0.1	0.08

Note: 1) <"x" signifies result was less than detection limit of "x"
2) na = not analyzed