Las Virgenes Municipal Water District
Triunfo Joint Powers Authority
Pure Water Project Demonstration

YEAR 2 PURE WATER DEMONSTRATION PERFORMANCE SUMMARY

FINAL | January 2023

PURE WATER PROJECT
LAS VIRGENES-TRIUNFO

Bringing Our Water Full Circle

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Abbreviations

%	percent
°C	degrees Celsius
µg/L	micrograms per liter
µm	micrometer
µS/cm	microsiemens per centimeter
ACU	apparent color unit
AOP	advanced oxidation process
BDCM	bromodichloromethane
$CaCO_3$	calcium carbonate
CEC	contaminant of emerging concern
CIP	clean-in-place
Cl_2	chlorine
CLR	calcium, lime, rust
CTR	California Toxics Rule
DBCM	dibromochloromethane
DBP	disinfection byproduct
DDW	Division of Drinking Water
Demo	Pure Water Demonstration Project
F	Fahrenheit
ft^2	square feet
gal	gallon(s)
gfd	gallons per square foot of membrane area per day
gpm	gallons per minute
HMI	human machine interface
IPR	indirect potable reuse
JPA	Joint Powers Authority
LRV	log reduction value
LVMWD	Las Virgenes Municipal Water District
mA	milliamperes
MCL	maximum contaminant level
MC	maintenance clean
MF	microfiltration
mg/L	milligrams per liter
MIT	membrane integrity test
mil	one thousandth of an inch
mJ/cm^2	millijoules per square centimeter

mL	milliliter
MPN	most probable number
MS2	MS2 Bacteriophage
mV	millivolt
mW/cm^2	milliwatts per square centimeter
NaOCl	sodium hypochlorite
NDMA	N-Nitrosodimethylamine
NDP	normalized differential pressure
ng/L	nanograms per liter
NL	notification level
NMOR	N-nitrosomorpholine
NPDES	National Pollutant Discharge Elimination System
NPF	normalized permeate flow
NSP	normalized salt passage
NTU	nephelometric turbidity unit
OCWD	Orange County Water District
ORP	oxidation reduction potential
pCi/L	picocuries per liter
PDT	pressure decay test
pg/L	picogram per liter
PMMoV	pepper mild mottle virus
psi	pounds per square inch
PSS	point source summation
PVC	polyvinyl chloride
Q	flow
RC	recovery clean
RED	reduction equivalent dose
Report	Year 2 Purification System Performance Report
RO	reverse osmosis
ROP	reverse osmosis permeate
RRT	response retention time
RWQCB	Regional Water Quality Control Board
s	second(s)
scfm	standard cubic feet per minute
SDI	silt density index
SiO_2	silica
sMCLs	secondary maximum contaminant level
TDS	total dissolved solids

THM	trihalomethane
TMP	transmembrane pressure
TOC	total organic carbon
UF	ultrafiltration
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
UV	ultraviolet
UVI	ultraviolet intensity
UVI/Q	ultraviolet intensity divided by flow
UVT	ultraviolet transmittance
VFD	variable frequency drive
WRF	water reclamation facility

EXECUTIVE SUMMARY

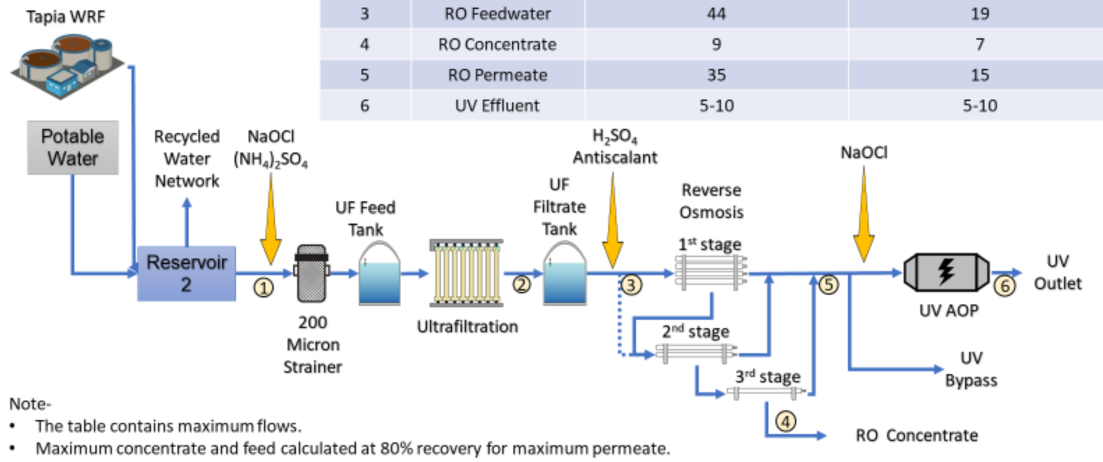
The Las Virgenes Municipal Water District (LVMWD) and Triunfo Joint Powers Authority (JPA) Pure Water Demonstration (Demo) was commissioned in late June 2020 and has operated continuously since commissioning. This report describes demonstration and testing activities carried out during the second year of operation of the Las Virgenes Triunfo Joint Powers Authority Demo. A more comprehensive characterization of Demo performance during the first year of operation is documented in the "Purification System Performance Report", dated August 2022. The first year report is referred to in this document as the Year 1 Report.

The wider goals of the Demo are to:

- Provide opportunities for public education, acceptance, and public outreach to the JPA's customers.
- Develop design criteria and operational procedures to inform and improve the full-scale design and provide experience to operators.
- Provide technical documentation and support for permitting the project by the State of California's Division of Drinking Water (DDW) and the Regional Water Quality Control Board (RWQCB) as a surface water augmentation project (DDW, 2018).

The Demo is connected to effluent from the Tapia Water Reclamation facility via Las Virgenes' Reservoir 2. Figure ES-1 provides an overview of the Demo process train and operational chemical addition and maximum design flow rates. Major treatment barriers at the demo include micro- and ultra- -filtration (MF/UF), reverse osmosis (RO) and Ultraviolet (UV) Advanced Oxidation Processes (AOP).

Stream	Description	3 Stage RO Max Flow (gpm)	2 Stage RO Max Flow (gpm)
1	UF Feedwater	100	100
2	UF Filtrate	96	96
3	RO Feedwater	44	19
4	RO Concentrate	9	7
5	RO Permeate	35	15
6	UV Effluent	5-10	5-10



Note-

- The table contains maximum flows.
- Maximum concentrate and feed calculated at 80% recovery for maximum permeate.
- Maximum permeate from H_2O innovations process narrative.
- In 2 Stage Mode, Feed Enters RO Stage 2 (Bypass Stage 1) – Dotted Line

Figure ES.1 Process Train Overview

The MF/UF system is a flexible open platform skid that allows parallel and independent operation and monitoring of up to 3 MF/UF products. The RO is designed to allow operation as either a 2-stage or 3-stage configuration. The UV AOP has been operated using sodium hypochlorite (free chlorine) as the oxidant to generate radical species and act as a chemical barrier to small uncharged chemicals that could resist RO treatment.

The Tapia Water Reclamation Facility (WRF) contributes a large majority of its treated effluent to an extensive non-potable recycled water network. During summer months, the recycled water demand can exceed treated effluent production. In these circumstances, potable water is blended into Reservoir 2 to meet demand. A consequence of this blending is that the feedwater to the Demo can have up to a 25 percent contribution of potable water – based on material balance estimates detailed in this report. The impact of blending this water did not appear to significantly impact performance of unit operations. However, the blending of potable water can dilute some water quality constituents and monitoring results suggest that the blending can increase variability of constituents throughout the day. To that end, the complete set of water quality parameters that may impact design of a MF/UF, RO, UV AOP facility were summarized into two data sets, the entire range of observations and the range of observations where the feed to the Demo should have been exclusively Tapia Effluent.

Consistent with the Year 1 Report, all process barriers continue to produce water with a high degree of uptime that has exceeded 90 percent for all processes. Causes of downtime are anticipated to be solved with redundancy at scale that is typically not considered feasible for inclusion in a demonstration scale system.

The MF/UF units tested have generally demonstrated sustainable hydraulic performance. During the second year of testing, the MF/UF units were challenged under different production and cleaning regimes. Regular maintenance cleaning did not appear to show significant performance improvement benefits at concentrations of more than 500 milligrams per liter (mg/L) of Sodium Hypochlorite. Each UF product was shown to be able to operate long term at fluxes (the flow per unit area of membrane) exceeding 40 gallons per square foot of membrane area per day (gfd) and a subset of products could operate at up to 50 gfd for shorter peak periods, provided the higher strength recovery cleans (sodium hypochlorite, followed by citric acid) were maintained at a monthly frequency. One of the UF modules did appear to suffer hydraulic performance and potentially integrity decline after approximately 18 months of operation. However, this loss of performance is suspected to have been caused by a malfunctioning fill valve which allowed drying out of the product. To that end, performance data reported for the Toray HFUG2020AN module is not anticipated to be an adequate representation of true performance..

Integrity testing via pressure decay tests for both other membrane products (the Dow/DuPont SFD 2880 XP and Pall UNA-620A) have demonstrated log reduction values (LRV) for protozoa (*Cryptosporidium* and *Giardia*) consistently exceeding 4.0 log units for the entire test period. Filtrate turbidity monitored independently on each UF module by high sensitivity meters has remained at 0.05 nephelometric turbidity unit (NTU) or below at the 95th percentile indicating excellent particulate removal.

The RO system has been operated predominantly as a 3-stage 85 percent recovery unit during the second year. There have been challenges maintaining RO membrane specific flux (an indicator of the driving force required to achieve flow targets), however, comparison of the Demo results with test results for a similar membrane product at Orange County Water District indicate that the baseline RO specific flux observed at the Demo is consistent across both sites. Maintaining this baseline specific flux has been possible with clean-in-place (CIP) intervals of between 60 to 90 days, provided there are no influencing events that trigger early fouling.

Online surrogates' total organic carbon (TOC) and conductivity were able to verify LRVs of 1.5 and 1.7 log units across the RO respectively. Offline grab samples of surrogates such as strontium and sulfate could demonstrate on average LRVs of 2.5 and 2.7, respectively. Strontium LRVs as high as 3.0 were able to be observed dependent of feed water concentration and the detection limit of the laboratories used for analysis.

N-Nitrosodimethylamine (NDMA) removal by the UV AOP unit appears to have met its target most of the time at the Demo based on the ultraviolet intensity (UVI) divided by flow (UVI/Q) metric, which has been stable. Free chlorine dosing has varied throughout the year and may have at times (<10 percent) reduced to levels that were not able to achieve 0.5 log reduction of 1,4 Dioxane. Such reduction in performance would be well monitored and controlled (and alarmed) for a future full-scale system so that the minimum free chlorine dose is maintained, or diversion of flow is implemented. Neither NDMA or 1,4 Dioxane have been detected above drinking water limits. The maximum NDMA concentration in the feed to the UV AOP from Year 2 monitoring data has increased from 19 to 27 nanograms per liter (ng/L) which may need to be taken into account for future UV system sizing to meet California Toxics Rule (CTR) requirements. This change is estimated to require at least 0.1 log unit additional removal of NDMA. It is also recommended that NDMA monitoring of the RO permeate continue as a means to better understand removal requirements.

Chapter 1

INTRODUCTION

The Las Virgenes Municipal Water District (LVMWD) and Triunfo Joint Powers Authority (JPA) Pure Water Demonstration (Demo) was commissioned in late June 2020 and has operated continuously since commissioning. This report contains a summary of key performance parameters and water quality from the start of July 2020 to the end of June 2022, the first two years of operation.

The wider goals of the Demo are to:

- Provide opportunities for public education, acceptance, and public outreach to the JPA's customers.
- Develop design criteria and operational procedures to inform and improve the full-scale design and provide experience to operators.
- Provide technical documentation and support for permitting the project by the State of California's Division of Drinking Water (DDW) and the Regional Water Quality Control Board (RWQCB) as a surface water augmentation project (DDW, 2018).

1.1 Demonstration Treatment Train Summary

The Source water from the Demo is secondary treated, filtered and disinfected effluent from the Tapia Water Reclamation Facility (WRF). The Tapia WRF effluent is stored in Reservoir 2 prior to transmission as part of a wider non-potable reuse network. The feedwater connection to the Demo is to Reservoir 2.

The Demo includes the following purification processes and monitoring equipment:

- **Microfiltration (MF) and Ultrafiltration (UF):** One open platform train designed to produce a total maximum flow of 100 gallons per minute (gpm) of filtered effluent. The train is equipped with three different suppliers' membranes (and thus three modules) which are independently monitored and operated in parallel. to undergo simultaneous testing. The modules that have been equipped during the collection of data in this report are:
  - UF1: Dow/DuPont SFD-2880XP:
    - Reported Nominal Pore Size 0.03 micrometer (µm).
    - Classification: Ultrafilter.
  - UF2: Pall UNA-620A:
    - Reported Nominal Pore Size 0.1 µm.
    - Classification: Microfilter.
  - UF3: Toray HFUG Type 2020AN:
    - Reported Nominal Pore Size 0.01 µm.
    - Classification: Ultrafilter.

- **Reverse Osmosis (RO):** One train, utilizing Toray TMG10D 4X40-inch membranes, can be operated as either a 2-stage (2:1 array) or 3-stage (4:2:1) array. Each vessel can hold a maximum of 7 elements. Recoveries of 80 to 85 percent have been evaluated during the first two years of operation.
- **Ultraviolet (UV) Advanced Oxidation Process (AOP):** One Xylem Spektron 30E reactor, which is capable of treating up to 20 gpm with a dose of 600 millijoules per square centimeter (mJ/cm^2) for N-Nitrosodimethylamine (NDMA) destruction coupled with an upstream dose of sodium hypochlorite for a minimum removal of 0.5-log of 1,4-dioxane. Flows have remained consistent at approximately 6 gpm through the system to generate higher dose values sufficient for NDMA destruction by photolysis and advanced oxidation (with the addition of sodium hypochlorite) of chemical pollutants such as 1,4 dioxane. At the current flow of 6 gpm, the UV supplier (Xylem/WEDECO) estimates a point source summation (PSS)-based UV dose of ~1500 mJ/cm^2, which was verified as part of testing detailed in the Year 1 Report.
- **Online Monitoring Systems:** Each of the three processes is being monitored online:
  - The UF system continuously monitors flux, transmembrane pressure (TMP), turbidity (feed, and filtrate of each module) and on the combined filtrate, oxidation reduction potential (ORP), pH, free ammonia, and total chlorine. Each UF can be scheduled to undergo a daily pressure decay test (PDT) to verify integrity and calculate an equivalent log reduction value (LRV) for *Cryptosporidium*.
  - The RO system continuously collects detailed online data which is coupled with daily logged data to monitor normalized flux, normalized salt passage/rejection, reduction of total organic carbon (TOC) across the membranes and normalized differential pressure.
  - The UV system continuously monitors UV dose, based upon a constant ultraviolet transmittance (UVT) input value (currently set to 98 percent), the online ultraviolet intensity (UVI) sensor, and flowrate using a PSS calculation. The system also monitors for free and total chlorine and UVT ahead of and after the UV system, as well as pH in the feed to the UV reactor. The accuracy of that UV dose is documented within the Year 1 Report (and also in a United States Bureau of Reclamation [USBR] report for the Demo) and compared with the WEDECO online dose calculation.
  - Operations staff have been verifying sensor accuracy as part of weekly checks. The online meter accuracy was reviewed in detail in the Year 1 Report but was not repeated for Year 2 operational data.

Figure 1.1 provides an overview of the Demo process train and operational chemical addition and maximum design flow rates.

Stream	Description	3 Stage RO Max Flow (gpm)	2 Stage RO Max Flow (gpm)
1	UF Feedwater	100	100
2	UF Filtrate	96	96
3	RO Feedwater	44	19
4	RO Concentrate	9	7
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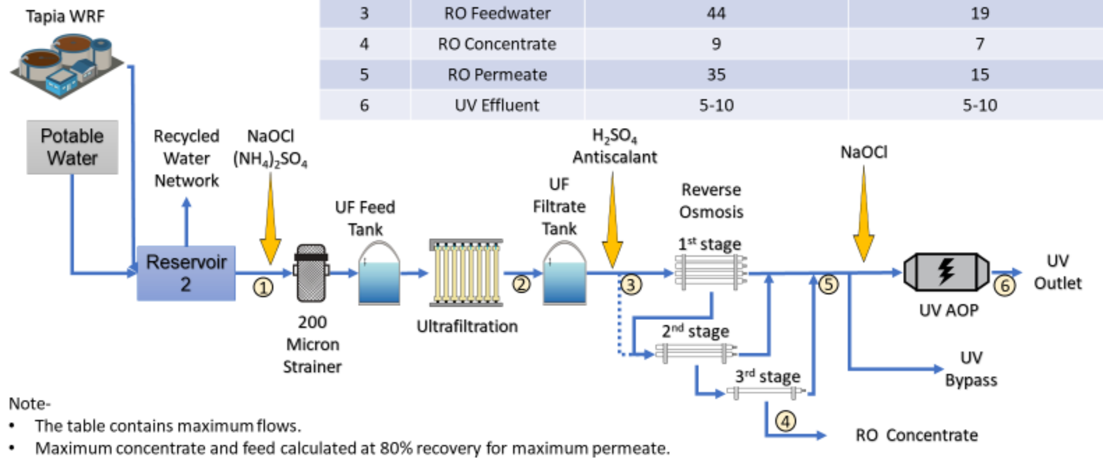
6	UV Effluent	5-10	5-10



Note-
- The table contains maximum flows.
- Maximum concentrate and feed calculated at 80% recovery for maximum permeate.
- Maximum permeate from H_2O innovations process narrative.
- In 2 Stage Mode, Feed Enters RO Stage 2 (Bypass Stage 1) – Dotted Line

Figure 1.1 Process Train Overview

1.2 Regulations

The future full-scale project will be required to meet the treatment requirements defined by the State of California (DDW, 2018), summarized in Table 1.1.

1.3 Prior Reports

This report provides an overview of important operational elements and water quality to support future full scale facility design. Prior reports are included as appendices. Where possible, efforts have been made to reduce duplication with the prior work. The contents of the prior reports are briefly summarized below.

1.3.1 Year 1 Purification System Performance Report

The purpose of the Year 1 Report was to summarize the treatment and monitoring system performance, operational efficiency, and ability of the treatment and monitoring system to meet the State of California regulations for potable water reuse (Table 1.1) (DDW, 2018).

1.3.1.1 Treatment and Monitoring System Performance

- Each key process unit (UF/RO/ UV AOP) has a number of online monitoring systems which were evaluated against periodic verification sampling.
- All three treatment and monitoring systems demonstrated a high level of performance and uptime.
- In general, offline periods where the systems were not producing would be addressed at full scale by means of additional redundancy and further automation of membrane cleaning processes.

Table 1.1 Title 22 Reservoir Water Augmentation Requirements for Potable Reuse (DDW, 2018)

Parameter	Criteria
Enteric Virus	8-log Reduction(1)
Giardia Cyst	7-log Reduction(1)
Cryptosporidium oocysts	8-log Reduction(1)
Full Advanced Treatment	RO and an AOP that achieves 0.5-log reduction of 1,4-dioxane
Inorganic Chemicals in Table 64431-A(1)	≤ MCLs
Radionuclide Chemicals in Tables 64442 and 64443	≤ MCLs
Organic Chemicals in 64444-A	≤ MCLs
Disinfection Byproducts in Table 64533-A	≤ MCLs
Lead and Copper	≤ Action Levels
Priority Toxic Pollutants in 40 CFR Section 131.38 and DDW-Specified Chemicals	≤ NLs(2)
Minimum Dilution of any 24-hour input of Recycled Water	100:1 with no additional pathogen log reduction 10:1 with 1-log additional pathogen reduction
Minimum Reservoir RRT	4 months with no additional pathogen log reduction 2 months with 1-log additional pathogen reduction

Notes:
Abbreviations: MCL - maximum contaminant level; ng/L - nanograms per liter; NL - notification level; RRT - response retention time.
(1) Log reductions are from the point of raw wastewater to the point of raw water to downstream surface water treatment plant. If dilution is less than 100:1, one additional log removal is required for all pathogens. If reservoir retention time is less than 4 months, one additional log removal is required for all pathogens. Reservoir retention time must >2 months for all cases.
(2) Notable among which is the NDMA goal of 10 ng/L or less. For discharge to the Las Virgenes Reservoir, due to California Toxics Rule enforcement, the NDMA requirement is 0.69 ng/L, which is below the current laboratory method reporting level of 2 ng/L.

1.3.1.2 Treatment System Operational Efficiency

- UF – three different models (Dow, Pall, and Toray) were analyzed for performance indicators such as recovery, permeability, flux, turbidity, PDT, Silt Density Index (SDI):
  - **Recovery** - in all three UF membrane models the target recovery of 95 percent was met (Dow at 95 percent, Pall at 96 percent, and Toray >97 percent):
    - There were challenges controlling the recovery of the Toray module:
      - The large surface area (969 square feet [ft^2]) necessitated a high backwash flow to meet the planned operational regime. Initial operation did not properly accommodate this and the backwash target was not met due to a control valve limitation.
      - After the Year 1 Report it was discovered that the initial fill volumes for the Toray module did not match manufacturer specifications and were later identified to be further limited due to due to a malfunctioning feed control valve . Due to this, there may have been unutilized portions of membrane that dried out which manifested in high pressure decay rates, lower than anticipated permeabilities and higher than targeted recoveries.

- Consequently, performance data reported for the Toray module is not anticipated to be an adequate representation of true performance.
- A new Toray module has been installed using the same fiber type as the original. Performance of this new module is anticipated to provide more representative performance.

- **Permeability** – used to indicate cleaning performance. During the demo maintenance cleaning was performed once a week and recovery cleaning was performed once a month. The Pall MF membrane had the highest permeability recovery whereas the Toray UF membrane had the lowest; however, this was most likely a result of the backwash limitations noted above.
- **Sustainable flux** – Permeability recovery due to cleans and backwashes was modelled to determine a flux that would result in no more than 30 percent of permeability loss across a 10 year operational life. The analysis suggested that with one maintenance clean per week and one recovery clean per month, each of the tested modules could operate sustainably at fluxes between 45 and 50 gallons per square foot of membrane area per day (gfd).
- **Turbidity** – the UF systems are providing high quality filtrate and did not exceed the 0.2 nephelometric turbidity unit (NTU) filtered water turbidity 95th percentile. Typically, filtrate turbidity of all modules was less than 0.05 NTU. In addition, the Tapia WRF effluent that is blended into Reservoir 2 is low in solids and has a low turbidity that is typically less than 1 NTU.
- **Pressure Decay Test** – From the PDT, a LRV can be calculated to represent protozoa removal. A value above 4 indicates the membrane barrier is intact and achieving greater than 99.99 percent removal of *Cryptosporidium* and *Giardia*. During the first year there was not PDT failure (LRV <4) for any module due to a membrane integrity issue. There were however three pressurization issues that were the result of a faulty pressure release valve in between the compressor and UF:
  - Following the Year 1 report, UF3 did begin to fail PDTs. However, this was suspected to be due to a malfunctioning fill valve and inadequate fill volumes as described above. An investigation is ongoing to determine the exact cause of the observed UF3 PDT failure. Preliminary details available at the time of writing this report are included.
- **SDI-15** – all three membrane products produced acceptable water for the RO membranes. During initial operation, the SDI was variable, but acceptable with all results less than 5.0. After a run-in period, SDIs from all modules were typically less than 3.0.
- **Virus challenge testing** – while UF units are not credited with virus LRV, all three membrane models demonstrated a virus removal for the two model viruses, pepper mild mottle virus (PMMoV) and MS2 bacteriophage (MS2). Virus challenge test results are reproduced for each module in Table 1.2.

Table 1.2 Summary of the Virus Challenge Test Results Conducted in Year 1 for Each UF Module

Module	UF1 – Dow	UF2 – Pall(1)	UF3 – Toray
Nominal pore size (µm)	0.03	0.1	0.01
PMMoV average LRV(2)	4.6	2.8	4.8
MS2 average LRV(3)	3.9	0.8	2.8

Notes:
(1) The Pall has a larger pore size and is not designed for virus removal but is still achieving almost 1 log reduction of MS2 and more than 2.5 log reduction of larger indigenous viruses indicated by PMMoV.
(2) PMMoV is a larger rod shaped virus with an 0.018 µm approximate diameter and 300 µm length. Indigenous PMMoV was sampled before and after each system for 8 separate sampling events during the first year.
(3) MS2 is a 0.025 µm model virus commonly used to challenge test membrane systems as it is representative of the smallest pathogenic viruses.

- RO – The RO was designed to operate in 2- or 3-stage configuration. In 2 stage mode, the feed bypasses the first set of four pressure vessels. There is an interstage booster between the second and third stage pressure vessels. Efficiency was quantified by normalized specific flux, permeate flow, differential pressure, and salt passage. During the first year of operation, the RO was systematically operated at either 80 or 85 percent recovery and 2- or 3- stage mode. Operational periods were targeted to be at least 1000 hours (or approx. 45 days). After each operational period, the RO was chemically cleaned before operational parameters were changed:
  - **Specific Flux** – Showed a steady declining trend over the course of the trial. In addition, an initial rapid decline in specific flux for approximately 5 days following the cleaning in place (CIP), followed by a slow decrease for the remaining 40+ days was observed. This behavior is characteristic of RO used in reuse of wastewater.
  - **Normalized Permeate flow** – Normalized permeate flow (analogous to specific flux) declined rapidly for the first 5 days of operation and then leveled off for the remaining 40-45 days. The rapid decline and then stabilization in permeate flow (and specific flux) may have indicated establishment of a colloidal organic fouling layer. Recent research has suggested that chloramine species may chemically alter the RO membrane surface and cause this performance reduction (Brown et al. 2022).
  - **Normalized Differential pressure (NDP)** – reductions in differential pressure was seen when converting from 3 stage to 2 stage due to reduction in cross flowrate. Similarly, reductions in differential pressure were observed when changing from 80 to 85 percent recovery as a result of slight reductions in feed flow and recovery per vessel at a higher overall system recovery. With the exception of these operational impacts, NDP was stable indicating low particulate and biological fouling of the RO system (and good integrity of the upstream UF.
  - **Normalized Salt passage** – slow reductions in salt passage were likely due to buildup of an organic fouling layer. During the fourth CIP, an increase in salt passage was traced to delamination of a single element as a result of permeate backpressure buildup during flushing. The damaged module was identified and replaced thereby rectifying the issue.
  - **RO Membrane Autopsy –** Systematic autopsies were conducted of the tail element of the final stage during each operational cycle and are described in detail in the Year 1 Report. After the first autopsy, increase in RO feed pH was proposed to reduce organic and suspected aluminum fouling. pH was increased from 6.4 to

6.8 thereby reducing sulfuric acid dosing. The pH increase appeared to benefit aluminum fouling but did result in scale formation at higher recoveries. Further optimization of pH is necessary to balance causes of fouling, However, based on autopsy results it was difficult to correlate fouling rate with a single parameter.

- UV AOP – performance and efficiency is impacted by influent (RO Permeate) UVT, UVI, the flow (Q) through the reactor and chemical dosing (free chlorine prior to the UV and chloramine prior to UF):
  - **UVT** – Chemicals with certain functional groups absorb UV light. The primary UV absorber in the Demo was chloramine, which is added to mitigate membrane biofouling. A lower UV influent UVT due to the presence of these chemicals requires more energy to deliver the same dose to water. At the Demo UV doses, which exceeded 1,500 mJ/cm^2, free chlorine and total chlorine were both reduced which results in an increased UVT in the UV outlet. The monochloramine dose target of 2-2.5 milligrams per liter (mg/L) as total chlorine ahead of RO, resulted in an inlet UVT of approximately 97 percent.
  - **Chemical dosing** – the efficiency of sodium hypochlorite as a source of hydroxyl radicals is impacted by pH – a lower pH leads to a more efficient UV AOP process. The native pH of the RO permeate/UV influent was always below 6.0.
  - **UVI/Q** – UV AOP challenge testing was run to determine operational recommendations. From this it was determine that a UVI/Q > 2.2 and free chlorine dose > 2.5 mg/L was necessary to meet NDMA and 1,4-Dioxane destruction goals, respectively.

1.3.1.3 Meeting State of California Regulations

- The Demo demonstrated full compliance based on drinking water requirements for potable water reuse based on 3 significant sampling events that measured over 300 regulated and unregulated chemicals. Assessment for compliance included MCLs, secondary maximum contaminant levels (sMCLs), NLs, and contaminants of emerging concern (CECs). In addition, the UV system was validated for NDMA destruction to levels exceeding 2 log reduction.
- The future full-scale project will be surface water augmentation of the Las Virgenes Reservoir and as a result may need to meet the California Toxics Rule (CTR). The CTR is a list of compounds most of which have maximum limits for chemicals which are much lower than that required for safe drinking water:
  - The finished effluent quality from the Demo met the CTR requirements for 64 chemicals which were either not detected (with detection limits lower than CTR requirements) or detected but at concentrations lower than CTR limits.
  - A further 24 CTR chemicals were not detected and do not yet have limits and were therefore presumed to be safe.
  - Chloroform (a trihalomethane) does not have a CTR limit but was detected up to a maximum concentration of 38 micrograms per liter (μg/L) which is lower than the trihalomethane (THM) MCL of 80 μg/L. Therefore, chloroform levels are safe but should be monitored pending changes to CTR limits.
  - A further 28 chemicals were not detected but the available commercial laboratory detection limits were higher than the numerical CTR limits. Therefore, these chemicals are presumed to be safe, but may be worth monitoring. NDMA is one

such example of a compound where the detection limit is typically 2 nanograms per liter (ng/L) for laboratories, but the CTR requirement is 0.69 ng/L.
  - Two THMs were identified at safe drinking water levels (per the MCL) but were higher than CTR limits. The two THMs with exceedances of the CTR were dibromochloromethane (DBCM) and bromodichloromethane (BDCM).
  - The presence of THMs exceeding CTR is suspected to be due to upstream wastewater chlorination practices. Further investigation into THM control options to ensure CTR can be reliably met is being undertaken by LVMWD.

1.3.1.4 Future Work

The Year 1 Report identified a number of options for future work for which a summary and status update is included below:

- The UF maintenance and recovery cleaning frequency was not significantly varied during the first year of operation and was suggested as an item for further investigation:
  - From February 2022 cleaning strength and frequency as well as chloramine dose was systematically varied to provide further information to help guide membrane design criteria.
- The RO CIP efficiency and its rapid decline after cleaning was recommended for investigation. The potential to try different chemicals that best restore and maintain specific flux were recommended or investigating the cleaning performance of a different RO membrane product. In addition, the need to better define and increasing CIP intervals (from the first year practice of 45 - 50 days) was noted:
  - Alternate preformulated cleaners for the RO were trialed during year two but these did not appear to change observed behavior.
  - During Year 2, the RO was cleaned as needed based on normalized performance data trends. The trends and a discussion of a more appropriate CIP interval are included within this report.
- Prevent reformation of NDMA through testing:
  - The initial report conducted NDMA reformation experiments during the spiked challenge testing of the UV reactor. Some potential formation was observed but further characterization of reformation under indigenous NDMA levels (i.e., non-detect) was recommended.
  - Further investigation of NDMA reformation did not proceed within the activities for this report. The optimization of upstream disinfection practices was suggested as a first step prior to evaluating the necessity to control reformation.
- Sampling at the Demo and upstream to identify options for reducing disinfection by-product (DBP) formation within the plan:
  - It was evident from water quality monitoring results that THMs were formed prior to the Demo.
  - Sampling and approaches were suggested to investigate the impact of preformed chloramination at the Demo (as opposed to inline chlorination then ammonia addition – as currently practiced) on DBP formation.
  - These investigations did not proceed as it was thought more important to optimize upstream disinfection practices at Tapia to obtain the largest benefit to performance.

- Monitoring gross beta in the source water and catchment to identify options for utilizing source control to improve RO concentrate compliance:
  - Gross Beta regularly exceeded the targeted limit of 50 picocuries per liter (pCi/L) in the RO concentrate for samples taken in Year 2.
  - It was noted that this evaluation limit was based on drinking water levels and that typically Gross Beta in the ocean is 300 pCi/L and predominantly due to naturally occurring potassium-40. The maximum Gross Beta concentration in the RO concentrate was 160 pCi/L, well below typically expected ocean concentrations. A more appropriate limit may need to be discussed and established for a future brine discharge permit
  - Sampling and investigation of the source of Gross Beta was not conducted as part of the Year 2 report.
- Dilute RO concentrate to levels that better represent toxicity compliance:
  - Initial RO concentrate toxicity was conducted without dilution and represented a highly conservative condition. The test passed for Topsmelt, Purple Sea Urchin, Sand Dollar and Giant Kelp but failed for Red Abalone.
  - Further RO concentrate analysis with an appropriate dilution factor was not conducted as part of Year 2 activities.

1.3.2 USBR Report

The USBR report was written for the USBR to provide information on the Pure Water Demonstration Facility and descriptions of the treatment systems, including design criteria and performance demonstration. The USBR report preceded the Year 1 report and contained a preliminary analysis of data available at that time. The USBR report highlighted that finished water sampling and analysis of critical control points have indicated that the Demo has met all water quality criteria regulated by the State of California for indirect potable reuse projects.

At the time of writing the USBR report, the following observations were made with respect to Demo performance:

- The UF system was operated at 40 gfd, with 2 mg/L of total chlorine dosed into the feedwater, weekly maintenance cleans and monthly recovery cleans. At the time of writing the USBR report, optimized flux and cleaning regimes had not been determined as performance has exceeded expectations and irrecoverable fouling had not occurred.
- The RO system had operated well in both a 2- and 3-stage array with an 80 percent recovery. The feedwater pH for the RO was set at 6.4 with an antiscalant dose of 3 mg/L. Performance loss was seen in the RO system due to organicfouling. Consequently, pH adjustments (increase to target 6.8) were under investigation to reduce fouling potential without inducing scaling. A higher recovery (85 percent) was also being tested and considered. In addition, sulfate and strontium were be added to the analyte sampling list as additional performance indicators for RO integrity. Finally, the RO membrane was tested for preservation performance which is important in managing the seasonal flow requirements at the future full-scale facility:
  - During the course of demonstration operation, it was necessary to preserve the stage 1 membranes. This was achieved after commissioning using Preservol, a proprietary formulated preservative provided by PWT Chemicals. Preservol appeared to adequately preserve the stage 1 membranes for the initial phase of

2-Stage operation (approximately 3 months). Later, a different proprietary preservative, Avista SafeGuard 100 was used successfully for the same purpose. The proprietary formulations were used as they did not require the frequent change outs that were known to be required when using sodium metabisulfite as a preservative. Both proprietary formulations were fit for purpose as the stage 1 membranes appeared to return to service with acceptable specific flux and salt rejection.

- The USBR report contains a description of the initial UV validation testing work conducted at the demo which included a relationship between the reduction equivalent dose (RED) (of *Aspergillus Brasilliensis*) and the ratio between UVI divided by flow. Based on the preliminary efforts, the Demo UV system was demonstrated to deliver a RED of 940 mJ/cm^2 at the flow setpoint of 6 gpm. This dose far exceeded that required for 6 LRV of protozoa and viruses of concern. The UV AOP did have one faulty UVI sensor which was replaced in August 2020 after 4 months of operations.
- During initial operation, Chlorate was found in exceedances in the finished water. The cause was determined to be the sodium hypochlorite feed stock that had degraded significantly. The supplier was notified, and the issue was rectified. The new sodium hypochlorite supply also helped reduce the threshold odor number which had exceeded acceptable criteria during initial testing.

1.3.3 Pure Water Demonstration Test Plan

The test plan was the first deliverable related to operation of the Demo and described the intent and testing and monitoring activities for the first year with speculative activities for the second year of operation. The test plan is attached as Appendix A to this report.

The test plan was organized with the following objectives:

- Pure Water Quality Assessment:
  - Several contaminants were shortlisted for sampling with results discussed further in this report and the Year 1 report.
- Membrane Operation Efficiency:
  - The UF system was intended to systematically step through 25 gfd, 30 gfd, and 35 gfd until fouling could not be sustainably managed.
  - The RO system was scheduled for different 1000-hour operational periods under each configuration.
  - Initial operational plans are found in Appendix A.
- Membrane Cleaning:
  - Preliminary approaches to cleaning both the UF and RO membranes were noted.
  - RO cleaning was later changed to use proprietary formulations to minimize the need for operators to blend chemicals onsite:
    - Further testing of the RO unit could benchmark the effectiveness of RO cleaning conducted with standard process chemicals such as sodium hydroxide and citric acid for high and low pH cleans respectively.
- Extended Water Quality Testing:
  - The intent to define the feed water quality, the impact of that water quality on performance, and the finished water quality pertaining to how it meets various regulations was described.

  - This includes process monitoring, performance surrogate sampling, key regulated chemical sampling, pathogen monitoring, regulated chemicals sampling, RO concentrate monitors and CECs.
- Production Reliability:
  - The test plan described an initial goal for the first 9 months of operation to evaluate and report treatment and monitoring system time off-spec or out of calibration, respectively. The Year 1 report considered both production uptime and reliability of online monitoring sensors in detail. This report includes production uptime for the first 2 years of operation.
- RO Concentrate Testing for National Pollutant Discharge Elimination System (NPDES) Compliance and Concentrate Scaling Evaluation:
  - In an appendix, the test plan contains a screening level assessment of which chemicals may pose a NPDES or Ocean plan compliance risk. The screening level assessment was used to shortlist chemicals for analysis as part of the 1st year of sampling in RO concentrate.
  - The test plan outlines a plan for evaluation of scaling potential of the RO concentrate for the future brine line. The results of the scaling potential evaluation are included in the Year 1 Report. Subsequent to Year 1 work, an online scaling potential evaluation has been set up in the Demo, connected directly to the RO concentrate line by the District to gain further information but the results are not included in the scope of this report.

1.4 Report Purpose

The purpose of this Year 2 Purification System Performance Report (Report) is to:

- Summarize the treatment and monitoring system performance for the entire two years of operational data.
- Quantify the treatment system operational efficiency and potential implications for full scale design.
- Confirm the ability of the treatment and monitoring systems to meet State of California regulations for indirect potable reuse (IPR) (DDW, 2018).

1.5 Report Contents

The content of this report is summarized below:

- Section 2 – Operational Reliability of Treatment Processes:
  - Contains a summary of the production up time of each key unit operation at the Demo and summarizes any maintenance or monitoring issues.
- Section 3 – General Feed Water Quality and Pretreatment:
  - Summarizes monitoring data for the feedwater to the UF and RO including online meters and offline samples analyzed by external laboratories.
  - Provides an overview of chemical dosing and strainer operation ahead to the UF.
  - Provides estimates of the level of potable water blending in reservoir 2 and its observed impact on water quality.
- Section 4 – Microfiltration and Ultrafiltration:
  - Contains an updated description of the operational rationale for the UF systems for the second year of operation.

  - Production efficiency (Flux, TMP, Permeability and Recovery) as well as membrane integrity testing results are updated to cover the first two years of operation.
  - Information is presented to support recommendations for sustainable flux and cleaning regime balance of the products tested.
- Section 5 – Reverse Osmosis:
  - Provides an overview of RO operational periods and intent.
  - Provides detail on the hydraulic performance at LVMWD and compares this data to the Toray TMG20D tested for 6 years at Orange County Water District (OCWD) which is the larger version of the Demo modules.
  - Summarizes integrity monitoring for the RO system.
- Section 6 – UV AOP:
  - Provides updated water quality and operational data for the UV AOP system in the second year of operation.
- Section 7 – Select Water Quality Analysis:
  - Summarizes the occurrence of frequently monitored compounds that have new data from the first year.
  - Provides a summary of RO concentrate testing.
- Section 8 – Conclusions and Recommendations:
  - Conclusions and recommendations based on this report.

Chapter 2

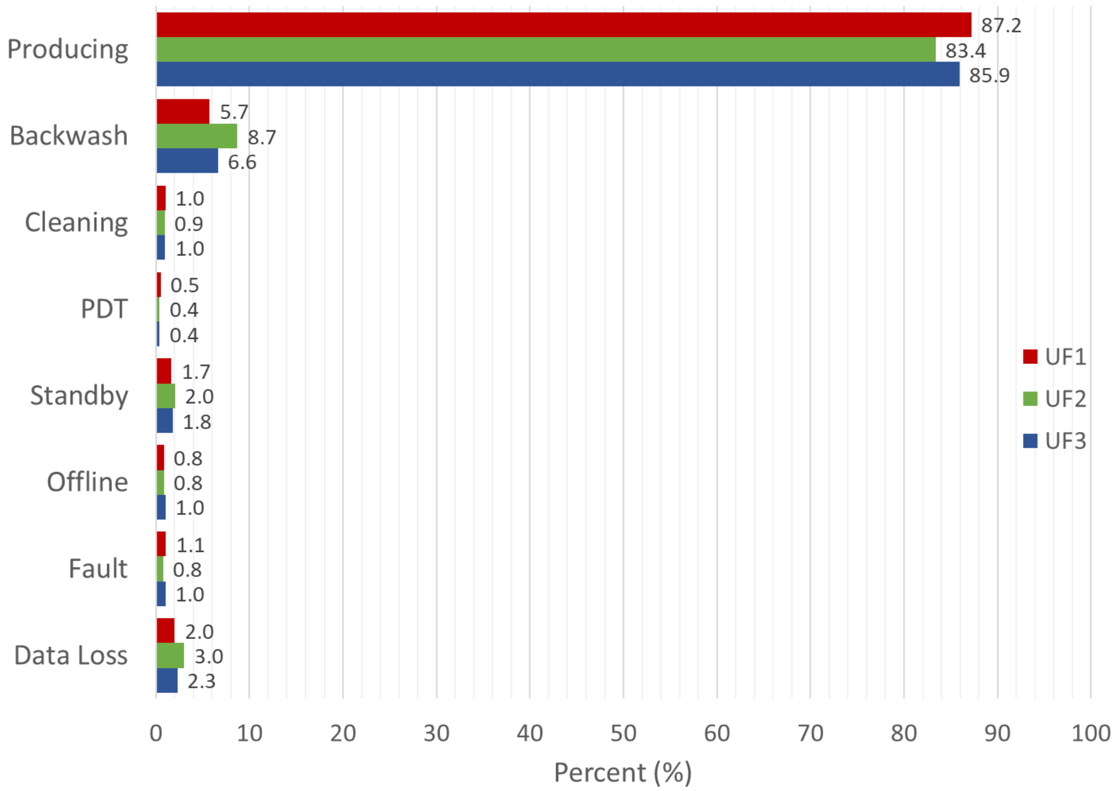
OPERATIONAL RELIABILITY OF TREATMENT PROCESSES

This section provides a general overview of each technology at the Demo and summarizes the operational reliability in terms of planned vs actual operational time. In addition, electronic logsheet entries available from November 2020 to July 1, 2022, were reviewed and information pertaining to maintenance issues for treatment or monitoring systems, and any impact on process downtime, was summarized.

To provide an overview of the operational reliability of the Demo, time online and offline as well as total production capacity was quantified for both years of Demo data commencing on July 1, 2020, through to June 2022. A comparison of both years is provided to identify any changes in reliability between the first and second year of operation. This section considers if the unit was producing normally based on production quantity indicators, an evaluation of water quality is included in later sections considering key parameters for each treatment process. The source data for this section was the intelogx remote historian which has been logging data from the pilot since commissioning. During the second year, a new remote historian IOsight was connected but the older system was chosen as the source for this report to maintain continuity.

2.1 MF/UF Operational Reliability

Operational reliability did not appear to change significantly from Year 1 to Year 2. A breakdown of Year 1 and Year 2 is provided in Table 2.1 and an overall summary of the reliability for each unit across the first two years of operation is shown in Figure 2.1.



Note: Faults are the result of alarm exceedances. Data loss is presumed to be a historian issue and not reflective of poor performance. Offline is due to planned shutdown. Standby is typically a shared equipment utility issue. PDT, Cleaning, Backwash and Production are all automated operational regimes.

Figure 2.1 Operational Uptime and Status of Each UF Module for the First Two Years of Operation

The following observations can be made from the overall trend of UF operation:

- General Uptime:
  - General uptime includes all logged automatic operations which are planned to occur i.e. PDT, Backwash, Cleaning (maintenance and recovery cleans) and Producing. The sum of all these criteria for each UF was:
    - UF1 – 94.5 percent.
    - UF2 – 93.4 percent.
    - UF3 – 93.9 percent.
  - General uptime of each product was high and a majority of limitations in uptime are due to limited redundancy requirements of a demonstration facility which would be addressed at scale.
- Data Loss:
  - Data loss is reported by the historian as unknown and occurred between 2 - 3 percent for all UF status tags.
  - The data loss did not appear to be localized to particular instances (i.e. it randomly occurred over time) and is suspected to be an occasional communication issue with the remote historian.
  - During data loss periods, it is reasonable to assume that the system was performing normally but data is not available to demonstrate this. Including data loss would increase general uptime by 2 - 3 percent.

  - Data loss would not be expected to occur to this extent with an onsite historian.
- Standby:
  - The UF systems share common equipment including a backwash pump filtrate tank. A majority of standby time is due to UF systems meeting their production target and waiting for the utility of the backwash pump. An alternative cause of standby time is waiting for there to be sufficient level in the filtrate tank to meet the permissive to perform a backwash.
  - Standby time is anticipated to be lower at full scale as their will be more redundancy on backwash pumps, more controlled scheduling of backwash times and larger filtrate tanks.
- Offline:
  - Offline time represents when the system has been purposefully shut down for planned maintenance:
    - The types of planned maintenance that require shutdown include:
      - Troubleshooting PDT failure.
      - Cleaning Sodium Hypochlorite or Ammonium Sulfate injection quills.
      - Stopping the system to fix leaks.
      - Inspection and cleaning of the feed screen.
  - During the first two years of operation, the system has only been shut down for a maximum of 1 percent or approximately one week of maintenance in two years.
- Faults:
  - Faults are a result of exceeding severe consequence alarm limits which trigger a system shutdown. Severe faults have been caused by the following issues:
    - Feed Pump variable frequency drive (VFD) failure:
      - This has occurred twice due to a blown fuse. There were power outages to the demo prior to each failure.
    - There was one high TMP alarm due to fouling on UF1 in mid-2022 after a period of low strength maintenance cleans coupled with low chloramine, discussed later in the membrane performance section. This was rectified with cleaning.
    - Low Feed Tank Level:
      - Caused due to a loss of flow into the feed tank.
    - Low Filtrate Tank Level:
      - Generally caused as a result of backwash and RO feed demands being too high relative to the filtrate tank level and UF instantaneous flux set point.
    - PDT Failure:
      - Successive PDT failures (i.e. a LRV < 4) or pressurization or depressurization issues will result in a shutdown of individual UF units:
        - Pressurization issues were isolated to a faulty pressure regulating valve on the compressed air line.
        - Depressurization issues were noted occasionally on the first PDT after a clean. It is suspected that some cleaning solution may have remained in the pipework and interrupted depressurization.
        - Actual pressure loss resulting in an LRV of < 4. UF3 suffered from observed pressure loss. It is suspected this was a false positive and the cause of this is discussed Sections 4.3.1 and 4.4.2.

A comparison of the Year by Year operational status is provided in Table 2.1.

Table 2.1 Year 1 and Year 2 Operational Status Comparison for Each UF Unit

Unit/Year	UF1 Status (% of Time)		UF2 Status (% of Time)		UF3 Status (% of Time)	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Producing	85.9	88.5	84.2	82.6	85.0	86.8
Backwash	6.9	4.5	8.2	9.3	7.4	5.8
Cleaning(1)	0.9	1.1	0.9	1.0	0.9	1.0
PDT	0.5	0.5	0.4	0.3	0.5	0.3
Total Uptime	**94.3**	**94.7**	**93.6**	**93.1**	**93.9**	**94.0**
Standby	1.5	1.8	1.9	2.2	1.5	2.0
Offline	0.7	0.9	0.8	0.9	0.8	1.2
Fault	0.9	1.2	0.7	0.8	1.1	1.0
Data Loss	2.6	1.4	3.0	3.0	2.8	1.8

Note:
(1) Cleaning refers to the combined maintenance and recovery clean cycle times.

A comparison of Year 1 and Year 2 operational status for each UF system showed minimal change in total uptime indicating consistent and reliable performance by the UF system.

Data loss seemed to improve marginally for UF1 and UF3 but remained the same for UF2. The cause of this is unknown.

In general, UF2 spent more time backwashing that UF1 or UF3. This was due to two factors. UF2 uses a constant backwash flowrate (8 gpm) and volume (8 gal). As a result, when flux was increased for UF2, the backwash interval was reduced to meet the constant production recovery. In Year 2, UF2 operated consistently at fluxes above 40 gfd resulting in shorter backwash intervals compared to the range of lower fluxes evaluated in Year 1.

The time spent cleaning or in PDT did not vary significantly between Year 1 and Year 2. Offline time was approximately the same for UF1 and UF2 but increased marginally for UF3. UF3 did spend some additional time offline in an effort to troubleshoot PDT failures.

Standby time increased marginally for all modules in Year 2. This is suspected to be due to more coincidences of backwashes needing to share the same backwash pumps. The higher number of coincident backwashes was due to the generally shorter filtration cycles for each module at higher fluxes in Year 2.

A number of specific maintenance events that were recorded in logs and their impact on UF plant operation were summarized into Table 2.2. Upon review of the maintenance logs, a number of observations were noted:

- Power Outages:
  - There were three power outages/blackouts at the Demo in the second year of operation that lead to shut downs. Backup power support may be an important consideration for the full scale facility.

- Hypochlorite dosing:
  - The most frequent maintenance issue were chemical leaks on the hypochlorite dosing line. This line forms partial plugs over time and requires flushing to maintain stable dosing and minimize over pressure.
  - The hypochlorite dosing pump, which is the most utilized, generated automatic service warnings in May 2021 (based on volumetric usage). The Hypochlorite UF CIP pump generated service warnings in July 2021. Yearly maintenance is acceptable for these units.
  - There was one event where the backflow valve arrangement was not set correctly and the feed flowed back into the hypochlorite tank.

Table 2.2 Maintenance Issues Logged for the UF System

Date	UF Maintenance Issue
12/6/20	Break in schedule 80 PVC line supplying the hypo to the UF system. Chlorine shut off for a day to fix.
12/22/20	UF feed hypochlorite injection connection leaking. Performed shutdown to replace fitting, cleaned quill/flushed injection line with RO permeate.
1/15/21	PCV-95834 instrument air pressure regulator: Leaking air out on the side. Did not appear to impact operation, was replaced.
1/18/21	Hypochlorite injection line and quill for UF Feed cleaned
2/26/21	Depressurize-fault trip occurred during MIT for UF1
2/19/21	System shutdown due to leak from broken SCH80 valve
4/8/21	Cleaned Amiad strainer basket
4/16/21	System shutdown to replace broken barb fitting connected to hypochlorite injection quill on the UF feed
4/26/21	System shutdown to clean out and flush hypochlorite line and quill for UF Feed due to sharp drop in UF filtrate total chlorine level
5/2/21	Service warning on UF feed hypochlorite pump. Ops staff ordered parts and serviced.
5/20/21	Hypochlorite leak at quill on UF Feed.
7/9/21	MIT's out of schedule due to brownout within facility
7/17/21	Service warning on UF CIP hypochlorite pump. Ops staff ordered parts and serviced.
9/20/21	UF Feed Hypo tank emptied and refilled with fresh NaOCl due to backflow of water into tank
9/24/21	Adjusted UF Feed Hypo concentration to 9.05% after running titration test
10/10/21	UF3 LRV warning alarm triggered (PDT LRV on 10/9/21 4.05)
11/26/21	System shutdown due to power outage.
2/3/22	System offline for UF maintenance which included hypochlorite and ammonium sulfate quill cleaning, strainer replacement on Amiad filter and pinning procedure on UF3
3/9/22	HMI offline from district server
6/22/22	Power outage in plant
6/27/22	UF1 alarm triggered due to high transmembrane pressure

Note:
Abbreviations: HMI - human machine interface; MIT - membrane integrity test; NaOCl - sodium hypochlorite; PVC - polyvinyl chloride.

2.2 RO Operational Reliability

Operational reliability did appear to improve from Year 1 to Year 2 for the RO. A breakdown of Year 1 and Year 2 is provided in Table 2.3 and an overall summary of the reliability for each unit across the first two years of operation is shown in Figure 2.2.

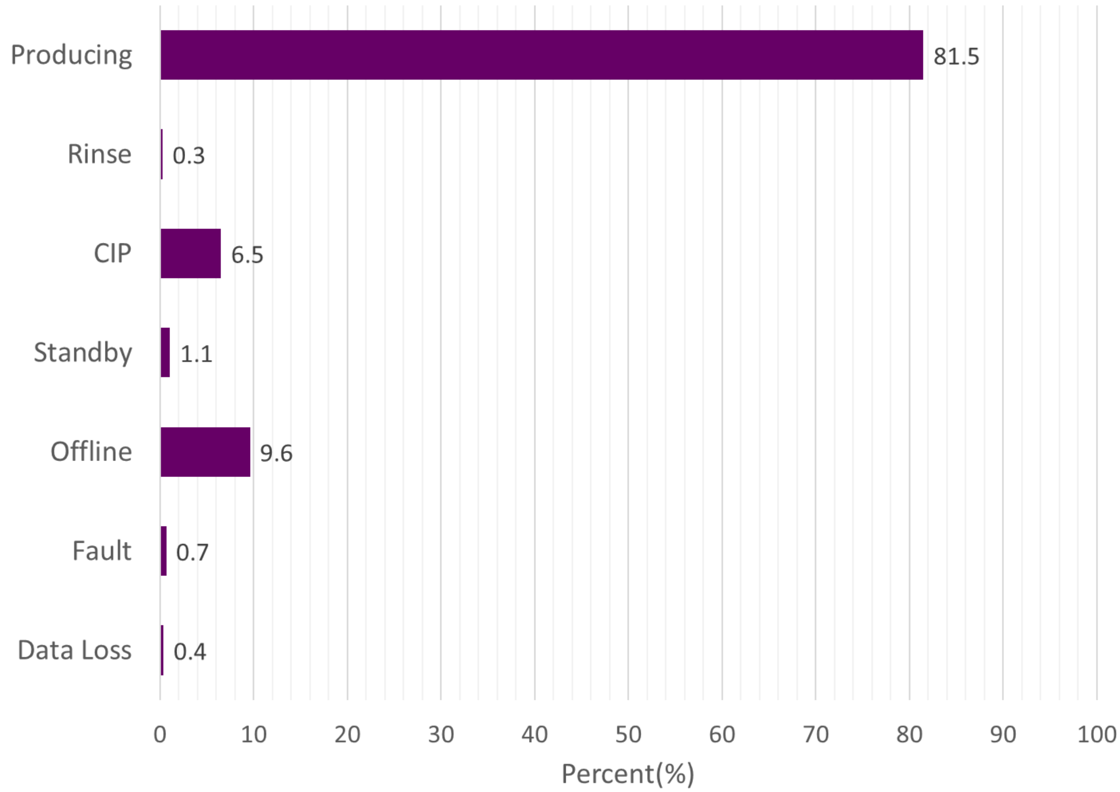


Figure 2.2 Operational Uptime and Status of the RO Module for the First Two Years of Operation

The RO operational status is summarized for Year 1 and Year 2 in Table 2.3.

Table 2.3 Year 1 and Year 2 Operational Status Comparison for the RO

Unit/Year	RO Status (% of Time)	
	Year 1	Year 2
Producing	79.1	83.6
Rinse	0.3	0.2
CIP	7.3	4.9
Standby	0.5	1.6
Offline	11.2	9.2
Fault	1.0	0.3
Data Loss	0.5	0.3

During the second year of operation, the time spent producing increased an outline of the causes of the change in parameters is described below:

- Producing:
  - Overall, the RO spent more time online (+4.5 percent) in the second year due to a reduction in faults and fewer and quicker CIPs.
  - Production time for the RO is lower than anticipated at a full-scale facility as there is no redundant RO array to continue production during cleaning, nor is there redundant MF/UF to provide flow from the MF/UF upon shut down for RCs. Nevertheless, RO production time has increased largely due to site staff efficiency in conducting manual cleans, and it has been continually operated for more than 80 percent of the first two years.
- Rinse:
  - The rinse cycle uses MF/UF filtrate and flushes this through all RO stages at an operator set period of time.
  - The rinse cycle is preprogrammed to occur whenever the RO is started up, shut down or moves in and out of standby due to filtrate tank low level.
  - The amount of time in rinse cycles did not appear to vary significantly between Year 1 and Year 2.
- CIP:
  - RO CIPs at the demo need to be conducted manually and the system needs to be taken offline which interrupts production. At a full-scale facility RO array redundancy is anticipated to maintain production during periodic CIP of individual arrays.
  - Regardless, the amount of time performing CIPs has reduced from Year 1 to Year 2 as:
    - The site operators have become very efficient at performing CIP operations.
    - There have been fewer CIPs in Year 2 as the goal has shifted to running the RO for longer CIP intervals in an effort to estimate cleaning requirement at scale.
- Standby:
  - The RO will automatically go into standby when the MF/UF filtrate tank reaches its low level alarm. The RO will remain in standby until the MF/UF filtrate tank has exceeded its high level alarm.
  - The Standby status is an estimate of the amount of time the RO was shut down due to interruptions in filtrate tank level either due to:
    - Insufficient net MF/UF filtrate flow which could be caused by having a unit out of service or having a flux set point which is too low to meet RO demand.
    - Maintenance cleans causing standby of other MF/UF systems and associated backwashes drawing the tank down below the low level for the RO.
  - Standby time increased in by 1.1 percent from Year 1 to Year 2. This is due to:
    - A generally increased frequency of maintenance cleans on the MF/UF with up to 3 x per week tested and 2 x per week per module typical.
    - Operation of the RO as a 3-stage system for a majority of the second year which requires almost double the net filtrate flow. This has led to shutdowns at lower MF/UF fluxes which have been tested.
- Offline:
  - Offline summarizes the amount of time the RO is shutdown.

  - Offline occurs for the following reasons:
    - The RO is purposefully shutdown for MF/UF recovery cleans to prevent the possibility of transferring high concentrations of cleaning chemicals downstream and contacting these with the RO membranes. Typically, a shutdown for a MF/UF recovery clean will exceed the total cleaning duration. (i.e. the RO is shutdown at 4 pm on a Friday but not restarted until an operator inspects the site at 8 am Sunday. There would have been periods when the RO could have operated in between cleans and there is time lag prior to restart.).
    - To that end, offline time is due to recovery cleans is estimated to be 2.5 days per month or up to 8 percent of offline time.
  - The remaining 1-2 percent of offline time is expected to be due to upstream maintenance issues which are summarized in the MF/UF section.
- Faults:
  - Similar to the MF/UF, faults are the result of severe alarm exceedances.
  - During the first year, faults included an integrity failure event due to permeate backpressure increase during a CIP, VFD and communication faults.
  - During the second year of operation, VFD and communication faults were the primary issues.
  - The VFD faults were resolved by power cycling the system. Their cause is not known.
  - Communication faults were the result of network maintenance during system network changes.
  - The level of faults has significantly decreased in the second year from 1.0 to 0.3 percent.
- Data Loss:
  - Similar to the MF/UF, data loss is a failure of the remote historian to capture status information from the system.
  - Data loss remained low and may have marginally decreased in the second year from 0.5 to 0.3 percent.
  - Data loss is not anticipated to occur with a well-designed onsite historian at the full scale facility and is an artefact of remote transmission of data.

A number of specific maintenance events that were recorded in logs and their impact on RO plant operation were summarized into Table 2.4. The following observations were made following review of RO maintenance logs:

- TOC Analyzer:
  - The TOC analyzer requires relatively frequent maintenance with quarterly reagent replacements, lamp replacements between 6 – 12 months and yearly service/calibration.
  - Ops staff flush the analyzer daily per manufacturer recommendations.
- Network and Power Outage Issues:
  - Power outages have caused alarms of RO pump VFDs and resulted in shutdowns.
  - Network maintenance and changeovers have also impacted RO operation causing Comms alarms and difficulty accessing the local HMI.
  - These issues have typically been resolved by power cycling the system and restarting the HMI.

- Antiscalant dosing was noted to have failed in September 2021. This resulted in a sharp decline in Stage 2 and Stage 3 specific flux and was presumed to be the result of scaling. The RO was flushed and taken offline until cleaning could occur. Cleaning was able to restore specific flux.

Table 2.4 Maintenance Issues Logged for the RO System

Date	RO Maintenance Issue
11/30/20	TOC analyzer oxidizer inspected. Replaced UV Lamp with spare.
12/20/20	ORP feed water alarm triggered on HMI for RO
12/23/20	Leak on skid at threaded plug where pipes connect to inlet side of stage 3 membranes
1/5/21	System shutdown for membrane cleaning
1/10/21	System shutdown till replacement of damaged membranes in stage 1
2/4/21	Replaced TOC oxidizer cartridge
2/19/21	System shutdown due to leak from broken SCH80 valve on UF
3/3/21	RO shutdown while sample collection for Avista antiscalant dosing testing
4/25/21	Alarms triggered due to RO system fault. Suspected to be caused by network issues. Resolved by power cycling
6/5/21	UV inlet free chlorine warning
6/12/21	System error. Suspected to be caused by network issues. Resolved by power cycling
6/21/21	RO offline for a brief period (cause unknown)
9/20/21	Shutdown due to antiscalant not pumping any chemical
10/9/21	Manual RO shutdown due to technical difficulties with sodium hypochlorite pump feeding into UV AOP
10/10/21	Unable to turn on RO due to technical difficulties with HMI screen. Suspected to be caused by network issues. Resolved by power cycling.
11/6/21	Combined ROP line device leak, valve turned off
11/8/21	TOC analyzer shutoff
11/25/21	RO system shutdown due to power outage on account of strong winds
12/11/21	RO offline due to high pressure buildup
4/15/22	Issues with RO feed water ORP probe
5/30/22	VFD pump trip. Resolved by power cycling.
6/19/22	TOC analyzer stopped after syringe flush.

Note:
Abbreviation: ROP - reverse osmosis permeate.

2.3 UV AOP Reliability

The UV system does not have a reliable status tag to determine operating status. Instead, a rule to establish an on criteria if flow was greater than 1 gpm was used to determine if the UV was operational. Using these criteria cannot differentiate between data loss and offline time and as such, these criteria were binned together.

The overall production time for the UV system for the full two years of demonstration operation is shown in Figure 2.3. Of the time available for the UV to produce (i.e. when there is flow from the RO), the UV was operational 94.7 percent of the time for the first two years of operation. There is some uncertainty due to the inability to differentiate data loss from shutdown. As such this is a conservative estimate of up time.

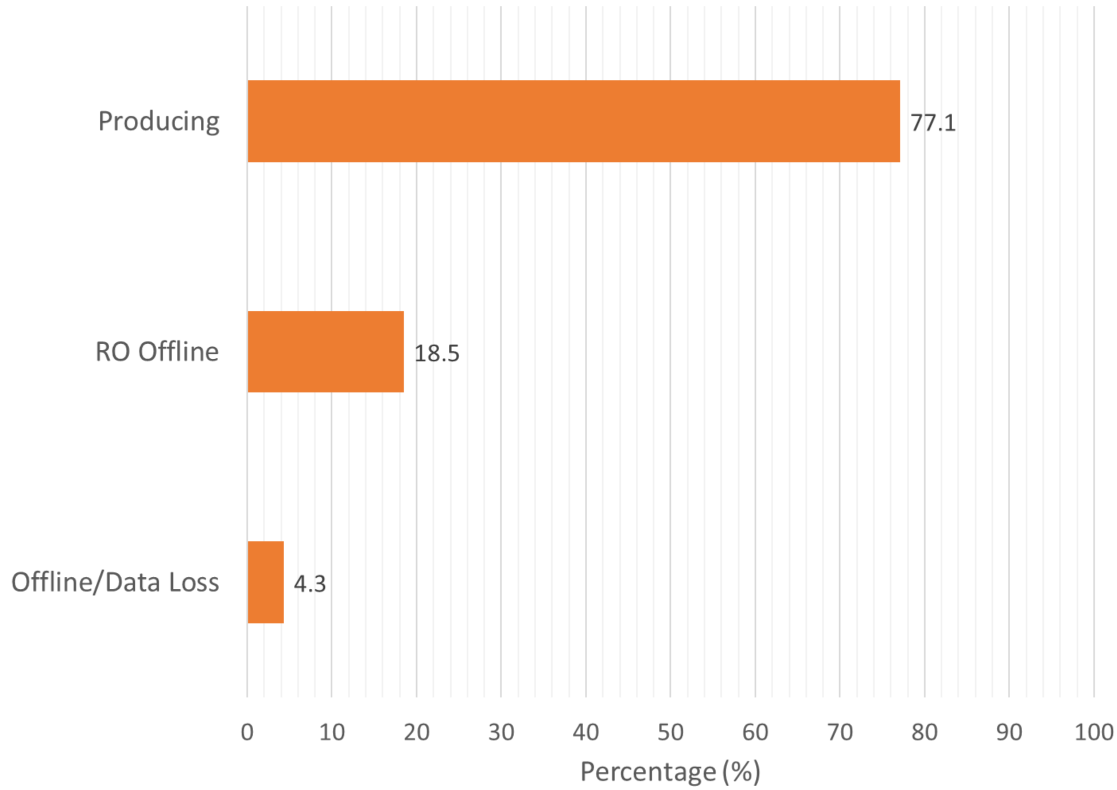


Figure 2.3 Operational Uptime of the UV System for the First Two Years of Operation

Table 2.5 shows the breakdown of the UV operational criteria for the first two years of operation.

Table 2.5 Year 1 and Year 2 Operational Status Comparison for the UV

Unit/Year	UV Status (% of Time)	
	Year 1	Year 2
Producing	76.6	77.7
RO Offline	20.8	16.2
Offline/Data Loss	2.6	6.0
Uptime Without RO Offline(1)	96.7	92.8

Note:
(1) Calculated as the producing time/(producing time + Offline/Data Loss) x 100 percent.

Although the UV system spent 1 percent more total time producing in Year 2, the RO was also producing flow more often. As a result, the proportion of time the UV was producing when flow was available decreased from 96.7 to 92.8 percent.

The precise cause for this was unable to be confirmed as there were no specific maintenance issues recorded for the UV system to explain this discrepancy. However, the calculation method employed may underestimate UV uptime as:

- It does not count the period of time taken to warm up the UV system after a shutdown and prior to flow, which is 5 minutes.
- There is uncertainty as to whether data loss is responsible for the decrease in observable production time.

A number of specific maintenance events that were recorded in logs and their impact on UV plant operation were summarized into Table 2.6. The following observations were made based on the recorded maintenance logs:

- UVT meters:
  - The major maintenance item for the UV system has been the UVT meters. The UVT outlet meter has been suffering a positioner fault (discussed in the next section).
  - The UVT meters are sensitive to humidity and require frequent regeneration and replacement of dehumidifier units.
  - The automated cleaning systems used for the UVT meters have had the peristaltic pump tubing fail, but not at a rate which is unexpected. The automated cleaners are not anticipated to be required in the RO permeate solution environment as there is very little lamp scaling that could occur. Also, manual cleaning can be performed as required.

Table 2.6 Maintenance Issues Logged for the UV System

Date	UV Maintenance Issue
1/10/21	UV system offline till replacement of damaged RO membranes in stage 1
2/19/21	Shutdown due to broken valve at UF Feed
3/20/21	Humidity fault in UVT inlet
3/29/21	CLR leak inside automated UVT cleaner cabinet due to broken peristaltic pump tube, cleans unable to be initiated. Leak fixed by ops staff.
6/1/21	Changed out dehumidifier in inlet UVT meter
6/21/21	UV AOP offline for a brief period (due to RO shutdown cause unknown)
6/26/21	Fault with humidifier in UVT analyzers
6/30/21	Fault in UVT outlet (lamp low)
7/14/21	Ribbon cable to be replaced in UV outlet UVT analyzer
7/18/21	Fault in UVT outlet (lamp low)
8/11/21	UVT outlet meter stuck, reading low values
10/9/21	UV AOP shutdown due to technical difficulties with sodium hypochlorite pump
10/23/21	Humidity fault with UVT inlet
11/1/21	Humidity fault with UVT inlet
11/25/21	UV system shutdown due to power outage on account of strong winds
12/11/21	UV AOP offline due to high pressure buildup in RO
12/14/21	Cracked pump housing inside inlet cleaning box. Replaced peristaltic tube onsite.
1/10/22	Recalibration of UVT meters required
1/17/22	Humidity fault at UVT inlet
2/16/22	Reset of UV AOP outlet meter required due to positioner error
3/22/22	Recalibration of free and total Cl_2 outlet meters required
4/22/22	Humidity fault at UVT inlet
5/8/22	Humidity fault at UVT outlet
5/22/22	Humidity fault at UVT inlet
6/22/22	Fault in UVT outlet (lamp low) – likely due to positioner fault.

Note:
Abbreviations: CLR - calcium, lime, rust; Cl_2 - chlorine.

2.4 Monitoring System Issues

Specific maintenance or calibration issues related to the online monitoring systems are noted in Table 2.7. In general, all monitoring systems were reliable at the demonstration facility. The exceptions were:

- The RO feed combined pH and ORP probe was unstable from installation and initially required reversal of the 4-20 milliamperes (mA) calibration to read the correct ORP. In March 2022 the probe failed to calibrate properly and a warranty replacement is being sought.
- The UV outlet UVT meter is an identical model Realtech to the UV inlet UVT meter. The outlet meter has a faulty positioner which results in the meter reading low values due to optical misalignment. The faults are able to be quantified as it is not possible for an outlet UVT meter to read lower than inlet after a high dose UV system (due to the destruction of chloramines by photolysis and subsequent increase in UVT through the reactor). The time faulted has been quantified to be 11.9 percent of all operational time. After market service for this meter has been poor and previously promised warranty parts have either not been provided or their install has not fixed the positioner issue.
- Both UVT meters require frequent replacement and regeneration of dehumidifier units to avoid the occurrence of humidity alarms (See Table 2.6 and 2.7).

A number of specific maintenance events that were recorded in logs and their impact on UV plant operation were summarized into the Table 2.7. The following observations were made based on the recorded maintenance logs:

- UF Filtrate:
  - Free ammonia (Endress + Hauser CAS40D) and total chlorine (Endress + Hauser CCS120) probes appear to drift and require calibration every 1 - 2 months.
  - Free ammonia monitoring in this location is challenging as it is at the low end of the analyzer range. A higher sensitivity ammonia monitoring solution that uses reagents may be more suitable for monitoring UF filtrate.
  - Total chlorine monitoring at this location is sensitive to pressure changes as a result of the backwash filtration cycles upstream. This causes variation in sensor signal. Use of reagent based analyzers for monitoring chlorine in this location, or, careful consideration of sensor connections at scale could mitigate the signal variation. A reagent based higher sensitivity free ammonia analyzer may also provide more accurate ammonia readings for the low levels dosed.
  - Turbidity meter cleaning is under reported but is generally conducted when the meters drift to higher than typical values. Under these conditions, the cleaning restores the low UF filtrate turbidity suggesting that biofilm formation is a major cause of higher UF filtrate turbidities.
  - With the exception of the RO feed pH/ORP meter fault, the pH meters generally require little maintenance with calibrations occurring approximately quarterly.
- UV AOP:
  - The Chlorine meters on the UV system (HACH Cl10sc) require little maintenance. At this location, the pressure and flow is stable, the chlorine dose is moderate (1 - 5 mg/L) and the pH is low (5 - 6). These factors are conducive to monitoring with the

amperometric probes employed. Calibration of the UV chlorine probes is required infrequently.

- As noted previously, the UV outlet UVT meter is problematic and faults frequently.

Table 2.7 Monitoring System Maintenance and Calibration Logs

Date	Monitoring Instrument Calibration and Maintenance
4/13/2021	UVT Outlet meter was faulted. UF filtrate Ammonia probe calibrated. Value changed from 0.59 - 1.42 with a verification reading 1.4
5/4/2021	UVT Outlet meter was faulted
7/6/2021	UVT Outlet meter was faulted
7/13/2021	Outlet UVT meter faulted and offline
7/20/2021	Outlet UVT meter faulted and offline
9/14/2021	RO Feed pH meter was calibrated using 2-point calibration with pH 4 & pH7 buffers.
9/15/2021	UF Filtrate pH meter was calibrated using 2-point calibration with pH 4 & pH7 buffers.
9/16/2021	UV AOP pH meter was calibrated using 2-point calibration with pH 4 & pH7 buffers.
10/6/2021	Performed 1-point calibration on UF Filtrate total chlorine sensor.
11/24/2021	Two grab samples of total chlorine from the UF filtrate were taken to confirm readings. Recalibration conducted.
12/16/2021	Tested UF filtrate grab sample twice for Total chlorine. Calibrated Analyzer by 1-point Calibration. Calibrated Outlet UVT meter. Tested Ammonia analyzer grab sample twice for Free ammonia. Calibrated UF filtrate ammonia analyzer by 1-point Calibration.
1/18/2022	Calibrated Total chlorine UF filtrate analyzer.
3/1/2022	UF filtrate Ammonia and total chlorine calibrated
3/8/2022	UF Filtrate total chlorine and ammonia probes were serviced by replacing membrane cap and electrolyte and calibrated. Cannot verify ORP, onsite handheld was not working.
3/29/2022	Calibrated UV inlet free and total chlorine analyzers. Ran test twice and recalibrated UVT outlet twice and still came out with a value over 100 for outlet.
4/5/2022	Performed routine Vial Cleaning on all turbidimeters.
4/19/2022	UF Filtrate pH meter was calibrated via 1-point calibration with grab sample. Cleaned out turbidity vials before verifications. RO feed ORP probe is malfunctioning again. Currently in communication with the vendor about replacing under warranty.
4/26/2022	Performed 1-point calibration on UF filtrate ammonia analyzer.
5/31/2022	Recalibrated RO feed & UV AOP pH probes. Recalibrated UF filtrate ammonia probe.
6/28/2022	Realtech UVT meter for grab samples requires a new UV lamp in order to perform verifications. UV lamp replacement is on order.

2.5 Overall Reliability

The Demonstration Systems have demonstrated a very high level of reliability (typically over 90 percent uptime) for the first two years of 24/7 operation. A majority of the causes for downtime are due to lack of automation and redundancy that would be included at a full facility but are typically not included at a demonstration scale.

With the exception of the UV, the proportion of documented uptime has increased, and the proportion of faults decreased. Manual processes such as RO CIP have become more efficient due to the ongoing efforts of site staff and have led to an increase in uptime. Monitoring systems have generally performed well with the exception of particular probes noted above that have suffered from manufacturing related faults.

Chapter 3

GENERAL FEEDWATER QUALITY AND PRETREATMENT

3.1 Reservoir 2

For most of the demonstration period, Reservoir 2 has been filled with Tapia effluent. However, during peak demand for non-potable recycled water, Reservoir 2 can be topped up with potable water. An assessment was undertaken to estimate the blending that has occurred in Reservoir 2 across the first two years of Demo operation.

3.1.1 Reservoir 2 Blending Estimate

For the period from July 1, 2020, to July 1, 2022, historian data covering the volume of water pumped from (to west and east recycled water services) as well as potable water and Tapia effluent pumped in to and the level of Reservoir 2 were obtained at hourly intervals. A mass balance model was developed to estimate the proportion of Tapia effluent within Reservoir 2 on a daily average basis. Reservoir 2 volume was estimated for each water level assuming a linear increase in reservoir surface area from the bottom of the reservoir to the highest water level, where surface area was known. The reservoir was assumed to initially contain 100 percent recycled water, and final volumes were calculated based on input and output flows for each hour. Using the final volume and total influent flows per hour, percentages of recycled water and potable water in the reservoir were calculated.

The purpose of this exercise was to investigate if there were potential Demo feedwater quality changes as a result of Reservoir 2 usage and fill sources. The results indicate that potable water top-up most commonly occurred in each year in summer months (between July and October in 2020 and as early as May to October in 2021). Sucralose is a common constituent of concern that is poorly removed through wastewater treatment and can be used as a tracer to indicate the presence of recycled water. Sucralose is a dissolved compound and is not anticipated to be significantly removed by MF/UF. The grab samples of Sucralose for RO feed are overlaid with the estimated potable water and Tapia effluent contributions to Reservoir 2 in Figure 3.1.

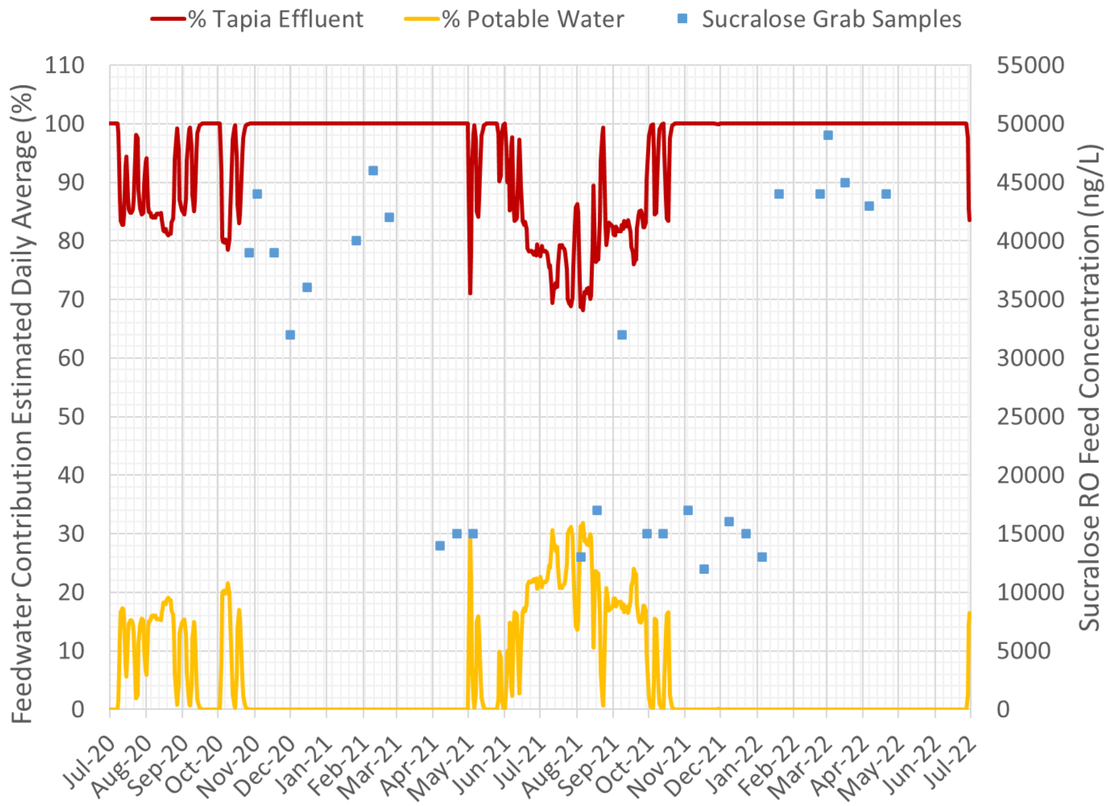


Figure 3.1 Estimated Feedwater Contribution to the Demo from Tapia and Potable Water Top-up into Reservoir 2. Sucralose is Overlaid as a Tracer of Wastewater Contribution and Does Appear to Occur At Higher Values During Periods Without Potable Water Top-up

The correlation of lower sucralose levels during potable water top-up in Reservoir 2 does suggest that the estimation approach for the blend in the Demo feed is reasonably accurate. There are some deviations with low sucralose concentrations appearing pre- and post-summer of 2021 where estimates suggest limited influence of potable water.

The impact of potential potable water top-up for online indicators of water quality TOC and conductivity in the feed to the RO were also investigated and are shown in the figures below across the study period. TOC and conductivity data were first filtered to ensure the RO was in operation and the sensors were receiving representative flow. Then a daily average, 5th and 95th percentile were calculated to show central tendency and variability. Available grab sample results (conductivity measured onsite as part of verifications) and TOC sent for laboratory analysis were overlaid. The following observations can be made from the observation of the online data in Figures 3.2 to 3.4:

- During potable water periods, TOC and conductivity are more variable during the day indicated by a wider variance between daily 5th and 95th percentiles. Average TOC and Conductivity are lower during potable water top-up periods.
- Grab sample results follow the same trend with online results and suggest that the online readings are accurate.
- There appears to have been a marginal increase in overall conductivity in 2021 - 2022 compared to 2020 - 2021. TOC appears to increase seasonally, seasonally increasing

before summer. TOC as opposed to conductivity, would be removed by the wastewater treatment processes at Tapia to some extent potentially mitigating any increase.

- Alkalinity, iron, and manganese all appeared to be at higher concentrations in the RO feed when the feed to the Demo was estimated to be 100 percent Tapia WRF effluent.

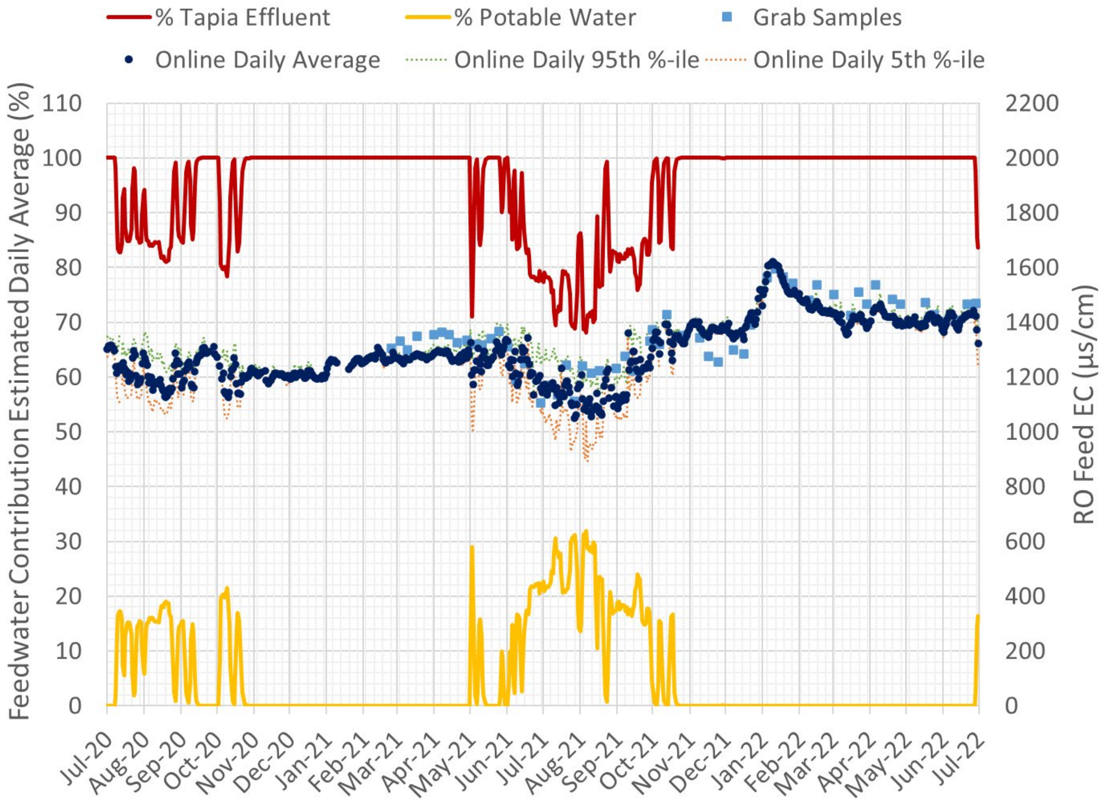


Figure 3.2 Impact of Potable Water Top-up and General Increase in RO Feed Conductivity Over the Demonstration Period

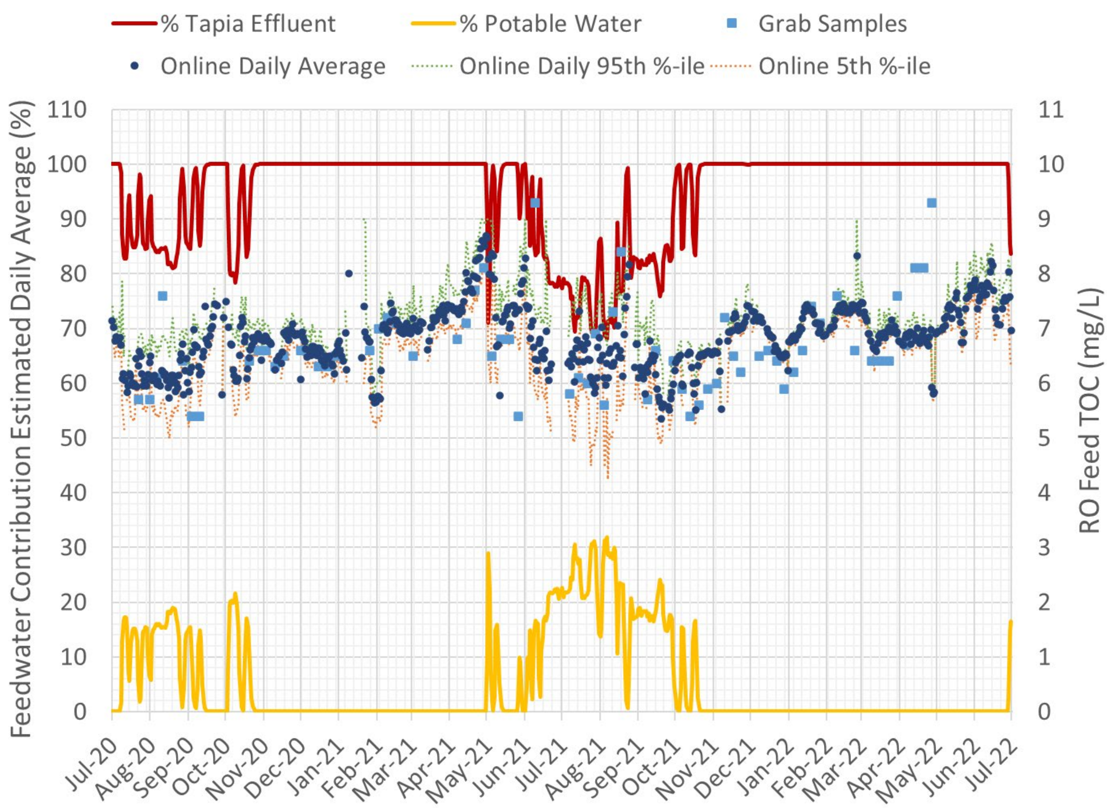


Figure 3.3 Impact of Potable Water Top-up on RO Feed TOC and General Increasing Trend in TOC From Winter to Summer

The generally increasing trend of conductivity in early 2022 relative to 2021 in the RO feed was investigated by overlaying daily totals of Tapia influent with the result shown below.

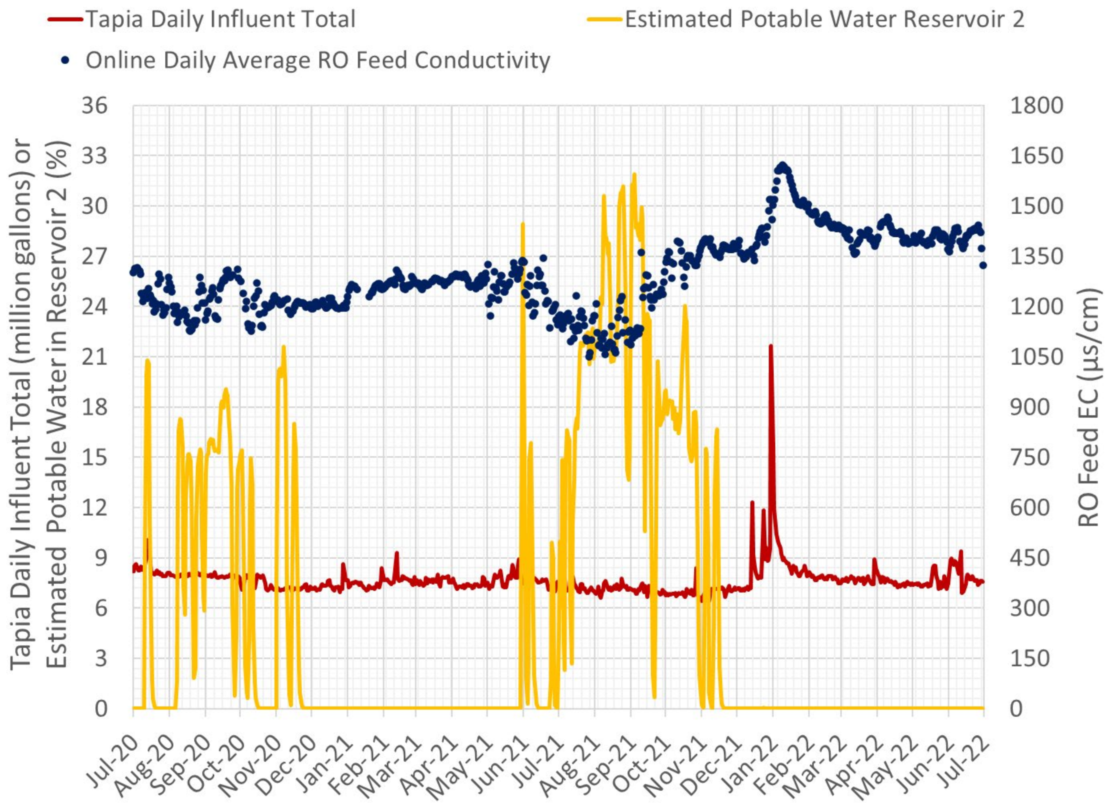


Figure 3.4 Tapia Daily Influent Flow Relative to RO Feed Daily Average Conductivity and Estimated Percent of Potable Water in Reservoir 2. The Spike in RO Feed Conductivity Appears to Trail a High Flow Event at Tapia. However, the General Increase in Conductivity Does Not Appear to be Related to Tapia Influent Flow

It was initially suspected that the increase in RO feed conductivity may have been the result of further water conservation, which was assumed to be shown as lower daily flows to Tapia. However, the flows to Tapia remained relatively stable between 2020 and 2022 and did not appear to correlate with RO feed conductivity. A high flow event at Tapia did appear to precede a high conductivity event at the demo in early January 2022. The cause of the general increase in RO feed conductivity remains uncertain.

3.2 General UF and RO Feed Water Quality

Typical feedwater quality parameters used for design of MF/UF and RO processes are summarized in Tables 3.1 and 3.2 below. Removal of specific disinfection by-products and other CECs was considered in the prior Year 1 Report with select compounds shown in later sections. Due to the potential impact of potable water top up on conductivity, TOC and other parameters, the data reported in the tables below considers sample results only when it was estimated that Reservoir 2 should be 100 percent Tapia effluent. To achieve this, data collected between 6/1 - 10/31 2020 and 5/1 - 10/31 2021 was excluded. This selection is presumed to be more representative of a feedwater to a future facility. Alternate versions of the tables are provided in Appendix B that show the statistics for all observations including periods when potable water top-up was occurring.

Table 3.1 UF Feed Water Quality Observations from Monitoring from July 2020 to July 2022. Observations Suspected to be Influenced by Potable Water Top up of Reservoir 2 Have Been Removed. 6/1 - 10/31 2020 and 5/1 - 10/31 2021 was Excluded

Parameter (units)	n	Min	10th percentile(1)	Av.	Med.	90th percentile(1)	Max
Calcium (mg/L)	1	61	-	61	61	-	61
Magnesium (mg/L)	1	27	-	27	27	-	27
Sodium (mg/L)	1	120	-	120	120	-	120
Potassium (mg/L)	1	17	-	17	17	-	17
Barium (µg/L)	1	15	-	15	15	-	15
Iron (mg/L) (2)	49	<0.005 (<0.020)	<0.009 (<0.020)	<0.019 (<0.020)	<0.020	0.027	0.032
Manganese (µg/L)	49	<2	17	35	29	55	130
Total Alkalinity (mg/L $CaCO_3$)	48	120	120	149	150	170	190
pH (online) (3)(4)	38,923	3.0(3)	7.0	7.3	7.3	7.5	14(3)
pH (grab)	46	6.9	6.9	7.0	7.0	7.1	7.2
Sulfate (mg/L)	1	180	-	180	180	-	180
Chloride (mg/L)	2	150	-	160	160	-	170
Fluoride (mg/L)	1	0.66	-	0.66	0.66	-	0.66
Nitrate (mg/L-N)	15	7.0	7.1	7.9	7.8	9.0	9.9
Nitrite (mg/L-N)	15	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Nitrate + Nitrite (mg/L-N)	34	6.3	6.7	8.0	8.0	9.4	10.0
Boron (mg/L)	1	0.37	-	0.37	0.37	-	0.37
Silica (mg/L SiO2)	48	17	17	20	20	22	24
Color (ACU)	1	10	-	10	10	-	10
TOC (grab) mg/L	24	6.1	6.3	7.1	7.1	8.1	8.9
Turbidity (online) (NTU) (3)	38,894	0.25(3)	0.38	0.96	0.56	1.92	26.35(3)
Turbidity (grab) (NTU)	41	0.41	0.48	0.66	0.59	0.90	1.70
Total Suspended Solids (mg/L)(2)	46	0.1 (<10)	0.4 (<10)	4.1 (<10)	2 (<10)	<10	<10
Temperature (online) (F)	38,828	64	68	71	71	76	81
Total dissolved solids (mg/L)	1	720	-	720	720	-	720

Notes:
Abbreviations: $CaCO_3$ - calcium carbonate; SiO2 - silicon dioxide; ACU - apparent color unit; F - Fahrenheit.
(1) Where there are less than 10 observations, a 10th and 90th percentile was not reported. Statistics were calculated by substituting the detection limit. Where a value is non-detect it is reported as "< detection limit".
(2) Multiple laboratories were used resulting in multiple method reporting limits. Statistics in brackets show the maximum detection limit reported, while lower detection limits are shown for reference. To calculate statistics, non-detects were substituted with the value of the detection limit reported for each observation.
(3) Minimum and maximum values from online data are suspected to be influenced by short-term instrumental error and may not be representative. Corresponding grab sample verification data is shown for reference. Use of 10th and 90th percentiles for online data is considered more appropriate to describe variability.
(4) Measured in the combined UF filtrate and assumed to be the same as UF feed.

Table 3.2 RO Feed Water Quality Observations from Monitoring from July 2020 to July 2022. Observations Suspected to be Influenced by Potable Water Top-up of Reservoir 2 Have been Removed. 6/1 - 10/31 2020 and 5/1 - 10/31 2021 was Excluded

Parameter (units)	n	Min	10th percentile(1)	Av.	Med.	90th percentile (1)	Max
Calcium (mg/L)	26	60	61	71	68	82	109
Magnesium (mg/L)	14	28	31	34	32	37	50
Sodium (mg/L)	14	120	123	141	145	157	160
Potassium (mg/L)	14	15	16	18	18	19	20
Barium (µg/L)	14	13	13	23	24	31	32
Strontium (mg/L)	24	0.39	0.40	0.54	0.57	0.66	0.71
Iron (mg/L) (2)	48	<0.005 (<0.02)	<0.007 (<0.02)	0.015 (<0.02)	0.015 (<0.02)	0.020	0.055
Manganese (µg/L)	48	5.5	9.6	26	20	41	100
Free Ammonia (online) mg/L-N (3)(4)	38,936	0.15(3)	0.44	0.86	0.67	1.44	9.77(3)
Free Ammonia (grab) mg/L-N (4)	46	0.30	0.50	1.12	0.95	1.85	4.8
pH (online) (3)(5)	31,248	1.3(3)	6.3	6.6	6.7	6.8	12.8(3)
pH (grab) (5)	45	6.3	6.5	6.7	6.7	6.8	6.9
Sulfate (mg/L)	24	210	210	259	255	307	370
Chloride (mg/L)	14	150	153	172	180	190	190
Fluoride (mg/L)	14	0.57	0.57	0.63	0.63	0.68	0.68
Nitrate (mg/L-N)	14	7.0	7.4	8.0	7.8	9.0	9.9
Nitrite (mg/L-N)	14	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Nitrate + Nitrite (mg/L -N)	34	6.1	6.9	8.1	8.0	9.5	10.0
Orthophosphate (mg/L-P)	12	2.1	2.3	2.61	2.6	3.0	3.2
Boron (mg/L)	16	0.37	0.37	0.39	0.39	0.41	0.45
Silica (mg/L SiO2)	48	17	17	20	19	22	23
TOC (online) (mg/L) (3)	28,207	0.1 (3)	6.5	7.0	7.0	7.6	9.0 (3)
TOC (grab) mg/L	48	5.9	6.3	7.0	6.7	8.0	9.3
Turbidity (online) (NTU)(3)(6)	115,156	0.012 (3)	0.014	0.021	0.018	0.030	1.000 (3)
Turbidity (grab) (NTU) (6)	123	0.05	0.06	0.07	0.07	0.09	0.16
Temperature (online) (F)	31,288	64	68	72	72	76	79
Conductivity (online) (µS/cm) (3)	31,289	1,163 (3)	1,211	1,358	1,380	1,476	1,629 (3)
Conductivity (grab) (µS/cm)	43	1,254	1,262	1,388	1,355	1,538	1,594

Notes:
Abbreviation: µS/cm - microsiemens per centimeter.
(1) Where there are less than 10 observations, a 10th and 90th percentile was not reported. Statistics were calculated by substituting the detection limit. Where a value is non-detect it is reported as "< detection limit".
(2) Multiple laboratories were used resulting in multiple method reporting limits. Statistics in brackets show the maximum detection limit reported, while lower detection limits are shown for reference. To calculate statistics, non-detects were substituted with the value of the detection limit reported for each observation.
(3) Minimum and maximum values from online data are suspected to be influenced by short-term instrumental error and may not be representative. Corresponding grab sample verification data is shown for reference. Use of 10th and 90th percentiles for online data is considered more appropriate to describe variability.
(4) Measured in the UF filtrate and downstream of ammonia addition for chloramination.
(5) pH reported after acid addition of RO feed.
(6) The data set for all three individual UF membranes was combined to calculate statistics.

3.3 MF/UF and RO Pretreatment

The MF/UF skid includes online monitoring of feedwater turbidity, flow to the feed tank, temperature, and feed tank level. The ammonium sulfate and sodium hypochlorite are dosed into the line feeding the feed tank. The measurement of free ammonia, ORP, pH and total chlorine occurs on the combined filtrate line after the mixing period in the feed tank and through the UF systems. Data in this section was filtered to remove values when feed flow was less than 10 gpm to omit data recorded when at least one UF system was not in operation. RO Feed data was filtered to ensure that readings were collected when the RO was in operation by selecting data only when Stage 2 permeate flow was greater than 6 gpm. The data is reported as daily average as well as 5th and 95th percentile of 1-minute instantaneous points filtered to ensure the sensor is receiving flow.

3.3.1 Chloramine Addition

Chloramine addition is controlled by setting flow paced dosage targets for the ammonium sulfate and sodium hypochlorite subject to the following rules:

- Target a 3:1 ratio of Cl_2 to Ammonia to minimize the potential for free chlorine formation.
- Typically observe an online reading of 0.5 mg/L as free ammonia:
  - Noting that at this level the online probe is at is very low range and not anticipated to be accurate.
- Target a residual of 2.0 – 2.5 mg/L as total chlorine:
  - Note, during the second quarter of 2022, a lower monochloramine target of 0.5 mg/L was trialed to assess the impact on UF and RO fouling as well as UV inlet UVT. The impact of chloramine dose set point on RO fouling are discussed in Section 5.3.
- Generally, chloramine addition was close to target however a full-scale system would benefit from a feedback loop with monitoring that is, flow pacing with a trim on feedback from a total or monochloramine analyzer. A feedback loop would mean that site operators do not have to continually make adjustments as a result of changing chlorine demand and strength in chemical stocks.
- Grab samples taken weekly for verification purposes indicated reasonable accuracy of the online meters.

Plots of the ammonia, chlorine and UF filtrate pH and ORP are shown below to represent the UF feedwater chemical addition and resulting level of chloramine in the UF filtrate/RO feed. Note, further pH adjustment is made, along with antiscalant addition prior to the RO Feed Monitoring Point.

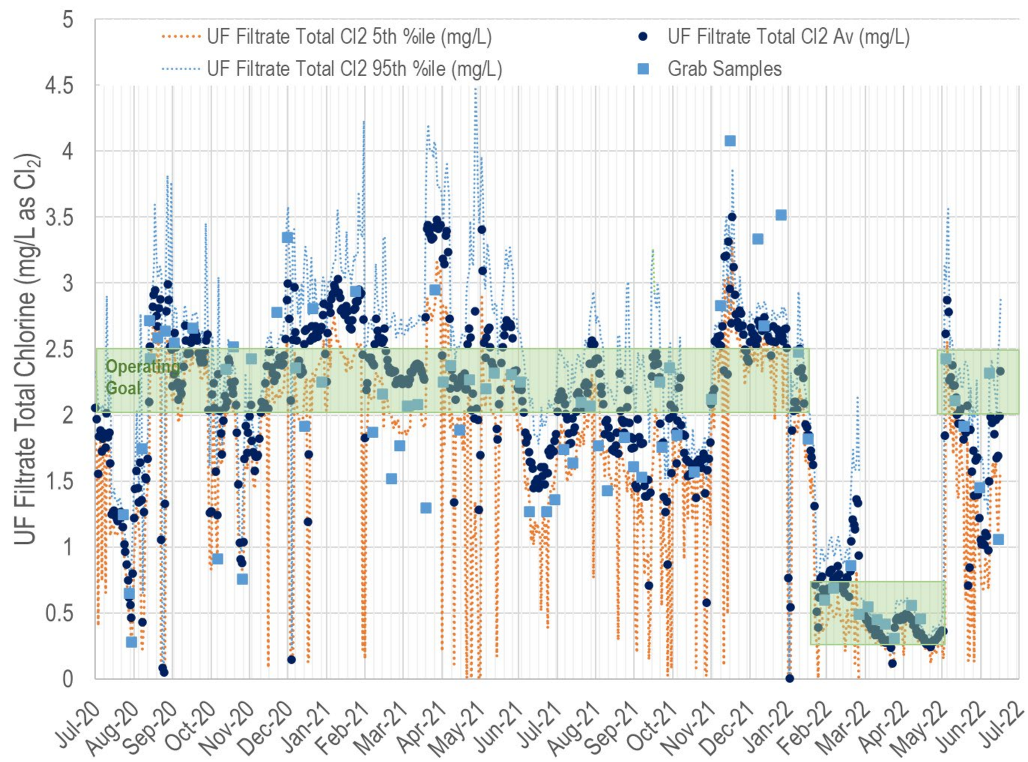


Figure 3.5 Daily Average, 5th and 95th Percentile of Online Total Chlorine Monitoring in the UF Filtrate Along with Grab Sample Verifications

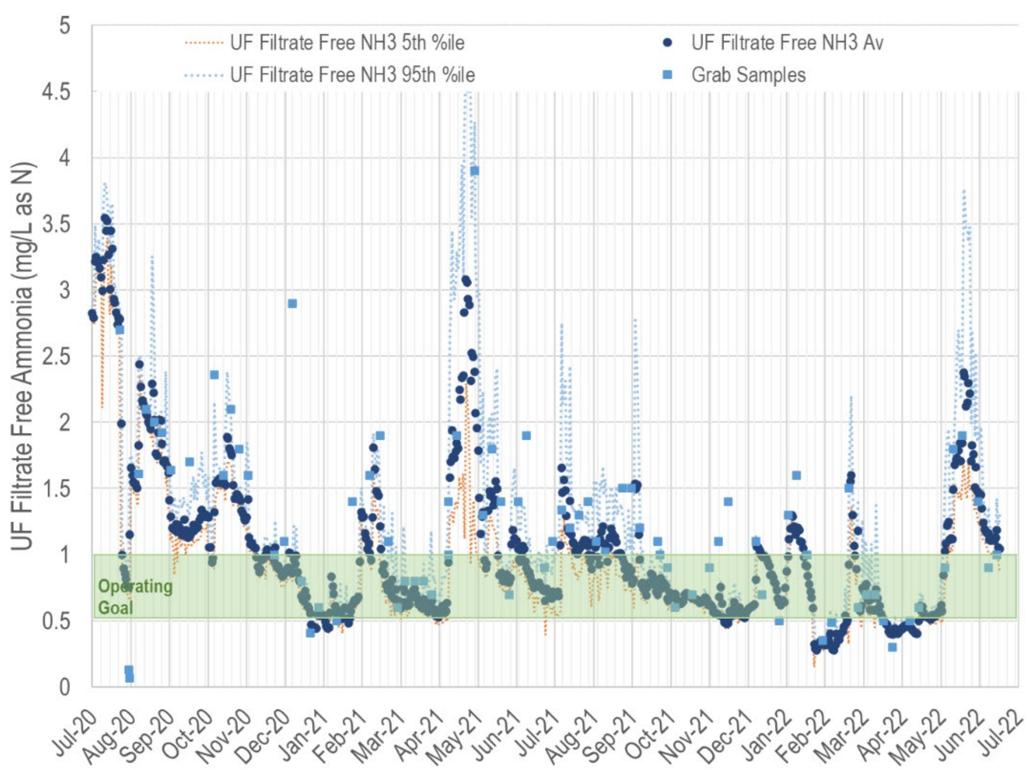


Figure 3.6 Daily Average, 5th and 95th Percentile of Online Free Ammonia Monitoring in the UF Filtrate Along with Grab Sample Verifications

In April - May 2021, there was a treatment performance upset at Tapia WRF and ammonia load to the demo was high. A similar ammonia spike that is tracked with grab sample verification data appeared to occur in late May to June 2022. Given that the spike tracked with multiple verification samples there may have been another treatment performance upset at Tapia. Turbidity of the UF feed also appeared to spike at a similar time (see Figure 3.7).

3.3.2 Feedwater Turbidity

Feed water turbidity to the UF system is typically low, between 0.5 and 1.0 NTU. However, there are a number of spikes in particular mid-February 2021 and early January 2022. The early January 2022 spike corresponded to a high flow event at Tapia and may be representative of a short term effluent quality excursion. A number of other peaks are observed which are preceded by an exponential increase and then sharp drop. These are characteristic of turbidity meter fouling resulting in a higher than true value. The drop occurs upon cleaning of the meter. Between February and May 2022 a lower chloramine target of 0.5 mg/L was trialed to investigate the impact on UF and RO fouling. While the impact on fouling was minimal, there was a noticeable increase in the frequency of cleaning required to minimize turbidity meter fouling. Cleaning frequency was increased from quarterly to 1 - 2 times per month in an effort to reduce false spikes in UF feed turbidity. The UF Feed turbidity data is shown in Figure 3.7 below. UF filtrate data is discussed in the MF/UF section as part of integrity monitoring.

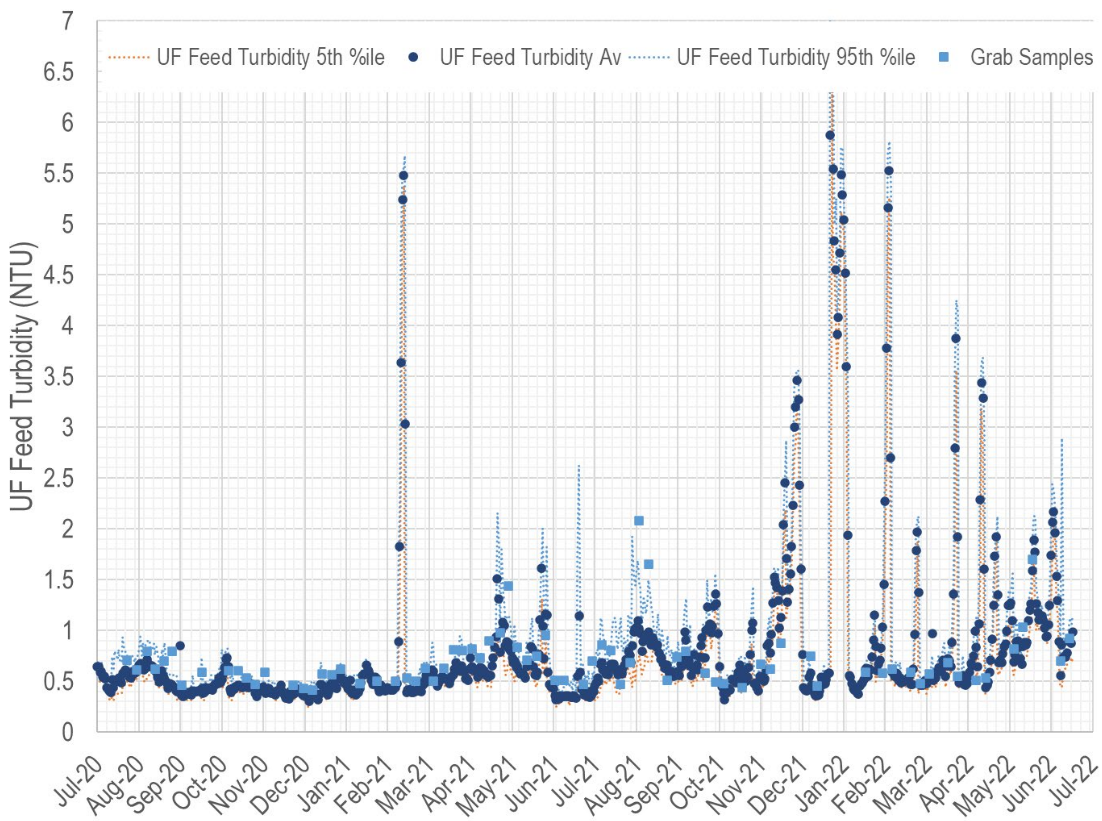


Figure 3.7 Daily Average, 5th and 95th Percentile of Online Turbidity Monitoring in the UF Feed Along with Grab Sample Verifications

3.3.3 UF and RO Feed pH and ORP

Variation in UF filtrate pH was generally low, with daily 5th – 95th percentiles close to the average. There was marginally increased variability corresponding to the period when potable water top-up was occurring in Reservoir 2, similar to that noted for conductivity. Verification samples for pH were typically lower than the online reading and there were several adjustments, corresponding to meter calibration that reduced UF filtrate pH. However, the pH meter appeared to drift back to higher values relatively quickly following calibration. The variable pressure environment in the UF filtrate may be responsible for the higher values as the meter is calibrated ex-situ in solution. Monthly calibration may help to keep the online pH reading closer to that observed for grab verification samples. However, overall relative deviation of the grab and online readings did not exceed 10 percent. The UF filtrate pH data is shown in the Figure 3.8.

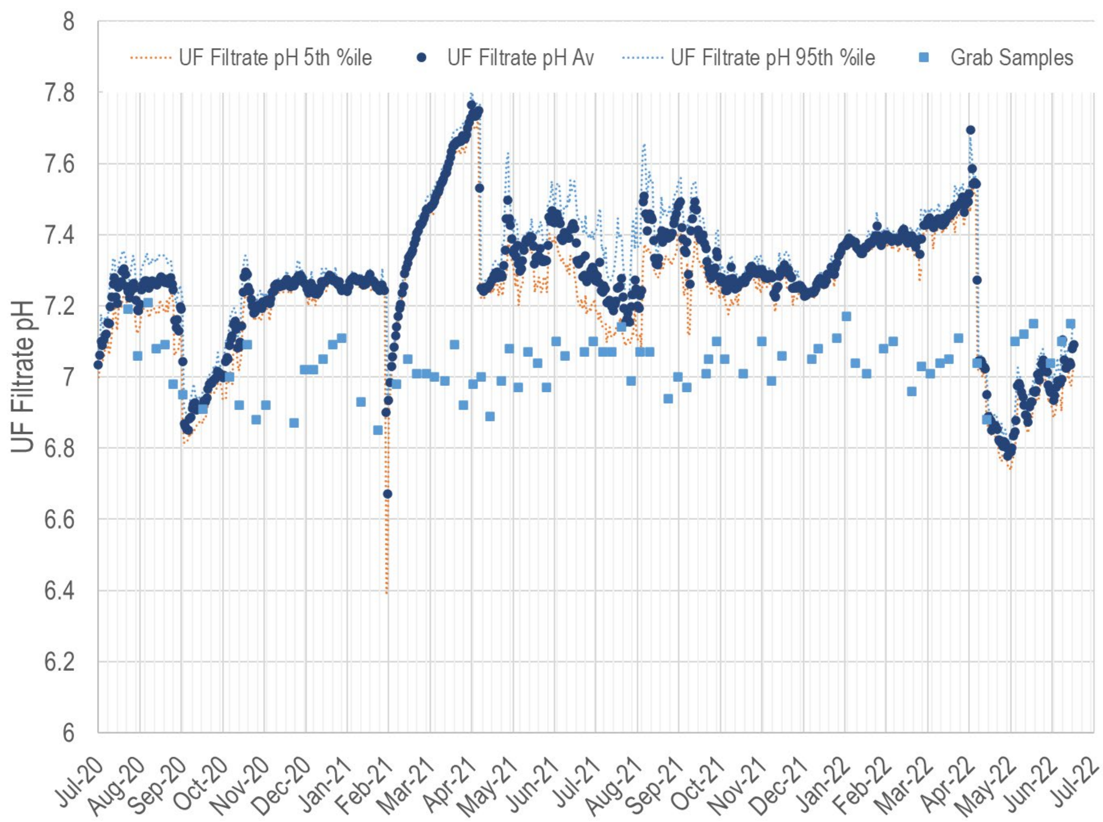


Figure 3.8 Daily Average, 5th and 95th Percentile of Online pH Monitoring in the UF Filtrate Along with Grab Sample Verifications

RO Feed pH was lower than the UF filtrate and was controlled via flow paced addition of sulfuric acid. A dosing target of 40 mg/L was used to target an RO feed pH of 6.4 early in operation but this was reduced to 20 mg/L later in the trial to target a pH of 6.8. In December 2021, the acid dosed was increased to target a pH of 6.4. The pH was decreased in an effort to minimize scaling that was noted during 2-stage 85% recovery operation as the intent was to continue operation at 85% 3-stage. pH readings became sporadic in late January 2022, corresponding to the change out of the RO Feed pH/ORP probe and may be unreliable as they did not correspond to grab samples which were close to the dosing target of 6.4. Prior to replacement, the RO Feed pH probe agreed with verification samples and calibration needs were minimal. The operations staff are seeking a replacement for this probe predominantly due to the failure of its ORP function. The RO Feed pH data is shown in Figure 3.9.

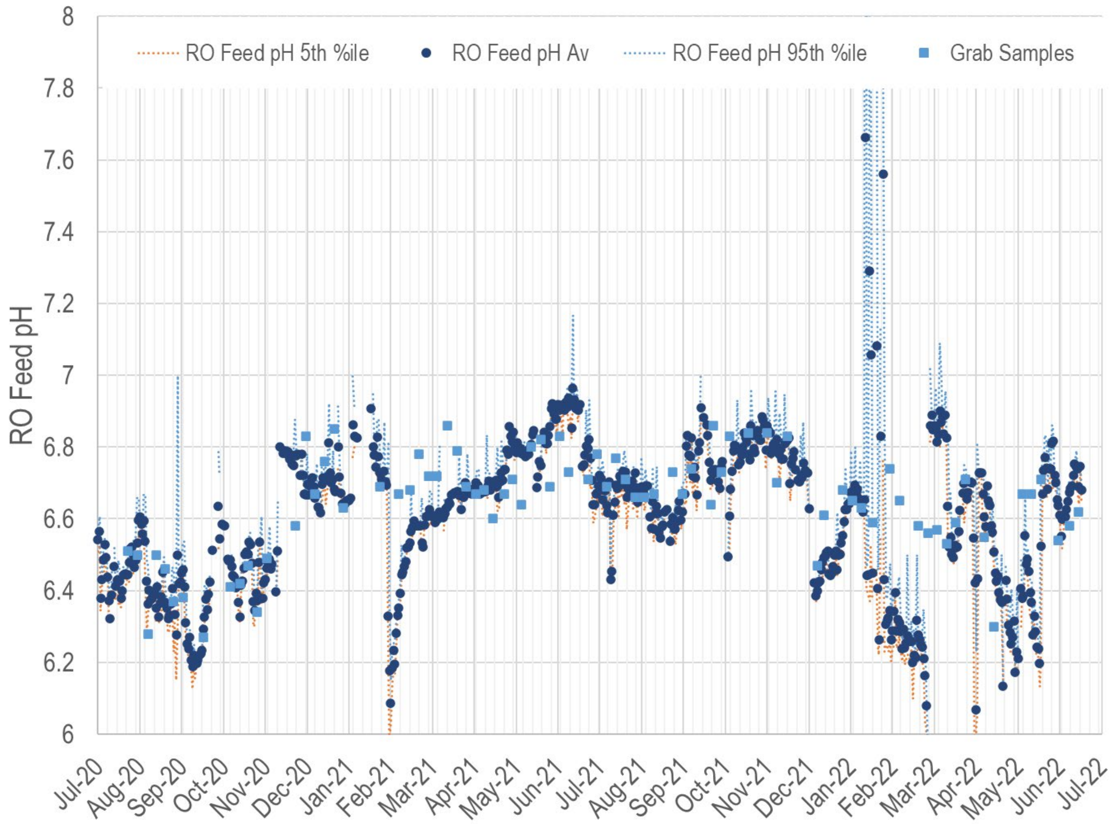


Figure 3.9 Daily Average, 5th and 95th Percentile of Online pH Monitoring in the RO Feed Along with Grab Sample Verifications. pH Readings Following the January 2022 Replacement of the RO Feed ORP Probe are Suspected of Being Inaccurate

UF Filtrate ORP agreed well with grab sample verifications except for 3 readings between January and March 2022 when it was reported that the hand held meter onsite was not working correctly. The ORP decreased from typical values of 450 millivolts (mV) to between 350 - 400 mV corresponding to the dosing set point reduction from a target of 2.0 - 2.5 mg/L of total chlorine to 0.5 mg/L of total chlorine. UF Filtrate ORP results are shown in Figure 3.10.

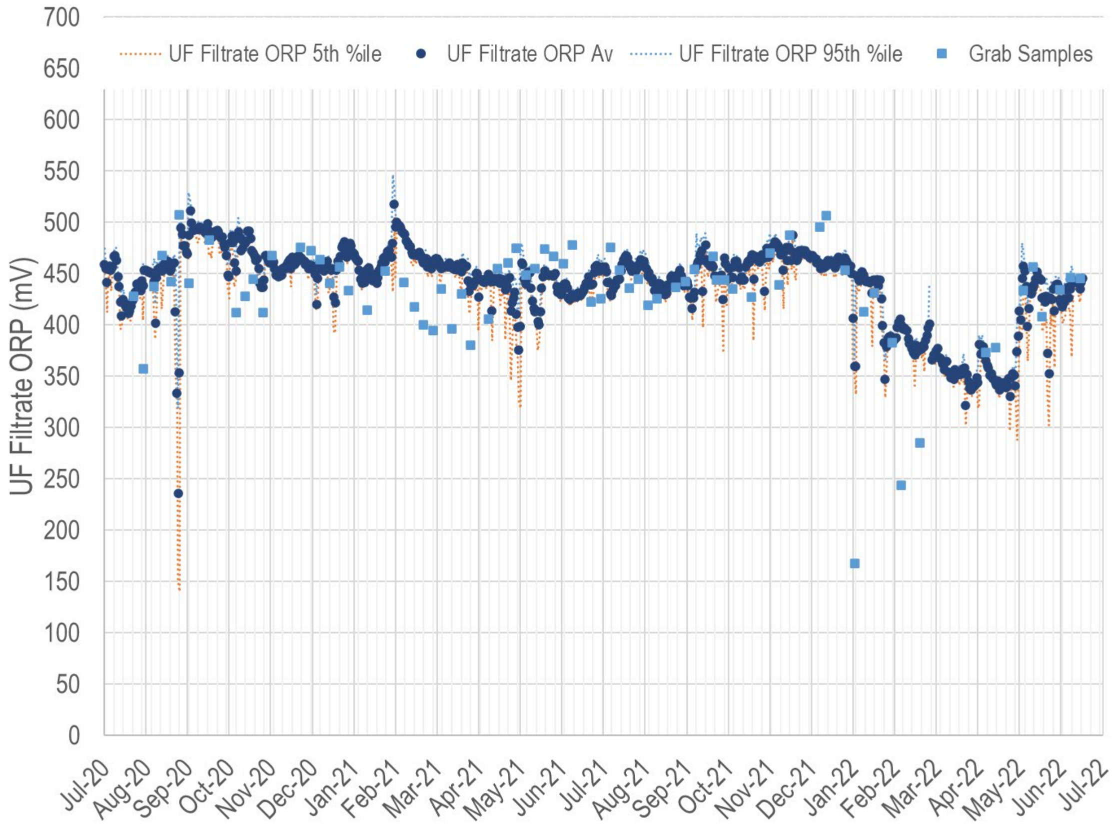


Figure 3.10 Daily Average, 5th and 95th Percentile of Online ORP Monitoring in the UF Filtrate Along with Grab Sample Verifications

On January 20th, 2022, the RO feed ORP probe was replaced. Following replacement, the ORP probe would read opposite to the verification reading with a similar magnitude. This led to negative ORP readings, contrary to grab samples. The 4 - 20 mA scale was switched and the ORP probe then appeared to read and verify correctly. In early April 2022, the RO feed ORP probe began to trend downwards, resulting in further negative values. The values then held constant from late April 2022. The Demo ops staff are requesting a warranty replacement for what is presumed to be a faulty probe. Prior to replacement, the ORP probe corresponded closely with verification samples. In general, the RO feed ORP read between 450 - 500 mV higher than the UF filtrate which was typically 450 mV. It is likely that the addition of sulfuric acid in the RO feed was responsible for this change. RO Feed ORP results are shown in Figure 3.11.

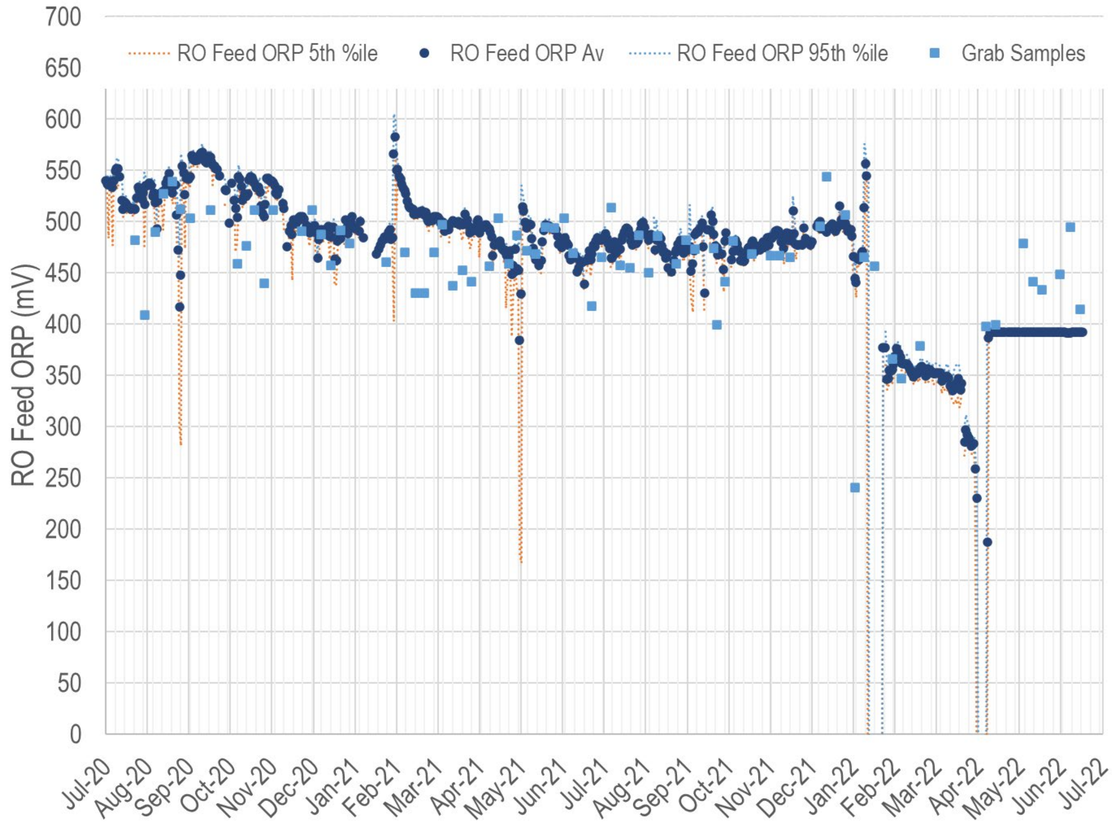


Figure 3.11 Daily Average, 5th and 95th Percentile of Online ORP Monitoring in the RO Feed Along with Grab Sample Verifications. ORP Readings Following the January 2022 Replacement of the RO Feed ORP Probe are Suspected of Being Inaccurate

3.3.4 Feed Screen

The Demo is equipped with an Amiad self-cleaning screen (Amiad TAF-750, 3 inch). The screen material is a 200-micron stainless steel mesh (Amiad TAF-750E, SS316). During an inspection in September 2020, it was recognized that the screen mesh was not installed, meaning early operation of the system had occurred without feed screening. This was rectified in September 2020. Faults or high differential pressure are used to trigger alarms on the Amiad unit. For the first two years of operation no alarms have occurred associated this this unit.

The driving force for water to pass across the feed screen is the Reservoir 2 transfer pumps which are not monitored or controlled by the demo. Feed to the feedwater tank (downstream of the feed screen) is controlled via a flow control valve (FCV_11250 - also downstream of the screen) to achieve a level set point. The level setpoint in the demo feed tank has remained at 85 percent for the first two years. Due to this control strategy, lower flows into the feed tank may result in higher observed pressure in the front of the feed screen. However, high flows and high feed screen pressure may indicate screen clogging. Low feed screen pressures may result from a combination of low Reservoir 2 pump set points and also high flows into the feed tank (less backpressure from the control valve).

The feed screen pressure is not recorded online but logged off a pressure gauge (PG-11248) during daily rounds. The feed screen pressure is shown as the daily logged readings, with the daily average feedwater flow overlaid in Figure 3.12.

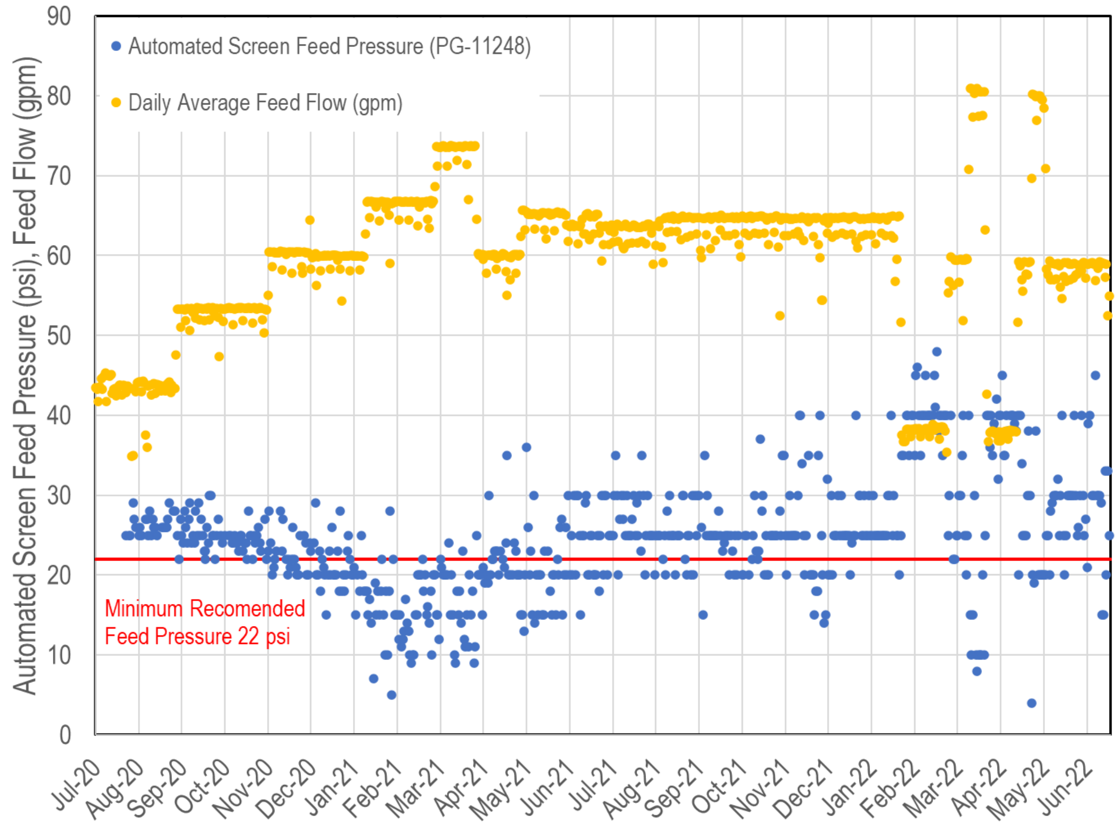


Figure 3.12 Amiad Feed Screen Pressure (Daily Round Observations) and Average Daily Flows into the Feed Tank (gpm). Higher Feed Pressures are Typically Associated with Lower Flows Due to the Backpressure from the Flow Control Valve. Lower Feed Pressures, are Observed at Higher Flows. Results Suggest Minimal Clogging of the Feed Screen

The feedwater screen is manually cleaned whenever an RO CIP is occurring to make the most of shutdown time. For the first 2 years of operation, the feed screen has performed satisfactorily with no significant buildup of fouling materials as a result of the current automated and manual cleaning frequency (45 - 90 days).

Chapter 4

MICROFILTRATION AND ULTRAFILTRATION

This section describes the operation and performance results specific to the MF/UF systems from the start of July 2020 to the end of June 2022.

4.1 System Description

The MF/UF system is equipped with three different membrane models as described in Table 4.1. The membranes have been operated at a constant flux to a target volumetric recovery of 95 percent. This setpoint is achieved via calculation of a production flow per cycle, after which the units backwash. The production flow varies depending on the backwash settings, module hold up volume and to a lesser extent maintenance and recovery clean frequencies. Backwash parameters are summarized in Table 4.1. These modules have been operated continuously since commissioning in June 2022.

Table 4.1 MF/UF Membrane Characteristics and Backwash Settings

Membrane Designation(1)	UF1	UF2(1)	UF3
Manufacturer	Dow/DuPont	Pall/Asahi	Toray
Model Number	SFD-2880XP	UNA-620	HFUG-2020AN
Active Membrane Surface Area (ft^2)	829	538	969
Nominal Pore Size (µm) (1)	0.03	0.1	0.01
Target Backwash Ratio Used	1.5 x Forward Flow	Constant 8 gpm	1.5 x Forward Flow
Backwash Time (s)	30	60	45
Target Backwash Airflow(2) (scfm)	5.0	3.0	3.5
Aeration Time (s)	30	30	45
Drain Time (s)	45	0(4)	45
Refill/Forward Flush Flow (gpm)	15	24	15
Refill/Forward Flush Duration (s)	45	20	35(3)

Notes:
Abbreviations: scfm - standard cubic feet per minute; s - seconds.
(1) Although the Pall (UF2) is not an ultrafilter, it is abbreviated as UF to match the naming conventions used on the HMI.
(2) Note, the backwash airflow is set using a rotameter on the compressed air line. The setpoint remains consistent but it is not monitored or reported.
(3) The Toray Refill flow was updated based on vendor advice due to concerns the module was not able to completely refill and may be 0.25 gallons short. The refill flow duration was increased from 35 to 45 seconds on 6/24/2022 but for a majority of the first two years was held at 35 seconds. During module change out, 45 seconds appeared to be inadequate due to a malfunctioning feed valve.
(4) The Pall system does not do a drain step but instead uses a higher flow forward flush. This marginally reduces feedwater recovery by avoiding loss of a feed side volume.

Maintenance cleans (MCs) - short duration, lower strength, frequent cleans and recovery cleans (RCs) - longer duration, higher strength, less frequent cleans were typically conducted for the same contact time and mode and kept consistent across each module for the duration of the pilot. The primary chemical strength (hypochlorite or citric acid) and frequency of maintenance cleans was changed as described in the next section. The typical contact mode and duration for MCs and RCs are reported in Table 4.2. The cleaning recipes were selected to be an amalgam of each vendor recommendations. Vendors recommended MCs with varying frequencies (daily to weekly) and strengths from 300 – 500 mg/L NaOCl. MC recommended by vendors had a contact time of approximately 30 minutes. RCs were typically recommended to be 2000 mg/L NaOCl with NaOH to target pH 10 -11 followed by a 2000 mg/L Citric Acid clean. RCs and MCs were applied consistently across all modules.

Table 4.2 MF/UF Cleaning Regimes for Maintenance Cleans and Recovery Cleans

Clean Type	MC	High pH RC	Low pH RC
Chemical(s)	Sodium Hypochlorite	Sodium Hypochlorite + Sodium Hydroxide	Citric Acid + Sulfuric Acid (1)
Chemical Strength(2)	500 mg/L Sodium Hypochlorite	2000 mg/L Sodium Hypochlorite	2000 mg/L Citric Acid
pH Target	Native from Hypo, typically pH = 8.0	pH 10 – 11 by addition of Sodium Hydroxide	pH 2 -3(1)
Temperature	Ambient	95°F	95°F
Dynamic Contact Flow	13 gpm	13 gpm	13 gpm
Contact Mode 1 Dynamic Feed Side Cross Flow	4 min	15 min	15 min
Contact Mode 2 Dynamic Feed to Filtrate Side	3 min	15 min	15 min
Contact Mode 3 Static Soak (3)	2 min	30 min	30 min
Contact Modes 1 – 3 Repeats (3)	4 cycles	3 cycles	3 cycles
Approximate Contact Duration (3)	34 min	150 min	150 min
Feed Side Flush	25 gal/module @ 15 gpm	25 gal/module @ 15 gpm	25 gal/module @ 15 gpm
Feed to Filtrate slide Flush	25 gal/module @ 15 gpm	25 gal/module @ 15 gpm	25 gal/module @ 15 gpm
Neutralization of CIP	Calcium Thiosulfate	Calcium Thiosulfate + Sulfuric Acid	Sodium Hydroxide
Backwash Cycles Prior to Return to Filtration	2	2	2

Notes:
Abbreviation: gal - gallon.
(1) During commissioning, the pH of the 2,000 mg/L citric acid solution was 2.75, as a result no additional sulfuric acid was added for pH suppression.
(2) 500 mg/L was used for a majority of MCs during operation but was varied during the first half of 2022 – see below Table 4.3. RCs were kept constant at a 2,000 mg/L target of either Hypochlorite or Citric acid. Citric RCs were scheduled to occur after a short period (< 1hour) of filtration following a Hypochlorite RC.
(3) Final soak step was observed to skip shortening overall contact duration by the length of one soak time.

4.2 MF/UF Operational Periods

The primary intent of the first year of operation was to step up flux to understand a potential sustainable design flux for operation of each of the tested UF products. A detailed analysis of sustainable flux was performed as part of the first-year report and is not repeated here (See Year 1 Report, Section 2.3.4.1). During the second year, the UF systems were mostly operated at fluxes suspected of being sustainable (i.e. 40 gfd) in order to obtain long term performance data. In addition, beginning early 2022 systematic changes were made to the feedwater chloramine dose, maintenance clean frequency and strength and target flux. The goal of these changes was to develop a machine learning model for permeability forecasting. The results are reviewed within this chapter as a means to help define appropriate cleaning dosages relative to flux targets.

Results that may have been influenced by potable water top-up in reservoir 2 are identified. Peak fluxes of 40 gfd were achieved for UF1 and UF3 and 50 gfd for UF2 during periods that should not have been impacted by reservoir 2 top up.

The operational periods for the MF/UF are summarized in Table 4.3.

Table 4.3 MF/UF Operational Targets for the Demo

Date Range	Target Flux	Cleaning Regime [2]	Comments	Potable Water Top Up In Reservoir 2?
7/1 – 8/28/2020	UF1 = 25 gfd[1] UF2 &UF3 = 30 gfd	2 x 500 mg/L MCs per week.	MCs only, RCs not performed.	Yes
8/28 – 9/28/2020	UF1,2 & 3 = 35 gfd	2 x 500 mg/L MC per week; 1 x RC per month	RCs performed late August before flux increase. Highest permeabilities observed after RCs for all modules.	Yes
9/28 – 11/2/2020	UF1,2 & 3 = 35 gfd	1 x 500 mg/L MC per week; 1 x RC per month	Reduced MC frequency.	Yes
11/2/2020 – 1/11/2021[3]	UF1,2 & 3 = 40 gfd	1 x 500 mg/L MC per week; 1 x RC per month		No
1/11 – 3/2/2021	UF1,2 & 3 = 45 gfd	1 x 500 mg/L MC per week; 1 x RC per month		No
3/2 – 4/1/2021	UF1,2 & 3 = 50 gfd	1 x 500 mg/L MC per week; 1 x RC per month		No
4/1 – 5/3/2021	UF1,2 & 3 = 40 gfd	1 x 500 mg/L MC per week; 1 x RC per month	Accelerated fouling on UF1 and UF3. Reduced flux to investigate. Backwash limitation identified that resulted in higher than target recovery.	No
5/3-6/4/2021	UF1&UF3 = 40 gfd UF2 = 55 gfd	1 x 500 mg/L MC per week; 1 x RC per month	Accelerated fouling due to backwash limitation at higher flows. Adjusted control valve limit to achieve 1.5 x forward flow.	Yes
6/4-8/11/2021	UF1&UF3 = 40 gfd UF2 = 50 gfd	2 x 500 mg/L MC per week; 1 x RC per month	Increased MC frequency	Yes
8/11 – 10/31/2021	UF1&UF2 = 45 gfd UF3 = 40 gfd	2 x 500 mg/L MC per week; 1 x RC per month	Permeability more variable than without potable water top-up	Yes
10/31/2021 – 1/31/2022	UF1&UF2 = 45 gfd UF3 = 40 gfd	2 x 500 mg/L MC per week; 1 x RC per month	No change to prior set points. No longer impacted by potable water top-up. Permeability more stable	No
1/31 – 3/7/2022	UF1,2 & 3 = 25 gfd	1 x 610 mg/L MC per week [4]; RC x 1 in 5 weeks	Chloramine target reduced to 0.5 mg/L as total chlorine[5]	No
3/7 – 3/21/2022	UF1,2 & 3 = 40 gfd	2 x 610 mg/L MC per week [4]; 1 x RC per month	Chloramine target reduced to 0.5 mg/L as total chlorine[5]	No
3/21-4/3/2022	UF1,2 & 3 = 55 gfd	2 x 610 mg/L MC per week [4]; 1 x RC per month	Chloramine target reduced to 0.5 mg/L as total chlorine[5]	No
4/3 – 4/25/2022	UF1,2 & 3 = 25 gfd	1 x 1220 mg/L MC per week [4]; 1 x RC in 6 weeks (occurred 5/14-16)	Chloramine target reduced to 0.5 mg/L as total chlorine[5]	No
4/25-5/5/2022	UF1,2 & 3 = 40 gfd	2 x 1220 mg/L MC per week [4]; 1 x RC in 6 weeks (occurred 5/14-16)	Chloramine target reduced to 0.5 mg/L as total chlorine[5]	No
5/5-5/16/2022	UF1,2 & 3 = 55 gfd	2 x 1220 mg/L MC per week [4]; 1 x RC in 6 weeks (occurred 5/14-16)	Chloramine target reduced to 0.5 mg/L as total chlorine[5]; RC did not recovery permeability to >90% of original; Possible ammonia spike due to upstream treatment upset.	No
5/16 – 5/23/2022	UF1,2 & 3 = 40 gfd	3 x 305 mg/L MC per week [4]; 1 x RC in 6 weeks (occurred 6/29-30)	Returned chloramine to 2.0 – 2.5 mg/L target; Permeability not fully recovered after last RC	No
5/23 – 5/30/2022	UF1,2 & 3 = 40 gfd	3 x 610 mg/L MC per week [4]; 1 x RC in 6 weeks (occurred 6/29-30)	Permeability not fully recovered after last RC	No
5/30 – 6/6/2022	UF1,2 & 3 = 40 gfd	3 x 1220 mg/L MC per week [4]; 1 x RC in 6 weeks (occurred 6/29-30)	Permeability not fully recovered after last RC; Possible ammonia spike due to upstream treatment upset	No
6/6 – 6/30/2022	UF1,2 & 3 = 40 gfd	1 x 305 mg/L MC per week [4]; 1 x RC in 6 weeks (occurred 6/29-30)	TMP exceeded 20 psi on UF1, brought recovery cleans forward; Not sustainable operating regime; Possible ammonia spike due to upstream treatment upset	No

Notes:
Abbreviation: psi - pounds per square inch.
(1) UF1 valve positioner resulting in poor flow control. Left UF1 at a lower flux until the control valve could be rectified. Resolved mid-August 2020.
(2) RCs refer to a 2000 mg/L sodium hypochlorite clean, followed by a 2000 mg/L citric clean as detailed in Table 4.2.
(3) Attempted to increase flux to 45 gfd on December 2nd, 2020, VFD faulted and fuses blew after power outage. Held flux until cause of VFD failure was not anticipated to be due to higher flow targets.
(4) Onsite strength of clean was verified at the start of the trial and shown to be 610 mg/L as free chlorine. Subsequent recipes scaled the adjusted reading.
(5) Unless otherwise specified, chloramine dosing target was 2.0 - 2.5 mg/L as total chlorine.

4.3 MF/UF Operating Performance

This section details the hydraulic operating performance (i.e., Recovery, Flux, TMP, Permeability and Cleaning) of each of the MF/UF systems during the first two years of operation.

4.3.1 MF/UF Recovery

The observed MF/UF recovery for the first two years of operation, calculated from daily total feed and product totals is included in Figure 4.1. As noted in the Year 1 report, actual recovery of UF3 was higher than targeted due to a backwash pump flow limitation. This was recognized and steps taken to rectify the issue in April 2021. Further adjustments were made in August 2021 to lower the actual UF3 recovery. The discrepancies between the target and actual recoveries observed for UF3 were principally due to difficulties quickly meeting the flow requirement to backwash the high active membrane surface area. As the backwash pump ramped up and down, theoretical targets could not be met. The problem was more pronounced when operating at higher fluxes, as the backwash flow requirement was also higher. Between August 21 and February 2022, UF3 recovery was maintained between 96 - 97 percent. In February 2022, further adjustments were made to bring recovery closer to 96 percent. The during the flux variation trials for machine learning, it was difficult to fine tune the recovery and higher recoveries were observed at higher fluxes, while lower recoveries were observed at lower flux (25 gfd). The 40 gfd recovery was closer to target, between 94 - 95 percent overall. At 55 gfd, the backwash pump was not able to meet its backwash target for UF3 and also had difficulty meeting the backwash target for UF1. The constant backwash flow for UF2 was easier to control and was consistently met with recovery between 95-96 percent for the first two years of operation. One outlier occurred in early March where the UF2 recovery dropped to 92 percent. On this day, recovery cleans were conducted and there was an unplanned production stall which lowered the possible recovery.

After this report it was identified that the feed flow control valve for UF3 was not opening correctly. It is uncertain when this valve begun to malfunction. The impact of the feed control valve meant that the initial fill volume for UF3 may not have filled the entire feed volume of the module. The malfunctioning feed control valve may also explain the difficulty in controlling UF3 recovery during the extreme flux changes implemented in early 2022 – as the feed water loss was variable and did not match calculated values. The consequences of the malfunctioning feed valve are as follows:

- Recovery was difficult to control and was higher than targeted. This would challenge UF3 with a higher solid loading relative to the other modules.
- UF3 was suspected of partially filling after backwash due to a fill volume set point less than the manufacturer specification. This would mean that:
  - The unfilled portion of the module may have dried out over time and could result in observations of higher-pressure decay rates – which were observed after 18 months in service.
  - Not all available membrane surface area was available for filtration. This means that the actual flux is higher than what was logged and observed.

Confirmation of the exact performance decline cause is underway for UF3 via an Autopsy, the findings of which are not available at the time of writing this report. UF3 was replaced in September 2022 by another Toray product with the same membrane formulation and a smaller housing (Toray HFUG B2315AN). Performance data for this module was not available for this report. Performance of this alternate product may help to identify if the shortfalls in permeability were as a result of the malfunctioning feed control valve. i.e. if the replacement product operates well, it could be assumed that the permeability losses noted for UF3 in this report are artefacts of poor filling. As a consequence of the operational difficulties and inadequate refill with UF3, the results reported below should be considered underestimates of true performance.

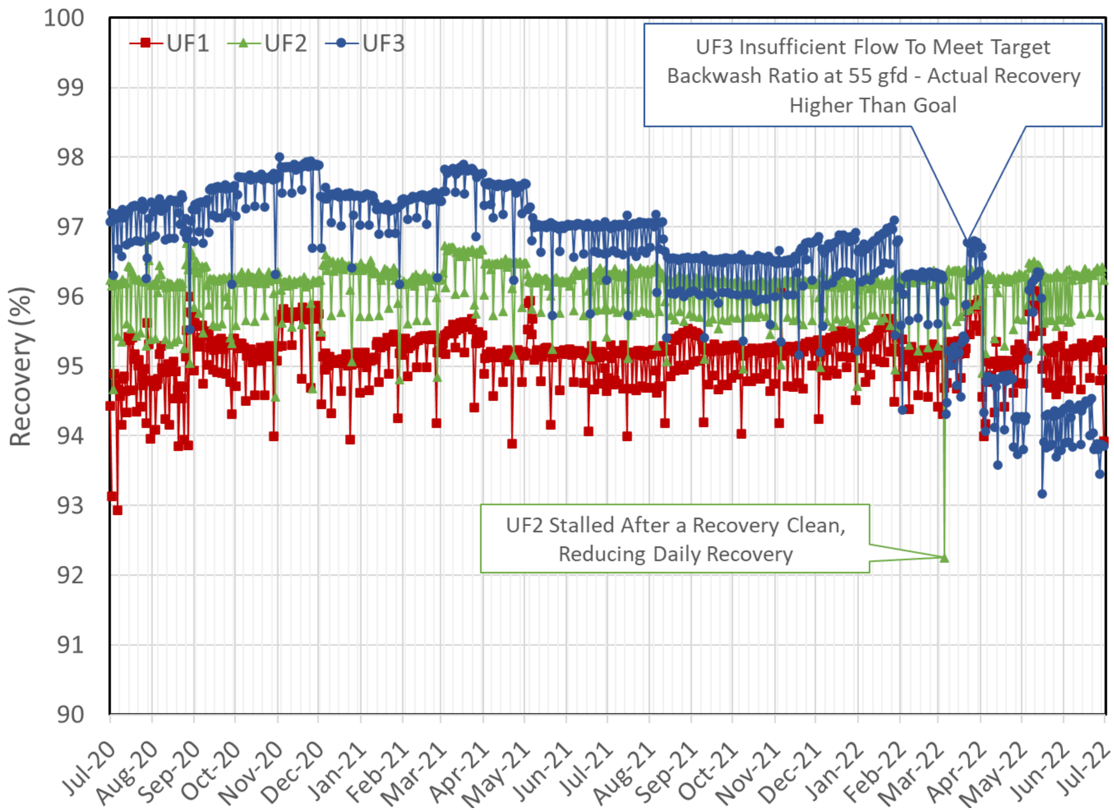


Figure 4.1 Recovery of the UF Modules for the First Two Years of Operation. The Larger Surface Area (and Larger Backwash Flow Requirement) of UF3 was Difficult to Consistently Meet. The Flow was Optimized for 40 gfd but Could Not be Met at 55 gfd Due to Pump Limitations

4.3.2 MF/UF Flux, TMP and Permeability

The flux, temperature corrected TMP and permeability as well as occurrence of MCs and RCs are shown for each UF system for the first two years of operation in Figures 4.2 to 4.4. Statistics for permeability, are also included for each module in Table 4.4.

Permeability reduced for all membranes in June 2022 when the MC strength was low and there may have been an upstream treatment performance upset indicated by higher-than-normal feedwater turbidity and ammonia. Subsequent to the data shown, recovery cleans were able to restore permeability to above 90 percent of the maximum value observed within the first year for UF1 and UF2. Recovery of UF3 performance may have been possible without the impact of the malfunctioning valves. Consequently, at the flux and cleaning regimes tested (and for the durations evaluated), no more than 10 percent irrecoverable fouling has formed in two years of continuous operation for UF1 and UF2.

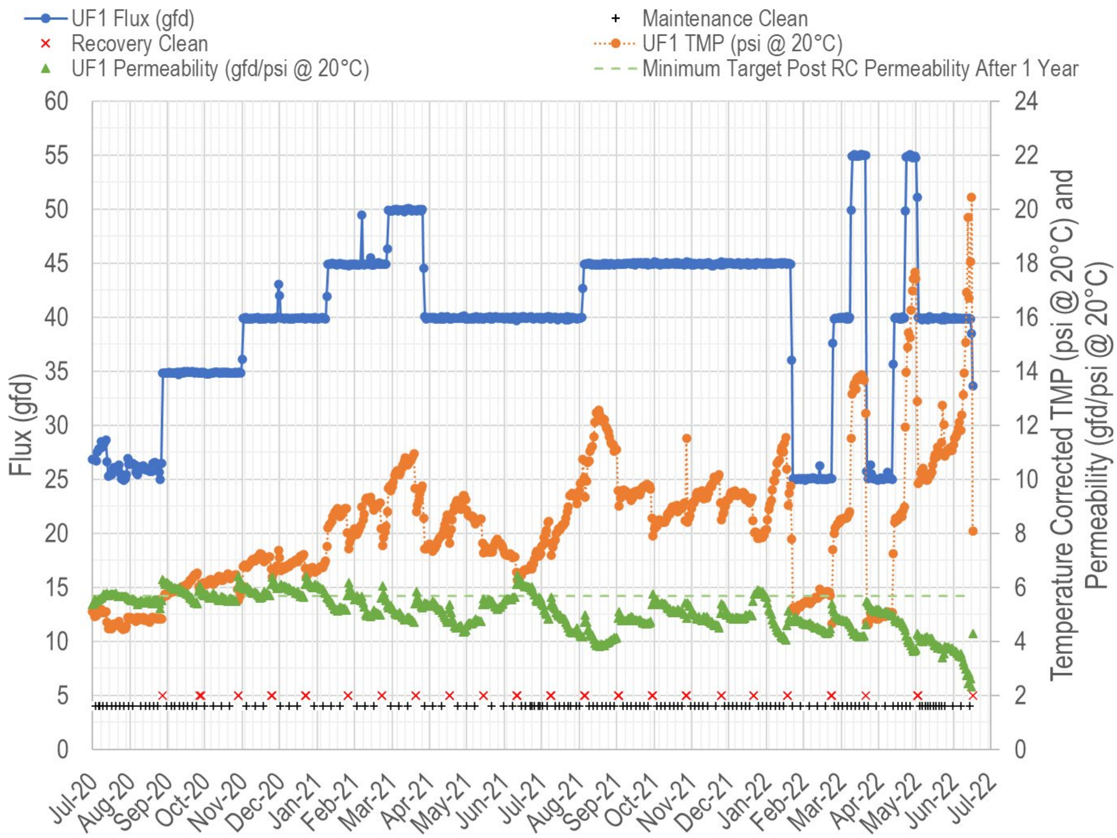


Figure 4.2 UF1 Daily Average Flux and Temperature Corrected TMP and Permeability, as well as Occurrences of MCs and RCs for the First Two Years of Operation

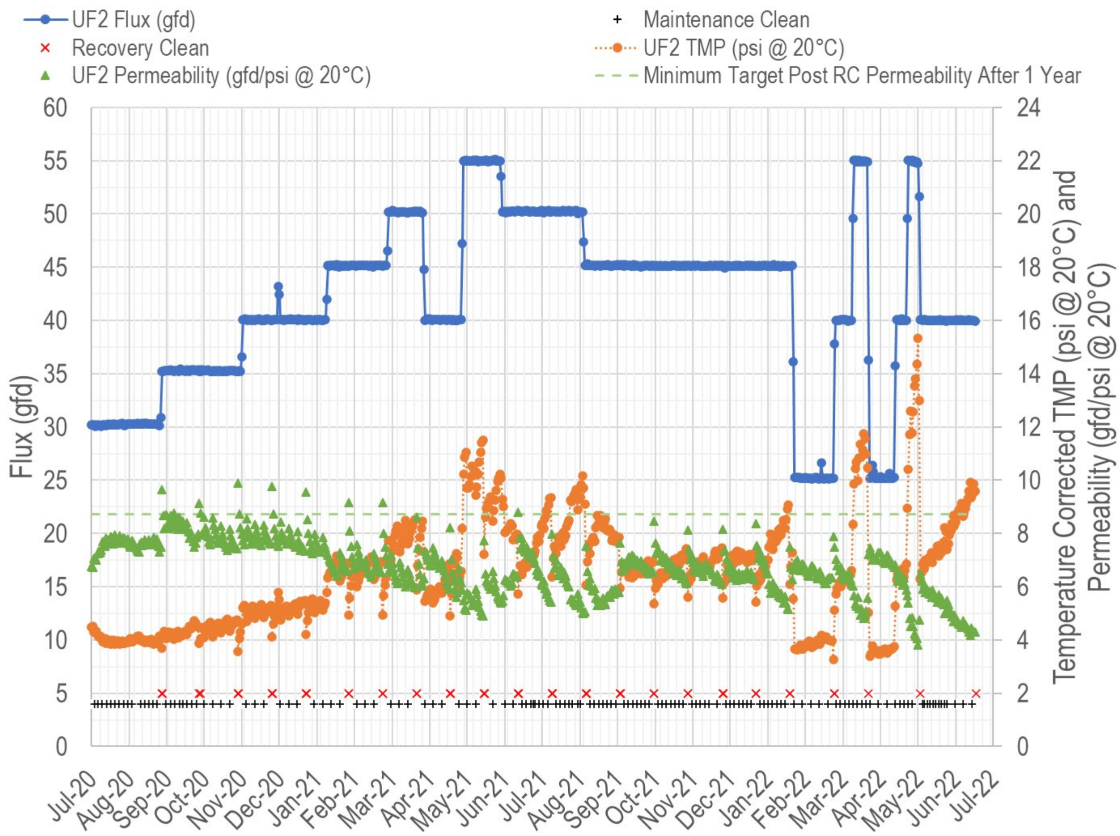


Figure 4.3 UF2 Daily Average Flux and Temperature Corrected TMP and Permeability, as well as Occurrences of MCs and RCs for the First Two Years of Operation

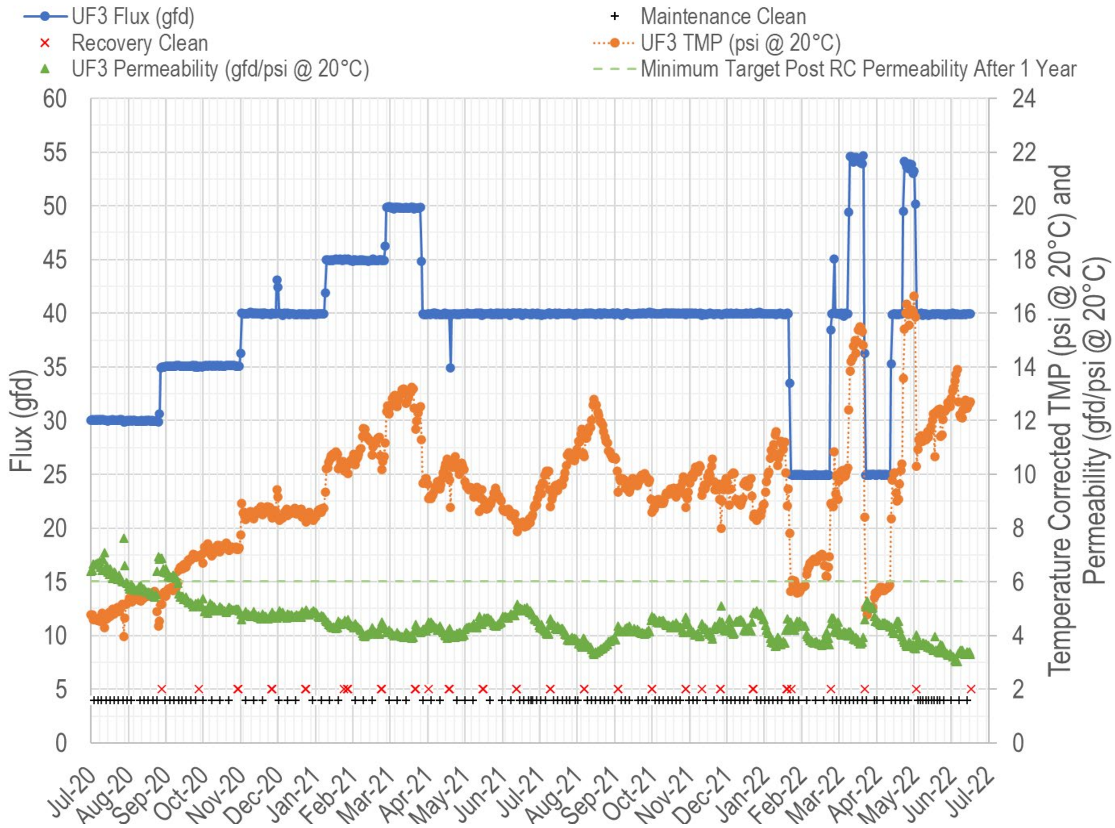


Figure 4.4 UF3 Daily Average Flux and Temperature Corrected TMP and Permeability, as well as Occurrences of MCs and RCs for the First Two Years of Operation. UF3 Permeability may have been Influenced by Malfunctioning Backwash and Refill Control Valves

Table 4.4 Permeability of Membrane Products Observed During the First Two Years of Operation

Parameter	Permeability (gfd/psi @ 20°C)		
	UF1	UF2	UF3(1)
Minimum Sustainable Permeability Target (90% of Year 1 after first RC)(2)	5.7	8.7	6.0
Minimum	2.3	3.8	3.0
5th Percentile	3.8	5.0	3.5
Average	5.1	6.8	4.5
Median	5.2	6.7	4.4
95th Percentile	6.0	8.3	6.2
Maximum	6.4	9.9	7.6

Notes:
Abbreviation: °C - degrees Celsius.
(1) UF3 performance data is a conservative estimate of performance due to malfunctioning refill and backwash valves.
(2) The minimum first year permeability target was taken as 90% of the daily average temperature corrected permeability after the first RC in late August 2020.

RCs significantly improved the permeability of UF2, which were followed by a rapid and then slowing drop-off to more stable values. UF3 performance was challenged due to malfunctioning valves and a higher recovery when compared to the other modules.

4.3.3 Flux and Cleaning Balance

The Year 1 Report suggested that sustainable fluxes of 44, 48 and 45 gfd would be possible for UF1, UF2 and UF3 respectively operating with 1 x 500 mg/L MC per week and 1 RC per month (per the regime in Table 4.2). Since the first report, prolonged operation has occurred for UF1 and UF2 at 45 gfd and UF3 at 40 gfd. Flux and cleaning were also varied.

Between April and June 2022, recovery clean frequency was reduced, occurring approximately every 6 - 8 weeks. During this period, fouling of all three membrane products occurred. This suggested that maintaining a monthly recovery clean was important for all products tested.

There did not appear to be a significant advantage of more than one maintenance clean per week (provided monthly RCs were conducted). However, when the RC frequency was reduced and the MC strength was reduced to once per week at 300 mg/L, permeability began to reduce. 500 – 600 mg/L at least once per week appeared to be an optimum MC frequency. There may have also been an upset at Tapia during late May to early June which impacted these observations as Demo influent turbidity and ammonia were higher than normal during this period (See Figures 4.5 and 4.6). Fluxes of 55 gfd were not sustainable for UF1 or UF3, but 40 gfd was sustainable for all products.

Based on the longer-term observations, the following conditions are anticipated to result in sustainable performance. Higher performance may be possible for UF3 noting the malfunctions that resulted in a higher than desired recovery and possible underutilization of membrane area (See Table 4.5).

Table 4.5 Pairing of Flux and Cleaning Regimes Based on Observed Performance Data

UF ID	UF1	UF2	UF3(1)
Vendor	Dow/DuPont	Pall	Toray
Product ID	SFP-2880XP	UNA-620A	HFUG-2020AN
Average and (Range) of Observed Recovery (%)	95 (93 – 96)	96 (92 – 97)	97 (93 – 98)
Flux(2)	45	45	40
MCs(3)	1+ per week	1+ per week	1+ per week
MC Strength(4)	500 mg/L Sodium Hypochlorite		
RCs(3)	1+ per month	1+ per month	1+ per month
RC Strength(5)	2000 mg/L Sodium Hypochlorite Followed by 2000 mg/L Citric Acid		

Notes:
(1) UF3 performance is a conservative estimate due to malfunctions with valves making recovery and refill difficult to control.
(2) Based on observation of long term runs in Year 2 in light of Year 1 initial modelling recommendations that suggested all UF products should be able to operate between 44 – 50 gfd. Short term performance <1 week up to 55 gfd may be possible based on studied conditions provided recovery clean frequency can be increased.
(3) Based on the contact times and modes listed in Table 4.2. Alternate contact modes may be optimal.
(4) Based on observations of lower performance with 300 mg/L and negligible difference in performance between 500 - 1220 mg/L.
(5) RC strength and contact regime has not been varied and could be subject to some optimization.

4.4 MF/UF Membrane Integrity Measurement

This section contains a summary of MF/UF integrity monitoring results including updated PDT, filtrate turbidity and SDI data to cover 2 years of operational performance. A brief summary of the virus challenge test results conducted in Year 1 is included, with the full set of results included in the Year 1 Report.

4.4.1 Turbidity Measurement

The daily average and 95th percentile for each UF unit is shown in Figures 4.7 to 4.9. Statistics covering the first two years of 15-minute data are reported in Table 4.6 for each UF. Prior to September 2020, there was a cross connection issue that allowed feedwater to syphon into the filtrate turbidity meters. This was identified and corrected. When reporting statistics, data prior to September 2020 is omitted.

Each UF unit has produced filtrate with very low turbidity, only one 95th percentile and average exceeded 0.2 NTU and this was for UF3 in late June 2021. There is a characteristic pattern observed for each filtrate turbidity where over a number of subsequent days, turbidity increases exponentially and then drops sharply to a baseline. This pattern is the result of biofouling of the meter, which is subsequently cleaned, returning the meter to normal baseline values. Biofouling events appeared to occur more frequently in summer and also when the chloramine dosage was reduced. Monthly cleaning of turbidity meters should be sufficient to minimize false positives due to biofouling of filtrate turbidity meters.

The difference between 95th percentile and average filtrate turbidity was minimal for most observations demonstrating that the UF systems showed small variation in filtrate turbidity throughout the day.

Grab samples are included for reference; however, the grab sample meter is not as sensitive as the laser turbidity meters installed for online readings. To that end, grab samples consistently read higher than UF filtrate turbidity.

Turbidity results show that each UF is consistently producing filtrate with minimal suspended solids.

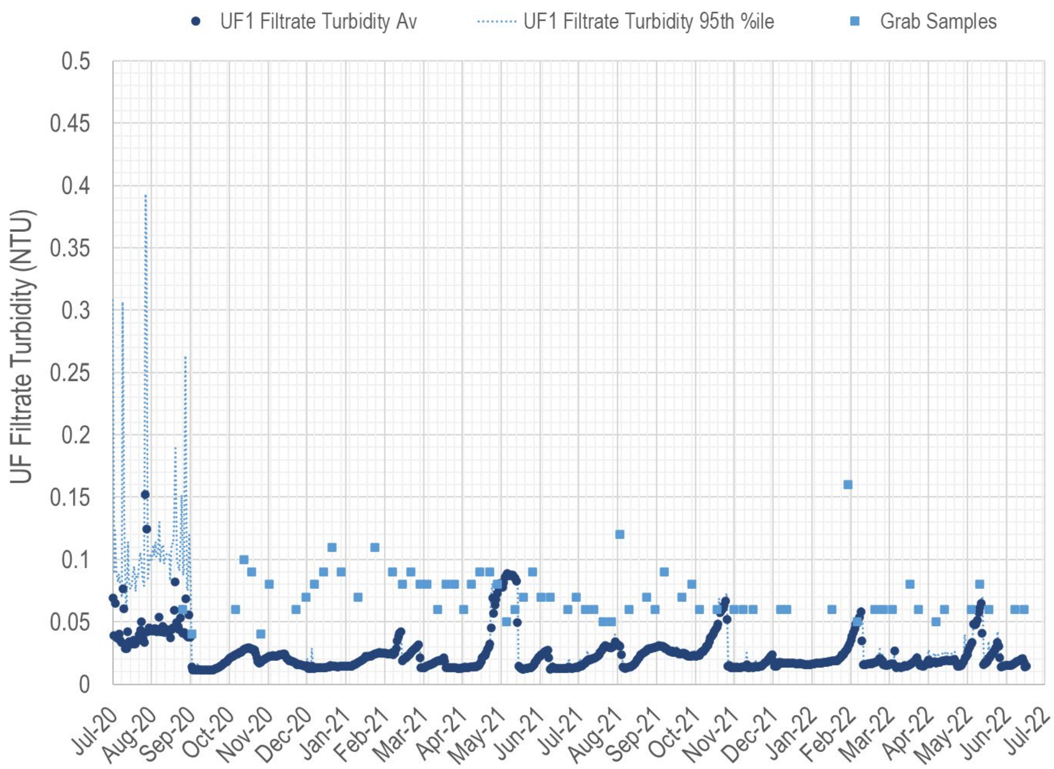


Figure 4.5 UF1 Daily Average and 95th Percentile Filtrate Turbidity Along with Periodic Grab Samples

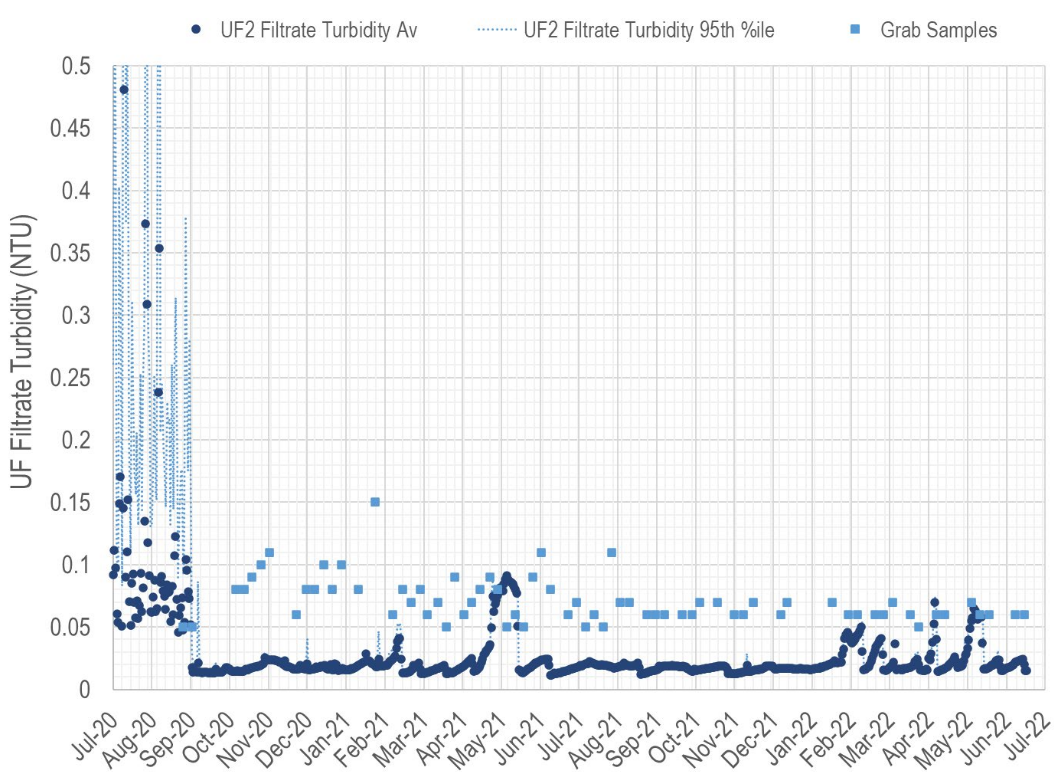


Figure 4.6 UF2 Daily Average and 95th Percentile Filtrate Turbidity Along with Periodic Grab Samples

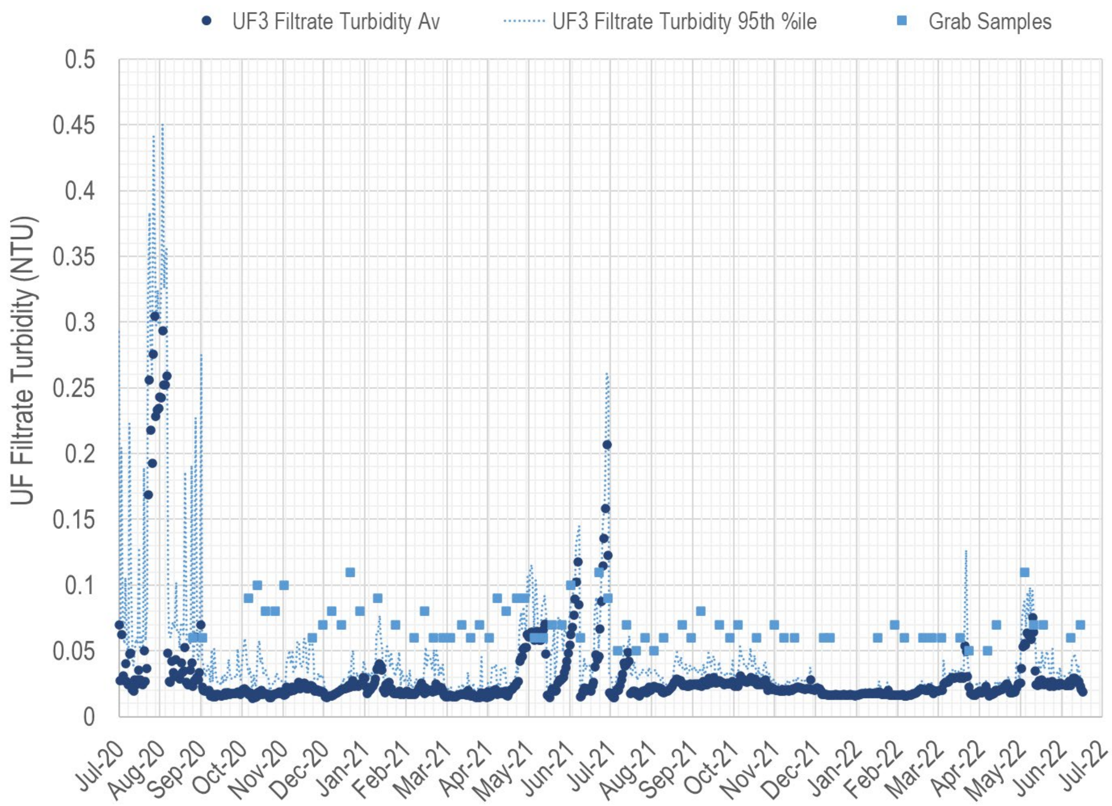


Figure 4.7 UF3 Daily Average and 95th Percentile Filtrate Turbidity Along with Periodic Grab Samples

Statistics for the first two years of operation based on 15-minute average turbidity data are included in Table 4.6. The period from July to September 2020 is excluded due to false positives as a result of meters being able to syphon unfiltered feed. Turbidity results between each filter are very close and suggest minimal difference in turbidity removal between each module.

Table 4.6 Filtrate Turbidity Statistics from Each UF Module from the First Two Years of Operation. The Period Prior to September 2020 was Omitted Due to False Positives From Cross Connection

Statistic	Turbidity (NTU)		
	UF1 Filtrate	UF2 Filtrate	UF3 Filtrate
N values (1)	60,891	61,288	61,073
Minimum (2)	0.011	0.011	0.011
5th Percentile	0.013	0.013	0.013
Average	0.023	0.022	0.025
Median	0.018	0.018	0.019
95th Percentile	0.055	0.055	0.057
Maximum (2)	0.483	0.373	0.450

Notes:
(1) Data is filtered to ensure that the UF is operating and averaged to 15 minute intervals before computing statistics. Differences in uptime result in different numbers of observations.
(2) Minimum and Maximum values may be subject to analyzer error.

4.4.2 Pressure Decay Testing

Pressure decay testing is scheduled to occur daily on each UF module. From the pressure decay rate, a LRV for protozoa is calculated. The PDT results for each module are shown in Figure 4.8. The target LRV for a pass is 4.0.

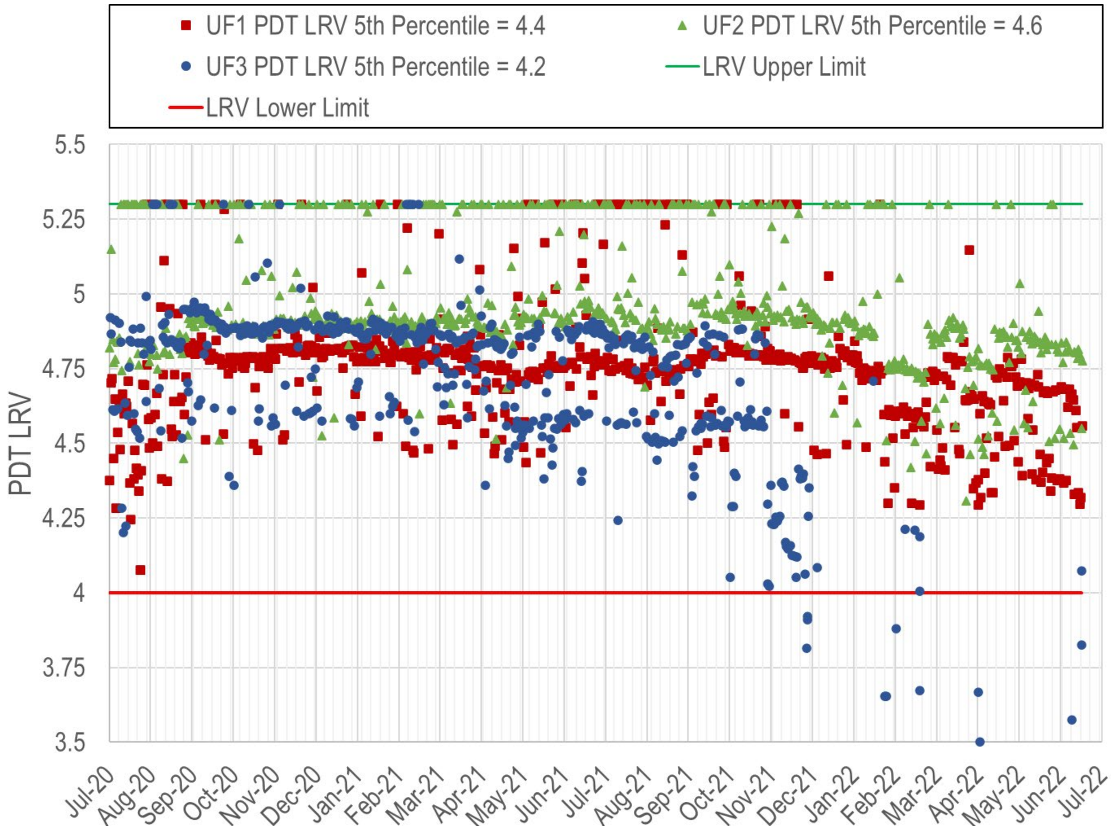


Figure 4.8 Daily LRV Calculated from PDT for Each UF Module for the First Two Years of Operation

Fifth percentile PDTs for all UF modules were above 4.0. However, the 5th percentile values for all modules has decreased by approximately 0.1 to 0.3 log units. UF1 and UF2 show a slowly declining trend of approximately 0.12 log units per year.

The declining trend in calculated LRV may be an artefact of marginally lower permeability. A decrease in permeability results in a higher TMP at a set flux. The TMP is inversely proportional to the calculated LRV result when the equations from the United States Environmental Protection Agency (USEPA) membrane filtration guidance manual are used.

In October 2021, UF3 failed a PDT and encountered warnings. The initial warning was thought to be a false positive as it occurred after a recovery clean and was suspected to be due to a poor run prior to calculation of the result or the result of cleaning fluid being stuck in the lines. PDTs continued to be variable on UF3 until they began to consistently fail in December 2021. Two separate pinning events were conducted in early February 2022 and mid-April 2022. During pinning a high initial flow of bubbles was noted and this slowed. During the first pinning event, two fibers were identified and pinned. During the second a further 29 fibers were pinned. Neither pinning event improved PDTs. PDTs were deactivated on UF3 and conducted manually by operators during daily rounds to ensure that the system could be restarted if it failed. Even with after failing for an LRV setpoint of 4.0, pressure decay rate did not exceed 0.5 psi/min. If there were broken fibers, the pressure decay rate is suspected to be an order of magnitude higher.

The suspected cause of the PDT failure at this time is drying out of a portion of the module due to the inadequate refill volume. The cause is to be verified by an autopsy which is yet to be conducted.

With the exception of UF3, which is presumed to be a false positive PDT failure, each UF system has maintained integrity and there have been no broken fibers.

4.4.3 Silt Density Index

The SDI Results including Year 1 data are shown for each membrane system below. An additional 39 SDI tests were conducted in Year 2 (compared to the 65 available from Year 1). For all MF/UF modules, the filtrate SDI has typically remained below 2.0 for the testing conducted in Year 2. The 95th percentile values of SDI-15 reduced marginally by 0.1 (when compared to the Year 1 data) for UF2 and UF3 and remained the same for UF1.

The SDI-15 produced by all three membrane products is satisfactory as feed to RO which typically requires values less than 5.0 (per Toray TMG10D specification sheet).

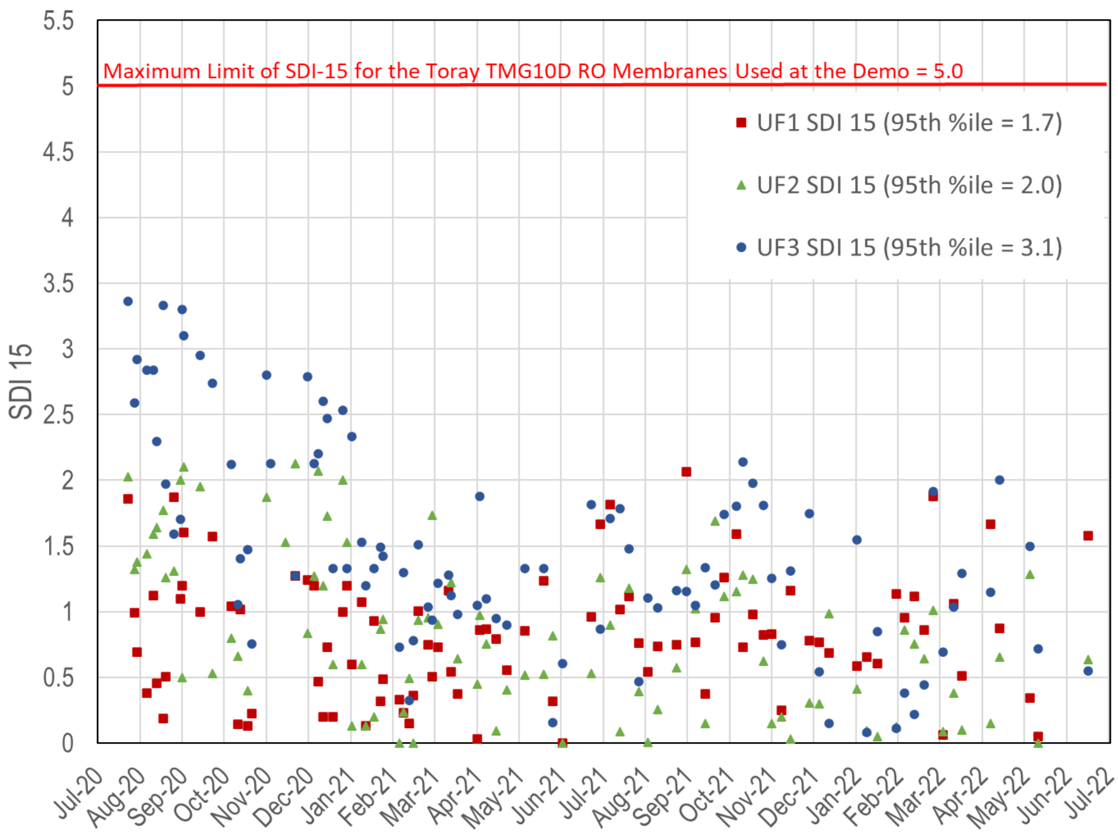


Figure 4.9 SDI-15 Results for Each of the MF/UF Filtrates. 95th Percentile Values Remain within 0.1 Units of Year 1 Data and All Modules Typically Produce Filtrates with an SDI-15 Less Than 2.0 Units

4.4.4 MF/UF Virus Challenge Testing

Virus challenge testing was conducted once, at 40 gfd for each UF module during the first year of operation, the results were reported in Chapter 2.3.5.4 of the Year 1 Report.

Challenge tests of the UF indicated that a virus LRV of between 0.8 to 3.9, depending on membrane product was able to be achieved:

- UF1 Average MS2 LRV = 3.9.
- UF2 Average MS2 LRV = 0.8:
  - Note UF2 is a microfilter with a pore size approximately 4 times larger than MS2 and appreciable removal was not expected.
- UF3 Average MS2 LRV = 2.8.

The virus challenge testing was conducted in April 2021, after 10 months of operation. The results were collected prior to identifying issues with the integrity of UF3. Given that the system has now operated for more than two years, it may be of interest to repeat the virus challenge testing.

4.5 Approaches for Further MF/UF Evaluation and Optimization

The modules were tested up to 55 gfd, at which point the cleaning regimes employed did not appear to be adequate to maintain permeability.

There has been not optimization of recovery clean recipes, however, performance results suggest that recovery cleans should occur at least monthly. Further optimization could be conducted as to the contact modes and flowrates of cleaning, however, this may be better suited to a full scale activity. The Demo could be used to test alternate MF/UF products to help inform anticipated performance for the full-scale project. In addition, it may be of interest to repeat MS2 challenge testing of the modules at similar conditions (40 gfd) to those tested in April 2021 in an effort to quantify if integrity has remained stable with respect to virus rejection.

Chapter 5

REVERSE OSMOSIS

This section describes the RO process at the demo, the operational regimes, hydraulic performance, water quality and surrogate removal. During the second year of operation the key operational goals of the RO system were to 1) investigate if different cleaning agents could help to restore specific flux and 2) conduct CIPs only as required by decline in specific flux/normalized permeate flow to gain a better understanding of the CIP interval that may be required at scale. Site staff were also conducting a RO brine scaling study and to that end, the system was left at a recovery of 85 percent in 3 stage configuration for a majority of 2022.

5.1 System Description

The RO system was designed to operate in either a 2- or 3-Stage configuration with changes between each stage made with manual valves to alter the flow path. The flow path during each type of operation is illustrated in Figure 5.1.

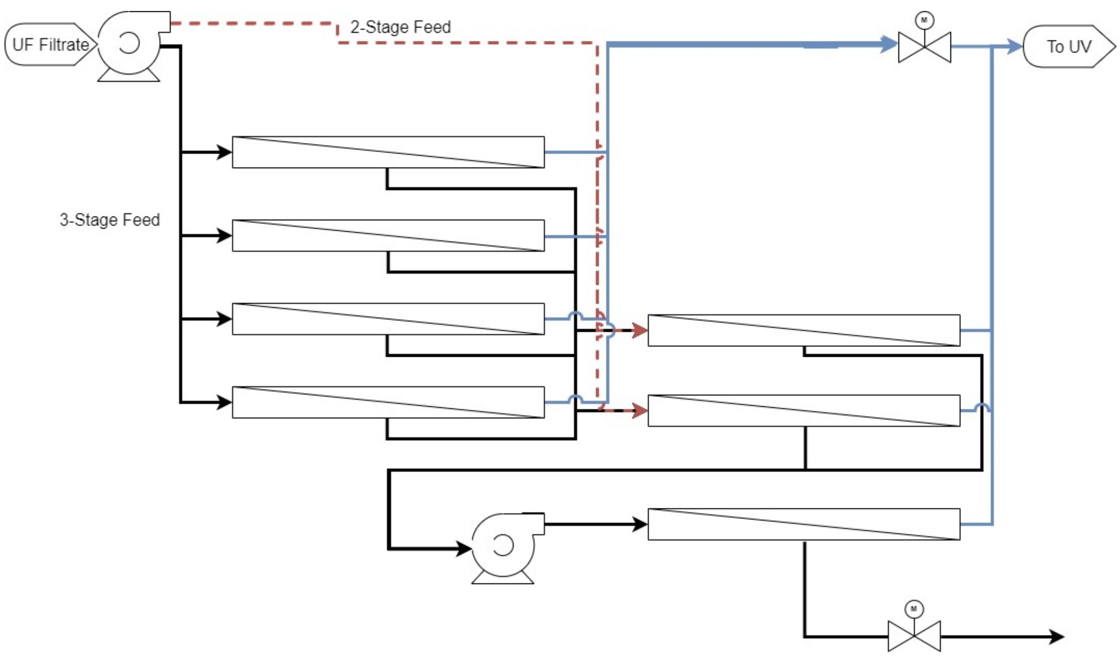


Figure 5.1 The RO Configuration Options for 2- or 3-Stage Operation at the Demo

The membrane specifics for the 2 and 3 stage configurations are summarized in Table 5.1.

Table 5.1 RO Membrane Characteristics and Configuration

Configuration	2-Stage	3-Stage
Target Average Flux (gfd)	11	11
Vessel Arrays	2:1	4:2:1
Membranes per vessel	7:7	6:6:6
Installed Membrane Area (ft^2)	1827	3654
TMG10D Membrane Properties From Vendor Product Data(1)		
Average Sodium Chloride Rejection (%)(1)		99.7
Minimum Sodium Chloride Rejection (%)(1)		99.5
Active Area Per Module (ft^2)		87
Length Per Module (in)		40
Module Diameter (in)		4
Spacer Thickness (mil)		34
Maximum Feed Water SDI-15		5
Production Flow Per Element (gallons per day)(1)		2,650

Note:
Abbreviation: NaCl - sodium chloride (salt).
(1) Standard test conditions for performance data: 15 percent recovery, 25 degrees Celsius, pH 7, 2000 mg/L NaCl, 150 psi Feed Pressure.

The RO is controlled using a stage 1 permeate flow control valve, high pressure feed pump and interstage booster pump between stage 2 and stage 3 to meet an operator defined recovery as well as individual set points for total permeate, stage 1 permeate and stage 3 permeate flows. During "2-Stage" operation the stage 1 flow defaults to 0 gpm. Early in operation, the RO system could only control based on recovery and total permeate flow. This meant that it was not possible to control and balance the flux for each stage. Flux balancing issues in the RO and was rectified with programming changes to meet the current mode of operation.

The flow setpoints used were consistent depending on whether 3 or 2-stage operation was desired and are documented in Table 5.2. The setpoints were arrived at using RO projection software to try and balance flux with each configuration and achieve an average overall flux of 11 gfd. Similar projections were run early in operation, that assumed the membrane area (80 ft^2) from originally specified Hydranautics membranes vs 87 ft^2 from Toray TMG10D , these resulted in operation at a lower than desired flux and were corrected early in the first year of operation.

Table 5.2 RO Flow Setpoints Used After Stagewise Flow Balancing Programming was Completed in October 2020 and Targets were Revised According to the Higher Toray Membrane Area and a Higher Recommended Flux of 11 gfd Average (vs 10.4 gfd) from November 2020

Configuration	2- Stage(1)	3 – Stage(2)
Total Permeate Flow (gpm)(3)	14.0	28.0
Total Average Flux (gfd)	11.0	11.0
Stage 1 Permeate Flow (gpm)	0.0	16.6
Stage 1 Average Flux (gfd)	0.0	11.4
Stage 2 Permeate Flow (gpm)	9.95	7.8
Stage 2 Average Flux (gfd)	11.8	10.8
Stage 3 Permeate Flow (gpm)	4.05	3.6
Stage 3 Average Flux (gfd)	9.6	9.9
Recovery (%)(4)	80 or 85	80 or 85

Notes:
(1) 2:1 Array, 7 elements per vessel. Flow enters stage 2.
(2) 4:2:1 Array, 6 elements per vessel (1 spacer in the lead position) Flow enters Stage 1.
(3) Stage 2 permeate flow is calculated by subtracting stage 1 and stage 3 from the total.
(4) The recovery setpoint along with the total permeate flow determines the concentrate flowrate.

Since commissioning, the RO system has operated with the same membrane product, 4-inch Toray TMG10D membrane modules, which are a typical brackish water RO element applied for water reuse. However, membranes have been extracted for autopsy from the tail position on the final stage and substituted with unused modules. Also, when the system is converted from 2- to 3-stage, membranes are replaced with a spacer (changing from 7 to 6 elements per vessel). Conversely, when the system is converted from 3- to 2-stage, the spacer is replaced with a new membrane. The elements that were removed were typically sent to Avista for full element cleaning and preservation. These were then returned to site for use as spares. Consequently, the age of membranes in the final stages (stages 2 and 3) is between 1 - 2 years with older membranes in the tail position. A total of 6 autopsies have been conducted meaning that no original membranes from the first year of operation remain in stage 3.

A summary of the membrane change out events and subsequent average age for each membrane position in stages 2 and 3 is summarized in Table 5.3.

Table 5.3 Membrane Position and Age Summary in Stages 2 and 3. Membranes Were Not Removed from Stage 1 and Were Originally Installed During Commissioning in June 2020

Date	RO Stage(1)(2)	Event	Operating Age of Membrane (days from installation)							
			Lead	2nd	3rd	4th	5th	6th	Tail	Average(4)
11/7/20	2	Conversion from 2- to 3-stage. Tail elements removed and preserved. Lead replaced with spacer before CIP.	SP(3)	135	135	135	135	135	135	135
3/14/21	2	Conversion from 3- to 2-stage. Lead spacer replaced with new unused element after CIP.	0	262	262	262	262	262	262	225
6/22/21	2	Conversion from 2- to 3-stage. Tail elements removed and preserved. Lead replaced with spacer before CIP.	SP(3)	100	362	362	362	362	362	318
7/1/22	2	End of Year 2 Trial Evaluation. Unit Operating as 3-stage since 6/22/21.	SP(3)	474	736	736	736	736	736	692
9/22/20	3	Removed from Stage 3 tail prior to second CIP after 2-stage operation. New element installed in lead position prior to CIP.	0	89	89	89	89	89	89	76
11/7/20	3	Removed from Stage 3 tail prior to third CIP after 2-stage operation. Spacer installed in lead position prior to CIP for conversion from 2- to 3-stage operation.	SP(3)	46	135	135	135	135	135	120
1/4/21	3	Removed from Stage 3 tail prior to fourth CIP after 3-stage operation. Damage occurred to tail element during CIP, so, an additional new module was installed after troubleshooting and before start up on 1/21/21.	SP(3)	0	0	194	194	194	194	129
3/11/21	3	Conversion from 3- to 2-stage. Additional element installed and lead spacer replaced with new unused element after CIP.	0	0	66	66	259	259	259	129
5/1/21	3	Additional element installed prior to 6th CIP.	0	51	51	117	117	310	310	137
6/22/21	3	Conversion from 2- to 3-stage. Tail element removed for autopsy. Lead replaced with spacer before 7th CIP.	SP(3)	52	103	103	169	169	362	160
7/1/22	3	End of Year 2 Trial Evaluation. Unit Operating as 3-stage since 6/22/21.	SP(3)	62	113	113	179	179	372	170

Notes:
(1) During 2 stage operation, the second stage as referenced in this table acts as the first stage receiving feed water.
(2) There are 2 stage 2 vessels, however, each was treated identically, and numbers presented in a single row summarize membrane age in each vessel.
(3) SP denotes spacer installed. Spacer is not included in average age.
(4) Average is calculated by the sum of operating days, divided by the number of elements. Spacers are not included in number of elements.

5.2 RO Operational Periods

The intent of the RO test plan was to identify any critical differences of system configuration (i.e., 2- or 3- stage) and recovery, 80 or 85 percent, on RO performance. During the first year, the intent was to run at each setpoint for at least 1000 hours (approximately 45 days) followed by a CIP to return the system to baseline and then move to the next setpoint. As noted in the prior section, the original installed flow control of the RO unit was not satisfactory to provide an accurate evaluation of operational setpoints. Although the RO was operated from June 2020, effective control was not implemented until programming changes were implemented October 2020. Preliminary operational periods prior to flow control are summarized in Table 5.3 and discussed in the Year 1 Report as they provide information about the long-term reliability of the RO system. The operational periods prior to flow balancing are not discussed in this report, with the exception of being listed in Table 5.4 and used to define initial specific flux/normalized performance of the membranes when new. Operational periods to the end of the second year of operation (July 2022) are summarized in Table 5.4.

Table 5.4 Operational Setpoint Timeline for the RO System

Dates(1)	Target Flux (gfd)				Target pH(3)	Target Recovery (%)	Configuration (4)	Reservoir 2 Potable Water Top-up	CIP Interval (days)
	Av Flux	S1 Flux	S2 Flux	S3 Flux					
June 25 - August 27, 2020(2)	10.1	-	10.3(10)	9.7(10)	6.4	80	2 Stage prior to flow balance	Yes	63
August 29 - September 22, 2020(2)	10.1	-	10.3(10)	9.7(10)	6.4	80		Yes	24
October 5 - November 7, 2020(2)	10.1	-	10.3	9.7	6.4	80	2 Stage - flow balanced	Yes	86
November 15, 2020 - January 4, 2021	11.0	11.4	10.7	10.0	6.8	80	3 Stage	No	50
January 21 - March 11, 2021	11.0	11.5	10.7	10.0	6.8	85	3 Stage	No	49
March 14 - May 1, 2021	11.0	-	11.8	9.6	6.8	85	2 Stage	No	48
May 2 - June 22, 2021	11.0	-	11.8	9.6	6.8	80	2 Stage	Yes	51
June 22 – August 24, 2021	11.0	11.5	10.7	10.0	6.8	80	3 Stage	Yes	63
August 25 – September 21, 2021(5)	11.0	11.5	10.7	10.0	6.8	80	3 Stage	Yes	27
September 25 – November 30, 2021	11.0	11.5	10.7	10.0	6.8	80	3 Stage	Yes(7)	66
December 2, 2021 –January 31, 2022(6)	11.0	11.5	10.7	10.0	6.4	85	3 Stage	No	60
February 2 – May 2, 2022(9)	11.0	11.5	10.7	10.0	6.4	85	3 Stage	No	89
May 5 – July 1, 2022	11.0	11.5	10.7	10.0	6.4	85	3 Stage	No	57

Notes:

(1) Aim during the first year was to operate for 1000 hours (c. 45 days) at each setpoint, clean and then move to the next. Between each listed operational period, cleaning was conducted.

(2) Initial fluxes targeted average of 11 gfd, but did not account for increased area of TMG10D compared to the Hydranautics ESPA2-LD4040 which is what initial design was based on. Hence effective target was 8 percent lower.

(3) Target pH was increased following the first autopsy that suggested that increasing pH might reduce aluminum fouling which was implicated in fouling. pH 6.4 was specified in original design projections using Advisor CI software (Avista, CA) but was revised to 6.8 based on autopsy report recommendations, also conducted by Avista. After scaling was observed on 2 stage 85% recovery operation, pH was reduced to the target of 6.4.

(4) Target antiscalant dose was 2.0 - 2.5 mg/L based on AdvisorCI (Avista, CA) projections. Antiscalant (Vitec 4000, Avista) was dosed at a constant 3.0 mg/L to allow a safety factor for the trial duration.Antiscalant optimization should still be conducted due to the high opex of this chemical.

(5) Run Terminated Early and CIP due to normalized permeate flow loss.

(6) CIP conducted prior to startup of RO at lower applied chloramine dosage to reset permeability.

(7) Impact of potable water not likely after October 31, 2021.

(8) Run terminated due to set point change or operational preference without significant fouling.

(9) Stage 3 Fouling accelerated, but Stage 1 and 2 Reduced on April 6th, 2022. This run used lower chloramine target of 0.5 mg/L relative to all others which targeted 2.0 - 2.5 mg/L as total chlorine.

(10) Target flux was 10.3 for stage 2 and 9.7 for stage 3 but without programing, the system operated to a total flux set point of 10.1 and did not control individual stage flux.

Considering the CIP intervals observed for 3 stage 85 percent recovery that were not impacted by potable water addition, a CIP interval of 2 months, or up to 3 months may be possible for the RO system. The general trend has been a requirement for CIP with most tested configurations at two months. Operational challenges such as antiscalant dosing failure that have brought CIPs forward could be more quickly recognized and mitigated at full scale by secondary monitoring of antiscalant flow.

There is still scope for pH optimization. Although targets were set, actual pH varied during each trial period as indicated in Table 5.3.

5.3 Specific Flux, Normalized Permeate Flow, Differential Pressure and Salt Passage

Specific flux as well as normalized permeate flow (NPF), differential pressure and salt passage are presented for the RO system in this section to summarize hydraulic performance.

Specific flux is analogous to NPF in that it is a flow metric that is normalized for the effects of temperature and osmotic pressure. In contrast to NPF, specific flux is also normalized by the installed membrane area. Specific flux for RO parallels can be used in the same way that temperature corrected permeability is used for MF/UF systems. Specific flux is advantageous for presentation of later trial results as the membrane area changes between 2- and 3-stage configurations. The change in membrane area leads to difficulties comparing NPF between each configuration, but specific flux allows for appropriate comparisons.

Normalized permeate flow is a permeate flow metric that adjusts for the temperature and osmotic pressure (as a result of total dissolved solids [TDS]) encountered by each stage. A decrease in NPF indicates fouling on the membrane surface. Generally, a sudden and exponential decrease in NPF is associated with biological fouling or scaling – if accompanied by increased salt passage, while a gradual reduction in NPF is associated with colloidal organic fouling.

Normalized salt passage (NSP) is an inverse of salt rejection by each stage that is normalized for temperature and osmotic pressure. Sudden increases in NSP can indicate integrity failure. Gradual increases in NSP may indicate inorganic scale formation on the membrane surface or cumulative subtle integrity failure. Reductions in NSP, combined with reductions in NPF, typically indicate buildup of an organic fouling layer that is acting to further reduce salt passage. It is common to observe slight increases in NSP following CIPs as 1) the CIPs remove the fouling layer and 2) CIPs if not carefully controlled can reduce the salt reduction of the membrane.

NDP is the differential pressure from the feed to the concentrate normalized for temperature. Increases in NDP are characteristic of particulate fouling, which will reduce the available feed side channel cross sectional area. Also, increases of NDP can be associated with biological fouling or scaling which may also plug feed side channels if they occur to a significant extent.

The specific flux is shown for each RO stage for the first 2 years of operation in Figure 5.2.

Specific flux was generally stable. As more run time occurred for each of the stages, noting that Stage 1 was preserved during 2-stage configurations), the specific flux of each stage converged.

Outlier events in Year 2 were noted as follows:

- Sharp decline in specific flux for all stages in late September 2021. Logsheets report an observed failure of the antiscalant dosing in late September which is presumed to have caused this decline.
- Decline in Stage 3 specific flux but an increase in Stages 1 and 2 in April 2022. This was during the low chloramine dose trial. During this trial biofouling was anticipated but this would be expected to reduce stage 1 and 2 flux, not stage 3. TDS was generally higher during this period and Stage 3 may have suffered from scaling.
- Accelerated decline in Stage 3 specific flux in May – June 2022 relative to other stages. It is unclear what may have caused this behavior. There was potentially an influence of an upstream treatment upset at Tapia during this period and TDS was generally higher than had been observed previously. In May 2022, RO feed pH was on a decreasing trend but was higher than the target. It is anticipated that the higher TDS and poor pH control resulted inscale formation and stage 3 fouling.

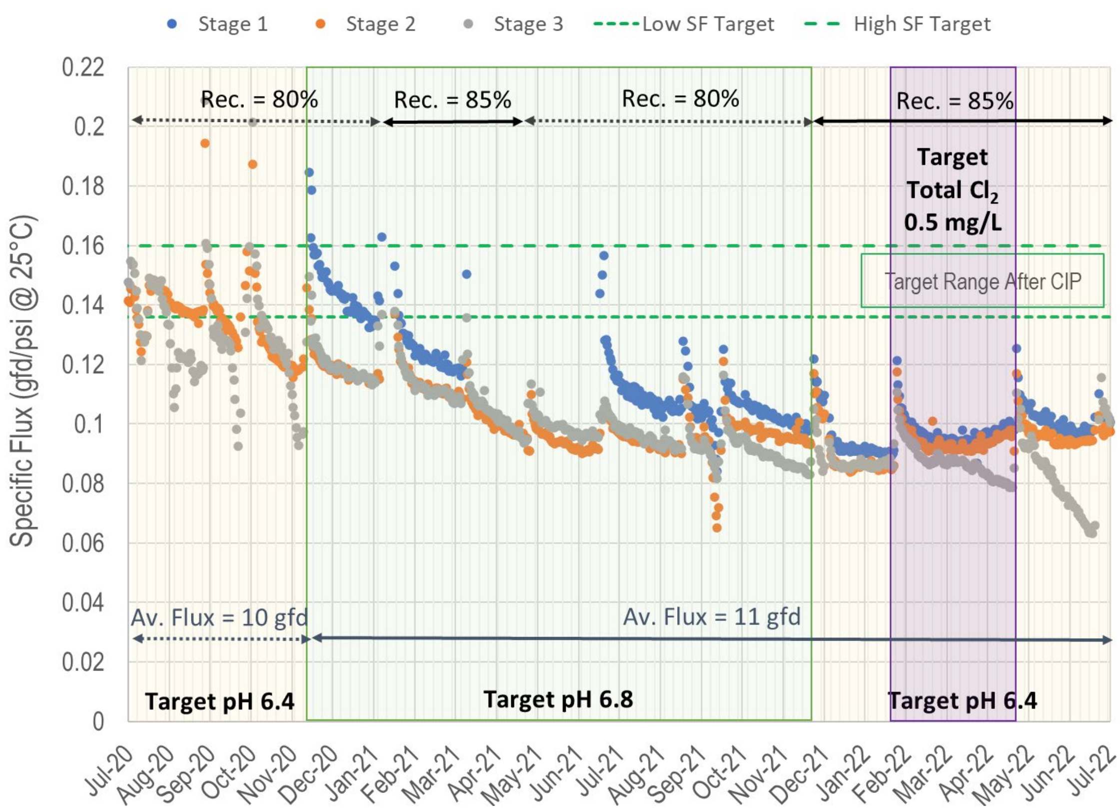


Figure 5.2 Specific Flux for the RO System

NPF data is shown in Figure 5.3. The trends in NPF mirror those shown by the specific flux. NPF has been relatively stable in Year 2, showing consistent level off to the same operational levels after cleaning. NPF also highlights the stage 3 permeability loss between May and July 2022.

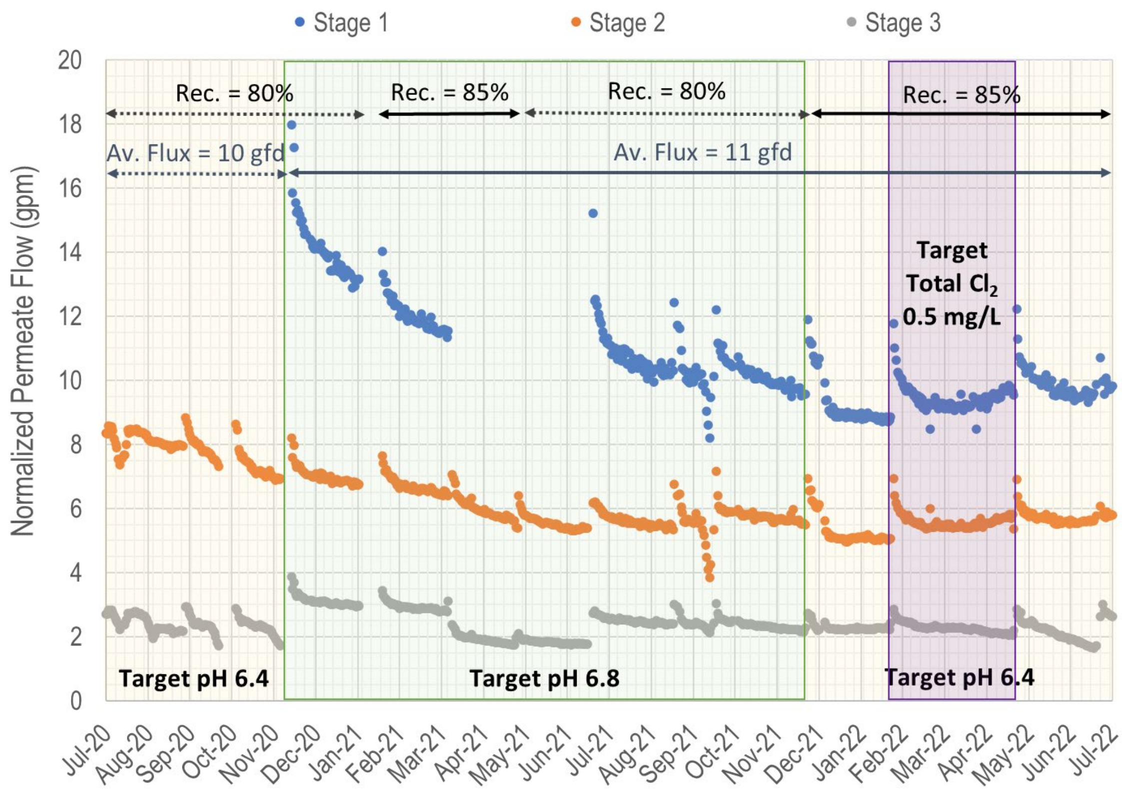


Figure 5.3 Normalized Permeate Flow from each RO Stage During the First Two Years of Operation

Normalized differential pressure is shown in Figure 5.4. NDP has remained relatively stable. Some step changes can be observed due to changing recovery (which changes crossflow – i.e. NDP is anticipated to be higher at lower recoveries). NDP for Stage 1 has been gradually rising since January 2022, although only by 1 psi. This may be due to an increased level of biofouling. Between March and July NDP of stage 3 decreased. This was due to the high level of fouling on Stage 3 preventing the interstage booster pump from reaching its crossflow target. As Stage 3 fouled further, the crossflow rate reduced and so did NDP. Stage 2 Differential Pressure has been stable and appears to only change as a result of recovery changes. The generally low rate of differential pressure change across the RO suggests that the MF/UF is adequately removing suspended particulates and that chloramination was controlling biofouling.

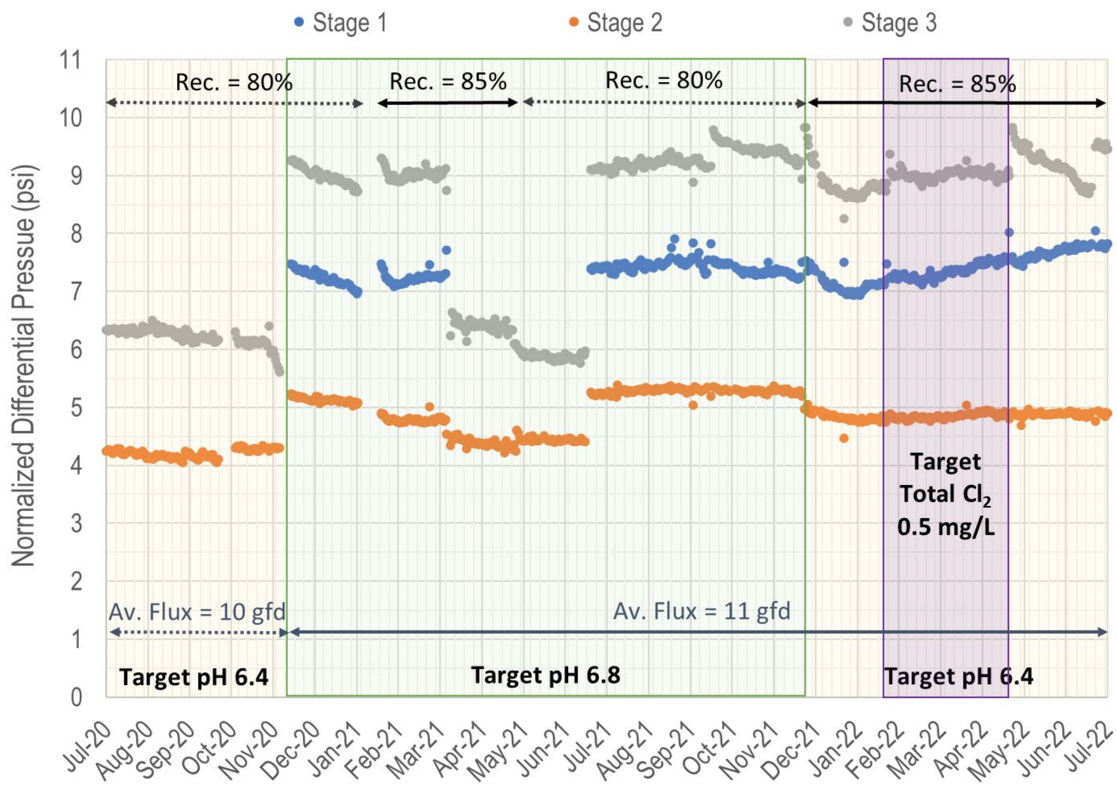


Figure 5.4 Normalized Differential Pressure from each RO Stage During the First Two Years of Operation

Normalized Salt Passage results are shown in Figure 5.5. Salt Passage for all stages has shown a decreasing trend with time. NSP for each stage typically rises after each CIP and then returns to baseline levels. Since April 2022, salt passage has trended upwards but not to levels exceeding Initial operational periods of July 2020 for Stages 2 and 3 and November for Stage 1.

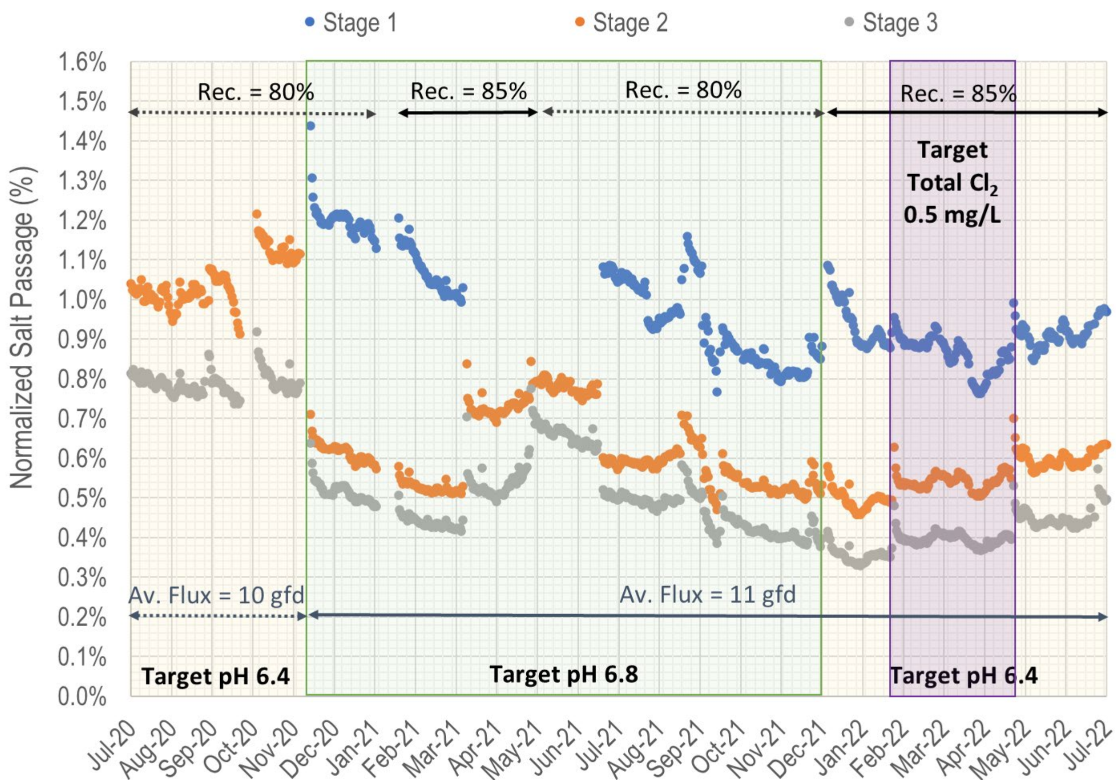


Figure 5.5 Normalized Salt Passage from each RO Stage During the First Two Years of Operation

5.3.1 RO Clean in Place Performance (Specific Flux Recovery)

Table 5.4 summarizes the cleaning regimes employed and the specific flux before and after each clean as well as the stabilized value (after initial decline noted above).

The RO CIP process was manual and involved the following steps. The full detail is included in Site SOPs:

- Fill the CIP tank with permeate and heat to 95 degrees F.
- Stop the RO system and flush with MF filtrate.
- Flush the RO system with half of the CIP tanks capacity, leaving 50 percent of heated RO permeate.
- Add the cleaning chemical and mix in the CIP tank.
- Recirculate through each of the RO stages individually at 10 gpm per vessel (so 20 gpm for stage 2, and 40 gpm for stage 1) for one hour each leaving stages to soak in between.
- Soak could be overnight depending on operations schedule.
- Recirculate again for 1 hour each stage to target a minimum contact time of 3 hours.
- Flush the residual cleaning chemical using MF filtrate.
- Repeat with the next chemical.

Cleaning performance was reasonable in terms of recovery of specific flux immediately following a clean. However, the RO system would typically level off to values close to those observed at the end of a run prior to the preceding clean.

The initial cleaning agents were selected based on recommendations from Avista for municipal RO systems. Initially, Avista ROClean Low pH L403 was used first, followed by Avista High pH L212. The exact order and chemicals used for each clean are summarized in Table 5.5. Given the rapid specific flux decline after cleaning, variations to the cleaning agents as well as the order and duration of cleans was trialed. An optimum cleaning agent has not been found.

The alternative high pH cleaner (RO Clean P112) was recommended by Avista following cleaning studies of samples sent for autopsy seemed to allow for repeatable recovery of specific flux immediately after and has been used consistently since September 2021. Choice of cleaners or regimes tested to date has not altered the initial rapid decline in performance.

Table 5.5 RO CIP Performance Tracking. Following CIPs Performance Would Reduce Significantly and then Stabilize. Changes Relative to Stabilized Values were used to Schedule Cleaning in Year 2.

Clean Date	Before, After or Stabilized	Specific Flux (gfd/psi @ 25°C)(2)			Configuration/Cleaning Chemicals (4)
		S1	S2	S3	
August 27, 2020	Before	-	0.14	0.12	2 Stage prior to flow balance Cleaning - Avista ROClean Low pH L403, feed flush, then High pH L212
	After	-	0.19	0.21	
	Stabilized(1)	-	-	-	
September 22, 2020	Before	-	0.13	0.09	
	After	-	0.19	0.20	
	Stabilized(1)	-	-	-	
November 7, 2020	Before	-	0.11	0.09	2 Stage - flow balanced (Started as 3 stage after Clean) Cleaning - Avista ROClean Low pH L403, feed flush, then High pH L212
	After	0.19	0.15	0.15	
	Stabilized	-(1)	0.12	0.12	
January 4, 2021	Before	0.13	0.11	0.11	3 Stage Cleaning - Avista ROClean Low pH L403, feed flush, then High pH L212
	After	0.16	0.14	0.14	
	Stabilized	0.12	0.11	0.11	
March 11, 2021	Before	0.12	0.11	0.11	3 Stage – 1st Stage Preserved after clean, not operated Cleaning - Avista ROClean Low pH L403, feed flush, then High pH L212
	After	0.15	0.14	0.14	
	Stabilized	-	0.11	0.11	
May 1, 2021	Before	-	0.09	0.10	2 Stage Cleaning - Avista ROClean Low pH L403, feed flush, then High pH L212
	After	-	0.11	0.11	
	Stabilized	-	0.09	0.10	
June 22, 2021	Before	-	0.09	0.10	2 Stage - Started as 3 stage after Clean Cleaning - Avista ROClean Low pH L403, feed flush, then High pH L212
	After	0.16	0.11	0.11	
	Stabilized	0.11	0.10	0.10	
August 24, 2021	Before	0.11	0.09	0.09	3 Stage – Trialed 3 back to back cleans, high pH, low pH, high pH Cleaning - Avista ROClean High pH L212, feed flush, then Low pH L403, feed flush, then High pH L212
	After	0.13	0.12	0.12	
	Stabilized	0.1	0.09	0.09	
September 21, 2021	Before	0.08	0.07	0.08	3 Stage – Trialed alternative high pH cleaner Cleaning - Avista ROClean Low pH L403, feed flush, then High pH P112
	After	0.13	0.12	0.12	
	Stabilized	0.11	0.10	0.09	
November 30, 2021	Before	0.10	0.10	0.08	3 Stage Cleaning - Avista ROClean Low pH L403, feed flush, then High pH P112
	After	0.12	0.12	0.11	
	Stabilized	0.10	0.09	0.09	
January 31, 2022	Before	0.09	0.09	0.09	3 Stage Cleaning - Avista ROClean Low pH L403, feed flush, then High pH P112
	After	0.12	0.12	0.11	
	Stabilized	0.09	0.09	0.09	
May 2, 2022	Before	0.10	0.09	0.08	3 Stage Cleaning - Avista ROClean Low pH L403, feed flush, then High pH P112
	After	0.13	0.12	0.11	
	Stabilized	0.10	0.10	0.09	
July 1st, 2022	Before	0.10	0.09	0.06	3 Stage Cleaning - Avista ROClean Low pH L403, feed flush, then High pH P112
	After	0.11	0.11	0.12	
	Stabilized	0.10	0.10	0.09	

Notes:
(1) Unable to identify stabilized period. Stabilized period identified visually as the point where the gradient of the specific flux daily averages slowed.
a. Specific flux numbers are rounded to 2 decimal places.

5.3.2 Specific Flux Variation and Cleaning Performance at Other Facilities

Comparative data was made available for the Toray TMG20D (404 days), which is the larger 8-inch version of the TMG10Ds used at the Demo, and Dow/DuPont BW30-XFRLE (244 days). The comparative data set was developed from testing modules in single satellite vessels installed for RO technology evaluation at the OCWD. These satellite vessels run in parallel to the first stage of the full-scale RO system as to operate on the same representative feedwater and pretreatment. The flux target for the satellite vessels is 15 gfd and the pH is typically 6.9. Longer term data (6 years) for the Toray product was also made available.

The specific flux for the initial evaluation period for the Toray and Dow/DuPont product from the OCWD trial is shown in Figures 5.6 and 5.7 and is normalized to days in operation since the trial start.

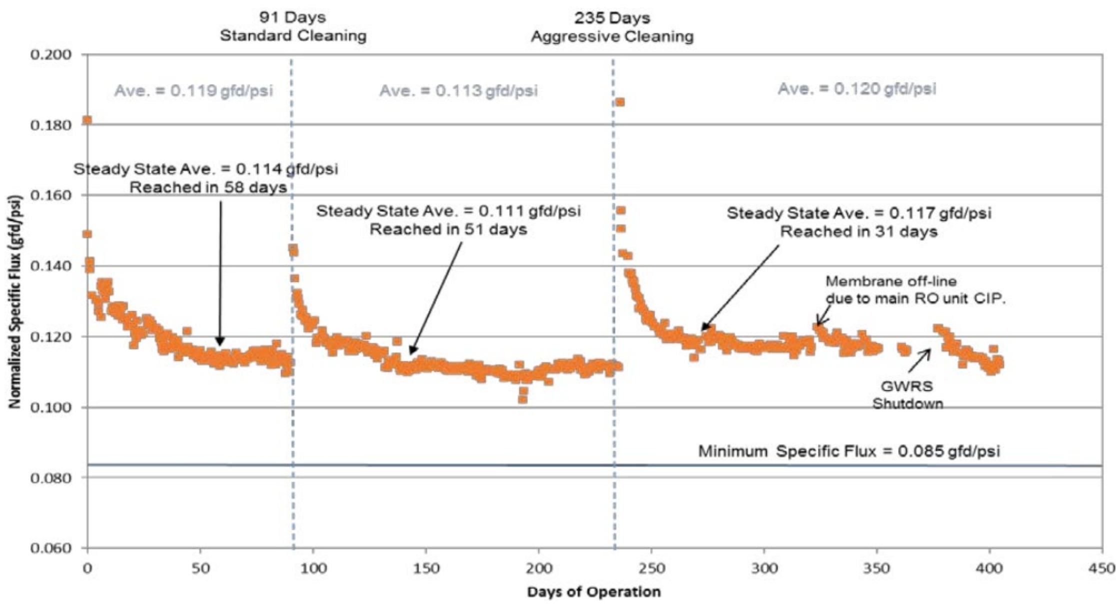


Figure 5.6 Toray TMG20D (8-Inch Version of Toray TMG10D) Specific Flux OCWD. Results are from a Satellite Vessel Running in Parallel to the first stage of the Main RO Plant

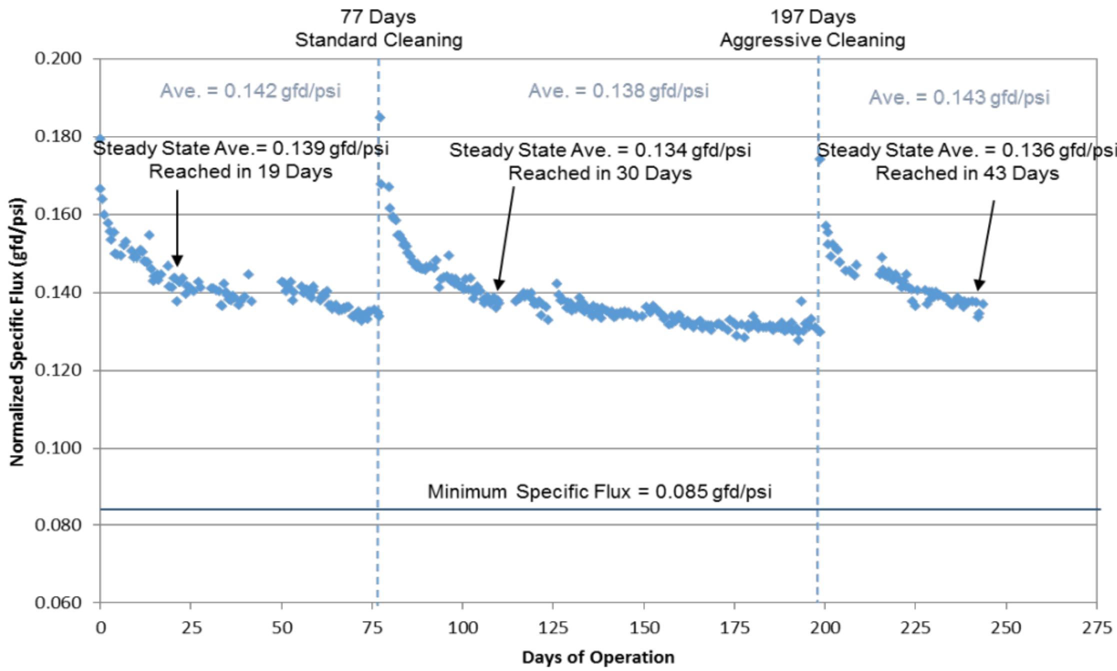


Figure 5.7 Dow/DuPont BW30-XFRLE Specific Flux from OCWD. Results are from a Trial Vessel Running in Parallel to the Main RO Plant

The comparative specific flux results show that it may be possible to observe a higher specific flux from other products. . However, the satellite vessels are installed parallel to the first stage any may exhibit a higher specific flux than for other stages (i.e. the 2^{nd} and 3^{rd} stage may have a lower specific flux). Also, the ultimate specific flux observed for the Toray TMG10D was around 0.11 gfd/psi, similar to that observed for the TMG 10D at the Demo. Also, the behavior of permeability loss, followed by stabilization is consistent with all RO membrane products and is characteristic of RO systems operated on municipal effluent.

Normalized salt rejection (100 – Normalized Salt Passage) was also compared for the Dow/DuPont and Toray Products with the results from OCWD shown in Figures 5.8 and 5.9.

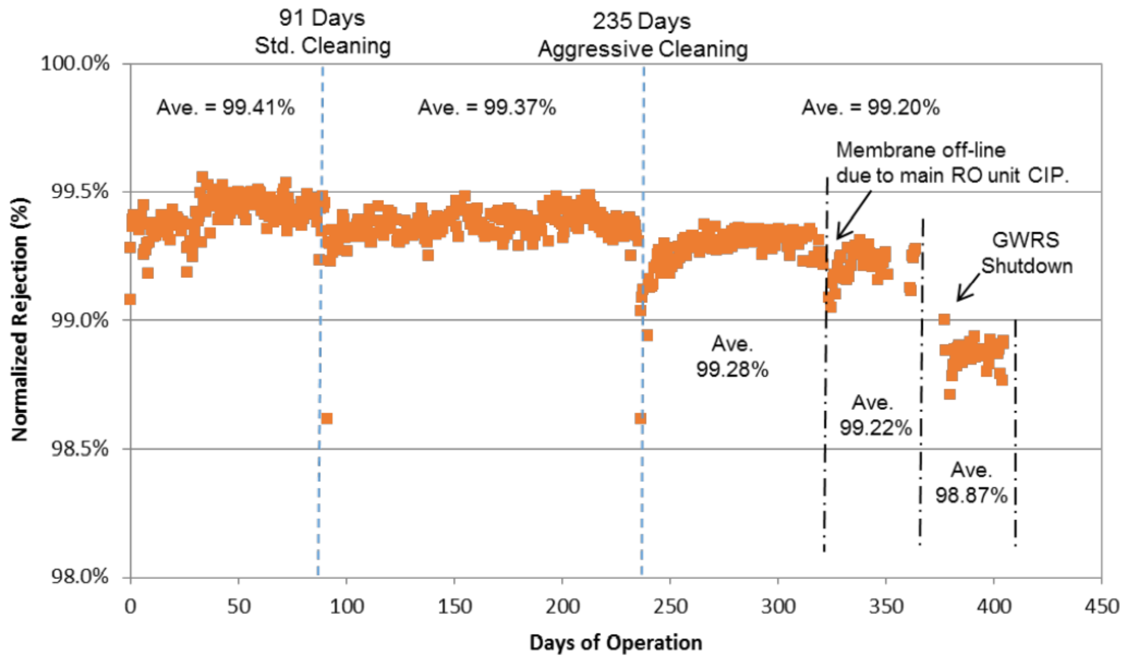


Figure 5.8 Toray TMG20D (8-Inch Version of Toray TMG10D) Normalized Salt Rejection OCWD. Results are from a Trial Vessel Running in Parallel to the Main RO Plant. The Decrease in Salt Rejection after Shutdown Appeared to Improve after Mechanical Seals were Investigated and Replaced

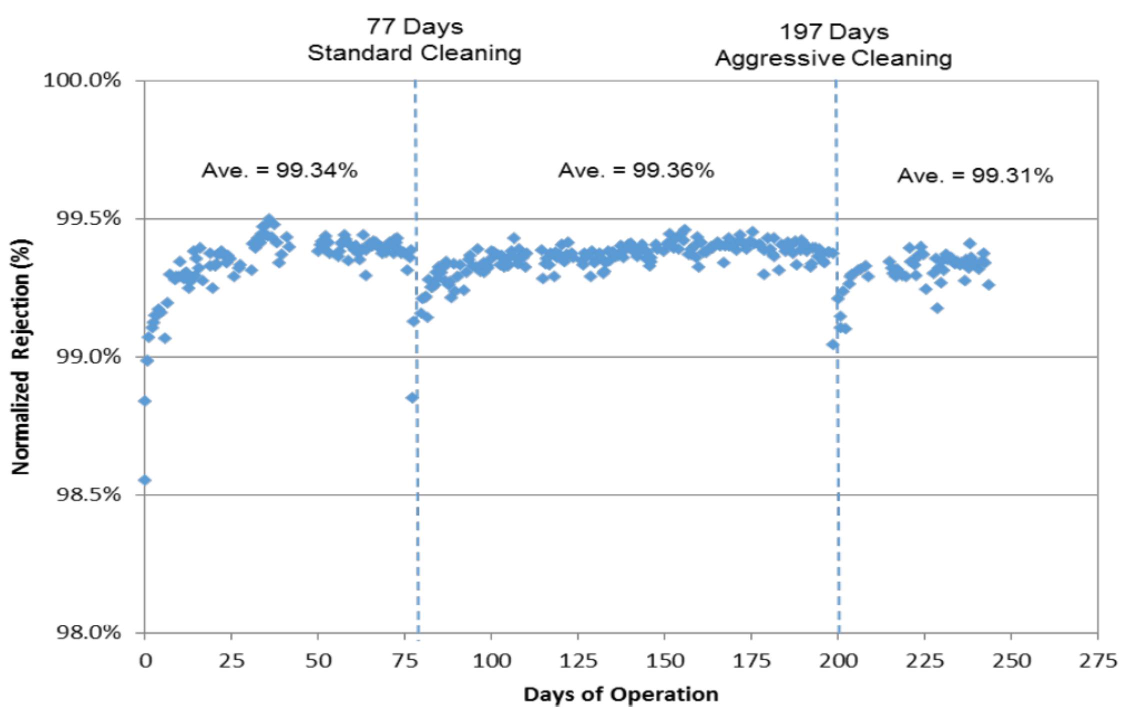


Figure 5.9 Dow/DuPont BW30-XFRLE Normalized Salt Rejection from OCWD. Results are from a Trial Vessel Running in Parallel to the Main RO Plant

Longer term (6 years) of trial results for the Toray TMG20D from the same site in Figures 5.10 and 5.11. System maintenance was conducted after 400 h to replace broken seals and improved salt rejection (Figure 5.10).

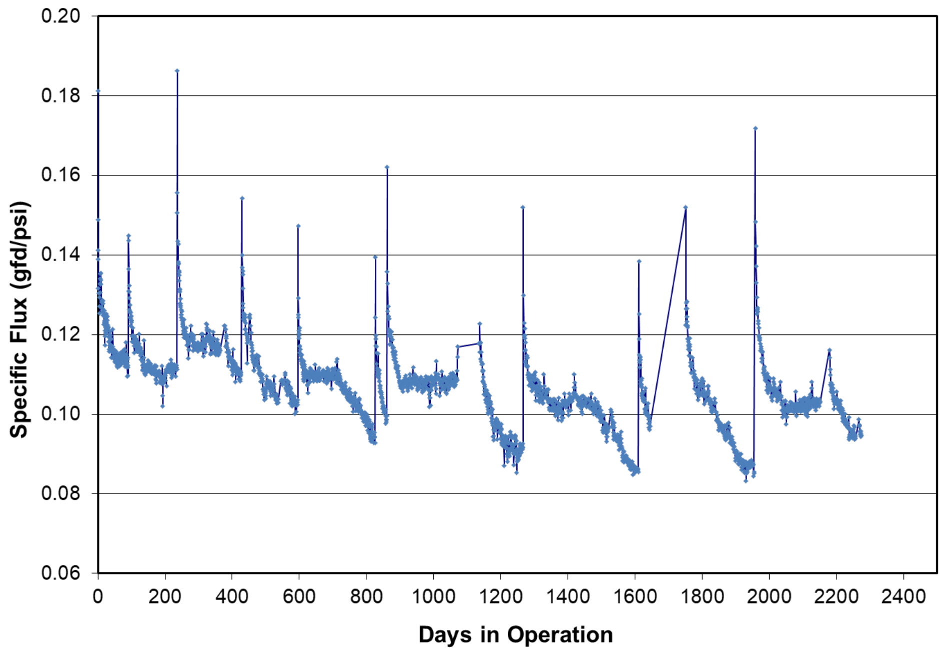


Figure 5.10 Specific Flux Results for Six Years of Operational Data for the Toray TMG20D from OCWD. Stabilized Specific Fluxes are Similar to Those Observed at the LVMWD Demo

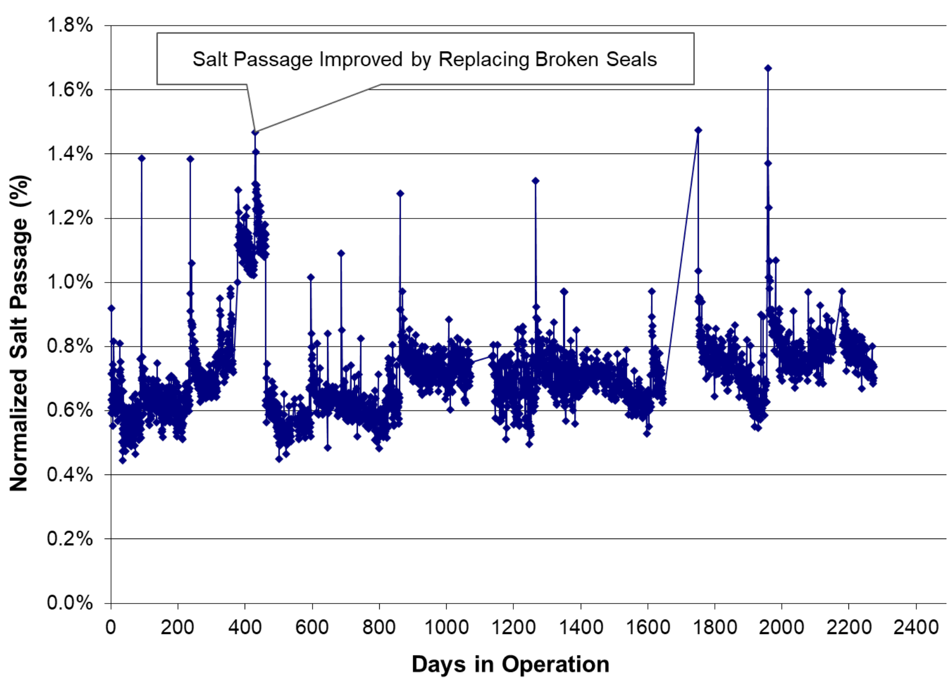


Figure 5.11 Normalized Salt Passage Results for Six Years of Operational Data for the Toray TMG20D from OCWD. Stabilized Specific Fluxes are Similar to those Observed at the LVMWD Demo

Salt passage results showed predictable trends, increasing briefly after cleaning and then returning to baseline levels. There was a gradual increase in salt passage of the 6-year test period. Generally, salt passage was between 0.5 and 1.0 percent. The normalized salt passage observed during the two years of testing at the Demo has varied between 0.5 - 1.0 percent depending on the Stage. Generally higher salt passage has been observed for Stage 1.

Normalized Differential Pressure was not reproduced here as it was stable for both comparative products and for the 6-year testing.

The trial results presented align well with the observations made at the Demo and suggest that a more reasonable target for RO specific flux may be 0.11 gfd/psi. Also, salt passage results are similar and did not seem to appreciably change over 6 years. These results suggest that similar performance of this product could be anticipated for the future full-scale facility.

However, the comparison with other membrane products suggests that trialing other membrane vendors may allow LVMWD to gain an understanding of the relative difference in specific flux and salt passage that could occur if other vendors are chosen for the full-scale design. Specific flux results suggest that there may be RO feed pump energy savings in the 20 - 30 percent range from investigation of other vendor products.

5.3.3 Autopsy Results

A number of RO autopsies were systematically conducted prior to cleaning on the tail element of the final operating stage. This element was selected as the most likely to suffer from scaling in the event of insufficient RO feed pH suppression, inadequate antiscalant dosing or poor cross flow velocity. The findings from the autopsy reports were summarized in Section 2.4.5 of the Year 1 report, including the full autopsy reports.

5.4 RO Membrane Integrity Monitoring

This section provides an update on online RO integrity monitoring via TOC and conductivity removal as well as removal of offline surrogates including sulfate, strontium and sucralose.

5.4.1 Online RO Membrane Integrity Surrogates

Figure 5.12 shows the daily 5th and 95th percentiles as well as the average for LRV of conductivity and TOC for the first 2 years of operation. At the end of the first year, the TOC meter was serviced and recalibrated. Part of the service included programming a pre-flush cycle before measuring RO permeate. Although this slowed measurement frequency, it significantly reduced the variability of permeate TOC readings. As a result of the TOC meter maintenance, the LRV based on TOC was significantly more stable in the second year of operation as indicated by less outliers. Conductivity monitoring remained stable. Statistics of the conductivity and TOC removal based on 15 minute paired data for the entire two year data set indicated that 5th percentile LRV between the two surrogates was minimal and that TOC monitoring provided little additional benefit for pathogen control (0.1 – 0.2 log units higher than conductivity). The 5th percentile and average TOC LRV were 1.5 and 1.8 respectively for the first 2 years of operation. The 5th percentile conductivity LRV were 1.7 and 1.8 respectively for the first 2 years of operation. TOC monitoring of RO permeate will still be of use and necessary for verification of chemical reduction.

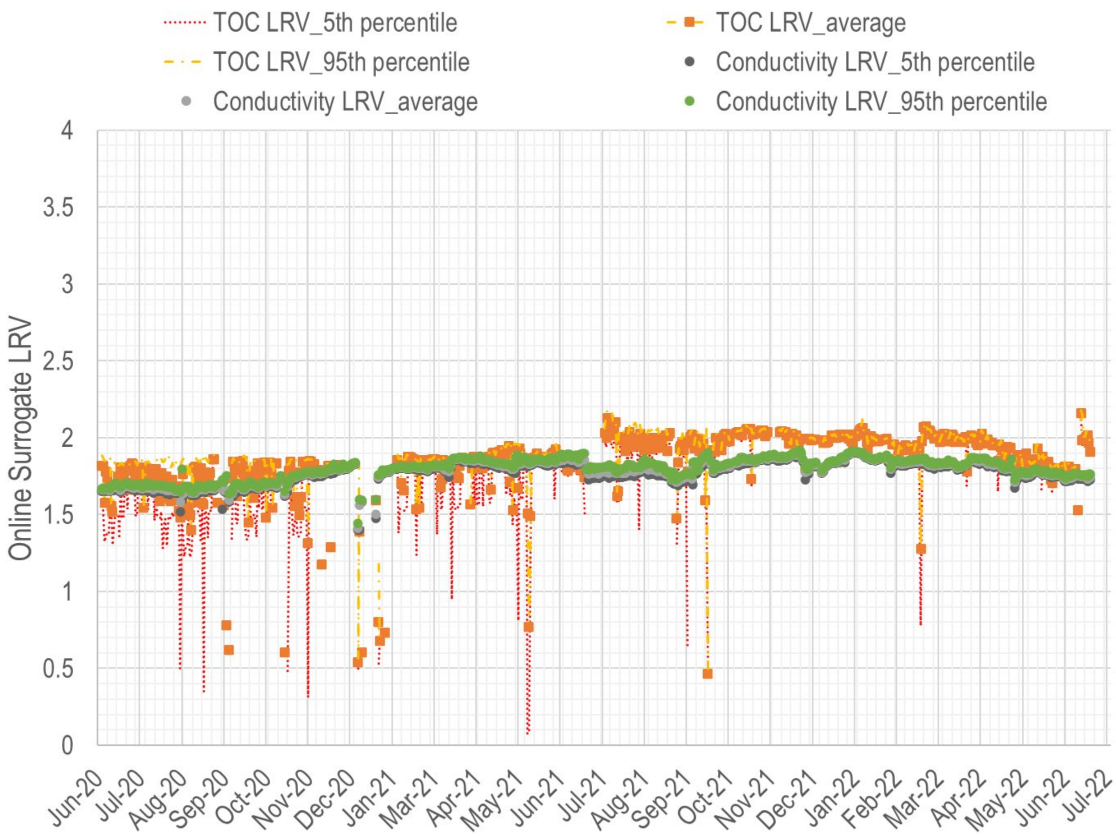


Figure 5.12 Daily Average, 5th and 95th Percentiles of Online LRVs for TOC and Conductivity. Variability in TOC Monitoring Improved due to Instrument Servicing at the Start of Year 2

5.4.2 Offline RO Membrane Integrity Surrogates

Figure 5.13 shows the removal of grab sample surrogates. Removal statistics are also included in Table 5.6. Initial strontium removals were limited as they were removed to below the detection limit. With the laboratory change in Year 2 a lower detection limit for RO permeate was possible and higher LRVs could be demonstrated. If enhanced pathogen removal performance was to be sought for the full-scale facility, then either strontium or sulfate would be able to verify LRV exceeding 2.5 log units. It would be important that the measurement technique for both had low permeate detection limits in order to demonstrate these removals.

Both offline and offline surrogates for pathogen removal stayed consistent for the first two years of operation demonstrating integrity of the RO unit.

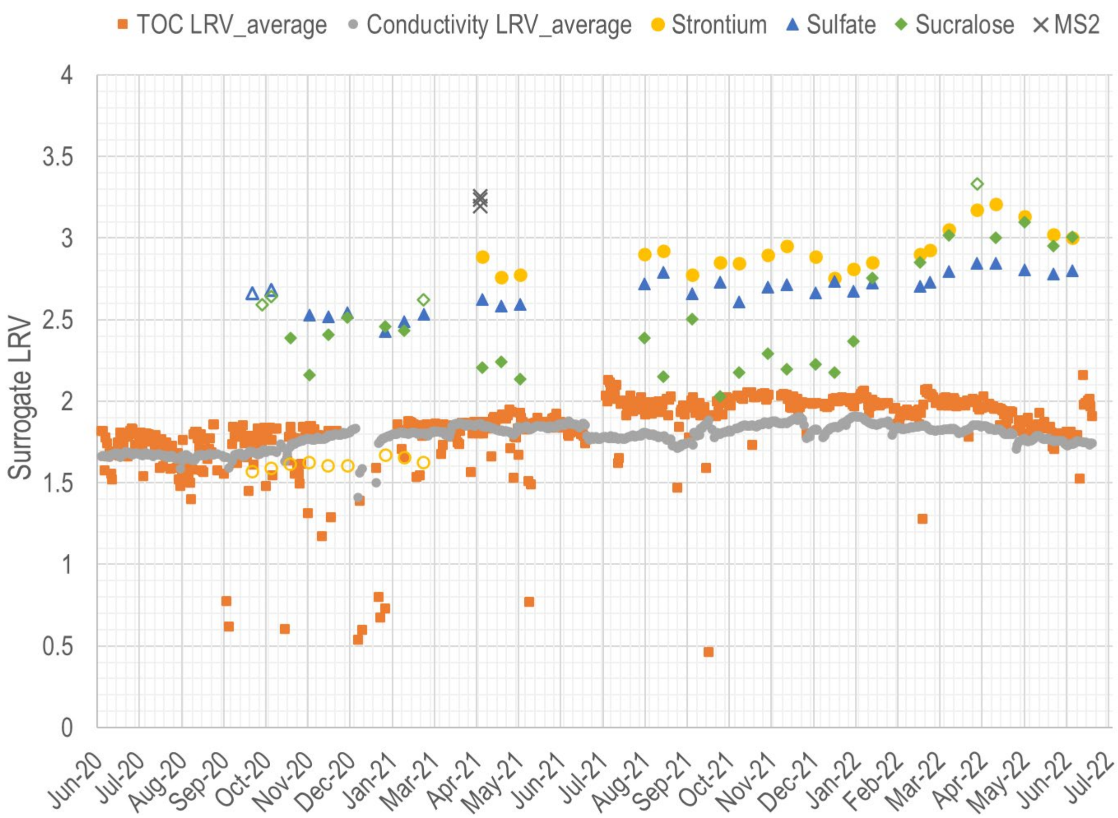


Figure 5.13 Daily Average Conductivity and Toc LRV Alongside Offline Surrogate Grab Sample LRVs. Open Symbols had Permeate Concentrations Below the Detection Limit and are Underestimates of True LRV

Table 5.6 summarizes the statistics of surrogate removal across the first two years of operation.

Table 5.6 Statistics of Surrogate Removal During the First Two Years of Operation

Parameter	LRV						
	n	Min(1)	5th percentile	Average	Median	95th percentile	max
TOC - online	578	0.5	1.5	1.8	1.9	2.0	2.2
Conductivity - online	682	1.4	1.7	1.8	1.8	1.9	1.9
Strontium	31	>1.6	>1.6	2.5	2.9	3.2	3.2
Sulfate	30	2.4	2.5	2.7	2.7	2.8	2.8
Sucralose	30	2.0	2.1	2.5	2.4	3.1	3.3

5.5 Approaches for Further RO Optimization

The specific flux loss of the RO is not unexpected but is higher than the fouling factors typically set by vendors for first year performance losses. It is possible that the high frequency of cleans utilized in the first year may have prematurely aged the membranes, made them less resistant to fouling and resulted in a higher than anticipated specific flux loss. The typical baseline values of specific flux noted for the Demo RO were similar to the 8-inch version of the product tested at OCWD for six years. Shorter term comparative testing at OCWD showed a difference between RO membrane vendor performance and baseline specific flux. To that end, it may be of interest to use the demo to investigate possible CIP intervals with alternate RO membrane vendors as there were notable differences in fouling performance in the side stream units tested at OCWD.

The CIP chemicals utilized have been proprietary blends to avoid the need for operators to manually handle and blend chemicals onsite. It may be advantageous to perform an evaluation of CIPs using standard bulk chemical blends (i.e. high pH with sodium hydroxide to a pH target and low pH with Citric acid. These cleaning results could be benchmarked against the proprietary chemicals and provide information as to the relative cleaning efficiency. It may be valuable to conduct this evaluation prior to any replacement of existing RO membranes so that the alternate cleaning performance can be representatively compared with existing results.

Chapter 6

UV ADVANCED OXIDATION PROCESS

6.1 System Description

The UV AOP has been operated using free chlorine to provide a source of hydroxyl radicals for advanced oxidation. The reactor flow and minimum dose target have been set to achieve the removal goals established in the Year 1 report and discussed below. The chosen flowrate of 6 gpm for the system means the reactor power meets its dose at 50 percent power without the need to modulate. Specifics on system performance and water quality influencing operation as well as chemical removal performance are discussed in this section.

6.2 UV AOP Feedwater Quality and Operational Data

Key water quality parameters in the RO permeate influencing sizing of UV systems are included in Table 6.1. These include online data such as UVT transmittance and pH as well as RO permeate NDMA concentrations. The UVT is known to be dependent on applied monochloramine dose ahead of the RO. At the typical target of 2.0 – 2.5 mg/L, inlet UVT was close to 97 percent. During trials with lower monochloramine dosages, higher UVTs were observed. pH was recorded with the online meter and was subject to drift in readings (see Section 6.4 below). The drift reduced when the meter was calibrated. Higher values of pH are suspected of being overestimates.

Table 6.1 RO Permeate/UV Feed Characteristics for the First Two Years of Operation

RO Permeate Parameter(1)	n	Min	5th percentile	Average	Median	95th percentile	Max
NDMA (ng/L)	22	2.9	3.6	10.0	8.2	21.3	27
UVT (%)(2) (3)	56,386	0.13	96.63	97.70	97.77	99.61	100.00
pH(3)	55,996	3.7	5.4	5.5	5.5	5.8	6.3

Notes:
(1) Considers the first two years of data until July 2022.
(2) Includes the impact of chloramine dosing at the Demo.
(3) Minimum and maximum values of online data are suspected of being instrument faults. Stats based on online data.

Statistics for the other online operational parameters of the UV system are included in the Table 6.2.

Table 6.2 UV Operational Statistics for the First Two Years of Operation. Operational Data is Based on 15-Minute Averages Filtered for When the System is in Operation

Operating Parameter	n	min(1)	1st percentile	5th percentile	Ave.	median	95th percentile	99th percentile	max(1)
PSS Dose (mJ/cm^2)	56,387	353	1,352	1,385	1,472	1,464	1,590	1,693	2,631
UVI (mW/cm2)	56,386	10.5	11.9	12.1	12.8	12.7	13.8	14.5	18.5
Flow (gpm)	56,409	2.1	5.8	5.9	6.0	6.0	6.1	6.2	25.1
Power (%)	52,995	50.0	50.0	50.0	50.4	50.0	50.0	69.3	100.0
Inlet Free Chlorine (mg/L-Cl_2)	56,376	0.0	0.4	1.8	2.8	2.9	3.6	4.2	18.7
Outlet Free Chlorine (mg/L-Cl_2)	55,932	0.0	0.1	0.6	1.4	1.5	2.2	2.8	20.0
Inlet Total Chlorine (mg/L-Cl_2)	49,089	0.0	1.3	2.5	4.6	4.8	6.1	6.7	13.9
Outlet Total Chlorine (mg/L-Cl_2)	49,074	0.0	0.5	1.3	2.0	2.1	2.6	3.0	8.0
Inlet UVT (%)	56,386	0.1	95.6	96.6	97.7	97.8	99.6	100.0	100.0
Outlet UVT (%)	49,407	82.3	97.8	99.1	99.5	99.6	100.0	100.0	100.0
Inlet pH	55,996	3.8	5.2	5.4	5.5	5.5	5.8	5.9	6.3

Notes:
(1) Minimum and maximum values from online data are suspected to be influenced by short-term instrumental error and may not be representative. Corresponding grab sample verification data is shown for reference. Use of 5th and 95th percentiles for online data is considered more appropriate to describe variability with 1st and 99th to describe outliers.

6.3 Sensor Performance

Operational plots of the daily average and 5th and 95th percentile inlet pH and UVT are shown below relative to target and maximum values are shown in Figure 6.1.

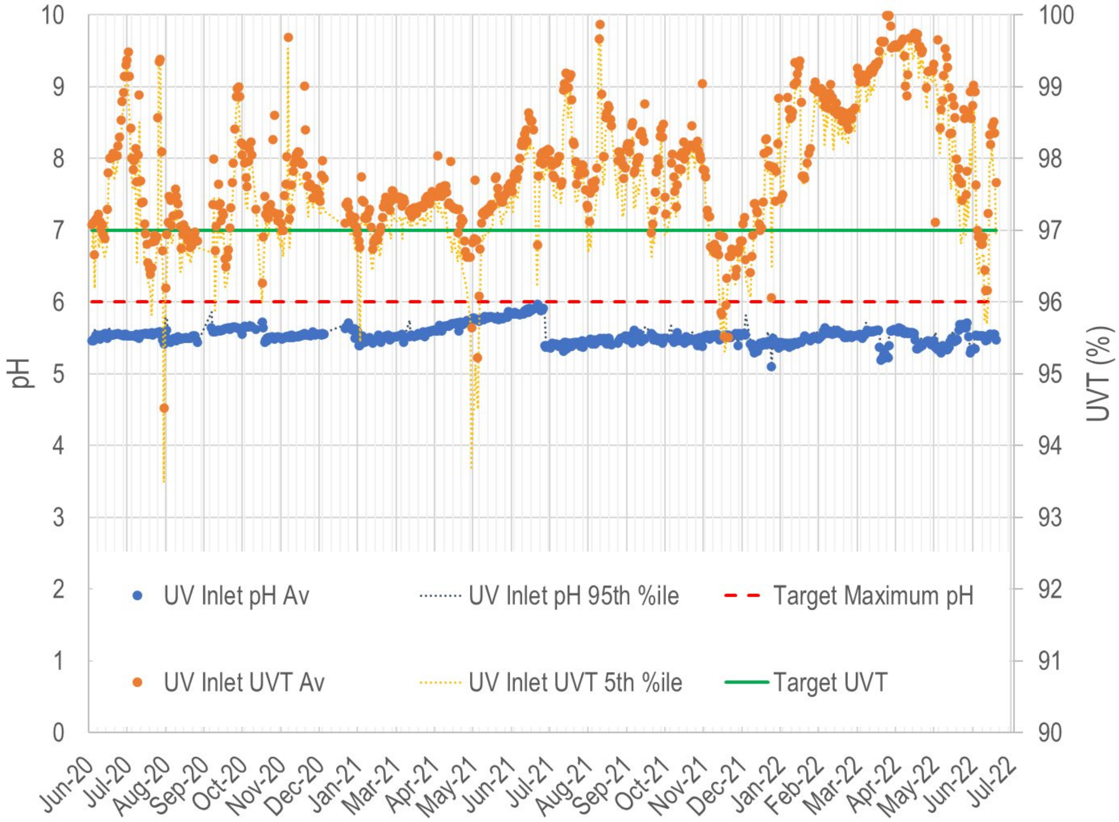


Figure 6.1 Inlet UVT and pH for the UV Reactor Shown as Daily Average, 5th and 95th Percentiles

There have been three events in May 2021, January 2022, and June 2022, where UVT has declined to below the target. May and June were documented events with higher ammonia and it is probable that some free chlorine reacted with excess ammonia that broke through the process. In early January 2022, there was a high flow event at Tapia that may have resulted in changes to UVT at the Demo. There is no significant long term impact that would suggest ammonia breakthrough as both free and total chlorine decreased in May - June 2022. It may be that some other chlorine demand was present in the system.

The sensor drift of the pH probe is evident by the gradual rise and then sharp reduction upon calibration. Even under the impact of sensor drift, the UV inlet pH has remained below the target maximum of 6.0. The pH is very stable throughout the day as the 5th and 95th percentile values are obscured by the average markers.

6.4 Pathogen and Chemical Removal Performance

Systematic validation testing was performed on the UV AOP to correlate pathogen removal, as well as the removal of chemicals NDMA and 1,4, Dioxane to operational parameters. The testing was described in Chapter 4 of the Year 1 Report.

Based on the Testing:

- UVI/Q was shown to hold a strong linear relationship with photolysis of pathogens and NDMA.
- For the current Demo operation:
  - A UVI/Q of > 0.6 milliwatts per square centimeter (mW/cm^2)/gpm will result in > 6 LRV of adenovirus removal.
  - A UVI/Q of > 1.9 mW/cm^2/gpm will result in > 1.5 LRV of NDMA, which should result in NDMA consistently below the CTR requirement of 0.69 ng/L based on the previously observed maximum NDMA RO permeate concentration of 19 ng/L (n = 8, see Chapter 4 of the Year 1 Report:
    - Further NDMA testing has been conducted subsequent to the Year 1 report. More recently, a higher maximum concentration of NDMA has been observed in the RO permeate at 27 ng/L. With this new maximum, a revised NDMA LRV target would be 1.6 log units.
    - Although NDMA has been detected in the UV AOP outlet, the maximum detected value has been 1.3 ng/L. All NDMA UV AOP outlet concentrations have been less than 2 ng/L and more than 5 times less than the CA NL of 10 ng/L.
- UVI/Q x Free chlorine dose was shown to hold a strong linear relationship with LRV of 1,4 - Dioxane:
  - A UVI/Q x Free chlorine of > 4.6 mW/cm^2/gpm.mg/L will result in a 1,4-Dioxane LRV of > 0.5.
  - Radical generation should remain effective at pH less than 6.0.
- Challenge testing for the UV AOP was conducted at close to the operating target of 97 percent UVT. Significant reductions in UVT, below 95 percent, may result in a shift in the correlations noted above.
- To account for this, conservatism has been built into the recommended operating limits of UVI/Q and UVI/Q x Free chlorine at the demo which are typically:
  - UVI/Q > 2.2.
  - UVI/Q x Free chlorine > 5.

UVI/Q and UVI/Q x Free Chlorine are shown as daily average data in Figure 6.2 covering the first 2 years of operation. Statistical parameters for each are included in Table 6.3.

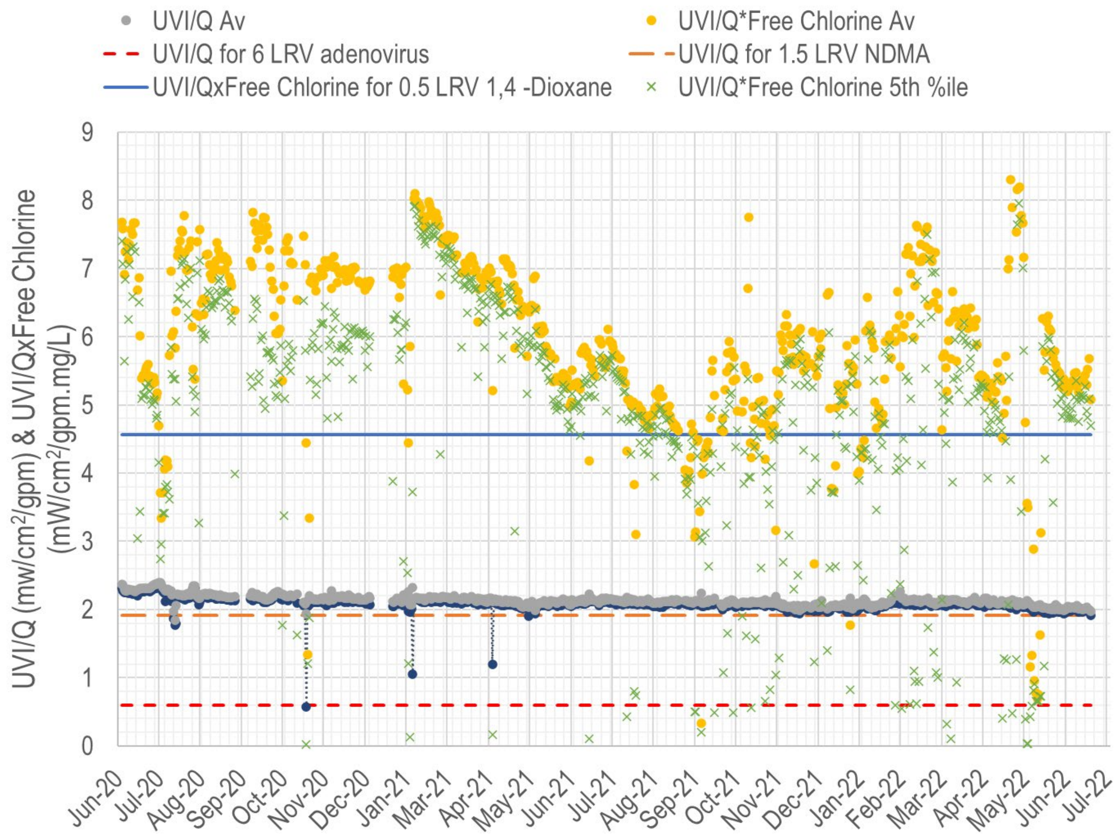


Figure 6.2 UV Chemical Reduction Surrogates. UVI/Q Showed Minimal Variability Indicating Stable Removal of NDMA. There was Some UVI/Q*Free Chlorine Variability Leading to Some Instances where 1,4 Dioxane Removal May have Reduced Below 0.5 Log Units

Table 6.3 Statistics of Key Operational Parameters for UV AOP Performance for the First Two Years of 15-Minute Average Operational Data

Parameter	UV Inlet pH	UV Inlet UVT (%)	UVI/Q (mW/cm2/gpm)	UVI/Q x Free Chlorine (mg/L.mW/cm^2/gpm)
5th Percentile	5.4	96.63	2.0	4.8
Median	5.5	97.77	2.1	6.8
95th Percentile	5.8	99.61	2.3	7.8

The UV system at the Demo has exceeded 6 LRV of adenovirus, and other pathogens, with a large safety margin.

The 5th percentile UVI/Q was 2.0 mW/cm^2/gpm, indicating that the UV AOP reactor has exceeded 1.5 LRV of NDMA for the entire two years of operation – based on a control limit of 1.9 mW/cm^2/gpm.

The 5th percentile UVI/Q x Free Chlorine was 3.8 mW/cm^2/gpm.mg/L which was lower than the target of 4.6 mW/cm^2/gpm.mg/L indicating that the UV AOP reactor has not always exceeded 0.5 LRV of 1,4-Dioxane. However, the 10th percentile was 4.6 indicating that 0.5 LRV of 1,4 Dioxane should have been met for 90 percent of 15 minute averages. It is suspected that 1,4 Dioxane reduction may have been impacted by the ammonia breakthrough events in May 2021 and May - June 2022 as well as other sources of chlorine demand. The Demo operates with fixed flow paced dosing. A full scale system would benefit from a chlorine dosing loop to ensure a stable supply of chlorine for AOP.

All 1,4 Dioxane finished water assays have been below regulatory limits. In addition, the Demo does have an SOP in place that prevents the filling of Tasting Tanks in the event that Ammonia is above typical values. The potential for pass through of ammonia and subsequent interference with AOP may warrant consideration of monitoring for ammonia and monochloramine at full scale prior to the UV AOP system. The readings from this instrument could help to guide diversion to ensure appropriate AOP treatment of all delivered water. UV inlet pH has been within acceptable ranges for the entire two years of operation to support efficient AOP.

There is some variability in the combined parameters on startup and shut down of the UV system as observed by sporadic low points. Therefore, it is recommended that the UV AOP system is activated and allowed to stabilize for at least one hour before sampling or tasting is conducted.

UVT targets (97 percent typical and >95 percent) have generally been met, with the exception of the ammonia breakthrough event in May 2021 and a similar event in May - June 2022 where there were high levels of monochloramine. pH has always remained below 6.0 which is favorable for radical production and advanced oxidation performance.

Total coliform and *E. coli* samples have been taken monthly and as needed for tasting tank samples. Unsurprisingly, all samples post UV AOP have been non-detect. Maximum and 95th percentile non-detects along with the number of samples is included in Table 6.4.

Table 6.4 Total Coliform and E.coli Monitoring Results for the UV AOP Outlet. All Readings have been Non-Detect

UV AOP Outlet	N data	95th Percentile (MPN/100 mL)	Maximum (MPN/100 mL)
E. coli	22	<1	<1
Total Coliforms	22	<1	<1

Note:
Abbreviation: MPN - most probable number; mL - milliliter.

Chapter 7

SELECT WATER QUALITY ANALYSIS

The purpose of this section is to provide an update for key constituents for which continued analysis occurred. In Chapter 5 of the Year 1 Report, detailed analysis of water quality parameters and constituents of concern was reported. Since completion of the Year 1 Report, the analytical schedule was rationalized and sampling for broad analytical suites was discontinued. Consequently, there is no reporting of MCLs, sMCLs, NLs or Priority Toxic Pollutants in this report. Instead, this section provides updated results for continued Monthly Sampling of RO concentrate, NDMA, N-nitrosomorpholine (NMOR), Bromide, and Bromate.

The analytical results for all grab samples collected for the first 2 years of demonstration operation are included in Appendix C for this report.

7.1 NDMA and NMOR

NDMA and NMOR concentrations are shown in Figure 7.1. NMOR has not been detected post RO or post UV AOP. Compared to the first year of data, the maximum NDMA concentration in the RO permeate has increased from 19 to 27 ng/L which would necessitate an increase from 1.5 to 1.6 log reduction by the UV AOP in order to meet the CA toxics rule requirement. There have been detections close to the detection limit for NDMA. All finished water NDMA results have been less than the CA NL. For Demo operation, it may be worthwhile considering raising the operating dose by marginally lowering the flow to ensure continued NDMA non-detects post UV AOP.

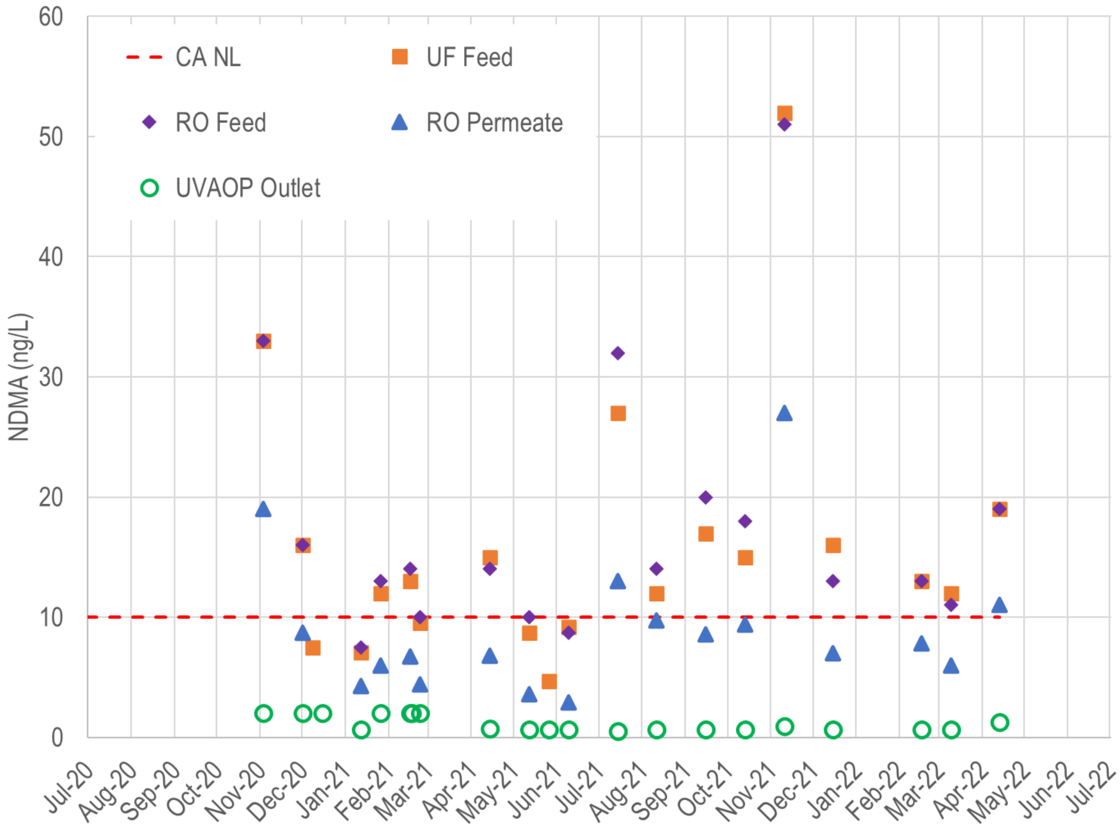


Figure 7.1 NDMA Occurrence Across the Demo. Most UV AOP have been Non-Detects and All have been Less Than the CA NL of 10 ng/L

Table 7.1 Statistics of NDMA Occurrence Across the Demo

Sample Point	N data	NDMA Concentrations (ng/L)					
		Minimum	5th Percentile	Average	Median	95th Percentile	Maximum
UF Feed	22	4.7	7.1	17	14	33	52
RO Feed	20	7.5	8.6	19	14	34	51
RO Permeate	20	2.9	3.6	10	8.2	21	27
UV AOP Outlet(1)	24	<0.63 (<2)	<0.63 (<2)	1.1 (<2)	0.74 (<2)	<2 (<2)	<2 (<2)

Note:
(1) Multiple detection limits were present for NDMA. Percentile values are reported by substituting the observed detection limit. Any non-detect readings are represented by < symbols. Numbers in brackets report the statistics for substitution of the maximum detection limit (from all observations) for all non-detects. The maximum detected NDMA value for UV AOP outlet was 1.3 ng/L.

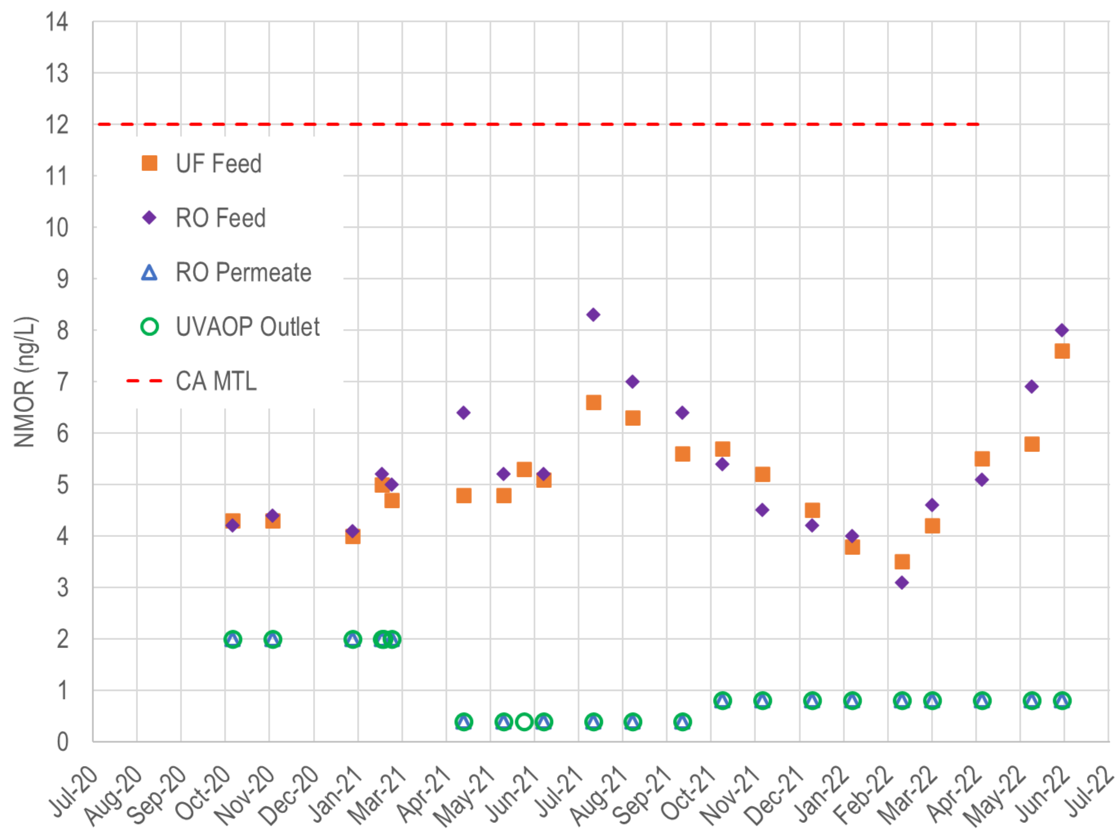


Figure 7.2 NMOR Occurrence Across the Demo. All RO Permeate and UV AOP Effluent Samples have been Non-Detects and All have been Less Than the CA MTL of 12 ng/L

Table 7.2 Statistics of NMOR Occurrence Across the Demo

Sample Point	N data	NMOR Concentrations (ng/L)					
		Minimum	5th Percentile	Average	Median	95th Percentile	Maximum
UF Feed	21	3.5	3.8	5.1	5.0	6.6	7.6
RO Feed	20	3.1	4.0	5.4	5.2	8.0	8.3
RO Permeate [(1)]	20	<0.4 (<2)	<0.4 (<2)	<1.0 (<2)	<0.81 (<2)	<2 (<2)	<2 (<2)
UV AOP Outlet[(1)]	22	<0.4 (<2)	<0.4 (<2)	<1.0 (<2)	<0.81 (<2)	<2 (<2)	<2 (<2)

Note:
(1) Multiple detection limits were present for NMOR. Percentile values are reported by substituting the observed detection limit. Any non-detect readings are represented by < symbols. Numbers in brackets report the statistics for substitution of the maximum detection limit (from all observations) for all non-detects. All NMOR values for RO Permeate and UV AOP Outlet were below the detection limit.

7.2 Bromide and Bromate

Bromate and Bromide results are shown in Figure 7.3 with statistics summarized in Table 7.3. Bromate has remained well below the MCL and is predominantly not detected post RO. Bromide concentrations have shown significant variability and may have been reduced in the 2021 summer months due to potable water top up to reservoir 2. Bromide analysis has been challenging to track as there have been multiple labs analyzing including one sub-contracting lab with a much higher method reporting limit more than 50 x higher than the other two.

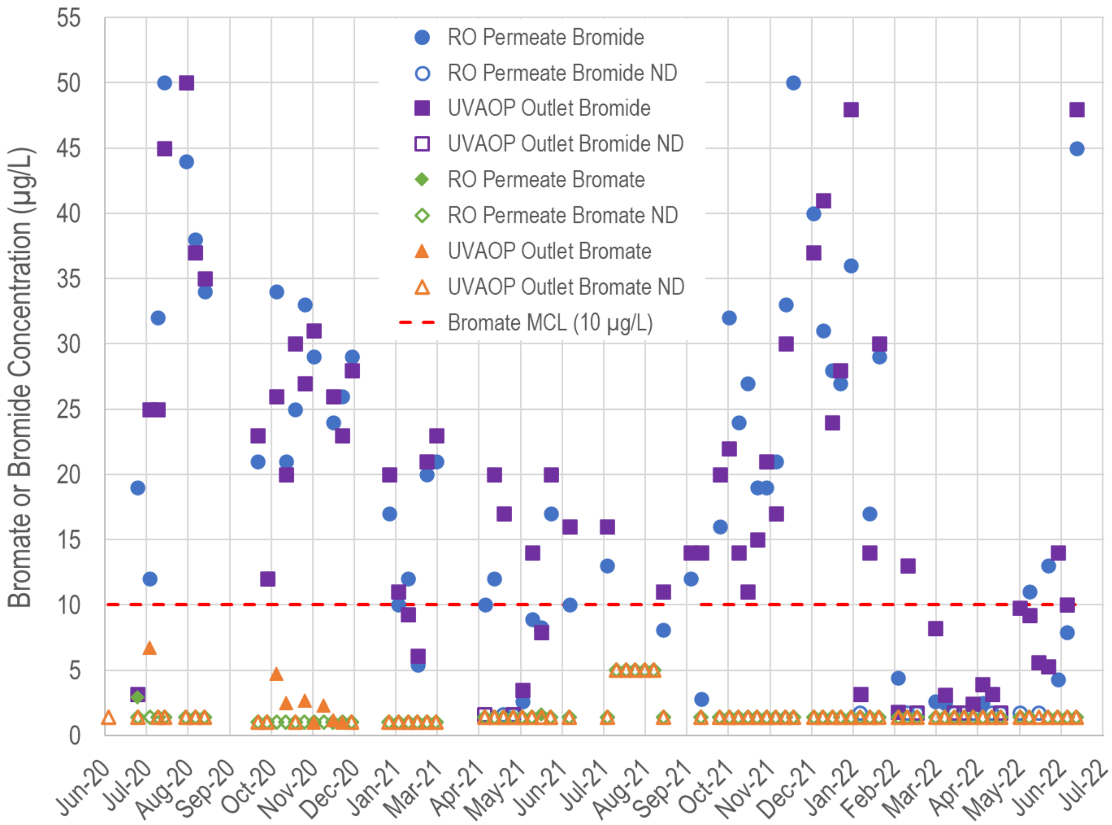


Figure 7.3 Bromide and Bromate Variation for the First Two Years of Operation

Table 7.3 Bromide Descriptive Statistics. Maximum Concentrations were the Result of a Sub-Contract Laboratory with a High Method Detection Limit

Sample Point	N data	Bromide Concentrations (ug/L)				
		Minimum	5th Percentile	Median	95th Percentile	Maximum
RO Permeate (1)	75	<1.6 (<100)	<1.7 (<100)	17	<100 (<100)	<100 (<100)
UV AOP Outlet (2)	76	<1.6 (<100)	<1.7 (<100)	17	<100 (<100)	<100 (<100)

Notes:

(1) Multiple detection limits were present for Bromide. Percentile values are reported by substituting the observed detection limit. Any non-detect readings are represented by < symbols. Numbers in brackets report the statistics for substitution of the maximum detection limit (from all observations) for all non-detects. The maximum detected Bromide value for RO Permeate was 50 ug/L.

a. Multiple detection limits were present for Bromide. Percentile values are reported by substituting the observed detection limit. Any non-detect readings are represented by < symbols. Numbers in brackets report the statistics for substitution of the maximum detection limit (from all observations) for all non-detects. The maximum detected Bromide value for UV AOP Outlet was 67 ug/L.

Table 7.4 Bromate Descriptive Statistics

Sample Point	N data	Bromate Concentrations (ug/L)				
		Minimum	5th Percentile	Median	95th Percentile	Maximum
RO Permeate (1)	78	<1 (<5)	<1 (<5)	<1.4 (<5)	<5 (<5)	<5 (<5)
UV AOP Outlet (2)	79	<1 (<5)	<1 (<5)	<1.4 (<5)	<5 (<5)	6.7

Notes:

(1) Multiple detection limits were present for Bromide. Percentile values are reported by substituting the observed detection limit. Any non-detect readings are represented by < symbols. Numbers in brackets report the statistics for substitution of the maximum detection limit (from all observations) for all non-detects. The maximum detected Bromate value for RO Permeate was 2.9 ug/L.

b. Multiple detection limits were present for Bromide. Percentile values are reported by substituting the observed detection limit. Any non-detect readings are represented by < symbols. Numbers in brackets report the statistics for substitution of the maximum detection limit (from all observations) for all non-detects. The maximum detected Bromide value for UV AOP Outlet was 6.7 ug/L.

7.3 RO Concentrate

RO Concentrate has been sampled monthly for a number of compounds. Table 7.5 compares the descriptive statistics for each sampled compound to the limits reported for the NPDES and Ocean plan originally summarized into the Test Plan (Appendix A).

There is a common issue with analysis of RO Concentrate as the method reporting limits are typically higher than the implied limits in the Ocean Plan or NPDES. Compounds which are non-detect but have reporting limits higher than either Ocean plan or NPDES are highlighted.

Gross Beta consistently exceeds the current limit of 50 pCi/L. However, as discussed in the Year 1 Report this low drinking water limit may not be appropriate given that Gross Beta in the ocean is typically 300 pCi/L and is predominantly due to naturally occurring potassium-40. Maximum RO concentrate gross beta was 369 pCi/L, and even without a dilution credit is close to the naturally occurring value in sea water. Consequently, screening against the drinking water limit of 50 pCi/L is very conservative.

Table 7.5 RO Concentrate Monitoring for Discharge Evaluation. Compounds in Bold were Not Detected but had Reporting Limits Higher than Specified Discharge Limits. Compounds with results below the MRL are reported as <MRL. For calculation of statistics, the value of the MRL was substituted.

Analyte	Unit	n	Median	90th percentile	Max	NPDES or Ocean Plan Effluent Limit
Gross Beta	**pCi/L**	**22**	**88**	**179**	**369**	**50[2] – Screening Level Based on MCL**
4-Nitrophenol	µg/L	16	<2.5	<6.2	<6.2	Phenolic Compounds (non-chlorinated) 30 (2,190 with dilution of 72 x)[3]
2-Nitrophenol	µg/L	16	<0.5	<1.3	<1.3	
Phenol	µg/L	16	<1.6	<2.9	<4.1	
2,4-Dimethylphenol	µg/L	16	<1.5	<2.7	<3.8	220 (16,060 with dilution of 72 x)[4] – for 2-Methyl-4,6-dinitrophenol 4.0 (292 with dilution of 72 x)[4] –for 2,4 -Dinitrophenol
2-Methyl-4,6-dinitrophenol	µg/L	16	<1.0	<2.8	<7.0	
2,4-Dinitrophenol	µg/L	16	<3.7	<9.4	<9.4	
Heptachlor	**ng/L**	**17**	**<12**	**<48**	**<50**	**0.05 (3.7 with dilution of 72 x)**
Heptachlor Epoxide	**µg/L**	**22**	**<0.0040**	**<0.0098**	**<0.1**	**0.00002 (0.0015 with dilution of 72 x)**
1,4-Dichlorobenzene	µg/L	16	<0.96	<2.4	<2.4	18 (1,314 with dilution of 72 x)
Bis(2-chloroisopropyl)ether	µg/L	16	<0.76	<1.9	<1.9	0.045 (3.29 with dilution of 72 x)
PCB 1260 Aroclor	**µg/L**	**22**	**<6.25**	**<10**	**<20**	
PCB 1254 Aroclor	**µg/L**	**22**	**<6.25**	**<10**	**<20**	
PCB 1221 Aroclor	**µg/L**	**22**	**<6.25**	**<10**	**<20**	
PCB 1232 Aroclor	**µg/L**	**22**	**<6.25**	**<10**	**<20**	**Sum of PCBs to be less than 0.000019 (0.0014 with dilution of 72 x)[4]**
PCB 1242 Aroclor	**µg/L**	**22**	**<6.25**	**<10**	**<20**	
PCB 1248 Aroclor	**µg/L**	**22**	**<6.25**	**<10**	**<20**	
PCB 1016 Aroclor	**µg/L**	**24**	**<6.25**	**<10**	**<20**	
Anthracene	**µg/L**	**16**	**<0.82**	**<1.41**	**<2.00**	
Pyrene	**µg/L**	**16**	**<0.5**	**<1.2**	**<1.2**	
Benzo (g,h,i) perylene	**µg/L**	**16**	**<0.84**	**<2.1**	**<2.1**	
Indeno (1,2,3-cd) pyrene	**µg/L**	**16**	**<0.49**	**<1.2**	**<2.8**	
Benzo (b) fluoranthene	**µg/L**	**16**	**<0.92**	**<2.3**	**<2.3**	
Benzo (k) fluoranthene	**µg/L**	**16**	**<0.44**	**<1.1**	**<1.1**	
Acenaphthylene	**µg/L**	**16**	**<0.7**	**<1.3**	**<1.8**	
Chrysene	**µg/L**	**16**	**<0.38**	**<0.95**	**<0.95**	**Sum of PAHs to be less than 0.0088 (0.64 with dilution of 72 x)[4]**
Dibenzo (a,h) anthracene	**µg/L**	**16**	**<0.3**	**<1.1**	**<2.6**	
Benzo (a) pyrene	**µg/L**	**16**	**<0.78**	**<2.0**	**<2 .0**	
Benzo (a) anthracene	**µg/L**	**16**	**<0.38**	**<0.95**	**<0.95**	
Acenaphthene	**µg/L**	**16**	**<0.76**	**<1.9**	**<1.9**	
Phenanthrene	**µg/L**	**16**	**<0.64**	**<1.6**	**<1.6**	
Fluorene	**µg/L**	**16**	**<0.7**	**<1.8**	**<1.8**	
alpha-BHC	ng/L	17	<11	<22	<28	
beta-BHC	ng/L	17	<15	<30	<38	4.0 (290 with dilution of 72 x)[3] – for sum of hexachlorocyclohexanes
delta-BHC	ng/L	17	<20	<38	<48	
gamma-BHC (Lindane)	ng/L	17	<10	<100	<100	
Bis(2-chloroethyl)ether	µg/L	16	<0.54	<1.4	<1.4	0.045 (3.29 with dilution of 72 x)
Monobutyltin	µg/L	5	<0.0029	-[1]	0.17	
Dibutyltin	µg/L	5	<0.0029	-[1]	0.015	
Tributyltin	µg/L	21	<0.0026	<0.0029	<0.003	0.0014 (0.1 with dilution of 72 x)
Tetrabutyltin	µg/L	5	<0.0029	-[1]	<0.003	
2,4-Dichlorophenol	µg/L	16	<0.52	<1.3	<1.3	
4-Chloro-3-methylphenol	µg/L	16	<0.5	<1.2	<1.2	
Pentachlorophenol	µg/L	16	<0.8	<2.0	<2.0	1.0 (73 with dilution of 72 x)[3] – for sum of chlorinated phenolics
2,4,6-Trichlorophenol	µg/L	16	<0.62	1.15	1.20	
2-Chlorophenol	**µg/L**	**16**	**<0.6**	**<1.4**	**<1.4**	
Bis(2-chloroethoxy)methane	µg/L	16	<0.5	<1.2	<1.2	4.4 (321 with dilution of 72 x)
Bis(2-ethylhexyl)phthalate	µg/L	16	<4.6	<12	<12	3.5 (256 with dilution of 72 x)
Di-n-octyl phthalate	µg/L	16	<0.92	<2.3	<2.3	
Dimethyl phthalate	µg/L	16	<0.36	<0.9	<0.9	820,000 (59,860,000 with dilution of 72 x)[4]
4-Bromophenyl phenyl ether	µg/L	16	<0.72	<1.8	<1.8	
Hexachlorobenzene	**µg/L**	**21**	**<0.98**	**<9.9**	**<10**	**0.00021 (0.015 with dilution of 72 x)[4]**
1,2,4-Trichlorobenzene	µg/L	16	<0.98	<2.4	<2.4	
2,4-Dinitrotoluene	µg/L	16	<0.92	<1.63	<2.3	2.6 (190 with dilution of 72 x)
1,2-Diphenylhydrazine/Azobenzene	µg/L	16	<0.7	1.6	<2.0	0.16 (12 with dilution of 72 x)
Fluoranthene	µg/L	16	<0.69	<1.2	<1.7	15 (1,095 with dilution of 72 x)
Endosulfan I	ng/L	17	<9	<38	<100	9.0 (660 with dilution of 72 x)
Endosulfan II	ng/L	17	<14	<38	<50	9.0 (660 with dilution of 72 x)
Endosulfan sulfate	ng/L	17	<26	<100	<100	
alpha-Chlordane	**ng/L**	**17**	**<29**	**<58**	**<72**	**0.023 (1.7 with dilution of 72 x)**
gamma-Chlordane	**ng/L**	**17**	**<46**	**<50**	**<58**	**0.023 (1.7 with dilution of 72 x)**
Chlordane	**µg/L**	**22**	**<0.9**	**<2.5**	**<5.0**	**0.000023 (0.0017 with dilution of 72 x)**
Mirex	ng/L	17	<12	<24	<30	
Aldrin	**µg/L**	**22**	**<0.005**	**<0.02**	**<0.025**	**0.000022 (0.0016 with dilution of 72 x)**

Table 7.5 RO Concentrate Monitoring for Discharge Evaluation. Compounds in Bold were Not Detected but had Reporting Limits Higher than Specified Discharge Limits (continued)

Analyte	Unit	n	Median	90th percentile	Max	NPDES or Ocean Plan Effluent Limit
1,2-Dichlorobenzene	µg/L	16	<0.9	<2.3	<2.3	5,100 (372,300 with dilution of 72 x)[4] for sum of dichlorobenzenes
1,3-Dichlorobenzene	µg/L	16	<0.8)	<2.1	<2.1	
trans-Nonachlor	ng/L	17	<17	<34	<42	
cis-Nonachlor	ng/L	17	<25	<50	<62	
2,3,7,8-Tetra CDD	**pg/L**	**22**	**<1.85**	**<9.9**	**<10**	**TEF = 1.0 = <10 TCDD**
Total Tetra CDD	pg/L	19	<1.1	<9.9	<10	
1,2,3,7,8-Penta CDD	pg/L	22	<1.8	<49	<50	
Total Penta CDD	**pg/L**	**19**	**<2.5**	**<49**	**<50**	**TEF for 2,3,7,8 penta CDD = 0.5 = < 25 TCDD**
1,2,3,7,8,9-Hexa CDD	pg/L	22	<2.75	<49	<50	
1,2,3,4,7,8-Hexa CDD	pg/L	22	<3.2	<49	<50	
1,2,3,6,7,8-Hexa CDD	pg/L	22	<2.2	<49	<50	
Total Hexa CDD	**pg/L**	**19**	**<4.2**	**<49**	**<50**	**TEF for 2,3,7,8 Hexa CDD = 0.1 = < 5 TCDD**
1,2,3,4,6,7,8-Hepta CDD	pg/L	22	<3.9	<49	<50	
Total Hepta CDD	**pg/L**	**19**	**<4.5**	**<49**	**<50**	**TEF for 2,3,7,8 Hepta CDD = 0.01 = <0.5 TCDD**
Octa CDD	pg/L	22	<12	<99	<100	TEF = 0.001 = <0.1 TCDD
2,3,7,8-Tetra CDF	**pg/L**	**22**	**<1.9**	**<9.9**	**<10**	**TEF = 0.1 = <1 TCDD**
Total Tetra CDF	pg/L	19	<2.0	<9.9	<10	
2,3,4,7,8-Penta CDF	**pg/L**	**22**	**<1.1**	**<49**	**<50**	**TEF = 0.5 = <25 TCDD**
1,2,3,7,8-Penta CDF	**pg/L**	**22**	**<1.3**	**<49**	**<50**	**TEF = 0.05 = <2.5 TCDD**
Total Penta CDF	pg/L	19	<1.1	<49	<50	
1,2,3,6,7,8-Hexa CDF	pg/L	22	<1.5	<49	<50	
1,2,3,4,7,8-Hexa CDF	pg/L	22	<1.5	<49	<50	
1,2,3,7,8,9-Hexa CDF	pg/L	22	<2.5	<49	<50	
2,3,4,6,7,8-Hexa CDF	pg/L	22	<1.4	<49	<50	
Total Hexa CDF	**pg/L**	**19**	**<4.1**	**<49**	**<50**	**TEF for 2,3,7,8 Hexa CDF = 0.1 = <5 TCDD**
1,2,3,4,7,8,9-Hepta CDF	pg/L	22	<5.1	<49	<50	
1,2,3,4,6,7,8-Hepta CDF	pg/L	22	<4.0 (<50)	<49	<50	
Total Hepta CDF	**pg/L**	**19**	**<4.8**	**<49**	**<50**	**TEF for 2,3,7,8 Hexa CDF = 0.01 = <0.5 TCDD**
Octa CDF	pg/L	22	<7.6	<99	<100	TEF for Octa CDF = 0.001 = <0.1 TCDD
TCDD Equivalents	**TCDD pg/L**	**-**	**-**	**-**	**<74.7**	**TEF x Concentration < 2.8 x 10^{-7} µg/L = 0.28 TCDD pg/L average monthly**
2,4'-DDT	**ng/L**	**17**	**<19**	**<42**	**<100**	**0.17 (12 with dilution of 72 x)**
4,4-DDT	µg/L	22	<0.0098	<0.0532	<0.1	0.00017 (0.012 with dilution of 72 x)
2,4'-DDD	ng/L	17	<22	<37	<100	
2,4'-DDE	ng/L	17	<19	<21	<25	
4,4´-DDD	ng/L	17	<7	<32	<54	
4,4´-DDE	ng/L	17	<14	<36	<100	
Dieldrin	**µg/L**	**22**	**<0.006**	**<0.033**	**<0.1**	**0.00004 (0.0029 with dilution of 72 x)**
2,6-Dinitrotoluene	µg/L	16	<0.5	<1.4	2.9	
N-Nitrosodi-n-propylamine (NDPA)	µg/L	16	<0.5	<1.3	<1.3	0.38 (28 with dilution of 72 x)
N-Nitroso-dimethylamine (NDMA)	µg/L	16	<1.0	<2.5	<2.5	7.3 (533 with dilution of 72 x)
N-Nitrosodiphenylamine	µg/L	16	<0.38	<0.95	<0.95	2.5 (183 with dilution of 72 x)
Hexachloroethane	µg/L	16	<1.0 (<2.5)	<2.5	<2.5	2.5 (183 with dilution of 72 x)
4-Chlorophenyl phenyl ether	µg/L	16	<0.8	<2.0	<2.0	
Endrin	ng/L	17	<20	<34	<42	2.0 (150 with dilution of 72 x)
Endrin aldehyde	ng/L	17	<38	<42	<50	
Methoxychlor	ng/L	17	<28	<100	<100	
Beryllium, Total	µg/L	22	<0.062	<1.0	<1.0	0.033 (2.4 with dilution of 72 x)
Hexachlorocyclopentadiene	µg/L	16	<0.62	<2.0	<4.9	58 (4,234 with dilution of 72 x)
Isophorone	µg/L	16	<0.4	<1.0	<1.0	730 (53,290 with dilution of 72 x)
Toxaphene	**µg/L**	**22**	**<5.0**	**<12**	**<20**	**0.00021 (0.015 with dilution of 72 x)**
Diethyl phthalate	µg/L	16	<0.7	<1.3	<1.7	33,000 (2,409,000 with dilution of 72 x)
Di-n-butyl phthalate	µg/L	16	<0.68	<1.2	<1.7	3,500 (2,555,500 with dilution of 72 x)
Butyl benzyl phthalate	µg/L	16	<1.0	<1.7	<2.5	
Hexachlorobutadiene	µg/L	16	<0.94	<2.4	<2.4	14 (1,022 with dilution of 72 x)
Naphthalene	µg/L	16	<1.0	<2.4	<2.4	
2-Chloronaphthalene	µg/L	16	<0.9	<2.2	<2.2	
3,3'-Dichlorobenzidine	**µg/L**	**21**	**<5**	**<25**	**<25**	**0.0081 (0.59 with dilution of 72x)**
Benzidine	**µg/L**	**21**	**<6.4**	**<49**	**<51**	**0.000069 (0.005 with dilution of 72x)**
Nitrobenzene	µg/L	16	<0.72	<1.8	<1.8	4.9 (358 with dilution of 72 x)

Notes:
Abbreviation: pg/L - picogram per liter.
(1) 90th percentile not calculated when less than 10 samples.
(2) Title 22 CCR § 64443 specifies Maximum Contaminant Limits (MCLs) for beta/photon emitters, Strontium-90, and Tritium. The 4 millirems/year MCL for beta/photon emitters has an equivalent gross beta particle activity concentration of 4 picocurie/liter (pCi/L). Similarly, Strontium-90 is 8 pCi/L, and C-4 tritium is 20,000 pCi/L. A screening-level of 50 pCi/L gross beta particle activity is used in this characterization to indicate whether further testing for specific radionuclides is deemed necessary.
(3) Ocean Plan 6 Month Median.
(4) Ocean Plan 30 day average Water Quality objective.

Chapter 8

CONCLUSIONS AND RECOMMENDATIONS

The Demo continues to operate with a high level of uptime and produce high quality potable water. Subsequent to the period in this report, UF3 was replaced with an alternate model and the fill cycle adjusted to avoid potential issues with drying out. Observation of the permeability of this product will help to provide information as to the potential underestimation with the UF3 results presented in this report.

The blending of potable water in Reservoir 2 does appear to make daily water quality to the demo more variable and appears to dilute some constituents. It may be worthwhile to consider planning any significant performance studies around winter months where potable water top-up does not appear to be as significant occurrence.

All MF/UF modules tested appear to be able to operate above 40 gfd in long term trials and may have the capability to operate a peak flux of 50 gfd provided cleaning frequency is increased. There did not appear to be additional benefit to maintenance cleans stronger than 500 mg/L of sodium hypochlorite or more frequently than 1 - 2 times per week on permeability recovery. However, monthly recovery cleans appear to be necessary to maintain permeability. All MF/UF systems consistently produced a very low turbidity filtrate with negligible suspended solids.

The RO system performance is in-line with separate reports for a similar product trialed for 6 years at OCWD. It may be of interest to use the Demo as a platform to evaluate other RO products in an effort to gain a better understanding of how membrane selection might impact full scale operation. The RO system integrity is consistent based on online and offline surrogate monitoring results which are demonstrating more than 1.5 and 2.5 LRV respectively.

The maximum value of NDMA measured in the RO permeate appears to have increased its and this may have impacts for the UV reactor sizing of a future full-scale facility in order to meet CTR criteria. It is recommended that NDMA monitoring in the RO permeate continue.

The UV system showed variability in free chlorine dose throughout the year. This variability led to some occurrences (< 10 percent) where the 1,4 Dioxane LRV estimated based on validation testing may have reduced below 0.5 log units. It may be warranted for more frequent adjustments to be made to the free chlorine dosing in the feed to the UV in order to maintain the target performance, noting that such controls and alarms would be automated in a full-scale system. Additional validation work may help to understand the removal of 1,4 Dioxane at a broader range of UVT that could be encountered at the full-scale facility.

There have been a number of events where either ammonia or some other chlorine scavenger has reached the UV AOP inlet. Although these occurrences are short, monitoring of the future full scale facility UV AOP may benefit from having monochloramine and ammonia analyzers on the feed to the UV.

RO concentrate monitoring continues to be a challenge due to the high reporting limits relative to NPDES or Ocean Plan targets. Review of these targets and current data is recommended. Identification of appropriate dilution credits would help to understand any potential compliance issues.

Chapter 9

REFERENCES

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Appendix A

PURE WATER DEMONSTRATION TEST PLAN

Las Virgenes - Triunfo Joint Powers Authority
Pure Water Demonstration Project

Technical Memorandum
PURE WATER DEMONSTRATION TEST PLAN

FINAL | November 2020

PURE WATER PROJECT
LAS VIRGENES-TRIUNFO

Bringing Our Water Full Circle

Las Virgenes - Triunfo Joint Powers Authority
Pure Water Demonstration Project

Technical Memorandum
PURE WATER DEMONSTRATION TEST PLAN

FINAL | November 2020

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Abbreviations

AOP	advanced oxidation process
AWPF	Advanced Water Purification Facility
BDCM	bromodichloromethane
BOD	biochemical oxygen demand
Carollo	Carollo Engineers, Inc.
CCPP	calcium carbonate precipitation potential
CCTV	closed-caption television
CEC	chemicals of emerging concern
cfs	cubic feet per second
CIP	clean-in-place
CMWD	Calleguas Municipal Water District
COC	chain of custody
DBCM	dibromochloromethane
DBP	disinfection byproduct
DDW	State of California's Division of Drinking Water
Demo	Las Virgenes - Triunfo Joint Powers Authority (JPA) Pure Water Demonstration Project
EC	electrical conductivity
EPA	United States Environmental Protection Agency
F	Fahrenheit
gfd	gallons per square foot per day
gpm	gallons per minute
H_2SO_4	sulfuric acid
HDPE	high-density polyethylene
HMI	human machine interface
JPA	Las Virgenes - Triunfo Joint Powers Authority
LRV	log removal value
LSI	Langelier Saturation Index
mA	milliampere
MC	maintenance cleaning
MCL	maximum contaminant level
MDL	method detection limit
MF	microfiltration
µg/L	micrograms per liter
µm	micrometer
mg/L	milligrams per liter
mgd	million gallons per day

mJ/cm^2	millijoule per square centimeter
MWD	Municipal Water District
$Na_2S_2O_4$	sodium dithionite
NaOCl	sodium hypochlorite
NaOH	sodium hydroxide
ND	non-detect
NDMA	N-nitrosodimethylamine
ng/L	nanograms per liter
NL	notification level
NMOR	N-nitrosomorpholine
NOEL	no observed effect level
NPDES	National Pollutant Discharge Elimination System
Ocean Plan	Water Quality Control Plan for the Ocean Waters of California
ORP	oxidation reduction potential
P&ID	process and instrumentation diagram
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/L	picocurie/liter
PDT	pressure decay test
PFAS	per/polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
pg/L	pictogram per liter
PLC	programmable logic controller
PMMoV	Pepper mild mottle virus
PPCP	pharmaceuticals, and personal care products
PSS	point source summation
QA/QC	quality assurance and quality control
qPCR	quantitative polymerase chain reaction
R	percent recovery
RC	recovery clean
RO	reverse osmosis
RPD	relative percent difference
RSD	relative standard deviation
RWQCB	Regional Water Quality Control Board
SD	standard deviation
SMP	Salinity Management Pipeline
SRM	standard reference material
SWRCB	State Water Resources Control Board

TBD	to be determined
TCDD	tetrachlorodibenzo-p-dioxin
TMDL	total maximum daily load
TMP	transmembrane pressure
TOC	total organic carbon
TOPA	total oxidizable perfluorinated assay
TSS	total suspended solids
TUa	acute toxic units
TUc	chronic toxic units
UF	ultrafiltration
UV	ultraviolet
UVI	ultraviolet intensity
UVT	ultraviolet transmittance
WQO	Water Quality Objective
WRF	water reclamation facility
WRP	water reclamation plant

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Section 1

PURE WATER DEMONSTRATION TEST PLAN

This Test Plan has evolved since the original publication (Spring 2019) to the current date. The system has been in operation and components of testing under this Test Plan have been started, or in some cases completed. As such, this Test Plan includes some preliminary findings that are used to guide revised testing goals and approaches.

1.1 Overview

The Las Virgenes - Triunfo Joint Powers Authority (JPA) Pure Water Demonstration Project (Demo) is a potable water reuse demonstration project. This Demo will develop the necessary information to successfully implement a future full-scale potable reuse Advanced Water Purification Facility (AWPF) for surface water augmentation to the Las Virgenes Reservoir. The existing Tapia Water Reclamation Facility (WRF) recycles wastewater through primary sedimentation, conventional activated sludge, media filtration, and chloramine disinfection, and will provide the influent for the Demo and the future AWPF.

At this time, planned future AWPF operation will be done seasonally when existing recycled water demands are low, a concept to be mimicked with this Demo. However, the JPA is seeking alternative sources of water (e.g., dry weather runoff, brackish groundwater) that would either be funneled through the wastewater collection system or supplied directly to the AWPF in the future.

JPA has identified the following as goals of the Demo:

- Provide opportunities for public education, acceptance, and public outreach to the JPA's customers.
- Develop design criteria and operational procedures to inform and improve the full-scale design and provide experience to operators.
- Provide technical documentation and support for permitting the project by the State of California's Division of Drinking Water (DDW) and the Regional Water Quality Control Board (RWQCB) as a surface water augmentation project.

This project was partially funded by the United States Bureau of Reclamation, Agreement Number R17AP00067.

This Test Plan is intended to be a fluid document. As new information is gathered, testing may be reduced or expanded depending upon what information is gathered. This Test Plan should be viewed as a starting point for collecting information that will evolve over the coming years. Some aspects of the Test Plan will be evaluated in 2020 and 2021 (Phase 1), while others may be examined subsequently (Phase 2).

1.2 Treatment Train

The Demo includes the following three critical purification processes. A process and instrumentation diagram (P&ID) is found in Appendix A. A few details on the processes include:

- **Microfiltration (MF) and Ultrafiltration (UF)**: One open platform train that will produce approximately 100 gallons per minute (gpm) of filtered effluent using three different suppliers' membranes (and thus three modules) to undergo simultaneous testing. System documentation (e.g., human machine interface [HMI] labelling) has been set up to refer to any MF/UF as a UF and the term UF is used interchangeably throughout the document.
  - UF1: Dow/DuPont SFD-2880XP.
    - Reported Nominal Pore Size 0.03 micrometer (µm).
    - Classification: Ultrafilter.
  - UF2: Pall UNA-620A.
    - Reported Nominal Pore Size 0.1 µm.
    - Classification: Microfilter.
  - UF3: Toray HFU Type 2020AN.
    - Reported Nominal Pore Size 0.01 µm.
    - Classification: Ultrafilter.
- **Reverse Osmosis (RO)**[1]: One train that will operate at 80 percent and 85 percent recovery in the following two modes of operation:
  - **Two-Stage**: 2:1 array with seven 4-inch elements per vessel and an interstage booster pump between stages to produce 10 - 15 gpm.
  - **Three-Stage**: 4:2:1 array with six 4-inch elements per vessel and an interstage booster pumps between stages 2 and 3 to produce 20 - 35 gpm.
- **Ultraviolet (UV) Advanced Oxidation Process (AOP)**: One reactor capable of treating up to 20 gpm[2] with a dose up to 600 millijoules per square centimeter (mJ/cm^2) for N-nitrosodimethylamine (NDMA) destruction coupled with an upstream dose of sodium hypochlorite for a minimum removal of 0.5-log of 1,4-dioxane. Lower flows are currently being run (approximately 6 gpm) through the system to generate high dose values sufficient for NDMA destruction and to best understand future AWPF design criteria. At the current flow of 6 gpm, the UV supplier (Xylem/WEDECO) estimates a point source summation (PSS)-based UV dose of ~1500 mJ/cm^2, which will be verified as part of testing detailed herein.

Figure 1 provides an overview of the process train and corresponding chemicals and flow rates. Appendix A contains the process flow diagrams that provide additional information on supporting systems.

Table 1 provides a summary of the key testing components detailed in this Test Plan.

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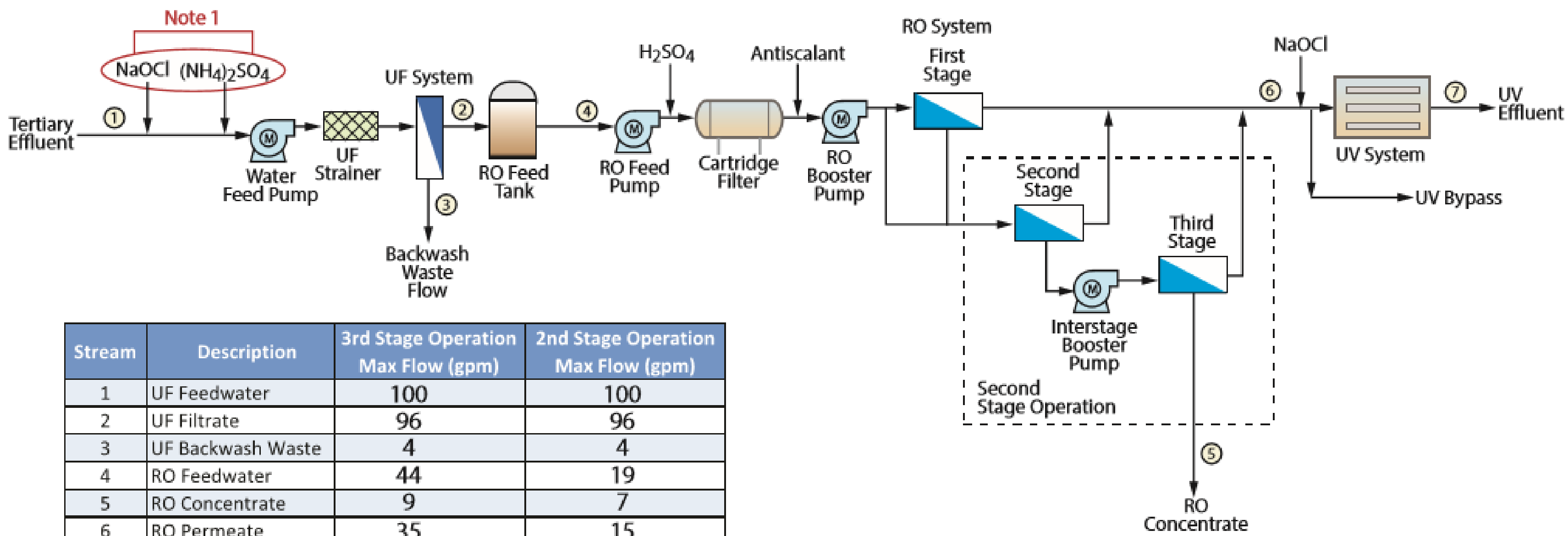
[1] Exact flow set points should be determined using RO design projection software. The flowrates above are indicative based on system capacity and will vary depending on target recovery and operating temperature.

[2] Uncertainty in dose prediction accuracy and hydroxyl radical scavenging by the proposed UV system require flexibility by this team as to the production flow (gpm) of the proposed unit. These details will be made clear during the Demonstration Project.

Table 1 Core Components of Test Plan

Test Component	Project Phase	Details	Schedule
Pure Water Quality Assessment	Phase 1	Evaluation of water quality in accordance with regulations as part of Grand Opening and Tasting Event.	Complete
Membrane Operational Efficiency Analysis	Phase 1	Evaluation of MF, UF, and RO performance over a range of flux and clean-in-place (CIP) intervals.	Ongoing through Spring 2021
Extended Water Quality Testing	Phase 1	Extensive evaluation of water quality across the AWPF.	Ongoing through Spring 2021
Process Challenge Testing	Phase 1	Challenge testing of MF, UF, RO, and UV AOP systems.	Winter 2020
Disinfection Byproduct Analysis	Phase 1 and Phase 2	Evaluation of conventional and emerging disinfection byproducts (DBPs) will be included within Phase 1 UV AOP testing. Pipe loop studies with stabilized water should include DBP reformation during Phase 2 of testing.	Phase 1 - Winter 2020 Phase 2 - TBD
Production Reliability	Phase 1	Evaluation of production reliability based upon down-time resulting from process and monitoring system challenges.	Ongoing through Spring 2021
Artificial Intelligence Investigations	Phase 1	Evaluation of water quality and membrane process performance as part of grants from MWD and METI.	Ongoing through Spring 2021
RO Concentrate Analysis	Phase 1 and Phase 2	Evaluation of RO concentrate quality as it may impact National Pollutant Discharge Elimination System (NPDES) discharge and RO brine line scaling.	Phase 1 - Winter 2020 Phase 2 - TBD
Product Water Stabilization	Phase 2	Evaluation of purified water quality and determination (and testing) of stabilization methods	TBD
Pathogen Monitoring	Phase 2	Evaluation of pathogen removal across the Tapia WRF.	TBD
Seasonal Operations Simulation	Phase 2	There is a potential that future AWPF operations are seasonal. The system is designed to allow for some components of the RO to be "mothballed" for periods of time, as is currently being done for some of the membranes.	TBD
Supplemental Flow Simulation	Phase 2	Testing of different water sources by the AWPF, such as brackish groundwater.	TBD



Stream	Description	3rd Stage Operation Max Flow (gpm)	2nd Stage Operation Max Flow (gpm)
1	UF Feedwater	100	100
2	UF Filtrate	96	96
3	UF Backwash Waste	4	4
4	RO Feedwater	44	19
5	RO Concentrate	9	7
6	RO Permeate	35	15
7	UV Effluent	5-10	5-10

Note - The table contains maximum flows.
Maximum concentrate and feed calculated at 80% recovery for maximum permeate.
Maximum permeate from H_20 process narrative.

Note 1 - Dosing point order can be changed to investigate NDMA formation potential. Preformed chloramine could be dosed at either location but would require additional dosing pumps, storage and blending tanks.

Figure 1 Process Train Overview

1.3 Ancillary Systems and Components

In addition to three treatment systems (UF, RO, UV AOP), this Demo includes:

- **Online Monitoring Systems**: Each of the three processes is being monitored online (both in real time and periodically) over the demonstration period by the instrumentation summarized in Table 2. In addition:
  - The UF system continuously monitors normalized flux, turbidity removal, and transmembrane pressure (TMP). It also conducts daily pressure decay tests (PDTs), and monitors oxidation reduction potential (ORP), pH, free ammonia and total chlorine on the filtrate.
    - The online turbidity meters have experienced some challenges, which have been rectified through better placement of bubble traps and removal of an accidental siphon.
    - No other monitoring system challenges have been noted.
  - The RO system continuously collects detailed online data which is coupled with daily logged data to monitor normalized flux, normalized salt passage/rejection, reduction of total organic carbon (TOC) across the membranes and normalized differential pressure. The RO performance is currently being tracked used calculations spreadsheets provided by Toray (the RO membrane supplier). Daily average flows and pressures are determined from logged data while the RO is operating and used to populate one point per day.
    - The online TOC probe has functioned well, with the exception of RO permeate data recording in which the HMI will read values higher than those logged within the system. To address this issue, the 4 - 20 milliampere (mA) scaling was optimized for RO permeate values between 0 - 1 mg/L.
    - No other monitoring system challenges have been noted.
  - The UV system continuously monitors UV dose, based upon a ultraviolet transmittance (UVT) input value (currently set to 98 percent), the online ultraviolet intensity (UVI) sensor, and flowrate using a PSS calculation. The system also monitors for free and combined chlorine and UVT ahead of and after the UV system, as well as pH in the feed to the UV reactor. The accuracy of that UV dose is undetermined at this point but testing within this document will determine the approximate dose delivery of the reactor and determine the accuracy of the online dose equation.
    - The UVI sensor maintained a consistent value and performance for the first several months of operation but has subsequently lost calibration and been replaced.
    - No other monitoring system challenges have been noted.
  - The intent is for all online meters to be calibrated weekly or monthly using either bench-scale calibrated devices or through laboratory analysis.
- **Equipment for Supporting Studies:** In adjacent rooms to the UF, RO, and UV AOP, the project team, depending upon need and budget, can study RO concentrate and finished water qualities through bench-scale or pipe loop studies.

Table 2 Online Water Quality Monitoring[4]

Parameter	UF Feed	UF Filtrate	RO Feed	RO Permeate	UVAOP Feed	UV AOP Effluent
pH		●	●		●	
Turbidity	●	●(1)				
Temperature	●		●			
Conductivity			●	●(2)		
TOC[3]			●	●		
ORP[3]		●	●			
UVT[3]					●	●
Free Chlorine			●		●	●
Total Chlorine		●			●	●
Free Ammonia		●				

Notes:
(1) On filtrate from each UF module.
(2) On permeate from each RO stage.
(3) ORP: oxidation reduction potential.
(4) There are no online water quality sensors on the RO concentrate.

1.4 Challenges

This Demo includes evaluation of several novel challenges, which are summarized here and detailed in subsequent sections of this Test Plan:

- **High Run Time (Phase 1):** Increasingly stringent water quality requirements are making seasonal discharge to Malibu Creek very challenging and would trigger a significant investment in treatment at the Tapia Water Reclamation Facility. Therefore, the JPA has gone through a stakeholder-driven process to consider options for regulatory compliance and selected indirect potable reuse utilizing Las Virgenes Reservoir as a preferred scenario. With that understood, no treatment process will run effectively 100 percent of the time. Accordingly, this project must develop a clear understanding of reliability of treatment performance to DDW standards and conclude on the levels of redundancy of treatment and monitoring systems to attain a target Water Production Reliability Goal (value to be determined [TBD]).
- **Feed Water Quality (Phase 1):** The feed to the future system will be tertiary recycled water treated with filtration and chloramination. The feed water for the Demo comes from Reservoir 2, which will have a different water age (anticipated to be shorter) than water to the future full scale AWPF. Further, during periods of effluent discharge for Tapia (instead of non-potable water reuse), the Tapia effluent is dechlorinated, which would result in low to zero chlorine residual in Reservoir 2. With that variation, the following issues must be considered during testing:
  - Variation in chloramine concentrations and contact time through the distribution system will impact the chloramine levels at the AWPF and the chloramine dosing needs at the AWPF.

  - That same variation in chloramine concentrations are anticipated to impact NDMA concentrations in the feed water to the AWPF.
  - Some evaluation of NDMA concentrations at the future AWPF location, measured through sampling of the non-potable reuse system at that location, is recommended.
- **RO Concentrate (Phase 1 and Phase 2):** As stated above, the RO concentrate from the full-scale AWPF will require long transport for disposal through a pressurized line. Scaling of that line will be problematic at best. Accordingly, the scaling potential of the RO concentrate must be studied, either through bench or flow through pipe reactors.
- **Seasonal Operation (Phase 2):** The JPA is committed to maintaining its current successful non-potable water reuse program. Thus, a future pure water potable reuse project may run seasonally, with pure water to the Las Virgenes Reservoir being in the wet weather months only. Accordingly, this Test Plan must evaluate the approach and impact of membrane storage during the non-potable reclaimed water season.
- **Alternative Feed Water (Phase 2):** The JPA is seeking to augment the wastewater purification process with alternative water supplies. For example, dry weather runoff and brackish groundwater can be added to the sewer collection system, processed at Tapia, then sent to the AWPF. Brackish groundwater can also be sent directly to the AWPF.
  - While the simulation of these new flows through Tapia to the AWPF are already being done at a low level (i.e., brackish groundwater), impacts to AWPF are not anticipated.
  - Simulation of alternative flows directly to the AWPF are possible with infrastructure modifications at the Demo. These modifications would require sufficient tankage or connect to the alternative water supply to run the Demo at full capacity for a month to two months at a time.
- **Stabilization (Phase 2):** The new purified water will ideally match or surpass the quality of the existing finished potable water supply that is fed into Las Virgenes Reservoir. The finished water must also meet chemical concentrations found within the California Toxics Rule. To that end, this Demo should investigate stabilization of the purified water (to avoid corrosion) and pipe loop studies to document DBP reformation.
- **RO Recovery (Phase 2):** The Demo facility is designed for 80 percent to 85 percent recovery. The future full-scale project must dispose of RO concentrate through a long transport line. There may be economic benefits of using a higher recovery RO system, such as the closed-circuit RO (Desalitech), reverse flow RO (ROTEC), or pulsed flow RO (IDE), as examples. These and other conventional high recovery systems could increase the recovery to >95 percent. The Demo has been plumbed for future evaluations of these or other high recovery RO systems, with testing to be performed in the back rooms of the Demo building.

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Section 2

TEST PLAN

Significant work has been accomplished based upon prior versions of the Test Plan. As such, some information is presented below along with a plan moving forward.

2.1 Pure Water Quality Assessment (Phase 1)

Each process, the MF/UF, RO, and UV AOP have performed well, and the combined system has been tested for a broad range of regulated and unregulated parameters and met all criteria for a high-quality potable water.

Appendix B contains a detailed summary of a limited Startup Testing. This work was done in advance of the Grand Opening and provided confidence in the purified water quality. Testing included:

- Process Performance Surrogates (e.g., turbidity, PDTs, TOC, electrical conductivity (EC), and UV dose).
- Pathogen Log Reduction Summaries.
- Regulated Chemical Constituent Monitoring.
- Unregulated Chemical Constituent Monitoring.

Results met or exceeded the water quality goals, demonstrating the ability to produce a high-quality purified water.

2.2 Membrane Operational Efficiency Analysis (Phase 1)

The membrane systems (MF, UF, and RO) are in the early phases of analysis, with experimentation being done to determine the optimum operational conditions (flux and chemical use). The MF/UF and RO systems have been in operation since June 26, 2020.

Since that time, the MF and UF systems have stepped through different flux values, 25 gallons per square foot per day (gfd), 30 gfd, and 35 gfd with little trouble. The RO system has seen some scaling challenges, but has been reprogrammed as of late September, and has now entered a new phase of operation. Moving forward (and looking back a bit), the membrane testing approach is shown in Table 3. Modifications to this testing approach is possible, and the project team will be flexible as we complete each phase and consider subsequent testing needs and understand the goals of the JPA and program management team. Only testing through March is defined, understanding that the results of testing will dictate subsequent membrane operational parameter, including flux and chemical use.

The results from the testing shown in Table 3 will be used to refine the MF/UF and RO design criteria (primary goal) as well as being used as part of the ongoing artificial intelligence grant efforts (secondary goal).

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Table 3 MF, UF, and RO Operational Plans

	September	October	November	December	January	February	March	April
MF/UF Flux	35 gfd for all three systems	35 gfd for all three systems	40 gfd for all three systems	TBD gfd for all three systems	TBD gfd for all three systems	TBD gfd for all three systems	TBD gfd for all three systems	Flux Adjustments TBD
MF/UF Chemical Feed and CIP	~2.5 mg/L chloramines, twice weekly MCs	~2.5 mg/L chloramines, once weekly MCs	~2.5 mg/L chloramines, once weekly MCs	~2.5 mg/L chloramines, TBD MCs	~2.5 mg/L chloramines, TBD MCs	~2.5 mg/L chloramines, TBD MCs	~2.5 mg/L chloramines, TBD MCs	Chemical Feed Adjustments TBD

RO Flux	Stage 1 - 11.2 gfd, Stage 2 - 10.6 gfd	Stage 1 - 11.2 gfd, Stage 2 - 10.6 gfd	Stage 1 - TBD gfd, Stage 2 - TBD gfd, Stage 3 - TBD	Stage 1 - TBD gfd, Stage 2 - TBD gfd, Stage 3 - TBD	Stage 1 - 11.2 gfd, Stage 2 - 10.6 gfd	Flux Values TBD
RO Stages and Recovery	2-stage 80% recovery	2-stage 80% recovery	3-stage 80% recovery	3-stage 85% recovery	2-stage 85% recovery	Stage and Recovery TBD
RO Chemical Feed and CIP	2-2.5 mg/L chloramines, RC 45 days or 1000 hours	2-2.5 mg/L chloramines, RC 45 days or 1000 hours	2-2.5 mg/L chloramines, RC 45 days or 1000 hours	2-2.5 mg/L chloramines, RC 45 days or 1000 hours	2-2.5 mg/L chloramines, RC 45 days or 1000 hours	anti-scalant acid, and other chemical dosing TBD

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2.3 Membrane Cleaning (Phase 1)

Membrane cleaning regimens are an important component of membrane performance.

2.3.1 MF and UF

The initial cleaning strategy is presented in Table 4. These parameters will be adjusted as necessary. Cleaning sequences, chemical type, chemical doses, cleaning sequence duration, and temperature may all be adjusted to maximize recovery clean (RC) permeability recovery.

Table 4 UF Initial Cleaning Protocols

Cleaning Strategy	Parameter	Value
Maintenance Cleaning (MC)	**Sodium Hypochlorite (NaOCl)**	
	Interval (per week)	1-2, as described in prior section
	Chemical Contact Duration (minutes)	30
	Target pH(1)	c.8
	Target Free Chlorine Residual (mg/L)(3)	500
Clean-in-Place (CIP)	**NaOCl**	
	Interval (days)	30
	Chemical Contact Duration (minutes)	180
	Heated Water Temperature (degrees Fahrenheit)	95
	Target pH(2)	10 - 11
	Target Free Chlorine Residual (mg/L)(3)	2,000
	Citric Acid	
	Interval (days)	30
	Chemical Contact Duration (minutes)	180
	Heated Water Temperature (degrees Fahrenheit)	95
	Target pH(4)	2 - 3
	Target Dose (mg/L)	2,000

Notes:
(1) Target pH determined by sodium hypochlorite addition only.
(2) Sodium hydroxide added to achieve target pH.
(3) Sodium hypochlorite will be dosed to achieve free chlorine residual target.
(4) Sulfuric acid will be dosed to achieve the target pH. On preliminary trials, 2000 mg/L achieved pH 2.8 so no sulfuric was dosed.

2.3.2 Reverse Osmosis

Online conductivity meters, temperature transducers, flow meters, and pressure gauges on the combined feed and on each stage of permeate will monitor the performance of the RO unit. From these instruments, the RO system programmable logic controller (PLC) will track permeate flow and pressures from each stage. This data can then be averaged and input into Toray provided normalization spreadsheets to calculate normalized permeate flow, differential pressure and salt passage.

The RO membrane modules require cleaning if one or more of the following parameters are applicable:

- Normalized permeate flow drops 10 percent.
- Normalized salt passage increases 5 percent.
- Normalize pressure drop increases (feed - concentrate) 10 to 15 percent.

Chemical cleaning strategies depend on the target foulant. At this time, a presumptive cleaning regime has been enacted using proprietary chemicals from Avista that are typically specified for use on RO membranes treating microfiltered WRF effluent as shown in Table 5.

Table 5 RO Initial Cleaning Protocols

Target Foulant	Cleaning Chemical	Cleaning Solution pH	Cleaning Solution Temperature (°F)
Inorganic Salts, Metal Oxides	RoClean L403	low (1 - 3)	100
Inorganic Colloids Biofilms Organics	RoClean L212	high (10 - 12)	100

The general RO CIP procedure is outlined below:

- First cleaning solution (RO Clean L403) followed by a subsequent clean with RO Clean L212.
- Fill CIP tank with permeate and then shutdown the RO.
- Heat the CIP tank to 100 degrees Fahrenheit and then flush with hot RO permeate to drain at 20 gpm with 50 percent of the CIP tank volume.
- Add cleaning chemical to supplier recommended dosage (approx. 1 5 gal pail/50 percent CIP tank volume) and mix.
- Recirculate the mixed cleaning chemical, one stage at a time, at 10 gpm/pressure vessel for 20 minutes to start contact time.
- Then conduct 2 cycles where one stage at a time is circulated for 60 minutes at 10 gpm/pressure vessel for 60 minutes while the other stages soak. This achieves a total contact time of 4 - 6 hours.
- Conduct an optional soak overnight (Preliminary cleaning results suggest that this does not significantly enhance cleaning performance).
- Upon completion, flush the system with feedwater to drain.
- Then repeat the process with the second cleaning solution.

2.4 Extended Water Quality Testing (Phase 1)

Extensive testing is necessary to define the feed water quality, the impact of that water quality on treatment performance, and the finished water quality pertaining to how it meets various regulations.

For convenience to the sampling team, the testing below is separately into tables focusing up the frequency of sampling; weekly (Table 4), twice monthly (Table 5), monthly (Table 6), quarterly (Table 7), and limited (Table 8). The testing focuses upon different values/benefits to the JPA's potable reuse program, noted within each of the respective tables, as follows:

- **Process Monitoring:** Testing which examines water quality that either indicates the potential for process challenges (e.g., high silica) or the performance of the system for a key regulatory parameter (e.g., removal of total nitrogen). Many process monitoring tests are frequent and can be reduced after sufficient data has established confidence in a stable water quality.
- **Performance Surrogate:** Testing which demonstrates performance for a regulated constituent (e.g., pathogen removal) through the removal of another constituent (e.g., strontium). In some cases, a constituent may be important for process monitoring and also be a performance surrogate (e.g., TOC).
- **Key Regulated Chemicals**: There are some constituents which are regulated but also substantially can impact engineering process decisions (e.g., NDMA). As such, these parameters are monitored more frequently than other regulated parameters (i.e., compared to maximum contaminant levels [MCLs]).
- **Pathogen Monitoring**: Measurement of protozoa, virus, or bacteria allows for direct quantification of pathogen reduction without the use of performance surrogates.
- **Regulated Chemicals**: Regulated chemicals include MCLs, secondary MCLs, notification levels (NLs), and other chemicals. Most regulated chemicals will be sampled quarterly, similar to a full-scale operational potable reuse system.
- **RO Concentrate Monitoring:** RO concentrate testing is focused upon NPDES compliance at the discharge location of the RO concentrate (e.g., to a brine line).
- **Public Perception:** The public remains concerned about the existence of trace level "chemicals of emerging concern" (CECs) or as more clinically defined "pharmaceuticals, and personal care products" (PPCPs). Sampling for a broad range of these constituents is included with the quarterly sampling to demonstrate the removal of these unregulated chemicals by the advanced treatment train.

For each of these testing tables, changes can and will occur. Data sets will be evaluated for overlap, consistency, and gaps, resulting in some testing being reduced and other testing being added.

Table 6 Weekly Sampling

Test	Method	Category	Sample Location			
			UF Feed	RO Feed	RO Permeate	UVAOP Outlet
Alkalinity	SM 8221	Process Monitoring	1			1
TSS	SM 2540 D		1			
TOC	SM 5310 B	Performance Surrogate and Process Monitoring		1	1	

Test	Method	Category	Sample Location			
			UF Feed	RO Feed	RO Permeate	UVAOP Outlet
Total Nitrogen	EPA 351.2	Process Monitoring	1	1	1	1
Silica	EPA 200.7		1	1	1	
Iron (total)	EPA 200.7		1	1		
Aluminum (total)	EPA 200.8		1	1		
Manganese (total)	EPA 200.8		1	1		
Bromide	EPA 300.1				1	1
Bromate	EPA 300.1				1	1

Table 7 Twice Monthly Sampling

Test	Method	Category	Sample Location		
			UF Feed	RO Feed	RO Permeate
Sulfate	EPA 300.0	Performance Surrogate		1	1
Strontium	EPA 200.8			1	1
Sucralose	SM 5310 B			1	1
BOD	SM 5210 B	Process Monitoring	1		
COD	EPA 410.4		1		
TOC	SM 5310C		1		

Table 8 Monthly Sampling

Test	Method	Category	Sample Location					
			Raw Water (pre-NH_2Cl)	UF Feed	RO Feed	RO Permeate	RO Concentrate	UVAOP Outlet
Iron (total)	EPA 200.7	Process Monitoring				1		
Aluminum (total)	EPA 200.8					1		
Manganese (total)	EPA 200.8					1		
Calcium	EPA 200.7				1	1		
Magnesium	EPA 200.7				1	1		
Sodium	EPA 200.7				1	1		
Potassium	EPA 200.7				1	1		
Barium	EPA 200.8				1	1		
Chloride	EPA 300.0				1	1		
Fluoride	EPA 300.0				1	1		
Boron	EPA 200.7				1	1		
NDMA	EPA 521	Key Regulated Chemicals	1		1	1		1
NMOR	EPA 521		1		1	1		1

Test	Method	Category	Sample Location					
			Raw Water (pre-NH_2Cl)	UF Feed	RO Feed	RO Permeate	RO Concentrate	UVAOP Outlet
Gross Beta	EPA 900	RO Concentrate Monitoring					1	
Tributyltin	Krone et al., 1989						1	
Aldrin	EPA 608						1	
Benzidine	EPA 625						1	
Beryllium	EPA 200.8						1	
Chlordane	EPA 608						1	
DDT	EPA 608						1	
3,3-Dichlorobenzidine	EPA 625						1	
Dieldrin	EPA 608						1	
Heptachlor expoxide	EPA 608						1	
Hexachlorobenzene	EPA 625						1	
PCBs	EPA 625						1	
Tetrachlorodibenzo-p-dioxin (TCDD) Equivalents	EPA 1613B						1	
Toxaphene	EPA 608						1	
PMMoV	Carollo Water ARC®	Performance Surrogate		1	3	1		
Total Coliforms	SM 9223B	Pathogen Monitoring						1

Table 9 Quarterly Sampling

Test	Method(s)	Category	Sample Location					
			Raw Water (pre-NH_2Cl)	UF Feed	RO Feed	RO Permeate	RO Concentrate	UVAOP Outlet
Primary MCLs	EPA 200.8, 100.2, 218.6, 245.1, 300, 524.2, 504.1, 505, 515.4, 525.2, 531.2, 547, 548.1, 549.2, 1613B, SM4500CN-F, SRL 524M-TCPs	Regulated Chemicals	1					1
Secondary MCLs	EPA 200.8, 524.2, 525.1, 300, SM5540C, SM2540C, SM210B		1					1
NLs	EPA 200.8, 524.2, 525.2, 521, 300, 522m, 556, 524-SIM		1					1
CECs and PPCPs	EPA 1694M-APCI, EPA 1694M-ESI-, EPA 1694M-ESI+	Public Perception	1			1		1
DBPs	EPA 552.2, EPA 542.2, EPA 300.1	Regulated Chemicals	1			1		1

Table 10 Limited Sampling

Frequency	Test	Category	Method(s)	Sample Location					
				Raw Water (pre-NH2Cl)	UF Feed	RO Feed	RO Permeate	RO Concentrate	UVAOP Outlet
Q1 Only	Total oxidizable perfluorinated assay (TOPA)	Process Monitoring	EPA 537M	1					1
	PFAS Suite (32 compounds)[1]		EPA 537M	1					1
Q1 only, most sensitive to be repeated in Q2, Q3 and Q4	Topsmelt (Atherinops affinis - survival and growth)	RO Concentrate Monitoring	EPA 600/R95/136 1995					1	
	Purple sea urchin (Strongylocentrotus purpuratus - growth and fertilization)		EPA 600/R95/136 1995					1	
	Sand dollar (Dendraster excentricus - growth and fertilization)		EPA 600/R95/136 1995					1	
	Red abalone (Haliotis rufescens - shell development)		EPA 600/R95/136 1995					1	
	Giant kelp (Macrocystis pyrifera - germination and growth)		EPA 600/R95/136 1995					1	
Q1 Only	Estrogen receptor-α	Regulated Chemicals	Escher et al. (2014) Environ. Sci. Tech. 48, 1940-1956			1	1		1
	Aryl hydrocarbon receptor		Escher et al. (2014) Environ. Sci. Tech. 48, 1940-1956			1	1		1

Note:
(1) Perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) are included in the quarterly sampling of NLs. This one-time sample event is to characterize all 32 types of per/polyfluoroalkyl substances (PFAS).

2.4.1 CECs and the State of California

The selection of CECs for analysis requires further discussion here. The State of California has specific CECs that they want to see monitored for full scale potable reuse projects, as shown in Table 11. All but two of these CECs (sulfamethoxazole and sucralose) are already part of different line items in the monitoring program. Commercial laboratories, such as Eurofins, have a standard CEC "suite", which uses United States Environmental Protection Agency (EPA) Method 1694 and includes sulfamethoxazole and sucralose as well as a broad range of other trace level chemicals. This Test Plan current calls for CEC testing per EPA 1694. The CECs for that method include:

2,4-D	Clofibric Acid	Isobutylparaben	Quinoline
1,7-Dimethylxanthine	Cotinine	Isoproturon	Salicylic Acid
4-nonylphenol (semi-quantitative)	Cyanazine	Ketoprofen	Simazine
4-tert-octylphenol	DACT	Ketorolac	Sucralose
Acesulfame-K	DEA	Lidocaine	Sulfachloropyridazine
Acetaminophen	DEET	Lincomycin	Sulfadiazine
Albuterol	Dehydronifedipine	Linuron	Sulfadimethoxine
Amoxicillin (semi-quantitative)	DIA	Lopressor	Sulfamerazine
Androstenedione	Diazepam	Meclofenamic Acid	Sulfamethazine
Atenolol	Diclofenac	Meprobamate	Sulfamethizole
Atrazine	Dilantin	Metazachlor	Sulfamethoxazole
Bendroflumethiazide	Diltiazem	Metformin	Sulfathiazole
Bezafibrate	Diuron	Methylparaben	TCEP
BPA	Erythromycin	Metolachlor	TCPP
Bromacil	Estradiol	Naproxen	TDCPP
Butalbital	Estriol	Nifedipine (semi-quantitative)	Testosterone
Butylparben	Estrone	Norethisterone	Theobromine
Caffeine	Ethinyl Estradiol - 17 alpha	OUST (Sulfameturon,methyl)	Theophylline (semi-quantitative)
Carbadox	Ethylparaben	Oxolinic acid	Thiabendazole
Carbamazepine	Flumeqine	Pentoxifylline	Triclocarban
Carisoprodol	Fluoxetine	Phenazone	Triclosan
Chloramphenicol	Gemfibrozil	Primidone	Trimethoprim
Chloridazon	Ibuprofen	Progesterone	Warfarin
Chlorotoluron	Iohexal	Propazine	
Cimetidine (semi-quantitative)	Iopromide	Propylparaben	

Table 11 Monitoring Requirements for CECs per SWRCB

Constituent	Relevance	MTL (in µg/L)	Example Removal Percentages (%)
1,4-dioxane	Health	1	--
NDMA(1)	Health and Performance	0.010	>25-50, 80
NMOR(2)	Health	0.012	--
PFOS	Health	0.013	--
PFOA	Health	0.014	--
Sulfamethoxazole(2)	Performance	-	>90
Sucralose(2)	Performance	-	>90
Dissolved Organic Carbon(2)	Surrogate(3)	-	>90
UV Absorbance(2)	Surrogate(3)	-	>50
EC(2)	Surrogate(3)	-	>90
Estrogen receptor-alpha bioassay(2)	Bioanalytical Screening	-	--
Aryl hydrocarbon bioassay(2)	Bioanalytical Screening	-	--

Notes:
(1) Health-based CECs and Bioanalytical Screening to be monitored following treatment.
(2) Performance indicator CECs to be monitored before RO and after treatment.
(3) Surrogates are provided as examples. Surrogates should be used to demonstrate effectiveness of individual processes for removing CECs.

2.5 Process Challenge Testing (Phase 1)

2.5.1 UF Challenge Testing

UF and MF treatment performance will be documented through a combination of turbidity and PDT results. These tests are supplemented by documenting the removal of Pepper mild mottle virus (PMMoV) across both UF and the single MF membrane. Initial results have been collected, documenting 1.6 log removal value (LRV) of PMMoV by MF and 2.9 LRV of PMMoV by the Toray UF membrane. Additional testing is listed in Table 8.

It has been suggested that to best support the PMMoV testing, inclusion of other indigenous viruses such as MS2 or other pathogenic viruses be included. One of the primary benefits of PMMoV testing is to utilize the large feed concentration and measurable effluent concentration for reliable quantification of removal. MS2 may be sufficiently quantifiable but is a culture-based method that is impacted by chlorine and chloramine disinfection, thus being problematic to confine reduction entirely to membrane filtration. Other pathogenic viruses that can be monitored by quantitative polymerase chain reaction (qPCR), such as adenovirus, are often not at sufficiently high levels in secondary or tertiary effluent to allow for reliable quantification of removal across MF or UF.

2.5.2 RO Challenge Testing

RO challenge testing is intended to identify the optimum parameters for log reduction credits for the RO system, including analysis of MS2 bacteriophage (MS2), PMMoV, EC, TOC, sulfate, sucralose, and strontium. The importance of this item is highlighted by the latest LRV for EC and TOC, at values of ~1.7 and 1.8, respectively. Higher LRVs have been documented at other sites using strontium (Pure Water San Diego) and sulfate (Perth Australia), documenting up to 3 LRV across RO. Novel testing with PMMoV is another method to increase RO LRV credits, which is included in Table 8. No testing of a fluorescent dye (e.g., Trasar) is planned at this time. Baseline RO performance for various surrogates would be developed over the entire test period, whereas damaged RO challenge testing would occur over a 3-day period. Challenge testing may include seeded MS2 testing, depending upon the ongoing results with PMMoV. Challenge testing will be performed over a 3-day period and will include repeated sampling for sulfate, strontium, sucralose, and TOC sampling. Some PMMoV sampling will be conducted to support the chemical analysis.

The specifics for how to "appropriately" simulate a RO membrane failure condition should be discussed with the JPA's program management team prior to performing the testing. Options include O-ring failure and free chlorine exposure of the RO membranes as follows:

- Baseline testing (historical data set) - no additional sampling.
- Baseline testing (week of testing):
  - PMMoV, strontium, sucralose, sulfate, TOC, and EC (potentially MS2 seeding).
  - Triplicate.
- Damage Condition #1:
  - PMMoV, strontium, sucralose, sulfate, TOC, and EC (potentially MS2 seeding).
  - Triplicate
- Damage Condition #2:
  - PMMoV, strontium, sucralose, sulfate, TOC, and EC (potentially MS2 seeding).
  - Triplicate.
- Damage Condition #3:
  - PMMoV, strontium, sucralose, sulfate, TOC, and EC (potentially MS2 seeding).
  - Triplicate.

At some point in the future, additional RO performance/challenge testing will be conducted to simulate RO operation during the "shoulder" and summer seasons when the full capacity of the system will not be required due to a lack of water for purification. The details of that testing are TBD and will be greatly informed by the development of supplemental water supplies by the program management team. Example operation may include consecutive days on followed by consecutive days of for the membrane systems.

2.5.3 UV AOP Challenge Testing

Due to the use of RO permeate in the UV reactor, general performance decline is not anticipated due to internal fouling (biological or scaling) within the UV reactor. Loss of UVI due to either UVI sensor drift or reduction in UV lamp output is being tracked through the use of the duty and standby UVI sensors.

General UV efficiency correlates to the feed UVT to the UV reactor, which is impacted by chloramine concentrations. Correlations will be developed between chloramines and UVT based upon the overall 12-month data set.

Regarding challenge testing, UV AOP challenge testing is intended to document 6-log reduction of virus, NDMA and N-nitrosomorpholine (NMOR) destruction to below California state requirements, disinfection byproduct formation (e.g., bromate, bromodichloromethane [BDCM] and dibromochloromethane [DBCM]) and a minimum of 0.5 log reduction of 1,4-dioxane.

Because the finished water will be required to reliably meet an NDMA limit of 0.69 nanograms per liter (ng/L) concentration at the Las Virgenes Reservoir (California Toxics Rule sets this standard below the commonly used detection limit of 2 ng/L), a component of this analysis must go beyond the standard dose/response of the UV reactor and look at NDMA formation ahead of the UV AOP. The Demo has the ability to dose ammonia and hypochlorite in series (with either first) or to dose them at the same location. Thus, the first series of tests under this section will examine NDMA formation as follows:

- Ammonia dosing followed by hypochlorite dosing.
  - Targeting chloramine concentrations in UF filtrate of 2 and 3 milligrams per liter (mg/L).
  - Utilizing excess free ammonia at molar ratios TBD in the field sufficient to protect RO membranes.
  - Sampling for these four test conditions would include NDMA, free chlorine, combined chlorine, ammonia, ORP.
- Hypochlorite dosing followed by ammonia dosing.
  - Targeting chloramine concentrations in UF filtrate of 2 and 3 mg/L.
  - Utilizing excess free ammonia at molar ratios TBD in the field sufficient to protect RO membranes. Sampling for these four test conditions would be NDMA, free chlorine, combined chlorine, ammonia, ORP.

Virus destruction testing will be performed second using the bacterial spore surrogate aspergillus, which has the ability to document UV dose delivery up to ~800 mJ/cm^2. The surrogate will be seeded into the UV reactor with testing of the following conditions:

- No free chlorine dosing. UV disinfection only.
- UV dose values based upon the WEDECO HMI calculation of 350, 400, 500, 600 and 800 mJ/cm^2.
- Triplicate sampling.

With the approximate dose delivery known based on reduction equivalent dose determined above using Aspergillus and correlated to the online UV monitoring and HMI UV dose calculations, and with NDMA concentrations known without seeding, subsequent testing of 24 test conditions of different operational test conditions (flow, UV dose, chloramine dose, sodium hypochlorite dose). Testing includes spiking of 1,4-dioxane, spiking of NDMA (if needed), and quenching of samples, as follows:

- Baseline testing (historical data set) - no additional sampling.
- Test Condition #1:
  - UV Dose - 600 mJ/cm^2 - based on HMI display.
  - RO Feed Combined Chlorine ~2 mg/L.
  - pH of ~5.5.
  - UV Feed Free Chlorine.
    - 2 mg/L.
    - 3.5 mg/L.
    - 5 mg/L.
  - Seeded 1,4 dioxane.
  - Seeded NDMA.

  - Samples pre- and post-quenching after UV AOP.
  - Single sampling.
- Test Condition #2:
  - UV Dose - 1200 mJ/cm^2 - based on HMI display.
  - RO Feed Combined Chlorine ~2 mg/L.
  - pH of ~5.5.
  - UV Feed Free Chlorine.
    - 2 mg/L.
    - 3.5 mg/L.
    - 5 mg/L.
  - Seeded 1,4 dioxane.
  - Seeded NDMA.
  - Samples pre- and post-quenching after UV AOP.
  - Single sampling.
- Test Condition #3:
  - UV Dose - 1800 mJ/cm^2 - based on HMI display.
  - RO Feed Combined Chlorine ~2 mg/L.
  - pH of ~5.5.
  - UV Feed Free Chlorine.
    - 2 mg/L.
    - 3.5 mg/L.
    - 5 mg/L.
  - Seeded 1,4 dioxane.
  - Seeded NDMA.
  - Samples pre- and post-quenching after UV AOP.
  - Single sampling.
- Test Condition #4:
  - UV Dose - 1,200 mJ/cm^2- based on HMI display.
  - RO Feed Combined Chlorine.
    - 2 mg/L.
    - 3 mg/L.
    - 4 mg/L.
  - pH of ~5.5.
  - UV Feed Free Chlorine - 0 mg/L.
    - Seeded 1,4 dioxane.
    - Seeded NDMA.
    - Samples pre- and post-quenching after UV AOP.
    - Single sampling.

Note: the tests above are intended to provide an important initial understanding of UV AOP performance. Should results be inconsistent or demonstrate an inability to reliably meet targets, then a more in-depth evaluation of hydroxyl radical scavengers may be required.

2.6 Production Reliability (Phase 1)

For the entirety of the first 9 months of operation, the treatment and monitoring system time off-spec or out of calibration, respectively, will be tabulated. The impact of such events on water production will be estimated and coupled with the time to repair/replace/calibrate to result in a determination of production reliability.

2.7 RO Concentrate Testing for NPDES Compliance (Phase 1 & Phase 2)

Detailed analysis was conducted to estimate which chemicals in the RO concentrate may pose an NPDES compliance risk, attached as Appendix C. As the JPA's project develops and the RO concentrate permitting issues are refined, this test list may need modification (Phase 2). Based upon the analysis within Appendix C, monthly sampling for specific constituents in RO concentrate is included in Table 8. Much more limited sampling, focused upon toxicity, is shown in Table 10. It should be noted that these tests will be conducted under different RO operational scenarios (number of stages, recovery).

2.8 RO Concentrate Scaling Evaluation (Phase 1 & Phase 2)

Scaling in the future line that would carry RO concentrate (brine) to the Calleguas brine line is a concern to the District. In parallel with this project, Calleguas is looking at the existing line for design features that would encourage scale, which includes a review of the hydraulic profile. Carollo Engineers, Inc. (Carollo) is assisting Calleguas and using a modeling tool called Blue Plan-it® to define hot spots through blending analysis of the different sources (existing and future). Since the pipeline is already installed, there will likely be recommendations for maintenance procedures, options for alternative valves and instruments, and potentially a recommendation to do source control of scale formers, such as softening of brine before it goes into the pipeline.

The initial evaluation will examine RO brine water quality data using water quality modeling tools to determine if it is sufficiently stable to travel from a full scale AWPF to the Calleguas brine line without precipitating scale within the brine line. In addition, water quality data will be sent to Avista for scaling potential analysis. The specific details of this testing will be adjusted after greater discussion with Avista.

However, the general plan is as follows:

1. Ship one or more 250-gallon tote (or 55-gallon drums) of water to the supplier (or lab).
2. Water to have 2 to 5 mg/L of chloramines in it.
3. Develop a matrix of inhibitor doses and recoveries to be tested. For example:
    a. 0.5 mg/L dose at 75 percent, 80 percent, 85 percent, and 90 percent recovery.
    b. 1 mg/L dose at 75 percent, 80 percent, 85 percent, and 90 percent recovery.
    c. 1.5 mg/L dose at 75 percent, 80 percent, 85 percent, and 90 percent recovery.
    d. 2 mg/L dose at 75 percent, 80 percent, 85 percent, and 90 percent recovery.
    e. 2.5 mg/L Dose at 75 percent, 80 percent, 85 percent, and 90 percent recovery.
4. Lab doses inhibitor to the water and concentrates the 250 gallons to the correct concentration(s) representing a range of recoveries.
5. Qualitative Test:
    a. Collect samples in beakers.
    b. Observe mineral scale formation (by photographs) on the air water surface over time:
        i. 0, 4, 8, 12, 16, 24, 48, 72 hours.

6. Quantitative:
   a. Collect samples in beakers:
      i. Test A: Measure micronic particle counts in the brine over time.
      ii. Test B: Measure dry weight of beaker before and after testing.
7. Summarize results.

Variations on the testing above may include:

- Performing all tests on site with JPA staff.
- Extended duration testing to determine if residual anti-scalants remain active.
- Aeration of RO concentrate to simulate aeration from an airgap discharge within the RO concentrate transmission line.
- Blending of existing brine in the Salinity Management Pipeline (SMP) with the AWPF RO concentrate after simulation of travel time.
- Pipe loop studies.

The bench testing could be accomplished by placing a fixed volume of brine on the benchtop and monitoring it daily for turbidity, running particle size distribution tests, and monitoring pH. The goal is to determine if crystallization is occurring over time. Furthermore, the pH of samples may be adjusted and additional antiscalant added to determine the impact of chemical addition on brine stability.

The District has expressed concern that the future long brine line will not always run full and may have increased scaling risk on those occasions. It remains TBD if more extensive testing, such as a pipe loop testing using high-density polyethylene (HDPE) piping, which is recommended for full scale brine line, should be performed as part of Phase 2 of this Test Plan.

2.8.1 Product Water Stabilization (Phase 2)

Water quality results from UV/AOP effluent will be analyzed using commonly available water quality models (i.e., MINEQL+, RTW) to determine the level of chemical treatment required to stabilize the water for positive Langelier Saturation Index (LSI) and calcium carbonate precipitation potential (CCPP) in order to decrease the corrosivity of the final product water. It is anticipated that the JPA will decide to test the desktop calculated stabilization doses at the bench and/or with a pilot post-treatment system as part of Phase 2 of testing, with the date TBD.

Quenching of chlorine (or chloramines) and stabilization methods may also impact NDMA reformation in the pipeline from the future full-scale AWPF and the reservoir. In particular, focus should be upon rapid stabilization of the purified water to control dichloramine formation (and thus NDMA reformation), and/or quenching of all chlorine species immediately after UV treatment.

2.8.2 Pathogen Monitoring (Phase 2)

Depending upon the need for additional pathogen reduction credit, the JPA may choose to complete extensive pathogen sampling across the Tapia WRP. This testing should include testing of screened raw wastewater, secondary effluent, and filtered unchlorinated effluent.

Based upon discussions with DDW and Carollo[3], DDW has concluded that log reduction credits for the combined primary/secondary treatment process should be based upon the following minimum level of testing:

- Testing to span 12 months of operation, covering the different types of effluent quality on a seasonal basis.
- At each sampling location:
  - 20 samples of Total Cultural Virus, before and after the Primary/Secondary Process.
  - 20 samples of Adenovirus, before and after the Primary/Secondary Process, with a preference for collecting both qPCR and culturable data.
  - 20 samples of *Giardia* and *Cryptosporidium*, before and after the Primary/Secondary Process, with a preference for collecting both qPCR and culturable data.
- Development of a suite of secondary process (e.g., TOC) and tertiary (e.g., turbidity) parameters to be used (ideally) as surrogates for pathogen removal.
- Use of positive and negative controls (e.g., colorseed for protozoa recovery).
- Pathogen surrogates, such as male specific coliphage & somatic coliphage (surrogates for virus), and Clostridium (surrogate for protozoa), are encouraged. Reduction of pathogen sampling in lieu of lower cost surrogate sampling may be allowed, pending development of data.

It should be noted that the cost to implement such a testing program will exceed $100,000 and is not include in Phase 1 of this Test Plan.

2.8.3 Seasonal Operations Simulation (Phase 2)

As shown in Figure 2, the JPA has high demand for non-potable reuse during the summer, but demand drops off during the winter, freeing up tertiary effluent for the future full scale AWPF. The JPA is prohibited from discharging to Malibu Creek from April 15 to November 15 except when creek flows drop below 2.5 cubic feet per second (cfs), at which point Tapia WRF must discharge reclaimed water to increase creek flow back up to 2.5 cfs. However, by May 22, 2022, the JPA will supplement the creek with potable water instead of reclaimed water in order to meet the Total Maximum Daily Load (TMDL) nutrient limits.

[3] 7/11/2019 conversation between Andrew Salveson and Brian Bernados of DDW.

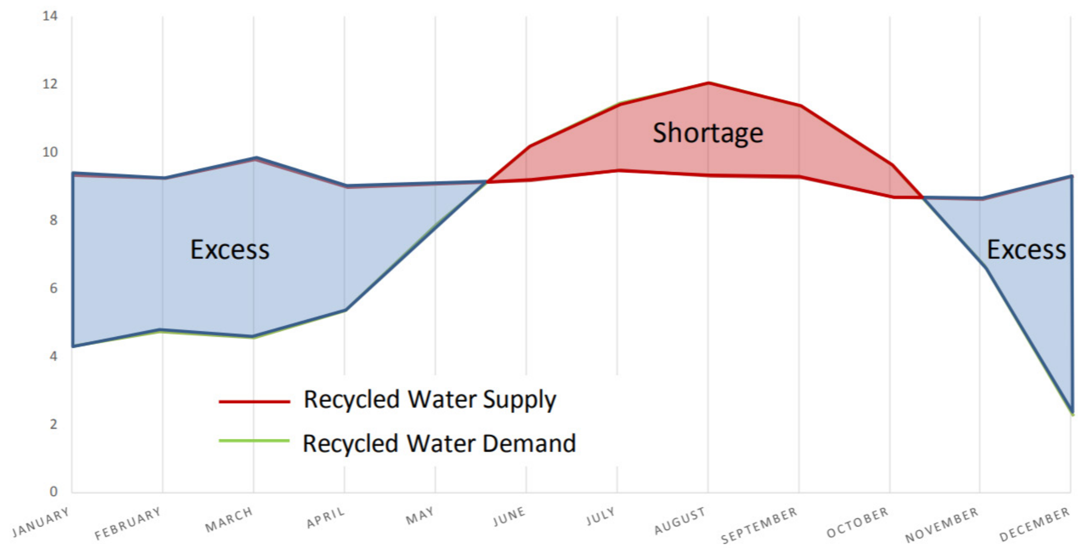

Figure 2 Tapia WRF Seasonal Flow Variation

For the 6 months between mid-May and mid-October, the full scale AWPF could be entirely offline, depending upon ongoing efforts to supplement the future AWPF with other flows, such as brackish groundwater or dry weather runoff. Pending upcoming analysis and findings from the JPA's program management team on supplemental flows, there may be a need to examine the on and off cycles that may occur due to a seasonal lack of flow to the AWPF.

2.8.3.1 Dry Season Operation

Under this seasonal flow scenario, the AWPF would not operate from mid-May to mid-October. Before this extended shutdown, operators should perform a CIP on the UF and RO membrane systems and preserve with manufacturer recommended chemicals.

2.8.3.2 Shoulder Season Operation

For the 1.5 months before and after the summer period from mid-May to mid-October (April through mid-May and mid-October through November), the full scale AWPF may treat a fraction of its design capacity, so only a portion of its treatment trains would be in service. During this period, each UF module should operate for one day then go offline for 1 day. Backwashes will take place at the time interval established during the first year of testing (Phase 1). Monitoring trends in operational parameters, such as TMP, will indicate whether a chlorinated MC is required at a shorter interval than previously determined during the first year of testing when all modules were operated continuously.

As an alternative to the approach listed above, or as a supplemental study, the MF/UF systems could be continuously run at a dramatically reduced flux.

In reuse applications, RO membranes should not be out of service for longer than 72 hours without first conducting a CIP (per Toray O&M manual), so the operating strategy should include rotation of each RO train back into service in intervals that maintain offline time without a CIP less than 72 hours. Operators must flush the RO membranes prior to removing them from service.

2.8.3.3 Seasonal Demonstration Approach

The Demonstration Project will simulate full scale seasonal operation in the second year (Phase 2) of testing, after determining the first-year optimal operating conditions. After the first year of operation, Carollo, the JPA, and the JPA's program management team will conduct a desk top analysis of the influent flow variation and number of UF trains and flux rate recommended for full scale at each of the seasonal flow conditions. The information from this analysis will inform the recommended flux rate for the second year of testing. Though the UF system online/offline regime is different from that of the RO system, an adequate number of UF modules need to remain in service to provide continuous flow to the RO system. The required flow to the RO system depends on whether two- or three-stage operation is proven most effective, based on the behavior of normalized RO operational parameters, during the first year of testing.

2.8.4 Supplemental Flow Simulation (Phase 2)

Pertaining to the potential to add supplemental flows to the AWPF during the dry (summer) and shoulder (Spring and Fall) seasons, such testing would be potentially simulated at the Demo during Phase 2 of testing. At this time, there is insufficient information to further develop the testing or the schedule beyond what is listed below.

- Brackish groundwater testing.
  - Fed directly to the Demo.
    - The Demo would need some modifications to house sufficient volumes of brackish groundwater to continuously feed to the AWPF for periods of 30 to 45 days, at a minimum. Tankage could be placed outside of the building and plumbed into the Demo through side rooms, feeding the UF feed tank.
    - Water to be fed into the UF feed tank at levels appropriate to the anticipated blend amount at full scale.
  - Fed into the sewer system.
    - Assuming the only significant chemical constituents within the brackish groundwater is salt, the preferred simulation approach may be the addition of salt to the UF feed tank at a level representative of the brackish groundwater addition amount to Tapia.
- Dry weather runoff testing.
  - Fed into the sewer system.
    - TBD how to simulate this addition in a meaningful way at the Demo.
  - Fed directly to the AWPF.
    - Pretreatment may be required, level TBD.
    - Water to be fed into the UF feed tank at levels appropriate to the anticipated blend amount at full scale.

Table 12 Phase 2 Seasonal Simulation Operating Schedule

System	S1: January through March	S2: April through Mid-May	S3: Mid-May through Mid-October	S4: Mid-October through November	S5: November through December
UF	Standard operating procedures	Operate MF/UF at low flux setpoint with reduced maintenance clean frequency. Conduct backwash and MCs at time interval determined during Phase 1 and monitor operational parameters to determine if MC frequency needs to be adjusted.	Out of service. Conduct CIP before placing into service and after taking out of service. Place membranes in manufacturer approved preservation chemical.	Operate MF/UF at low flux setpoint with reduced maintenance clean frequency. Conduct backwash and MCs at time interval determined during Year 1 and monitor operational parameters to determine if MC frequency needs to be adjusted.	Standard operating procedures
UF - ALT(1)	Standard operating procedures	Operate all skids at reduced capacity while adjusting backwash interval to maintain target recovery and at reduced MC frequency.	Out of service. Conduct CIP before placing into service and after taking out of service. Place membranes in manufacturer approved preservation chemical.	Operate all skids at reduced capacity while adjusting backwash interval to maintain target recovery and at reduced MC frequency.	Standard operating procedures
RO	Standard operating procedures	Cycle placing into service for 3 days and out of service for 3 days. Conduct RO flush before placing into service and after taking out of service.(2)	Offline. Conduct CIP before placing into service and after taking out of service. Place membranes in manufacturer approved preservation chemical.	Cycle placing into service for 3 days and out of service for 3 days. Conduct RO flush before placing into service and after taking out of service.	Standard operating procedures
UV AOP	Standard operating procedures	Cycle placing into service for 3 days and out of service for 3 days. Drain and rinse UV system after taking out of service.	Offline. Drain and rinse UV system after taking out of service.	Cycle placing into service for 3 days and out of service for 3 days. Drain and rinse UV system after taking out of service.	Standard operating procedures

Notes:
(1) The listed alternative to the UF evaluation could be a supplemental study or an alternative. Discussion with the project team is needed after completion of Phase 1 of the Test Plan.
(2) The on/off operation places stress on product water connector O-rings. The RO challenge testing from Phase 1 and the various surrogate work may be sufficient to determine O-ring integrity impacts. TBD if further challenge testing is needed during Phase 2.

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Section 3

DAILY OPERATIONAL DATA

Online data is currently recorded by the H_2O Innovation Intelogx soft water package. Daily run sheets are currently recorded by hand but are anticipated to transition to digital input and recording. The run-sheets are included in Appendix D of this Test Plan.

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Section 4

QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance and Quality Control (QA/QC) are necessary aspects of any project, and particularly so for this project as it pertains to the protection of public health. The project team will work closely with certified laboratories running accepted standard methods to ensure data precision and accuracy (defined below). Method detection limits (MDLs) will be used to determine the statistical significance of any detectable response. Certified laboratories will be performing the analysis in this project and will be responsible for internal QA/QC for each sampling parameter.

4.1 Sample Replicates

The Demonstration Project will run for 12 months, with online monitoring of a range of parameters, daily inspection of online equipment, and monthly or more frequent sampling for a wide range of offline laboratory parameters.

Sample replicates will be conducted for 5 percent of all samples, with a minimum of one replicate for each MCL, NL, or CEC.

4.2 Precision

The precision of duplicate samples is assessed by calculating the relative percent difference (RPD) according to:

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100\%$$

where,
S = Sample concentration.
D = Duplicate sample concentration.

If calculated from three or more replicates, the precision is determined using the relative standard deviation (RSD):

$$RSD = \frac{SD}{Average} \times 100\%$$

where,
SD = Standard deviation for the replicate samples.

4.3 Accuracy

For measurements where matrix spikes (constituent seeding) are used, accuracy is evaluated by calculating the percent recovery (R):

$$R(\%) = \frac{S - U}{C_{SA}} \times 100\%$$

where,
S = Measured concentration in spiked sample.
U = Measured concentration in unspiked sample.
C_{SA} = Calculated concentration of spike in sample.

When a standard reference material (SRM) is used, the Recovery is determined by:

$$R(\%) \frac{C_m}{C_{SRM}} \times 100\%$$

where,
C_m = Measured concentration of SRM.
C_{SRM} = Actual concentration of SRM.

4.4 Method Detection Limit

The MDL will be as reported by the contract laboratory.

A typical approach to determine the MDL involves at least seven replicates of a laboratory fortified blank at a concentration of three to five times the estimated instrument detection limit is analyzed through the entire analytical method. The MDL for each constituent tested will be determined by the laboratory in accordance with the standard method listed for each constituent. It is important to show that the detection limit for each chemical parameter is sensitive enough such that it can measure below the regulatory limit and show appropriate removal of each compound in question.

The MDL is calculated using the following equation:

$$MDL = (t) \times (SD)$$

where,
t = t value for 99 percent (t for 7 replicates = 3.14).
SD = Standard deviation for the replicate samples.

4.4.1 Comparability

On-site online monitors and field kits will analyze much of the critical data, and outside laboratory analysis will be used for remaining analyses. It is important to prove consistency between laboratories and have a common practice to ensure QC across various laboratories. Comparability is the degree of consistency between a data set obtained at one laboratory and data sets from another. It is achieved by use of consistent methods and materials (i.e., standards). Comparability of data will be promoted by adherence to the standard and certified analytical methods decided by each outside laboratory.

4.5 Sample Transport

Sampling will be performed by Carollo and JPA staff, depending upon who is on site at the necessary dates of sampling. Operators will package the samples in coolers/shipping boxes and provide shipping information. Samples should be in coolers with fresh ice (or freezer bricks) and a chain of custody (COC). Due to hold time and preservation concerns, the samples should be shipped FedEx "Priority Overnight" to outside labs. The samples should be shipped only Monday through Wednesday as some of the labs are closed on Friday. The cases should be insured for a minimum of $700 in case of loss or damages due to shipper error and note no signature needed upon arrival.

Two to 5 weeks is the industry standard for report turnaround times from labs. If the results are needed sooner, surcharges may be applied.

4.5.1 External Laboratory Samples

Lab-prepared sample bottles will be sent from each lab (BioVir, Weck, Eurofins, GAP, Water ARC®, and University of Arizona) to the WRF, who will then take the bottles and coolers to the test site. Before sampling, approximately 1 to 2 liters of water will be flushed from the sample port to minimize potential contamination from sample lines. Each sample bottle will be filled with minimum bubbling, without external agents touching and disturbing the internal integrity of the inside of the bottle. All bottles will be immediately capped post sampling, placed in a cooler with the date and sample ID, and sent to the lab within the allowable holding time provided by the lab for each parameter to be measured. All coolers will contain a COC (log of samples) and will be clearly marked with identification tags before shipment. Samples will be shipped priority overnight unless otherwise directed to respective labs by Carollo and follow up communication and tracking will take place after each shipment to confirm receipt of all samples.

Sample teams will abide by the following sampling protocol for trace organics (CECs):

- Place ice packs into freezer upon arrival and confirm that they are frozen before sampling begins.
- Wear gloves, always, during sampling and avoid touching or even breathing on the samples. Measuring compounds at ng/L levels renders them very prone to contamination.
- Use caution (reference Material Safety Data Sheets) when handling sample bottle, which contains toxic preservative.
- Do not rinse or overfill sample bottle and leave approximately 1-inch headspace.
- Use sampling tap that is free of aerators, strainers, or hose attachments.
- Flush for 3 to 5 minutes to obtain a representative sample (preferably using a tap that is constantly flowing).
- For Field blank, please transfer water provided into Field blank sample bottle.
- Make sure cap is tightly sealed.
- Fill out Sample Information Sheet/COC and include any additional water quality data available.
- Place samples in 1 to 4-degree Celsius refrigerator to cool sample prior to shipping (minimum 2 hours).
- When ready to ship place sample bottles into blue shipping case, add ice packs and Sample Information Sheet/COC in a sealed plastic bag.

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Appendix A

PROCESS FLOW DIAGRAMS

VALVE SYMBOLS

N.OPEN N.CLOSED

- BALL
- V-BALL
- BUTTERFLY
- DIAPHRAGM
- GATE
- GLOBE
- NEEDLE
- PLUG
- SAMPLE/DRAIN
- CHECK
- BACKFLOW PREVENTER
- 3-WAY, 4-WAY
- PRESSURE REGULATING
- BACK PRESSURE REGULATING
- FLOW CONTROL
- 2-WAY SOLENOID
- 3-WAY SOLENOID
- 4-WAY SOLENOID
- AIR RELEASE
- VACUUM BREAKER
- PRESSURE RELEASE
- SLUICE GATE/WEIR

VALVE ACTUATOR SYMBOLS

- PNEUMATIC (FAIL LAST POSITION)
- PNEUMATIC FAIL CLOSE
- PNEUMATIC FAIL OPEN
- ELECTRIC
- DIAPHRAGM
- POSITIONER (ANY ACTUATOR TYPE)
- HAND OVERRIDE (ANY ACTUATOR TYPE)
- TRAVEL STOPS (ANY ACTUATOR TYPE)

FLOWMETER SYMBOLS

INTEGRAL | CLOSE COUPLED | REMOTE

- MAGNETIC
- PADDLE
- VORTEX
- DP/ORIFICE
- THERMAL
- ROTAMETER

INSTRUMENTATION SYMBOLS

LOCALLY MOUNTED	IN CONTROL PANEL	DESCRIPTION
X nnnnn	X nnnnn	DISCRETE INSTRUMENT
	X nnnnn	PRIMARY PLC OR DCS SHARED CONTROL
	X nnnnn	SECONDARY PLC OR DCS SHARED CONTROL
	X nnnnn	COMPUTER FUNCTION

INSTRUMENT FUNCTIONS

- K — SIGNAL PROCESSING FUNCTION
- A/M — AUTO/MANUAL
- Σ — ADDITION/SUMMATION
- Δ — DIFFERENTIAL
- I — INTERLOCK LOGIC FUNCTION
- X/n — AVERAGING

INSTRUMENT CONNECTIONS

- SOCKETWELD
- THREADED
- WELDED

PIPING SYMBOLS

- FLANGED CONNECTION
- THREADED CONNECTION
- BLIND FLANGE
- DOUBLE CONTAINMENT
- QUICK DISCONNECT VICTAULIC
- x" INSULATION THICKNESS — INSULATION
- QUICK DISCONNECT CAMLOK
- x" INSULATION THICKNESS — HEAT TRACING E=ELECTRIC S=STEAM G=GLYCOL
- CAPPED PIPE END
- DRAIN OUTLET
- UNION
- REDUCER
- EXPANSION/FLEXIBLE/ ISOLATION JOINT
- ECCENTRIC REDUCER

PIPING ABBREVIATIONS

316 SS	316 STAINLESS STEEL
304 SS	304 STAINLESS STEEL
316L SS	LOW CARBON 316 STAINLESS STEEL
304L SS	LOW CARBON 304 STAINLESS STEEL
CPVC	CHLORINATED POLYVINYL CHLORIDE
CS	CARBON STEEL
DI	DUCTILE IRON
HDPE	HIGH-DENSITY POLYETHYLENE
PE	POLYETHYLENE
PVC	POLYVINYL CHLORIDE
RLCS	RUBBER LINED CARBON STEEL
SCH.	SCHEDULE
SDR	STANDARD DIMENSION RATIO

LINE SYMBOLOGY

- MAIN PROCESS LINE
- SECONDARY PROCESS LINE
- PROCESS LINE, BY OTHERS
- COMM LINK (EX. PLC TO HMI)
- COMM LINK (EX. PLC TO DCS)
- ELECTRIC WIRING
- PNEUMATIC LINE
- LINE JUMPER
- PIPE DISCONTINUATION
- FLOW DIRECTION ARROWS
- 4" 316 SS SCH.10 — LINES SIZE/ MATERIAL IDENTIFIER
- SKID BOUNDARY — NOT BY H_2O Innovation / SKID BY H_2O Innovation
- REVISION
- LINES TO/FROM OTHER SHEETS — DESCRIPTION — C01-0001 SHT 1 — DESTINATION

PUMP SYMBOLS

- CENTRIFUGAL
- CHEMICAL METERING
- DIAPHRAGM
- POSITIVE DISPLACEMENT
- VACUUM
- SUBMERSIBLE OR FLOATING
- VERTICAL TURBINE
- PERISTALTIC/HOSE

MISCELLANEOUS EQUIPMENT SYMBOLS

- CARTRIDGE FILTER HOUSING
- IMMERSED HEATER (TC nnnnn)
- IN-LINE HEATER (TC nnnnn)
- AUTOMATIC STRAINER
- ULTRASONIC LEVEL TRANSMITTER (LIT nnnnn)
- SILENCER
- FLOAT-STYLE LEVEL TRANSMITTER (LIT nnnnn)
- MIXER
- CHEMICAL CONTAINMENT (ST-nnnnn)
- STATIC MIXER
- CALIBRATION COLUMN
- RESIN TRAP
- MOTOR
- MEMBRANE
- EDUCTOR OR VENTURI
- Y STRAINER
- UV STERILIZER
- CONICAL OR TEMPORARY STRAINER
- DIFFUSERS: COARSE BUBBLE
- PULSATION DAMPENER
- DIAPHRAGM
- FINE BUBBLE
- FLOW ORIFICE
- POSITIVE DISPLACEMENT BLOWER
- AIR COMPRESSOR
- RUPTURE DISK (PRESSURE)
- REGENERATIVE BLOWER
- RUPTURE DISK (VACUUM)
- SPECTACLE BLIND (NORMALLY OPEN, NORMALLY CLOSED)
- CENTRIFUGAL BLOWER
- INJECTION QUILL
- TURBOCHARGER
- FILTER
- BIO-WHEEL
- REFRIGERATED AIR DRYER
- MMF TANK
- TANK
- MANWAY

FLOW INSTRUMENTS

FAH	FLOW ALARM HIGH
FAL	FLOW ALARM LOW
FCV	FLOW CONTROL VALVE
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FIC	FLOW INDICATING CONTROLLER
FIT	FLOW INDICATING TRANSMITTER
FR	FLOW RECORDING
FSH	FLOW SWITCH HIGH
FSL	FLOW SWITCH LOW
FV	FLOW CONTROL OR ON/OFF VALVE
FQ	FLOW TOTALIZER
FY	FLOW SIGNAL CONVERT, I/P, OR SOLN

PRESSURE INSTRUMENTS

PAH	PRESSURE ALARM HIGH
PAL	PRESSURE ALARM LOW
PC	PRESSURE CONTROLLER
PCV	SELF REG PRESS CONTROL VALVE
PDH	DIFFERENTIAL PRESSURE HIGH
PDI	DIFFERENTIAL PRESSURE INDICATOR
PDIT	DIFF PRESS INDICATING TRANSMITTER
PDSH	DIFFERENTIAL PRESS SWITCH HIGH
PG	PRESSURE GAUGE
PI	PRESSURE INDICATOR
PIC	PRESSURE INDICATING CONTROLLER
PIT	PRESSURE INDICATING TRANSMITTER
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
PSV	SELF REG PRESS SAFETY VALVE
PT	PRESSURE TRANSMITTER
PY	PRESS SIGNAL CONVERT, I/P, OR SOLN
PSLH	PRESSURE SWITCH LOW HIGH

LEVEL INSTRUMENTS

LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW
LCV	SELF REG LEVEL CONTROL VALVE
LE	LEVEL ELEMENT
LG	LEVEL GAUGE
LI	LEVEL INDICATOR
LIC	LEVEL INDICATING CONTROLLER
LIT	LEVEL INDICATING TRANSMITTER
LSH	LEVEL SWITCH HIGH
LSL	LEVEL SWITCH LOW
LT	LEVEL TRANSMITTER
LV	LEVEL CONTROL OR ON/OFF VALVE
LY	LEVEL SIGNAL CONVERT, I/P, OR SOLN

TEMPERATURE INSTRUMENTS

TAH	TEMPERATURE ALARM HIGH
TAL	TEMPERATURE ALARM LOW
TC	TEMPERATURE CONTROLLER
TE	TEMPERATURE ELEMENT
TG	TEMPERATURE GAUGE
TI	TEMPERATURE INDICATOR
TIC	TEMP INDICATING CONTROLLER
TIT	TEMP INDICATING TRANSMITTER
TSH	TEMPERATURE SWITCH HIGH
TSL	TEMPERATURE SWITCH LOW
TT	TEMPERATURE TRANSMITTER
TV	TEMP CONTROL OR ON/OFF VALVE
TY	TEMP SIGNAL CONVERT, I/P, OR SOLN

ELECTRICAL ABBREVIATIONS

JB	JUNCTION BOX
MCP	MAIN CONTROL PANEL
RIO	REMOTE I/O PANEL
PP	POWER PANEL
VFD	VARIABLE FREQUENCY DRIVE
HOA	HAND-OFF-AUTO

ANALYTICAL INSTRUMENTS

AAH	ANALYTICAL ALARM HIGH
AAL	ANALYTICAL ALARM LOW
AE	ANALYTICAL ELEMENT
AI	ANALYTICAL INDICATOR
AIC	ANAL INDICATING CONTROLLER
AIT	ANAL INDICATING TRANSMITTER
ASH	ANALYTICAL SWITCH HIGH
ASL	ANALYTICAL SWITCH LOW
AT	ANALYTICAL TRANSMITTER
AY	ANALYTICAL SIGNAL CONVERT, I/P, OR SOL

MISCELLANEOUS INSTRUMENTS

HS	HAND SWITCH
HI	HAND SWITCH POSITION INDICATOR
II	CURRENT INDICATOR
QQI	TOTALIZER INDICATOR
SC	SPEED CONTROLLER
SI	SPEED INDICATOR
YA	MOTOR ALARM
YC	MOTOR CONTROL
YI	MOTOR ON/OFF INDICATOR
ZIC	SWITCH CLOSE INDICATOR
ZIO	SWITCH OPEN INDICATOR
ZSC	POSITION SWITCH CLOSED
ZSO	POSITION SWITCH OPEN
ZT	POSITION TRANSMITTER
ZI	POSITION INDICATOR

VALVES & EQUIPMENT

AC	AIR COMPRESSOR
ARV	AIR RELEASE VALVE
AS	AIR SUPPLY
B	BLOWER
BT	BULK TOTE
CBD	COARSE BUBBLE DIFFUSER
CV	CHECK VALVE
ED	EDUCTOR
F	FILTER
FBD	FINE BUBBLE DIFFUSER
FL	FAIL LAST (DEFAULT IF NOT SHOWN)
FC	FAIL CLOSED
FO	FAIL OPEN
FQG	CALIBRATION COLUMN
H	HEATER
HCV	HAND CONTROL VALVE
HTR	HEATER
HV	HAND VALVE
M	MOTOR
MX	MIXER
P	PUMP
RT	RESIN TRAP
ST	SPILL TANK
STR	STRAINER
T	TANK
UV	ULTRAVIOLET
HV	HAND VALVE
MV	MULTI FUNCTION VALVE

OTHER ABBREVIATIONS

CAP	CAPACITANCE
CIP	CLEAN-IN-PLACE
COND	CONDUCTIVITY
DO2	DISSOLVED OXYGEN
ESP	EMERGENCY STOP
IA	INSTRUMENT AIR
I/P	CURRENT TO PNEUMATIC CONVERTER
ORP	OXIDATION REDUCTION POTENTIAL
pH	HYDROGEN ION
RES	RESISTIVITY
RTD	RESISTANCE TEMP DETECTOR
SOL	SOLENOID
SP	SET POINT
uS	MICROSIEMENS

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		REFERENCE DRAWING				
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TOLERANCES FRACTIONS: ±1/16" DECIMALS 0.X: ±0.030 0.XX: ±0.015 ANGLES: ±0.5° HOLE SIZES: ±1/32" HOLE CENTERS: ±1/32"
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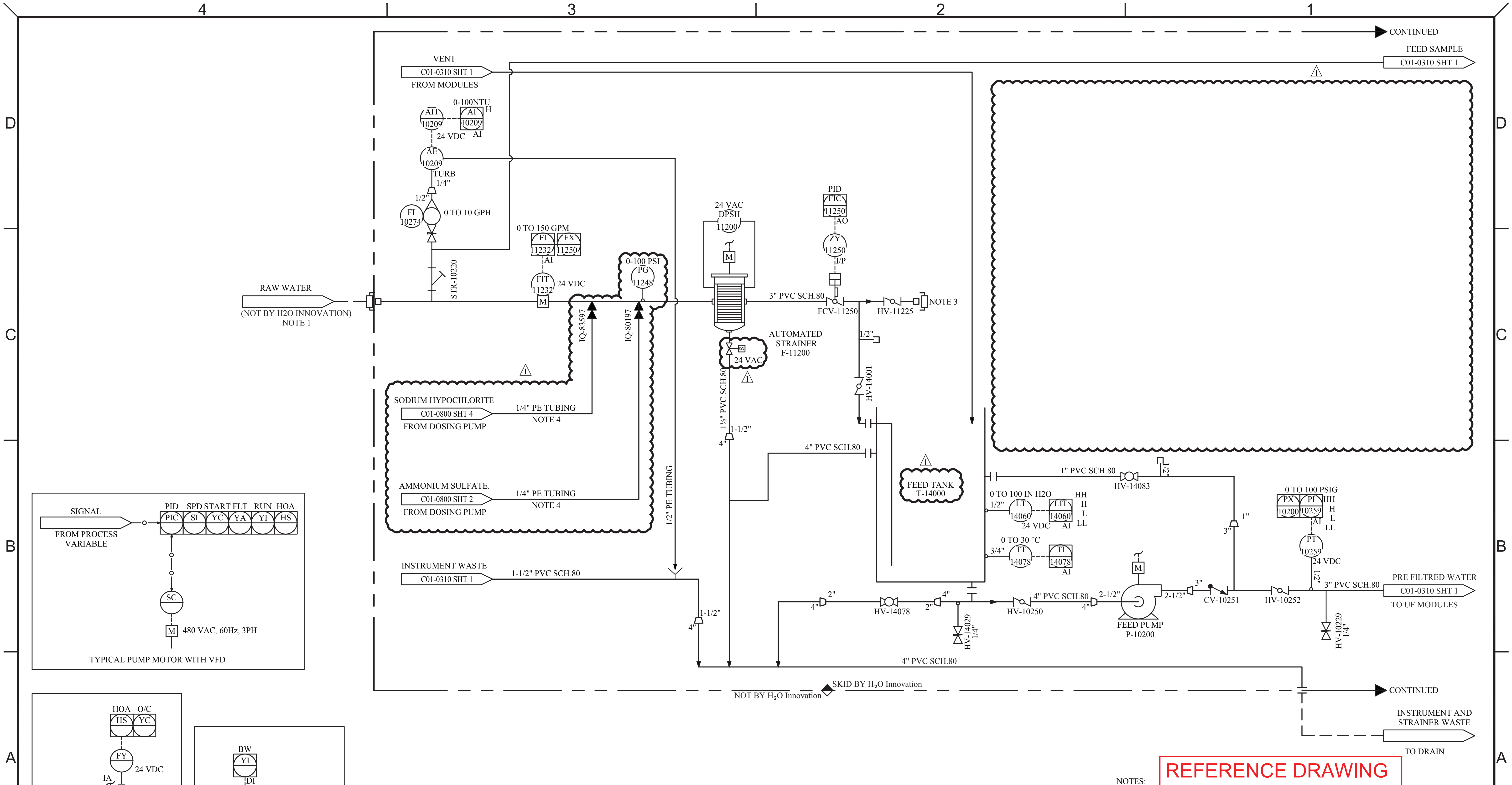
UF-RO SYSTEM

LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

TITLE: PIPING AND INSTRUMENTION DIAGRAMS LEGEND

SCALE: N/A | DRAWING NUMBER: 19U5064-C01-0001 | REVISION 01 | SHEET: 1 of 1



NOTES:

1. MINIMUM FEED PRESSURE IS 25 PSIG FOR STRAINER BACK WASHING.
2. MAX. HEIGHT OF EACH SKID SECTION IS 88" TO FIT IN STANDARD ISO CONTAINER.
3. FOR FUTURE OXIDATION TANK CONNECTION INCLUDE SPACE IN POWER PANEL FOR SUBMERSIBLE TRANSFER PUMP FROM OXIDATION TANK.
4. CHLORINE & AMMONIUM SULFATE TO BE ROUTED APART FROM EACH OTHER ON SKID.

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UF-RO SYSTEM

LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

TITLE: RAW WATER PIPING & INSTRUMENTATION DIAGRAM

SCALE: N/A

DRAWING NUMBER: 19U5064-C01-0110

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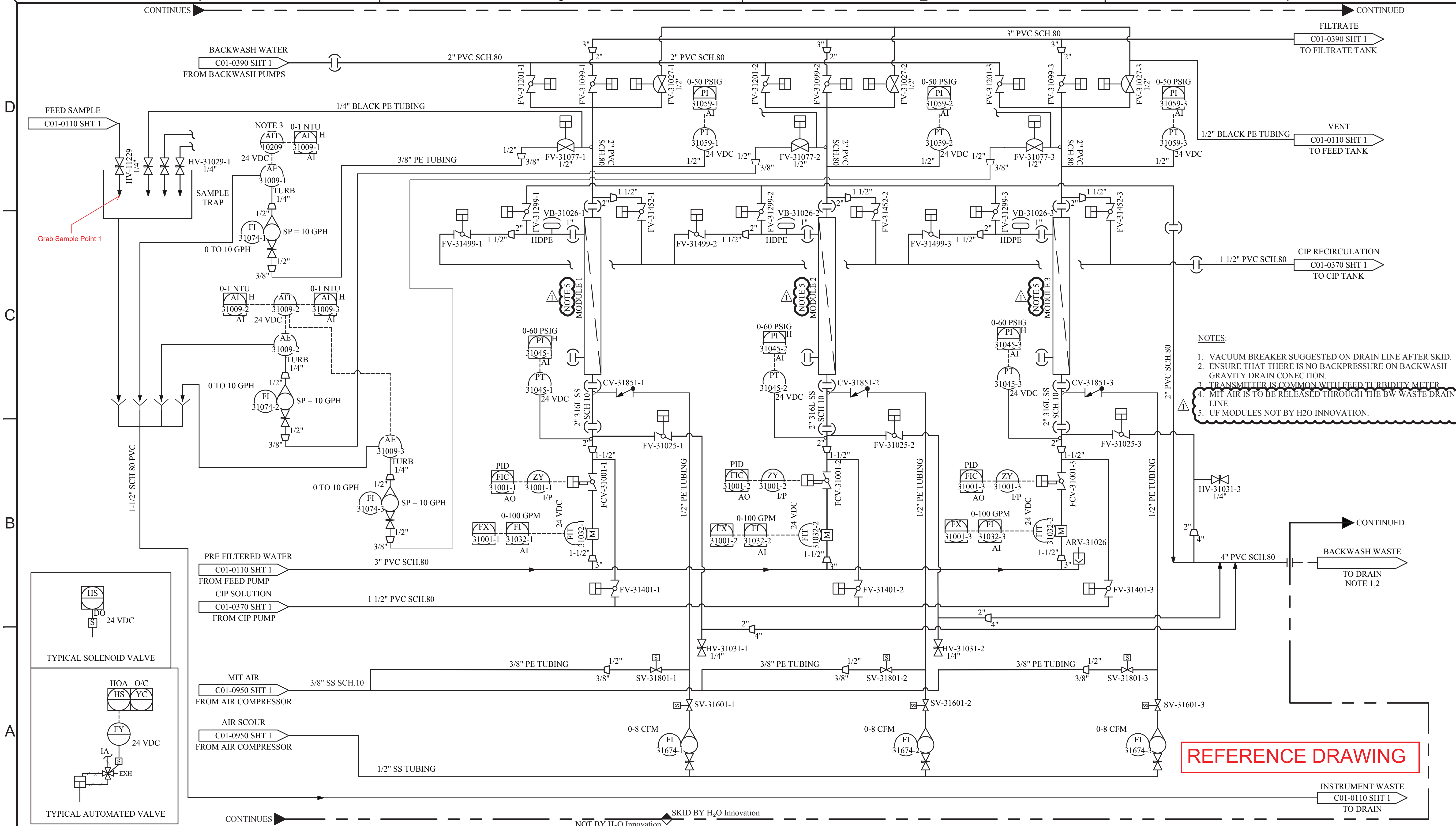
REVISION 01



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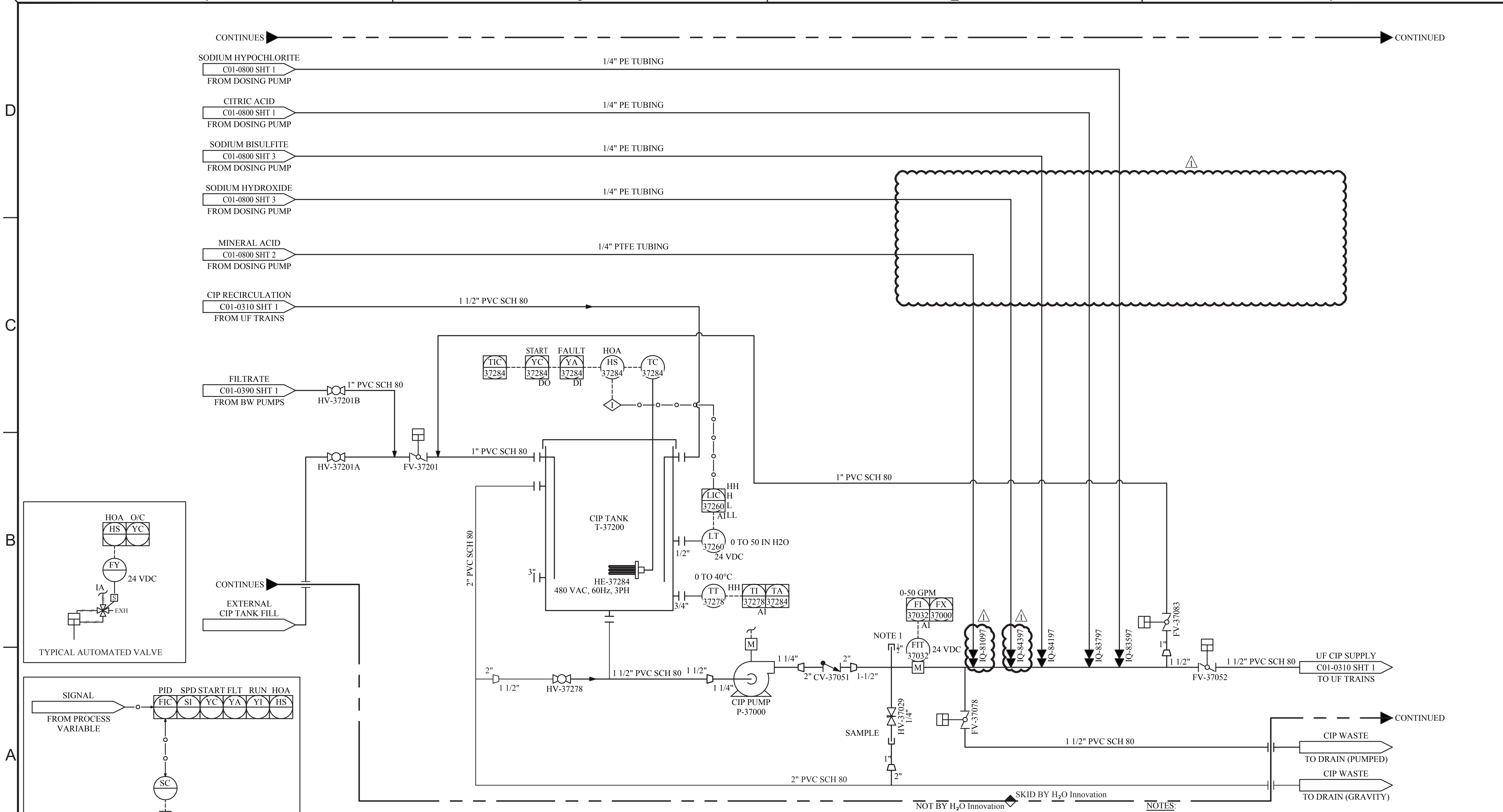
UF-RO SYSTEM

LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

TITLE:
ULTRA FILTRATION UNIT
PROCESS & INSTRUMENTATION DIAGRAM

SCALE:	DRAWING NUMBER:	REVISION
N/A	19U5064-C01-0310	01

SHEET: 1 of 1



NOTES:

1. ALLOW FOR 2 x AI AND 1 x DO IN ELECTRICAL DESIGN FOR ADDITION OF NEUTRALIZATION INSTRUMENTATION. ALLOW SPACE AS WELL.
2. AFTER NEUTRALIZATION CHEMICAL HAS BEEN ADDED, OPERATOR INTERVENTION REQUIRED TO DISCHARGE WASTE TO DRAIN.

REFERENCE DRAWING

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DECIMALS 0.X: ±0.030
0.XX: ±0.015
ANGLES: ±0.5°
HOLE SIZES: ±1/64"
HOLE CENTERS: ±1/64"
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UF-RO SYSTEM

LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

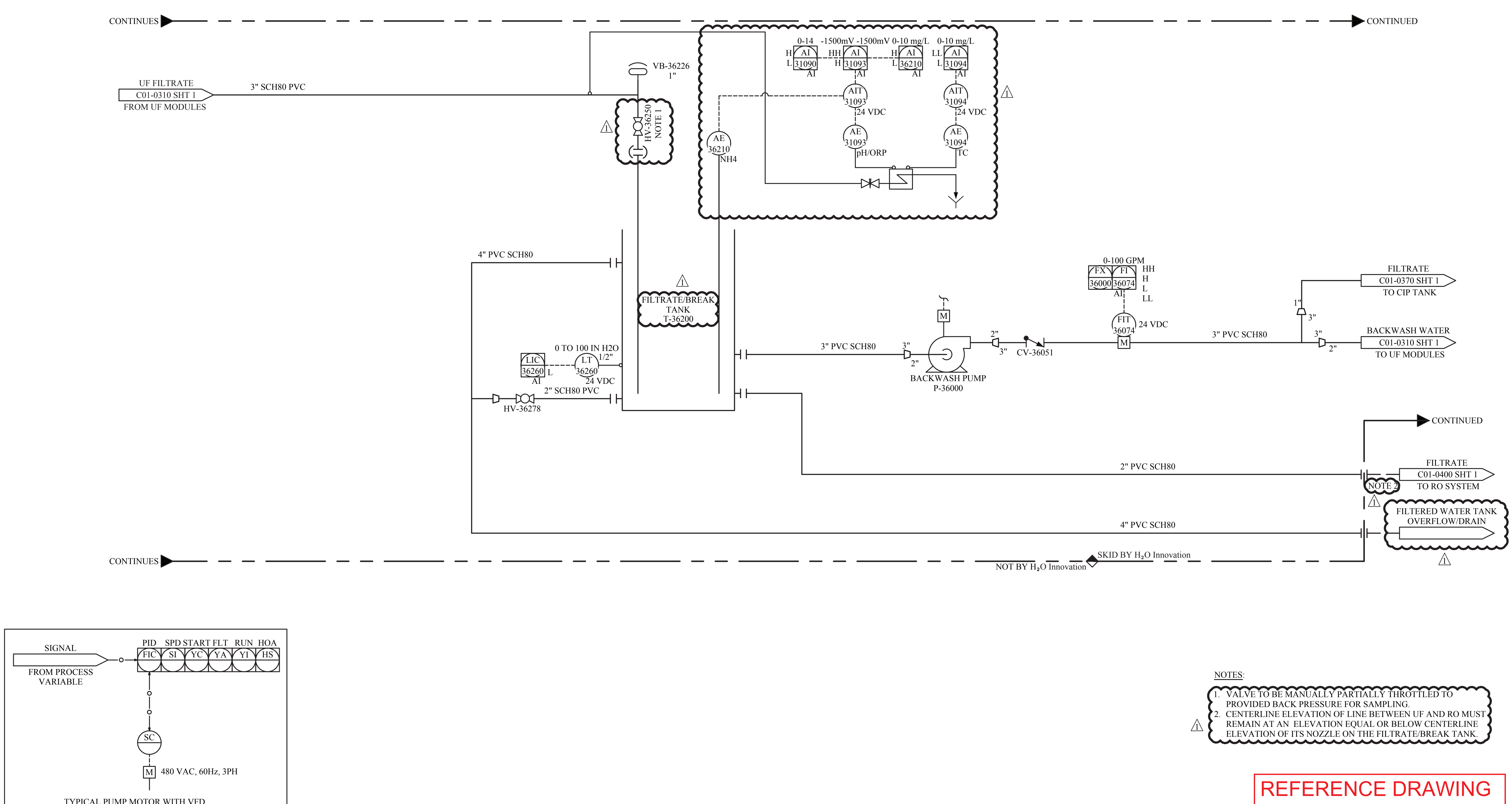
TITLE: UF CIP SYSTEM
W/ VFD CONTROLLED PUMP
PROCESS & INSTRUMENTATION DIAGRAM

SCALE: N/A

DRAWING NUMBER: 19U5064-C01-0370

SHEET: 1 of 1

REVISION 01



NOTES:

1. VALVE TO BE MANUALLY PARTIALLY THROTTLED TO PROVIDED BACK PRESSURE FOR SAMPLING.
2. CENTERLINE ELEVATION OF LINE BETWEEN UF AND RO MUST REMAIN AT AN ELEVATION EQUAL OR BELOW CENTERLINE ELEVATION OF ITS NOZZLE ON THE FILTRATE/BREAK TANK.

REFERENCE DRAWING

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TOLERANCES
FRACTIONS: ±1/16"
DECIMALS 0.X: ±0.030
0.XX: ±0.015
ANGLES: ±0.5°
HOLE SIZES: ±1/32"
HOLE CENTERS: ±1/32"
DO NOT SCALE PRINTS

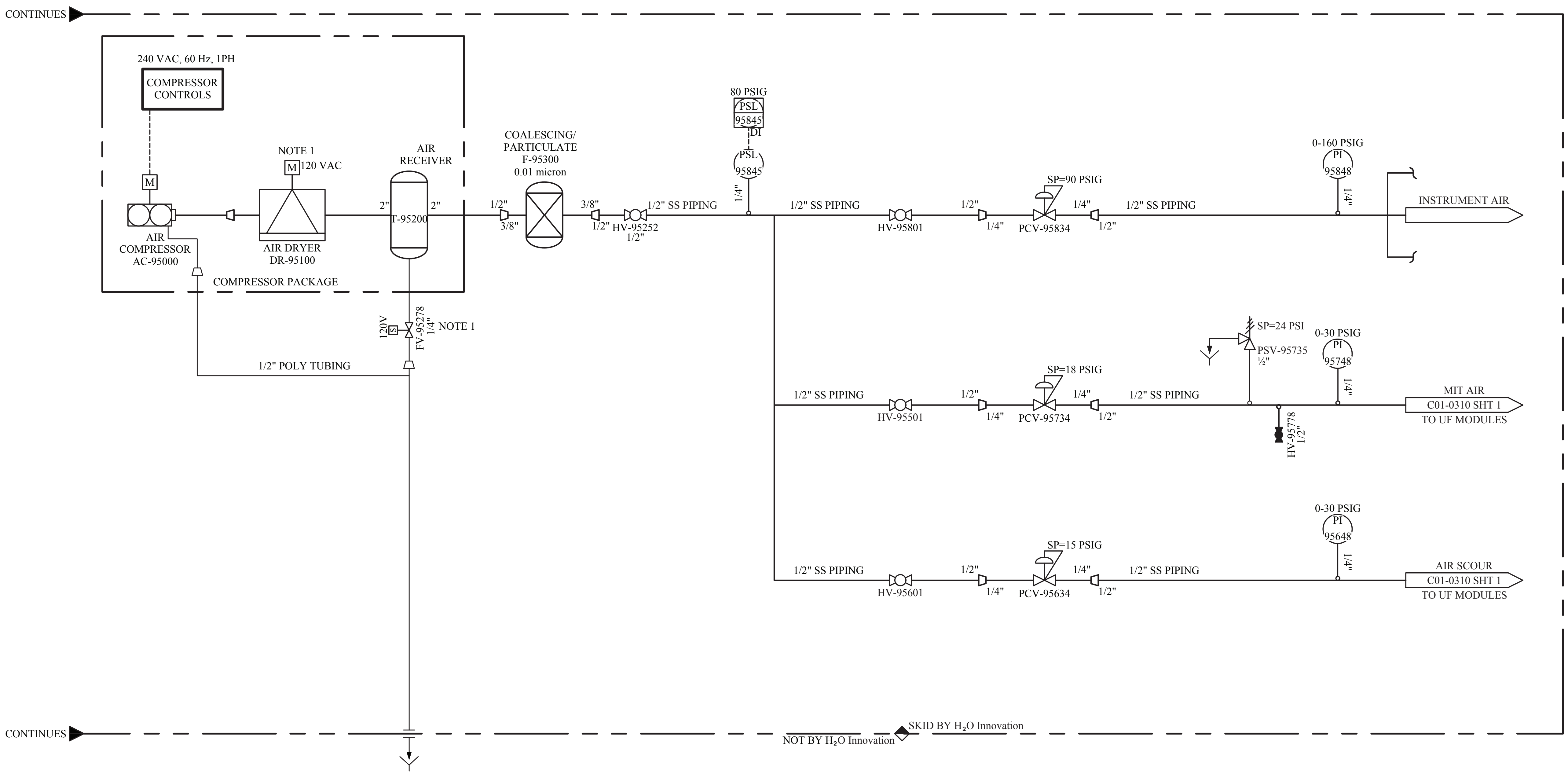
UF-RO SYSTEM

LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

TITLE: BACK PULSE / FILTRATE PUMP AND TANK
PROCESS & INSTRUMENTATION DIAGRAM

SCALE:	DRAWING NUMBER:	REVISION
N/A	19U5064-C01-0390	01

SHEET: 1 of 1



NOTE:
1. DRAIN VALVE REQUIRES 120V POWER FEED; NO LOGIC.

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UF-RO SYSTEM

LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

TITLE:
AIR COMPRESSOR SYSTEM
PROCESS & INSTRUMENTATION DIAGRAM

SCALE: N/A
DRAWING NUMBER: 19U5064-C01-0950
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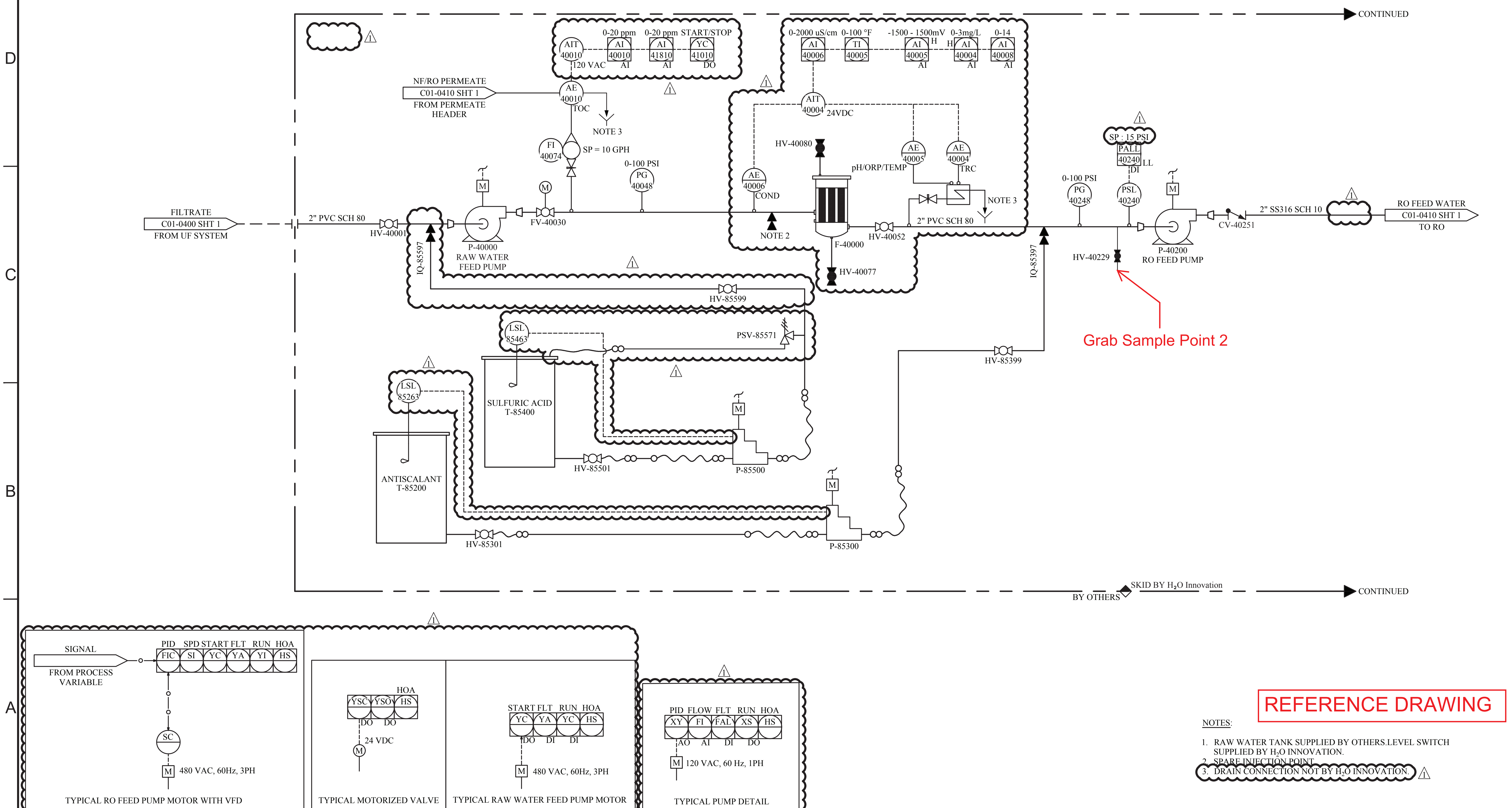

REFERENCE DRAWING

NOTES:

1. RAW WATER TANK SUPPLIED BY OTHERS.LEVEL SWITCH SUPPLIED BY H_2O INNOVATION.
2. SPARE INJECTION POINT.
3. DRAIN CONNECTION NOT BY H_2O INNOVATION.

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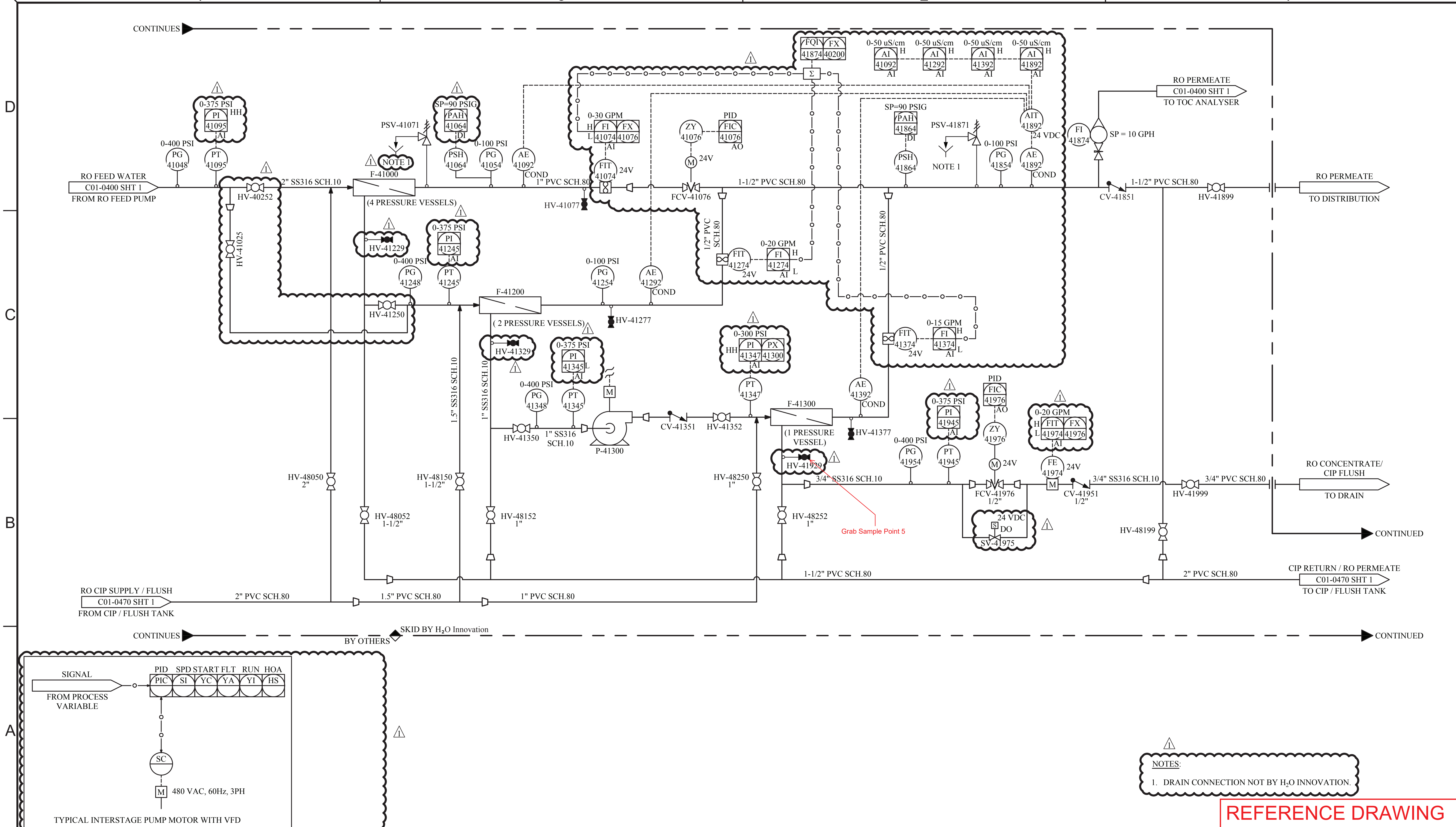
UF-RO SYSTEM

LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

TITLE: RO CARTRIDGE FILTERS AND FEED PUMPS
PROCESS & INSTRUMENTATION DIAGRAM

SCALE: N/A
DRAWING NUMBER: 19U5064-C01-0400
REVISION: 01
SHEET: 1 of 1



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TITLE:
RO MODULES - 3 STAGES
PROCESS & INSTRUMENTATION DIAGRAM

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DRAWING NUMBER: 19U5064-C01-0410
REVISION: 01
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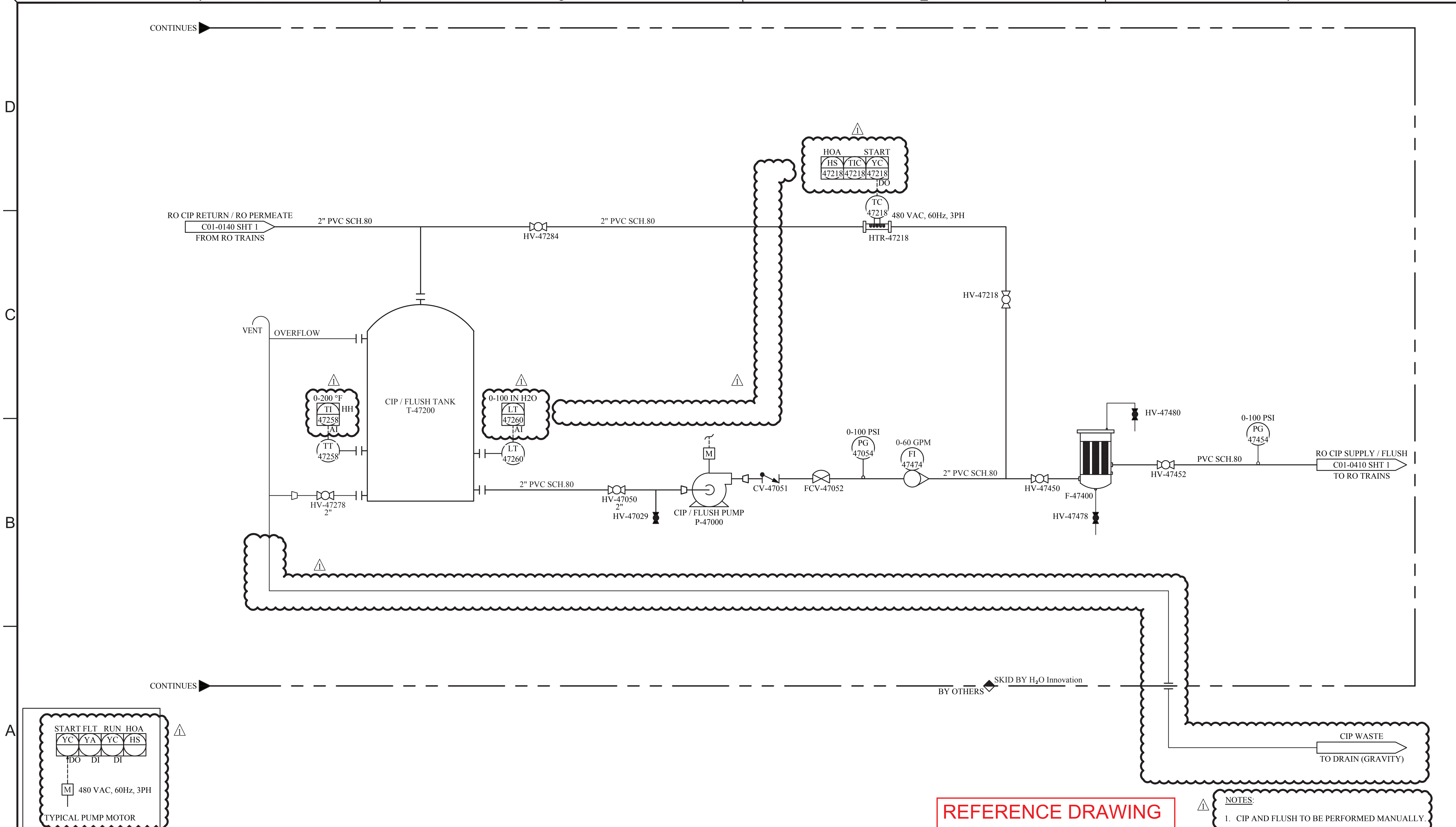

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LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

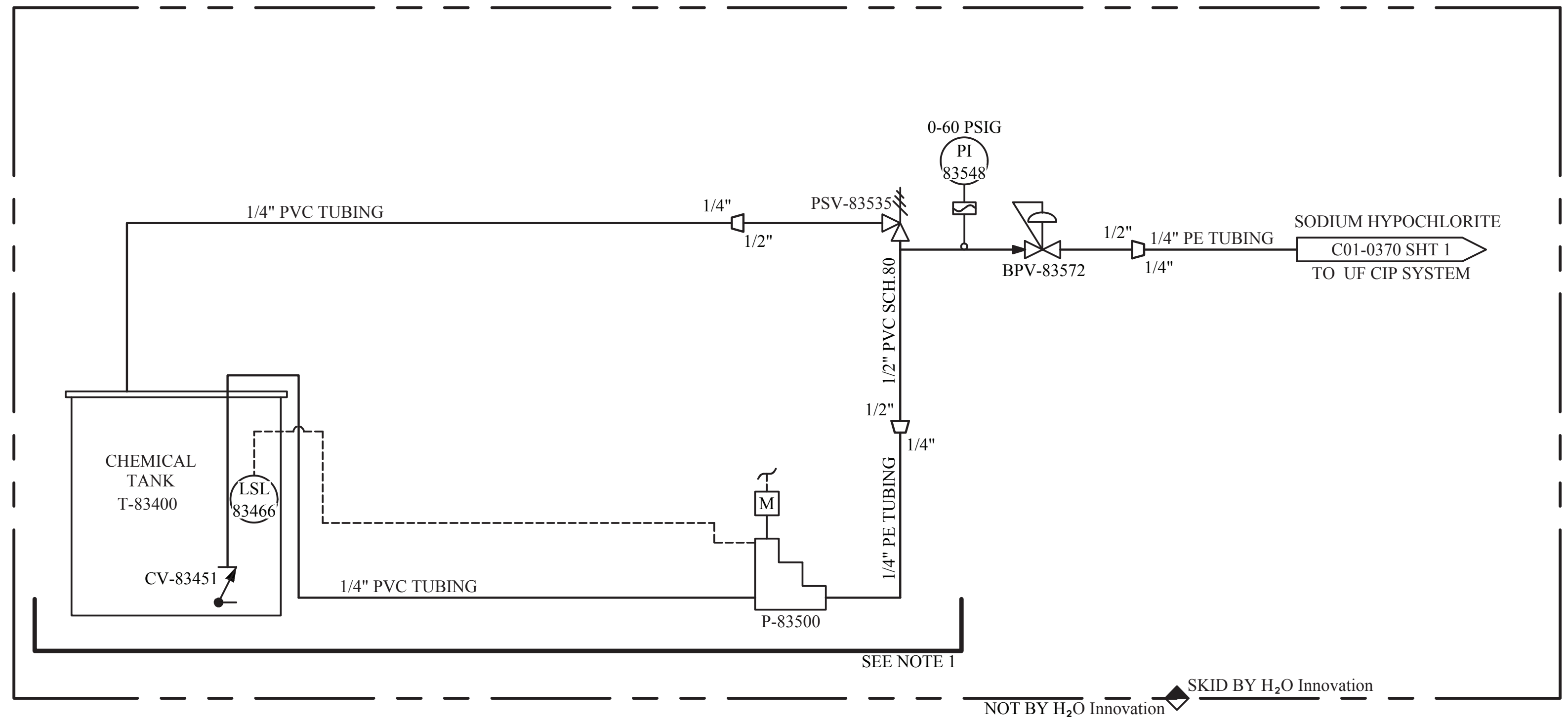
TITLE: RO CIP AND FLUSH SYSTEM PROCESS & INSTRUMENTATION DIAGRAM

SCALE: N/A

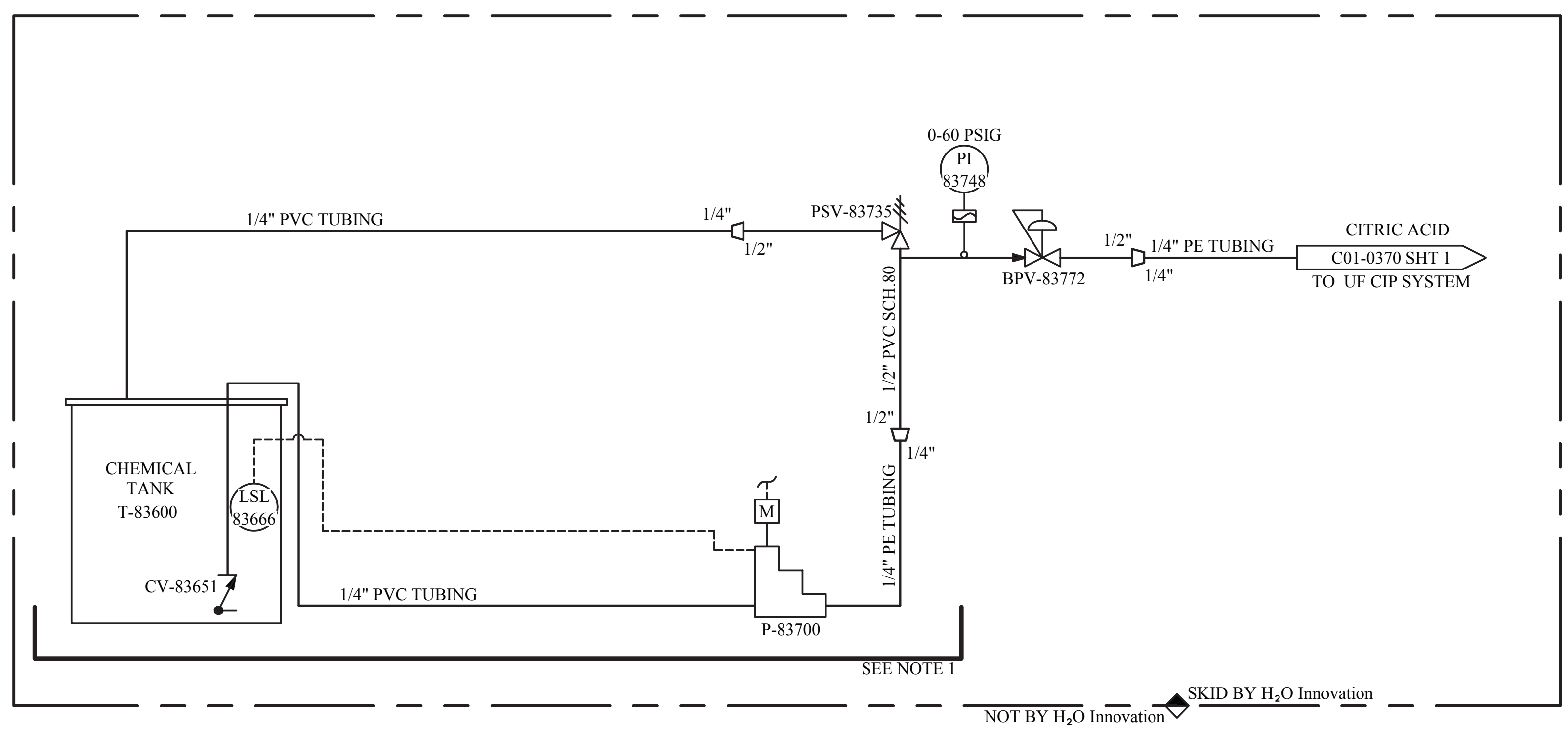
DRAWING NUMBER: 19U5064-C01-0470

SHEET: 1 of 1

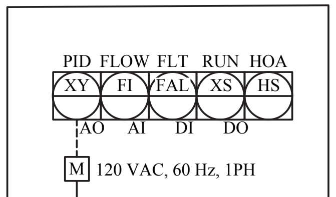
REVISION: 01



SODIUM HYPOCHLORITE (10.3%)
DOSING SYSTEM



CITRIC ACID (50%) DOSING SYSTEM



TYPICAL PUMP DETAIL

REFERENCE DRAWING

NOTE:
1. SECONDARY CONTAINMENT BIN.
2. PUMP FEED BACK AND ANALOGUE CONTROL MAY NOT BE INCLUDED. CHECK PUMP DATASHEETS.

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LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

TITLE:
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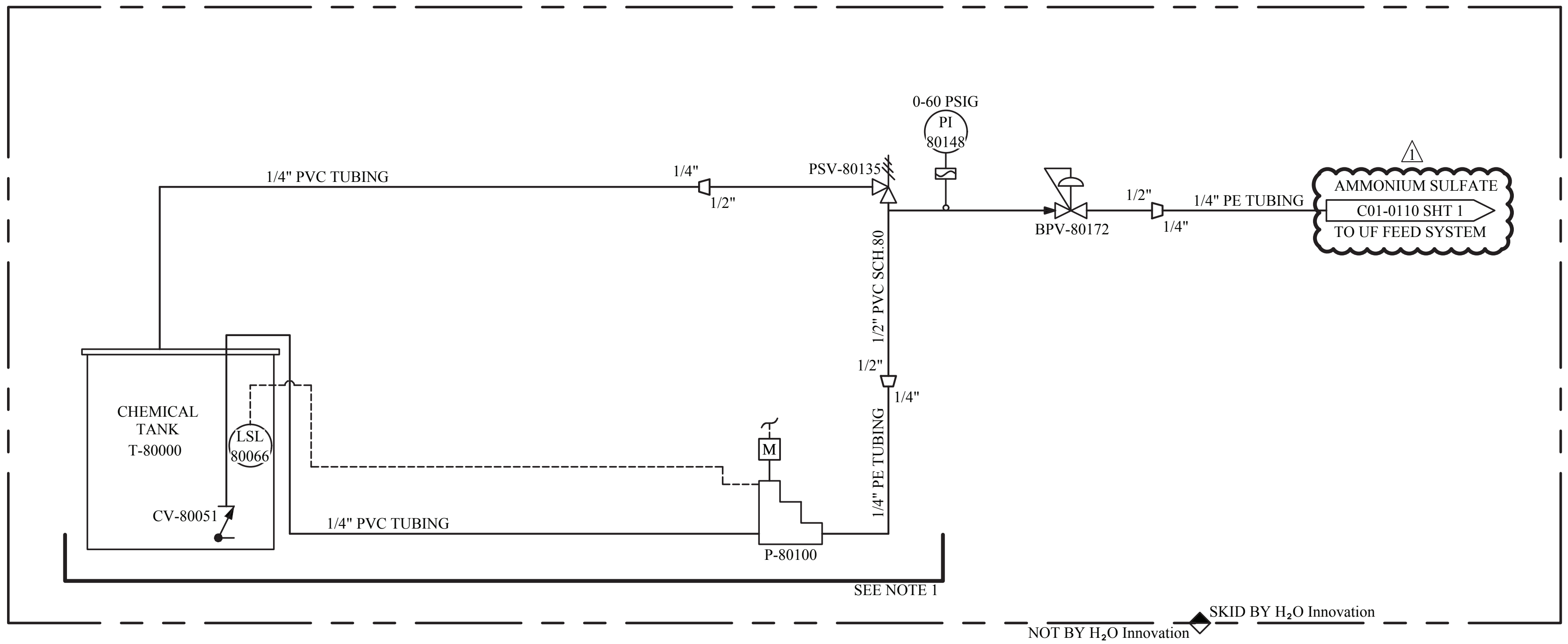
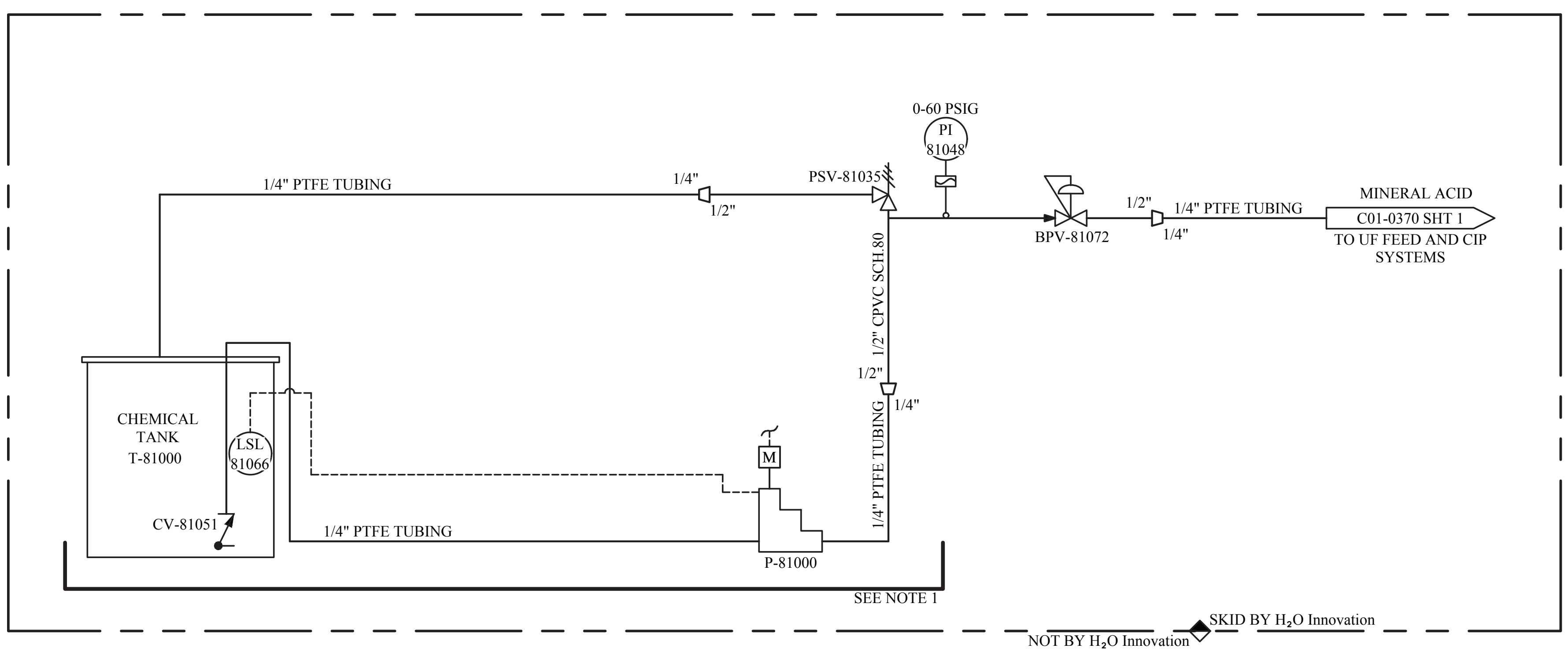
PROCESS & INSTRUMENTATION DIAGRAM

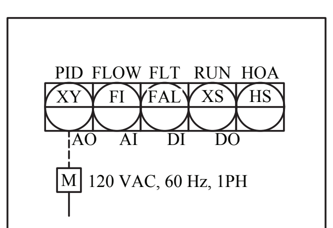
SCALE: N/A
DRAWING NUMBER: 19U5064-C01-0800
SHEET: 1 of 4
REVISION 01



AMMONIUM SULFATE, 38% DOSING SYSTEM



MINERAL ACID DOSING SYSTEM



TYPICAL PUMP DETAIL

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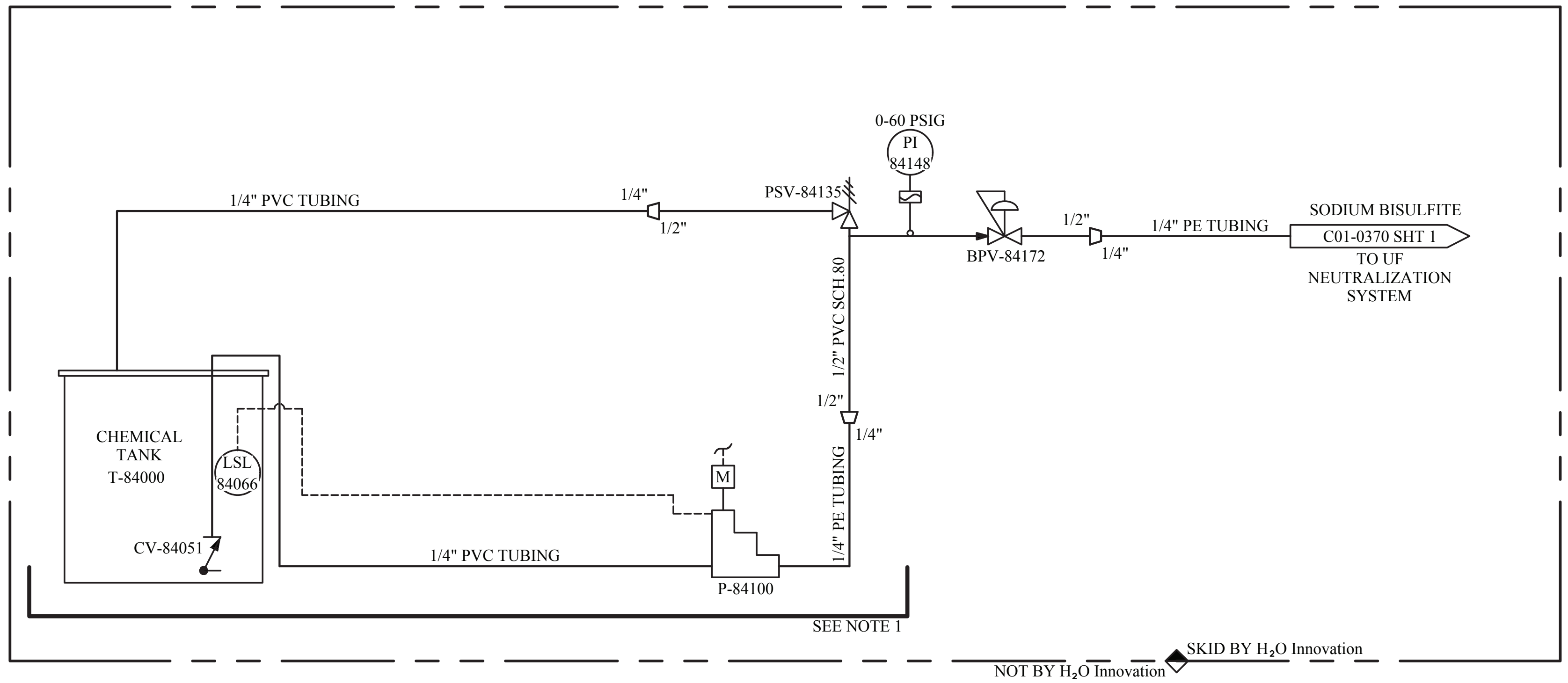
LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

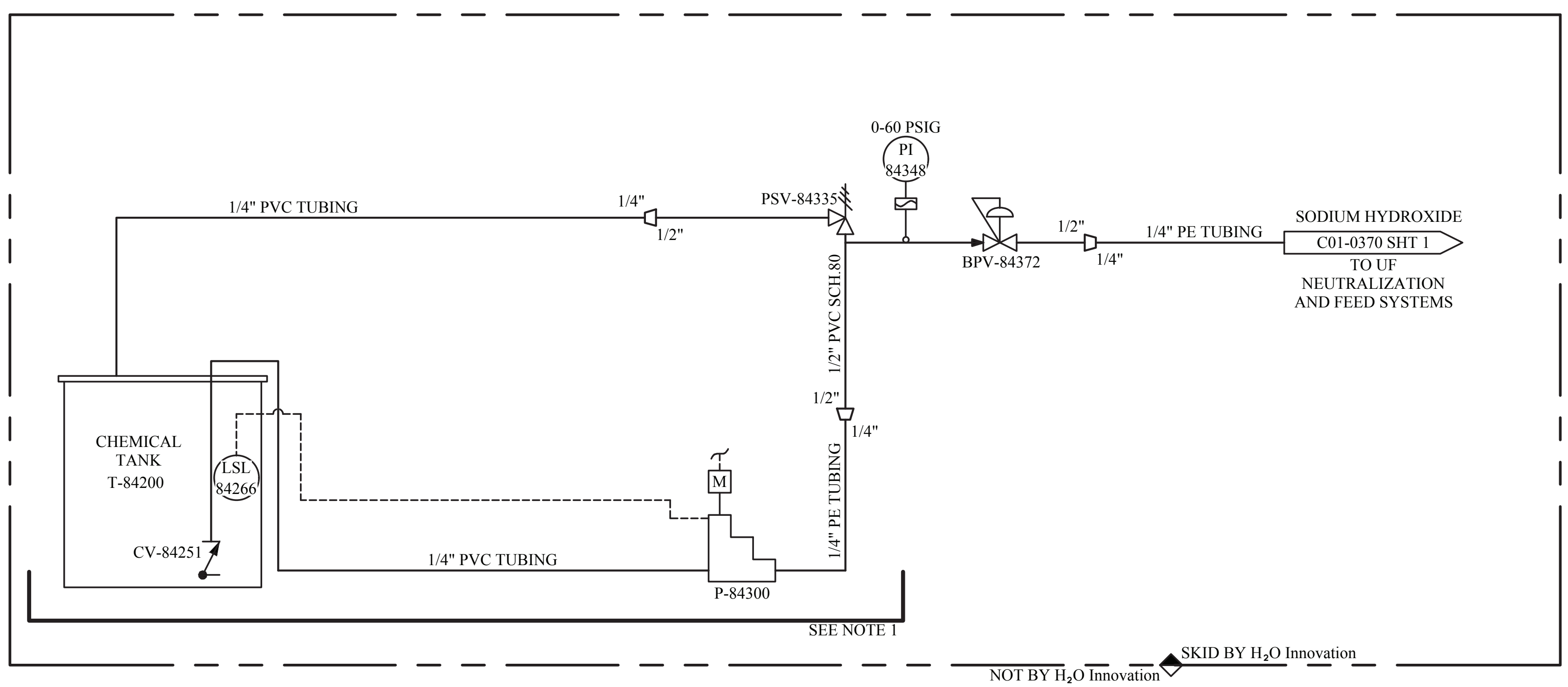
TITLE:
DOSING SKIDS
PROCESS & INSTRUMENTATION DIAGRAM

SCALE:	DRAWING NUMBER:	REVISION
N/A	19U5064-C01-0800	01

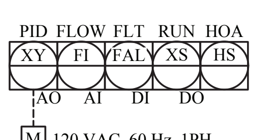
SHEET: 2 of 4



SODIUM BISULFITE (38%) DOSING SYSTEM



SODIUM HYDROXIDE (50%) DOSING SYSTEM



TYPICAL PUMP DETAIL

REFERENCE DRAWING

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TOLERANCES
FRACTIONS: ±1/16"
DECIMALS 0.X: ±0.030
0.XX: ±0.015
ANGLES: ±0.5°
HOLE SIZES: ±1/32"
HOLE CENTERS: ±1/32"
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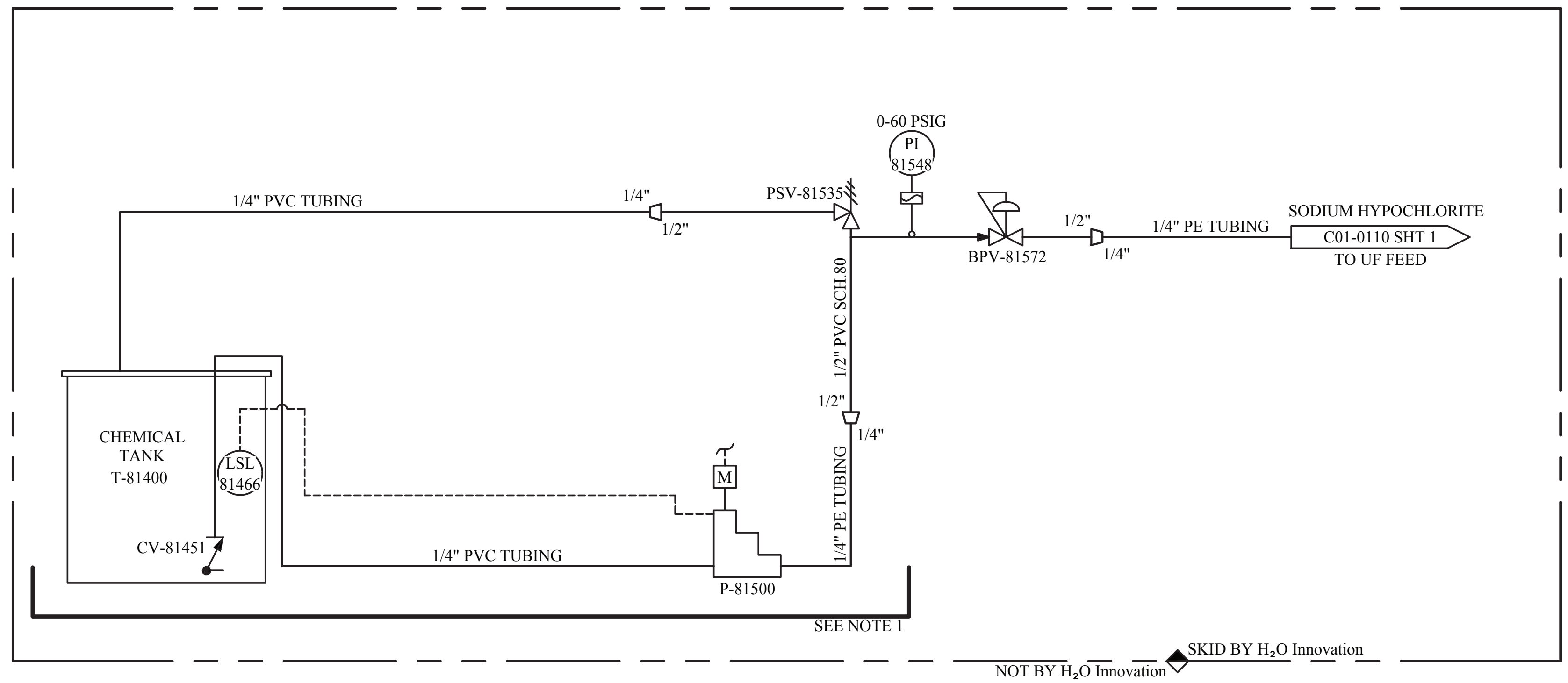
UF-RO SYSTEM

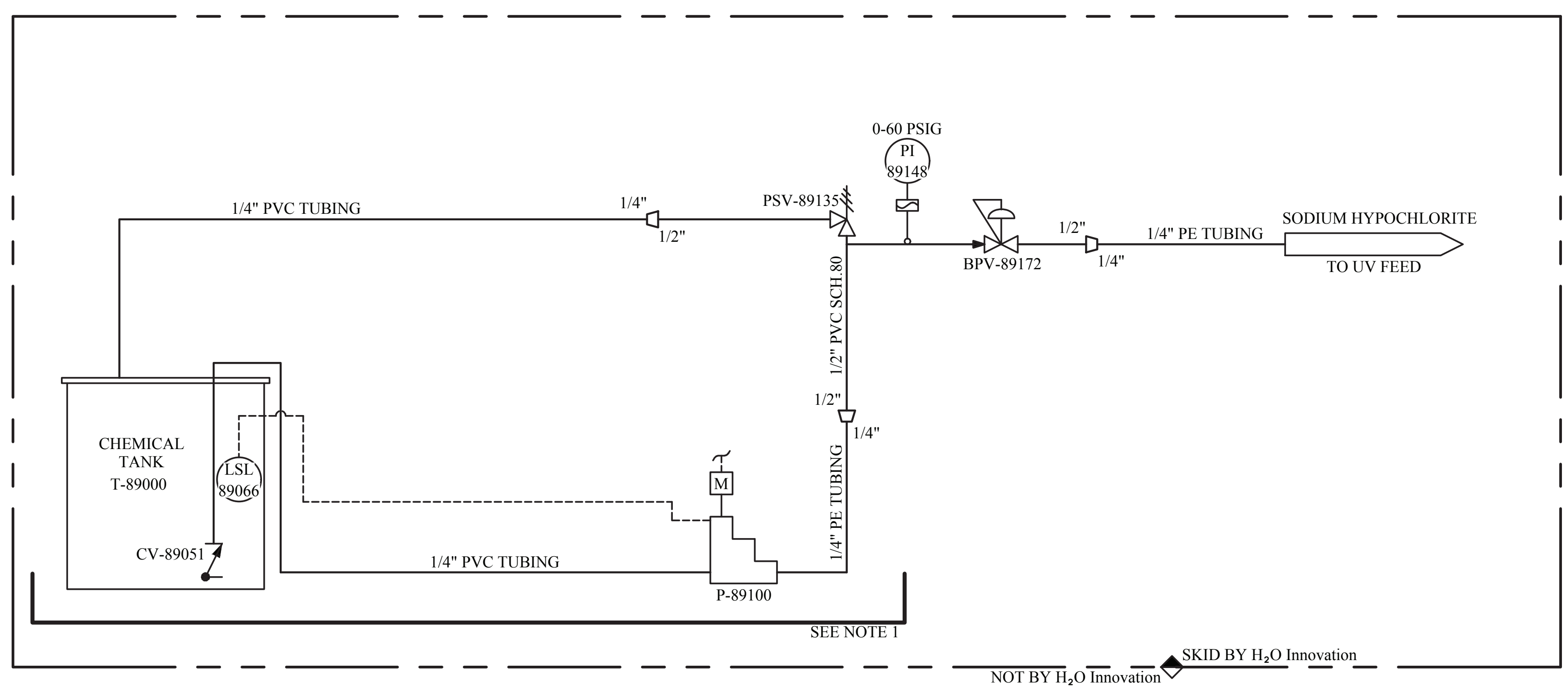
LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

TITLE:
DOSING SKIDS
PROCESS & INSTRUMENTATION DIAGRAM

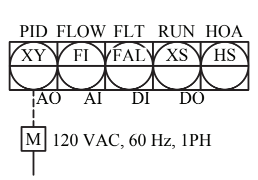
SCALE:	DRAWING NUMBER:	REVISION
N/A	19U5064-C01-0800 SHEET: 3 of 4	01



SODIUM HYPOCHLORITE (10.3%)
DOSING SYSTEM



SODIUM HYPOCHLORITE (10.3%)
DOSING SYSTEM



TYPICAL PUMP DETAIL

REFERENCE DRAWING

NOTE:
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LAS VIRGENES-TRIUNFO PURE WATER DEMONSTRATION PROJECT

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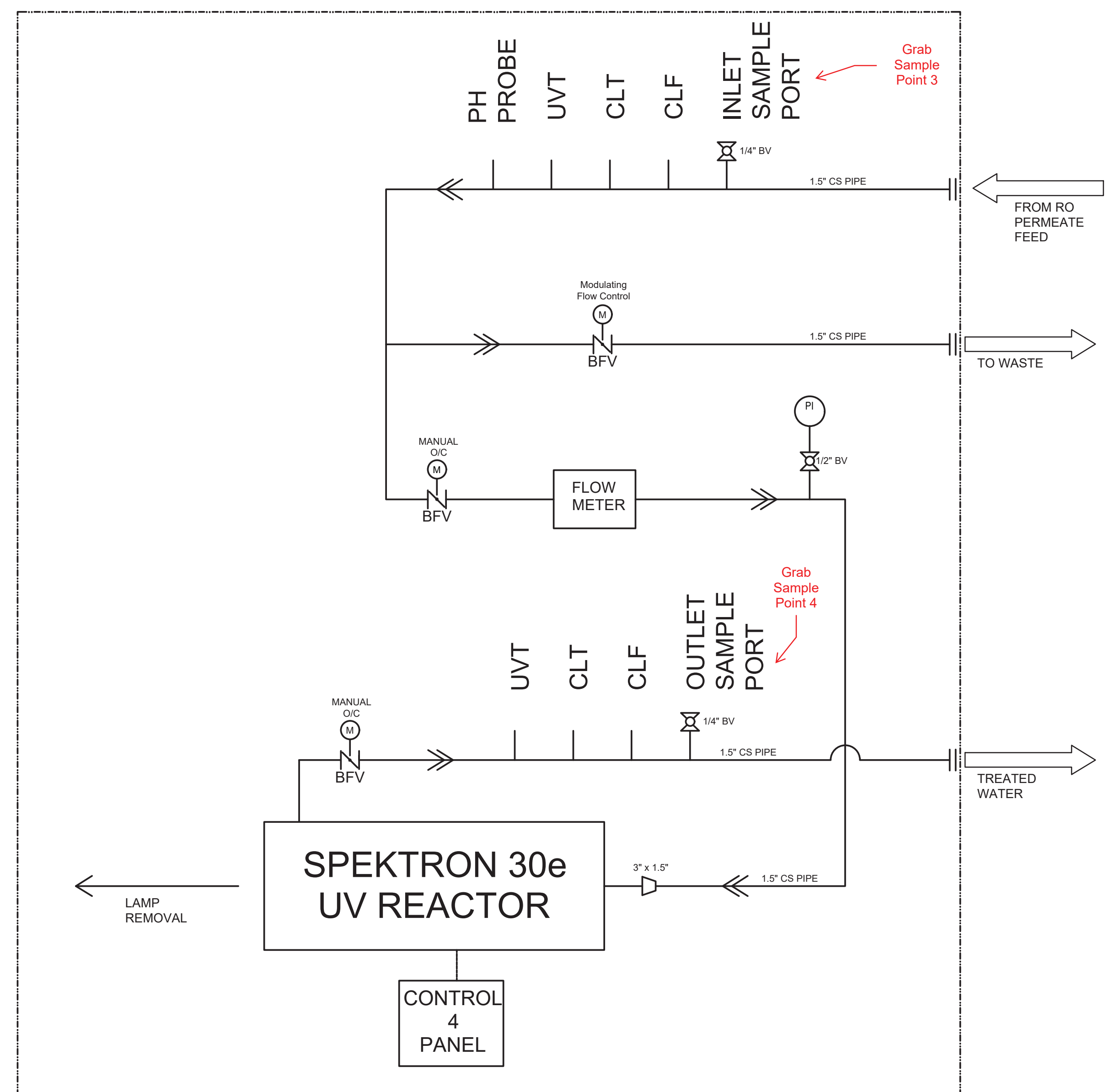
DOSING SKIDS
PROCESS & INSTRUMENTATION DIAGRAM

SCALE:	DRAWING NUMBER:	REVISION
N/A	19U5064-C01-0800	01

SHEET: 4 of 4



REFERENCE DRAWING

NOTES:
1. A (*) DENOTES ITEMS NOT SUPPLIED BY XYLEM.
2. UV VESSEL BOUNDARY SHOWN FOR GENERAL LAYOUT PURPOSES ONLY.
3. ALL PIPING AND FITTINGS EXTERNAL TO SKID BOUNDARY ARE SUPPLIED BY OTHERS.

REV	REV # ECN #	SHEET (ZONE)	DESCRIPTION	DATE	APPROVAL

REVISIONS

FOR INFORMATION ONLY

PROJECT: LAS VIRGENES
LOCATION: LAS VIRGENES, CA
CUSTOMER: LAS VIRGENES
CONSULTING ENGINEER:
NAVISION NUMBER:
JOB NUMBER: U18028

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X/X = $\pm\frac{1}{16}$ .X = ±.05 .XX = ± .02 .XXX = ± .005 ANG = ± 1°
THIRD ANGLE PROJECTION

DESIGNER: JDM
DATE: 1/29/2019
APPROVED BY:
DATE:

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TITLE: PROCESS DIAGRAM
SKID LAYOUT

MODEL NO.: SPEKTRON 30e w/ CONTROL 4

SIZE	DRAWING NO.	REV
B	U18028-PID-02	-

SCALE	WEIGHT	MATERIAL	FINISH	SHEET
				1 OF 1

Appendix B
PURE WATER STARTUP TESTING

PROJECT MEMORANDUM

PURE WATER DEMONSTRATION PROJECT

Date:	8/21/2020
Project No.:	11019A.10

Las Virgenes-Triunfo JPA

Prepared By:	Andy Salveson
Reviewed By:	Amos Branch, Lydia Holmes
Subject:	Pure Water Results from Startup Testing

Purpose

This project memorandum (PM) summarizes treatment performance and water quality of the Pure Water Demonstration (Demo) based upon a limited amount of initial testing. This PM reviews treatment process surrogates, pathogen reduction, and chemical water quality.

Summary

This PM documents the pathogen and chemical removal ability of the Demo based upon a series of testing and online performance in July and August of 2020. While the provided data are snapshots, continual collection and analysis of online data indicates that the treatment process performance is stable and the collected data is expected to be representative of broader performance.

Bulk treatment performance, as indicated by UF filtrate turbidity and reduction of EC and TOC by RO, is summarized below and followed by a summary of pathogen reduction. The results from this project demonstrate a high level of pathogen removal, as indicated in the summary table below, noting that extensive future testing will be used to validate the preliminary information presented in this PM.

Table 1 AWPF Online Monitoring Summary

Water Quality Target	UF	RO	UV/AOP
Turbidity	<0. 2 NTU	-	-
TOC	5 to 7 mg/L	0.1 mg/L	-
EC	~1,100 uS/cm	<30 uS/cm	-

Table 2 AWPF Pathogen Performance Summary

Water Quality Target	UF	RO	UV/AOP	Free Chlorination	Total
Virus LRV	>2	1.5	6	4	13.5
Protozoa LRV	>4	1.5	6	-	11.5

As detailed within this report, apart from TON and chlorate, all measured chemicals met regulatory standards for potable water reuse. Both TON and chlorate were found to be the result of a low-quality batch of sodium hypochlorite that has since been remedied (with data provided herein). Detected chemicals along with their regulatory levels, are show in the table below.

Table 3 Summary of Detected Chemicals with Regulatory Limits

Constituent	Measured Value	Regulated Value
Total Trihalomethanes	41 ug/L	80 ug/L
Chlorate	1,100 ug/L[1]	800 ug/L
TON	12[2]	3
Chloride	7.8 mg/L	250 mg/L
Sulfate	1.5 mg/L	250 mg/L
Total Organic Carbon	<0.3 mg/L	0.3 mg/L
Total Nitrogen	0.29 mg/L	10 mg/L
Gross Alpha	0.48 pCi/L	15 pCi/L
Gross Beta	0.88 pCi/L	50 pCi/L
Conductance	49 uS/cm	900 uS/cm
Total Dissolved Solids	19 mg/L	500 mg/L

A list of Chemicals of Emerging Concern (CECs) was also sampled, with 19 CECs below detectable levels and 10 CECs detected. No CECs are present at levels near or above health-based screening levels, where those levels have been established

General Process Performance

Ultrafiltration and Microfiltration

The Demo utilizes three different low-pressure membranes, run in parallel, to provide treatment ahead of reverse osmosis (RO). These membranes are, in order, an ultrafilter (UF) from DOW (designated UF1), a microfilter (MF) from Asahi (designated UF2), and a UF from Toray (designated UF3). The ultrafilters utilize a smaller pore size compared to the MF, and UFs have been shown to reliably remove virus, but are not credited with virus removal by the State of California Division of Drinking Water (DDW).

The primary value of MF/UF is *Giardia* and *Cryptosporidium* removal and pretreatment ahead of RO. Performance of the MF and UF systems are broken into turbidity reduction and membrane integrity test (MIT) results, as reviewed below.

Turbidity

Turbidity is an indirect and online method to document membrane integrity. For both potable and non-potable water reuse projects, the State of California Division of Drinking Water (DDW) requires low pressure membrane systems (such as UF) to maintain an effluent turbidity of 0.2 NTU or less 95 percent of the time and to never exceed 0.5 NTU (DDW, 2018).

Example turbidity results, which are generally representative of performance, are shown in Table 4, below. Values are typically well below regulated values. Turbidity challenges seen to date are intermittent and appear to be linked to biofouling and air bubbles. Neither of these represent a public health or water quality concern.

[1] See section on Chlorate, noting that chlorate concentrations were the result of degraded sodium hypochlorite supplies.
[2] See section on TON, noting that the high TON value was an anomaly and subsequent values were at a TON of 1.

Table 4 Example Turbidity Removal Via UF1, UF2, and UF3

Date	Time	Tertiary Effluent	UF1 Effluent	UF2 Effluent	UF3 Effluent
8/16/2020	0600	0.496	0.0145	0.0139	0.0119
8/18/2020	-	0.564	0.0163	0.0144	0.0121
8/21/2020	0400	0.466	0.0155	0.0140	0.0121

Pressure Decay Testing

While turbidity removal through membrane processes is a gross indication of process performance, referred to as "continuous indirect integrity monitoring" by the U.S. EPA (2005), pressure decay testing (PDT) is a "direct integrity test" U.S. EPA (2005). The PDTs are designed to measure if there is membrane damage sufficient to pass a 3 µm particle, which is the lower bound of the *Cryptosporidium* size range (U.S. EPA, 2005).

Through size exclusion, the UF membranes remove bacteria, protozoan, and viral pathogens (Cheryan, 1998, USEPA, 2005). The State of California Division of Drinking Water (DDW, formerly the California Department of Public Health (CDPH)) has previously granted virus removal credit for UF (CDPH, 2014), approving "at least 1-log" virus removal while also approving 4-log protozoa removal. However, DDW currently does not grant virus credit due to the lack of a continuous or daily method to verify membrane integrity to the level sufficient to remove virus.

PDT is sometimes referred to as membrane integrity testing (MIT) through which the integrity of the membrane is determined based upon an air pressure test in which the membranes are pressurized with air, then put in a "hold" mode and the air slowly leaks from the membranes. Too fast a leak means that the membrane has been compromised. The air leakage rate, can be converted to a LRV for protozoa (*Giardia* and *Cryptosporidium)* using constants specific to each membrane system. Based upon daily MIT readings for UF1, UF2, and UF3, all three membrane systems remain intact and providing for robust removal of protozoa. All daily PDT results for each of the three low pressure membranes have indicated protozoa LRV > 4 with example protozoan LRV results shown in Table 5 below.

Table 5 Example LRV Results for UF1, UF2, and UF3

Date	Time	UF1 Effluent	UF2 Effluent	UF3 Effluent
8/16/2020	0600	4.95	4.80	5.30
8/18/2020	-	4.64	5.30	5.30
8/21/2020	0400	4.53	5.30	4.82

Reverse Osmosis

RO provides a robust barrier to both pathogens and chemical pollutants, as represented below by the removal of total organic carbon (TOC) and electrical conductivity (EC).

For both potable water reuse projects, the State of California DDW requires RO systems to maintain, on average, an RO permeate TOC level of <0.5 mg/L (DDW, 2018). Reducing TOC to this level (or below) is considered an important barrier to reduction of chemical pollutants. Further, DDW allows for the reduction of TOC across RO to be a conservative surrogate for both virus and protozoa removal (Los Angeles, 2018).

Tables 6 and 7, below, show TOC and EC reduction across the RO.

Table 6 Summary of Total Organic Carbon Removal Through Reverse Osmosis

Date	Time	TOC (mg/L)		LRV
		Sample Location		
		RO FEED	RO Permeate	
8/16/2020	0600	4.99	0.1	1.7
8/18/2020	-	6.00	0.19	1.5
8/21/2020	0400	6.09	0.1	1.8

Table 7 Summary of Conductivity Removal Through Reverse Osmosis

Date	Time	EC, uS/cm		LRV
		Sample Location		
		RO FEED	RO Permeate	
8/16/2020	0600	1144	24	1.7
8/18/2020	-	1081	23	1.7
8/21/2020	0400	1200	26	1.4

Ultraviolet Light Advanced Oxidation Process

Ultraviolet light advanced oxidation process (UV AOP) technologies are used with potable reuse applications for:

- 6 LRV of pathogens.
- Photolysis of NDMA, reliably below the NL of 10 ng/L.
- Advanced oxidation of 1,4-dioxane. Per 22 CCR, with a minimum LRV of 0.5. The AOP uses an oxidant added upstream of the reactor to generate hydroxyl radicals that oxidize and break down various chemical pollutants, including 1,4-dioxane.

For the Demo, the UV AOP utilizes hypochlorite and a high dose UV reactor, noting that future testing may examine the use of hydrogen peroxide in lieu of hypochlorite.

UV Disinfection

Under UV disinfection, pathogens absorb UV light in the water, which damages the pathogen's DNA or RNA, making it non-infectious. The UV dose is based on adenovirus, since it is shown to resist inactivation with UV light better than other viruses. Adenoviruses comprise a large group of serologically different viruses that can cause a broad spectrum of diseases with varying severity (USEPA, 2010).

Research on the dose-response relationship of Adenoviruses, using Low Pressure (LP) UV radiation on a bench-scale collimated beam setup, is mainly limited to Adenovirus types 2, 40, and 41. The dose response relationship at high UV doses (>200 mJ/cm2) is more widely published for Adenovirus type 2 (Ad2), and shows that 6 LRV of Ad2 may be obtained at a dose of 235 mJ/cm^2 (Gerba et al., 2002). The dose response relationship of Ad2 as well as other viruses is shown in Figure 1, demonstrating that Ad2 is a conservative surrogate for a wider range of viruses.

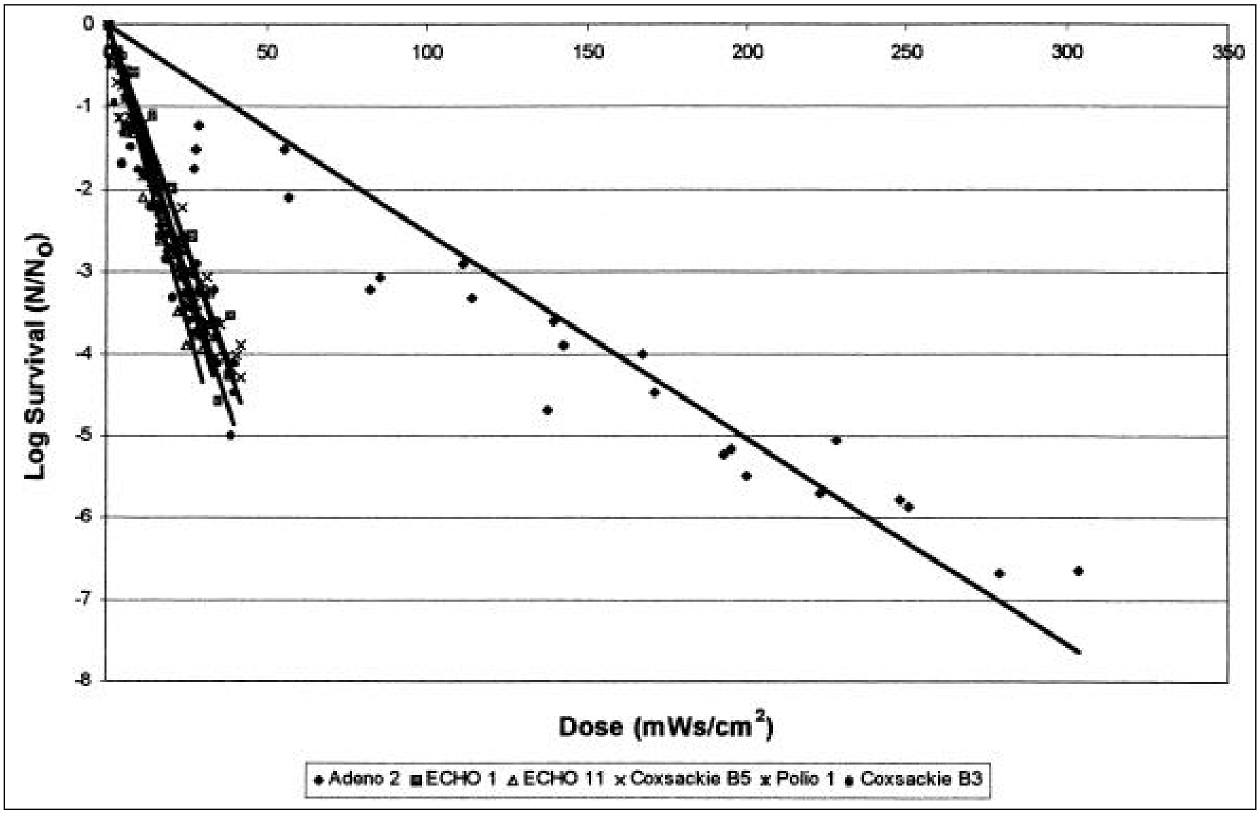

Figure 1 LP UV Dose Response Relationship of Ad2

USEPA (2010) published a dose-response equation for Ad2 of:

$$\text{Log Reduction (Ad2)} = 0.0262 * \text{UV Dose} + 0.2774$$

This dose response relationship is based on a dose range between 20 and 160 mJ/cm2 (USEPA, 2010). Other studies have shown similar dose responses, consistently indicating that a LP UV dose of up to 235 mJ/cm^2 results in 6 LRV of Ad2.

The USEPA document entitled "Innovative Approaches for Validation of Ultraviolet Disinfection Reactors for Drinking Water Systems," (Innovative Approaches for Validation) (USEPA 2018) provides UV dose requirements for 6 log inactivation of Cryptosporidium, Giardia, and adenovirus of 85, 84 and 276 mJ/cm2, respectively.

No pathogen challenge work has been conducted to date on the installed UV system at the Demo. However, it is being run at a UV dose of ~1600 mJ/cm^2, well in excess of the minimum UV dose of 276 mJ/cm^2 for 6 LRV of adenovirus (and thus all pathogens).

NDMA Photolysis

NDMA destruction via photolysis is regulated by DDW (DDW, 2018), with a notification level (NL) of 10 ng/L. However, the Regional Water Quality Control Board (RWQCB) is expected to regulate the discharge to the Las Virgenes Reservoir under the California Toxics Rule (CTR). The CTR would require NDMA levels to be 0.69 ng/L, which is below the detection limit (typically 2 ng/L). As such, robust NDMA destruction will be required from the Demo's UV reactor.

The literature indicates that 1 LRV of NDMA occurs within the UV dose range of 700 **mJ/cm^2** to 1,100 **mJ/cm^2**, as shown and referenced in Figure 2 below. Typical NDMA concentrations in tertiary effluents may range from the low ng/L level to the 100s of ng/L. At this time, there is no data on Tapia effluent NDMA, and thus the dose needed to meet the DDW and CTR requirements is not known. However, the UV system is currently being run at a UV dose of 1,600 mJ/cm^2, and is resulting in NDMA concentrations of <2 ng/L.

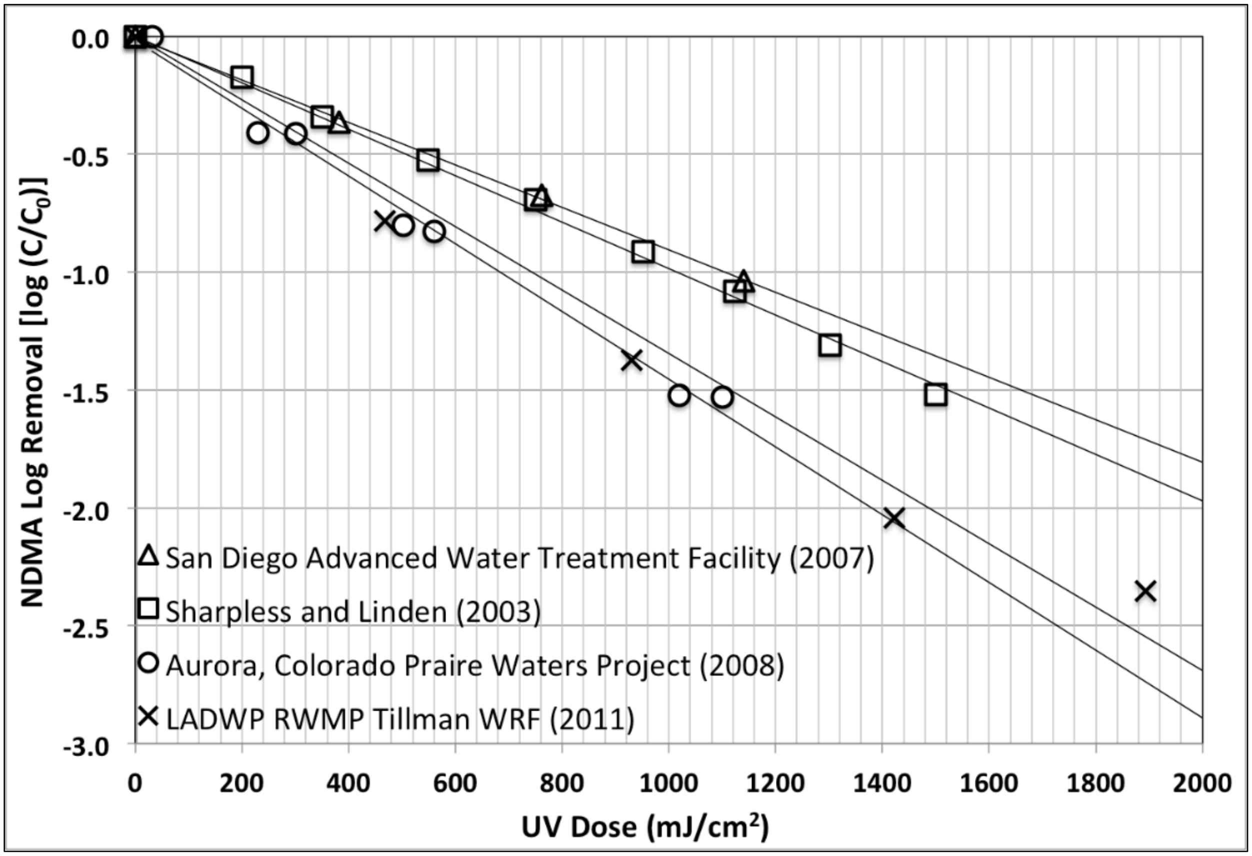

Figure 2 Collimated Beam Bench Testing Results for NDMA Collected in different Studies (San Diego, 2007; Sharpless and Linden, 2003; Swaim et al., 2008; Hokanson et al., 2011). Graphic credit: Trussell Technologies

Advanced Oxidation

The UV AOP at the Demo combined high intensity UV light with sodium hypochlorite to generate the necessary radicals for destruction a broad range of other chemical pollutants. DDW (2018) requires all IPR groundwater recharge and reservoir augmentation projects to provide, at a minimum, 0.5-log removal of 1,4-dioxane after the RO process. Destruction of 1,4-dioxane is a surrogate for broader removal of trace pollutants, as demonstrated by Hokanson et al. (2011) (Figure 3).

The destruction of 1,4-dioxane has been shown to directly correlate with the combined dose of UV and the oxidant (e.g., hypochlorite) (Oxnard (2018), City of Los Angeles (2018)), noting that performance appears to be site specific and the dose must be determined on site. To date, no UV AOP testing has been performed at the Demo, though the UV system is operating at a high UV dose (~1,600 mJ/cm^2) and with a free chlorine feed concentration of ~2.5 to ~3.0 mg/L, sufficient to attain the DDW requirements for 0.5-log removal of 1,4-dioxane.

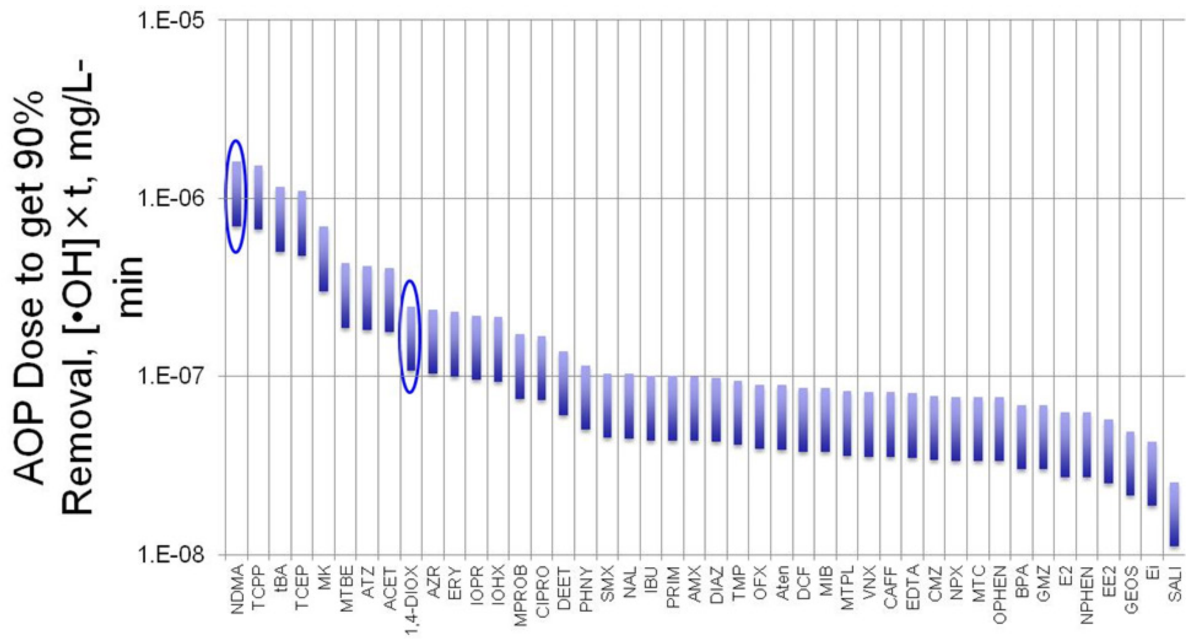

Figure 3 Destruction of Trace Pollutants by UV AOP (Hokanson et al., 2011)

Free Chlorination

The free chlorine dosed ahead of the UV reactor is dual-purpose, providing for advanced oxidation ahead of UV and also providing for a free chlorine residual that provides a measure of disinfection. While USEPA has clear guidance on pathogen credits for free chlorination in water, DDW relies upon regulatory analysis and guidance from Australia (WaterSecure, 2017), as shown in Figure 4 below.

pH	Log_{10} inactivation	≤0.2 NTU					≤2 NTU					≤5 NTU				
		5 °C	10 °C	15 °C	20 °C	25 °C	5 °C	10 °C	15 °C	20 °C	25 °C	5 °C	10 °C	15 °C	20 °C	25 °C
≤7	1	4	3	2	2	1	4	3	2	2	1	4	3	2	2	1
	2	5	4	3	2	2	5	4	3	2	2	6	4	3	2	2
	3	7	5	4	3	2	7	5	4	3	2	7	5	4	3	2
	4	8	6	4	3	2	9	6	4	3	2	9	7	5	3	3
≤7.5	1	7	5	4	3	2	7	5	4	3	2	8	6	4	3	2
	2	10	7	5	4	3	10	7	5	4	3	13	9	6	5	4
	3	13	9	7	5	4	13	9	7	5	4	16	12	9	6	5
	4	16	11	8	6	4	16	11	8	6	4	21	15	11	7	6
≤8	1	9	7	5	3	3	10	7	5	4	3	12	9	6	4	3
	2	14	10	7	5	4	15	10	7	5	4	19	13	9	7	5
	3	18	13	9	7	5	19	13	10	7	5	25	18	13	9	7
	4	23	16	12	8	6	23	16	12	8	6	32	23	16	11	8
≤8.5	1	11	8	6	4	3	12	9	6	5	4	14	10	7	5	4
	2	17	12	9	6	5	19	13	9	7	5	21	15	11	8	6
	3	23	16	12	9	6	25	17	13	9	7	29	21	15	10	8
	4	29	21	15	10	8	31	22	16	11	8	37	26	18	13	9
≤9	1	13	9	6	5	3	14	10	7	5	4	15	10	7	5	4
	2	20	14	10	7	5	22	16	11	8	6	23	16	12	8	6
	3	28	19	14	10	7	30	21	15	11	8	32	23	16	11	8
	4	35	25	17	12	9	38	27	19	13	10	41	29	20	14	10

Figure 4 CT Tables per the Australian Protocol (WaterSecure, 2017)

Following the UV is a small storage tank of ~30 gallons. Prior to a tasting event, the finished water will be fed into the container and held to achieve 4 LRV of virus based upon the information below. After holding, the water will go through a flash chilling device and to the tap for tasting.

The CT (free chlorine residual times contact time) required for different virus log reduction credits from WaterSecure (2017) can be calculated using a conservative temperature (20 degrees C in this case, which is well below the current finished water temperature of 23 to 24 degrees C) and pH of <7 (the pH in the finished water is ~5.5). CT values based upon LRV targets are shown below:

- 1 LRV of virus – Minimum CT of 2 mg-min/L.
- 2 LRV of virus – Minimum CT of 2 mg-min/L.
- 3 LRV of virus – Minimum CT of 3 mg-min/L.
- 4 LRV of virus – Minimum CT of 3 mg-min/L.

The operational plan is to provide the CT of >3 mg-min/L by storing the water for sufficient time with sufficient residual (e.g., 3 minutes at 1 mg/L of free chlorine). It should be noted that the Australian data was capped due to local regulations at 4 LRV. In addition, the experiments to produce the chlorination curves were not conducted on RO permeate, but filtered recycled water. On RO permeate, the efficacy of chlorine disinfection would be expected to be higher as there is no chlorine demand. If the curve were extrapolated to a contact time of 5 - 6 mg-min/L (i.e. waiting 6 minutes instead of 3) then arguably over 6 LRV for virus could be achieved. Accordingly, the 4 LRV claimed at a contact time of 3 minutes is conservative.

Pathogen Data

Limited testing of indigenous virus has been completed at the demo. To date, only one sampling event has been completed for indigenous pathogens, focusing only upon pepper mold mottle virus (PMMoV) and SARS-CoV-2 (Covid-19), with data showing robust reduction (~99%) of PMMoV across the low pressure membrane systems (MF and UF), and the lack of detection of SARS-CoV-2 in the tertiary feed water to the Demo as well as in the RO permeate.

Chemical Water Quality

Regulated Chemicals

A broad list of chemicals are regulated for potable water reuse projects, including inorganics, radioactivity, organics, disinfection byproducts, and other chemicals. The regulations utilize "maximum contaminent levels" (MCLs), secondary MCLs (sMCLs), and notification levels (NLs).

Appendix A contains a complete list of the regulated chemicals for a potable reuse project in California. Appendix B contains the raw sample results from the contract laboratory for the June 30th sampling event. Table 8 contains a list of all detected regulated chemicals based upon sampling for the full list of regulated chemicals (Appendix A). Note that all detected chemicals were found below regulated levels, with the exception of TON and chlorate which were subsequently solved through the use of higher quality sodium hypochlorite.

Table 8 Summary of Detected Chemicals with Regulatory Limits

Constituent	Measured Value	Regulated Value
Bulk Parameters		
Conductance	49 umhos/cm	900 umhos/cm
Total Dissolved Solids	19 mg/L	500 mg/L
Total Organic Carbon	0.3 mg/L	0.3 mg/L
TON	12[3]	3
Total Trihalomethanes	41 ug/L	80 ug/L
Total Nitrogen	0.29 mg/L	10 mg/L
Radioactivity		
Gross Alpha	0.48 pCi/L	15 pCi/L
Gross Beta	0.88 pCi/L	50 pCi/L
Combined Radium-(226&228)	0.508 pCi/L & 0.519 pCi/L	5 pCi/L
Miscellaneous Chemicals		
Chlorate	1,100 ug/L[4]	800 ug/L
Chloride	7.8 mg/L	250 mg/L
Formaldehyde	6.8 ug/L	100 ug/L
Sulfate	1.5 mg/L	250 mg/L

Chemicals of Emerging Concern

A list of Chemicals of Emerging Concern (CECs) was also sampled, with all results presented below, including results below detectable levels.

- 19 CECs were not detected: Gimfibrozil (<1 ng/L), Ibuprofen (<1 ng/L), Iopromide (<5 ng/L), Naproxin (<1 ng/L), Acetaminophen (<20 ng/L), Amoxicillin (<400 ng/L), Atenolol (<1 ng/L), Caffiene (<1 ng/L), Carbamazapine (<1 ng/L), Cotinine (<2 ng/L), Diazepam (<1 ng/L), Meprobamate (<1 ng/L), Methadone (<1 ng/L), Phytoin (<65 ng/L), Primidone (<1 ng/L), Sulfamethoxazole (<1 ng/L), TCEP (<5 ng/L), TDCPP (<42 ng/L), and Trimethoprim (<1 ng/L).
- 10 CECs were detected. None are present at levels near or above health-based screening levels, where those levels have been established, as shown in the table below.

[3] See section on TON, noting that the high TON value was an anomaly and subsequent values were at a TON of 1.
[4] See section on Chlorate, noting that chlorate concentrations were the result of degraded sodium hypochlorite supplies.

Table 9 Summary of Detected CECs with Health Based Concentrations

Detected Chemical	Detected Concentration in Finished Water (ng/L)	Health Screening Level for drinking (ng/L) (1)
Bisphenol A	13	35,000(2)
Salicylic Acid	56	110,000(2)
Triclosan	4.5	2,100,000
Atorvastatin	4.7	1,000(2)
Azithromycin	43	120(2)
Ciprofloxacin	100	23,000(2)
DEET	3	200,000
Fluoxetine	8.3	2,000(2)
Sucralose	270	150,000,000
TCPP	140	-(3)

Notes:
(1) Health screening and concentration data taken from Trussell et al. 2013 unless otherwise specified
(2) Health screening level taken from (Drewes et al. 2018). The lowest (most conservative) health screening value was selected.
(3) No health screening level available, lowest health screening level for a similar flame retardant TCEP from Drewes et al. 2018 is 2,500.

A broad range of Per and Polyfluoroalkyl Substances (PFAS) were included with the CEC analysis, noting that two PFAS chemicals (PFOA and PFOS) are regulated in California. Only PFHpH, which is not regulated, was found in the finished water, at a concentration of 9.9 ng/L[5].

Chlorate

In initial testing, chlorate was found in the finished water from the Demo exceeding the DDW NL value of 800 *u*g/L. Other work on site suggested that the sodium hypochlorite feed stock provided by the chemical supplier was not “fresh”, meaning that the stock solution was old and had degraded, in some cases substantially. It is known that chlorate is a degradation product of sodium hypochlorite. Subsequent batches of sodium hypochlorite were obtained that were fresh, with a percent by weight over 13%. Those batches did not see the higher (and concerning) concentrations of chlorate. Data from several rounds of testing is shown in Figure 5, below. These data show that, under the important determination of “fresh” hypochlorite, a free chlorine dose of ~3 mg/L will not result in an exceedance of the DDW NL of 800 *u*g/L.

In addition to the chlorate testing, the District operators with assistance from Carollo are now taking the following steps to manage chlorate formation:

- Monitoring the concentration of hypochlorite deliveries upon arrival,
- Investigating alternate suppliers with less variable quality, and
- Continuing monitoring sampling of chlorate to increase water quality confidence.

[5] See section on QA/QC, this detection was likely either a lab or sampling error.

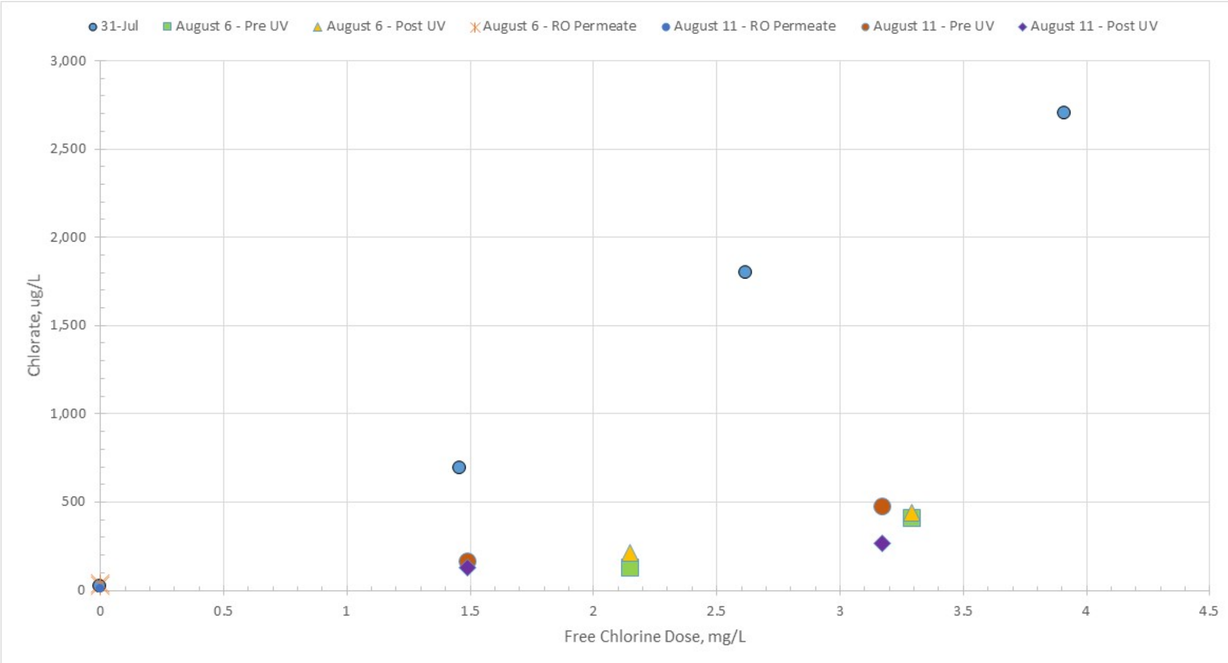

Figure 5 Chlorate Concentrations at the Demo

Threshold Odor Number

Similar to the chlorate findings, initial TON values exceeded regulatory guidance (this time, exceeding the secondary MCL of 3 with a value of 12). Subsequent TON testing with "fresh" sodium hypochlorite documented TON values all of 1.

QA/QC

Perspective is important in analyzing one set of results for a broad range of contaminants. Often some of these chemicals are found in the low ng/L range. Improper sampling, contamination during transport, contamination in the laboratory, and laboratory error all contribute to a level of uncertainty with the final results. Repeated testing coupled with blanks, duplicates, and other measure of quality control are important for a level understanding of long-term results.

With that said, challenges with data quality are noted below:

- Analytical Recovery:
  - High recoveries, in excess of 150 percent, where seen for PFHpA, salicylic acid, amoxicillin, ciprofloxacin, meprobamate, continine, sucralose, sulfate, and chlorate.
  - Low recoveries, below 50 percent, where seen for diquat, iohexal, and phenytoin.
- Field Blanks:
  - For the finished water sampling on June 30th, all Per and Polyfluoroalkyl Substances (PFAS) were below detection with the exception of PFHpA, detected at 9.9 ng/L. However, the field blank for PFAS showed ND for all PFAS with the exception of PFHpA with a field blank value of 10 mg/L for that same chemical.
- Laboratory Blanks:
  - The following chemicals were found in laboratory blanks: atenolol, azithromycin, caffiene, ciprofloxacin, cotinine, galaxolide, quinoline, and sucralose. For simplicity, the measured concentrations are not listed here but can be found in Appendix B.

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Appendix A

WATER QUALITY REQUIREMENTS FOR POTABLE WATER REUSE

Table A1 Inorganics with Primary MCLs or ALs[1]

Constituents	Primary MCL or AL (in mg/L)	Constituents	Primary MCL or AL (in mg/L)
Aluminum	1.0	Fluoride[5]	2
Antimony	0.006	Lead	0.015[3,4]
Arsenic	0.010	Mercury	0.002
Asbestos	7 (MFL)[2]	Nickel	0.1
Barium	1	Nitrate (as N)	10
Beryllium	0.004	Nitrite (as N)	1
Cadmium	0.005	Nitrate + Nitrite (as N)	10
Chromium	0.05	Perchlorate	0.006
Copper[5]	1.3[3]	Selenium[5]	0.05
Cyanide	0.15	Thallium	0.002

Notes:
(1) Based on Table 64431-A and Section 64678.
(2) MFL - Million fibers per liter, with fiber lengths > 10 microns.
(3) Regulatory Action Level; if system exceeds, it must take certain actions such as additional monitoring, corrosion control studies and treatment, and for lead, a public education program; replaces MCL.
(4) The MCL for lead was rescinded with the adoption of the regulatory action level described in footnote '3'.
(5) Central Coast Basin Plan Water Quality Objective is more stringent: copper-0.2 mg/L; fluoride-1 mg/L; selenium 0.02 mg/L.

Table A.2 Radioactivity[1]

Constituents	MCL (in pCi/L)	Constituents	MCL (in pCi/L)
Uranium	20	Beta/photon emitters	50[2]
Combined radium 226 & 228	5	Strontium-90	8[2]
Gross alpha particle activity	15	Tritium	20,000[2]

Notes:
(1) Based on Tables 64442 and 64443.
(2) MCLs are intended to ensure that exposure above 4 millirem/yr does not occur.

Table A.3 Regulated Organics[1]

Constituents	MCL (in mg/L)	Constituents	MCL (in mg/L)
Volatile Organic Compounds			
Benzene	0.001	Monochlorobenzene	0.07
Carbon Tetrachloride	0.0005	Styrene	0.1
1,2-Dichlorobenzene	0.6	1,1,2,2-Tetrachloroethane	0.001
1,4-Dichlorobenzene	0.005	Tetrachloroethylene	0.005
1,1-Dichloroethane	0.005	Toluene	0.15
1,2-Dichloroethane	0.0005	1,2,4 Trichlorobenzene	0.005
1,1-Dichloroethylene	0.006	1,1,1-Trichloroethane	0.2
cis-1,2-Dichloroethylene	0.006	1,1,2-Trichloroethane	0.005
trans-1,2-Dichloroethylene	0.01	Trichloroethylene	0.005
Dichloromethane	0.005	Trichlorofluoromethane	0.15
1,3-Dichloropropene	0.0005	1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2
1,2-Dichloropropane	0.005	Vinyl chloride	0.0005
Ethylbenzene	0.3	Xylenes	1.75
MTBE	0.013		
SVOCs			
Alachlor	0.002	Heptachlor	0.00001
Atrazine	0.001	Heptachlor Epoxide	0.00001
Bentazon	0.018	Hexachlorobenzene	0.001
Benzo(a) Pyrene	0.0002	Hexachlorocyclopentadiene	0.05
Carbofuran	0.018	Lindane	0.0002
Chlordane	0.0001	Methoxychlor	0.03
Dalapon	0.2	Molinate	0.02
Dibromochloropropane	0.0002	Oxamyl	0.05
Di(2-ethylhexyl)adipate	0.4	Pentachlorophenol	0.001
Di(2-ethylhexyl)phthalate	0.004	Picloram	0.5
2,4-D	0.07	Polychlorinated Biphenyls	0.0005

Constituents	MCL (in mg/L)	Constituents	MCL (in mg/L)
Dinoseb	0.007	Simazine	0.004
Diquat	0.02	Thiobencarb	0.07/0.001[2]
Endothall	0.1	Toxaphene	0.003
Endrin	0.002	1,2,3-Trichloropropane	5x10-6
Ethylene Dibromide	0.00005	2,3,7.8-TCDD (Dioxin)	3x10-8
Glyphosate	0.7	2,4,5-TP (Silvex)	0.05

Notes:
(1) Based on Table 64444-A.
(2) Second value is listed as a Secondary MCL.

Table A.4 Disinfection By-Products[1]

Constituents	MCL (in mg/L)	Constituents	MCL (in mg/L)
Total Trihalomethanes	0.080	Bromate	0.010
Total haloacetic acids	0.060	Chlorite	1.0

Note:
(1) Based on Table 64533-A.

Table A.5 Constituents/Parameters with Secondary MCLs

Constituents[1]	sMCL (in mg/L)	Constituents[2]	sMCL (in mg/L)
Aluminum	0.2	TDS	500
Color	15 (units)	Specific Conductance	900 uS/cm
Copper	1	Chloride	250
Foaming Agents (MBAS)	0.5	Sulfate	250
Iron	0.3		
Manganese	0.05		
MTBE	0.005		
Odor Threshold	3 (units)		
Silver	0.1		
Thiobencarb	0.001		

Constituents[1]	sMCL (in mg/L)	Constituents[2]	sMCL (in mg/L)
Turbidity	5 (NTU)[3]		
Zinc[4]	5		

Notes:
(1) Based on Table 64449-A.
(2) Based on Table 64449-B.
(3) NTU - nephelometric turbidity unit; *u*S/cm - microsiemens per centimeter.
(4) Central Coast Basin Plan Water Quality Objective is more stringent: zinc-2 mg/L.

Table A.6 Constituents with Notification Levels[1, 2]

Constituents	NL (in µg/L)	Constituents[3]	NL (in µg/L)
Boron[4]	1,000	Methyl isobutyl ketone (MIBK)	120
n-Butylbenzene	260	Naphthalene	17
sec-Butylbenzene	260	N-Nitrosodiethylamine (NDEA)	0.01
tert-Butylbenzene	260	N-Nitrosodimethylamine (NDMA)	0.01
Carbon disulfide	160	N-Nitrosodi-n-propylamine (NDPA)	0.01
Chlorate	800	Perfluorooctanoic acid (PFOA)	0.0051
2-Chlorotoluene	140	Perfluorooctanesulfonic acid (PFOS)	0.0065
4-Chlorotoluene	140	Propachlor	90
Diazinon	1.2	n-Propylbenzene	260
Dichlorodifluoromethane (Freon 12)	1,000	RDX[3]	0.3
1,4-Dioxane	1	Tertiary butyl alcohol (TBA)	12
Ethylene glycol	14,000	1,2,4-Trimethylbenzene	330
Formaldehyde	100	1,3,5-Trimethylbenzene	330
HMX	350	2,4,6-Trinitrotoluene (TNT)	1
Isopropylbenzene	770	Vanadium	50
Manganese	500(2)		

Notes:
(1) Based on https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/notificationlevels/notification_levels_response_levels_overview.pdf , published August 23, 2019
(2) The web link above also contains the levels of the pollutants in this table that must result in a removal of the water source from service.
(3) RDX - Research Department Explosive (O2NNCH2)3.
(4) Central Coast Basin Plan Water Quality Objective is more stringent: boron- 750 ug/L (500 ug/L is the "no problem" water quality guideline); vanadium-

Table A.7 Monitoring Requirements for CECs per SWRCB (2019a)

Constituent	Relevance	MTL (in µg/L)	Example Removal Percentages (%)
1,4-dioxane	Health	1	--
NDMA(1)	Health and Performance	0.010	>25-50, 80
NMOR(2)	Health	0.012	--
PFOS	Health	0.013	--
PFOA	Health	0.014	--
Sulfamethoxazole(2)	Performance	-	>90
Sucralose(2)	Performance	-	>90
Dissolved Organic Carbon(2)	Surrogate (example)	-	>90
UV Absorbance(2)	Surrogate (example)	-	>50
EC(2)	Surrogate (example)	-	>90
Estrogen receptor-alpha bioassay(2)	Bioanalytical Screening	-	--
Aryl hydrocarbon bioassay(2)	Bioanalytical Screening	-	--

Notes:

(1) Health-based CECs and Bioanalytical Screening to be monitored following treatment.

(2) Performance indicator CECs to be monitored before RO and after treatment.

(3) Surrogates are provided as examples. Surrogates should be used to demonstrate effectiveness.

Appendix B

LABORATORY REPORT FOR JUNE 30TH, 2020 SAMPLING EVENT

Certificate of Analysis

FINAL REPORT

WECK LABORATORIES, INC.

Work Orders:	0F30024	**Report Date:**	8/21/2020
		Received Date:	6/30/2020
Project:	Pure Water Testing	**Turnaround Time:**	Normal
		Phones:	(818) 251-2200
		Fax:	(818) 251-2109
Attn:	Frank Almaguer	**P.O. #:**	
Client:	Las Virgenes Municipal Water District 4232 Las Virgenes Road Calabasas, CA 91302	**Billing Code:**	

DoD-ISO ANAB # • ELAP-CA #1132 • EPA-UCMR #CA00211 • HW-DOH # • ISO17025 ANAB #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • SCAQMD #93LA1006

This is a complete final report. The information in this report applies to the samples analyzed in accordance with the chain-of-custody document. Weck Laboratories certifies that the test results meet all requirements of TNI unless noted by qualifiers or written in the Case Narrative. This analytical report must be reproduced in its entirety.

Dear Frank Almaguer,

Enclosed are the results of analyses for samples received 6/30/20 with the Chain-of-Custody document. The samples were received in good condition, at 3.4 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Regina M. Giancola
Project Manager

14859 Clark Avenue,City of Industry CA, 91745 | Phone: (626) 336-2139 | Fax: (626) 336-2634
www.wecklabs.com

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, CA 91302

Project Number: Pure Water Testing

Project Manager: Frank Almaguer

Reported: 08/21/2020 15:59

Sample Summary

Sample Name	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
Finished Water	ATS	0F30024-01	Water	06/30/20 10:00	
Field Blank		0F30024-02	Water	06/30/20 09:30	

Analyses Accreditation Summary

Analyte	CAS #	Not By NELAP	ANAB ISO 17025
EPA 521 in Water			
N-Nitrosodimethylamine	62-75-9	✓	
N-Nitrosomethylethylamine	10595-95-6	✓	
N-Nitrosodiethylamine	55-18-5	✓	
N-Nitrosodi-n-propylamine	621-64-7	✓	
N-Nitrosomorpholine	59-89-2	✓	
N-Nitrosopyrrolidine	930-55-2	✓	
N-Nitrosopiperidine	100-75-4	✓	
N-Nitrosodi-n-butylamine	924-16-3	✓	
NDMA-d6		✓	
EPA 556 in Water			
Formaldehyde	50-00-0	✓	
2,4,5-TFAP	129322-83-4	✓	
LC/MS/MS in Water			
Iohexol	66108-95-0	✓	
SM 5910B in Water			
UV 254		✓	
SRL 524M-TCP in Water			
1,2,3-Trichloropropane	96-18-4	✓	

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Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, CA 91302

Project Number: Pure Water Testing

Project Manager: Frank Almaguer

Reported: 08/21/2020 15:59

Sample Results

Sample: Finished Water — 0F30024-01 (Water) — Sampled: 06/30/20 10:00 by ATS

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
1,4-Dioxane by SPE/GCMS SIM, EPA Method 522							
Method: EPA 522			**Instr:** GCMS20				
Batch ID: W0F1841 — **Preparation:** EPA 522/SPE			**Prepared:** 07/01/20 09:00				**Analyst:** mld
1,4-Dioxane	ND		0.070	ug/l	1	07/02/20	
Surrogate(s)							
1,4-Dioxane-d8	*98%*	*Conc: 9.84*	*70-130*			*07/02/20*	
Acrylamide low levels by EPA Method 8316							
Method: EPA 8316			**Instr:** LCMS02				
Batch ID: W0G0592 — **Preparation:** _NONE (LC)			**Prepared:** 07/13/20 11:28				**Analyst:** kan
Acrylamide	ND		0.10	ug/l	1	07/13/20	
Aldehydes and Carbonyl Compounds by GC/ECD							
Method: EPA 556			**Instr:** GC08				
Batch ID: W0G0132 — **Preparation:** EPA 556/Micro Ext.			**Prepared:** 07/06/20 08:35				**Analyst:** amw
Formaldehyde	**6.8**		2.0	ug/l	1	07/10/20	
Surrogate(s)							
2,4,5-TFAP	*112%*	*Conc: 22.4*	*70-130*			*07/10/20*	
Anions by IC, EPA Method 300.0							
Method: EPA 300.0			**Instr:** LC04				
Batch ID: W0G0250 — **Preparation:** _NONE (LC)			**Prepared:** 07/07/20 12:35				**Analyst:** jna
Chloride, Total	**7.8**		1.0	mg/l	2	07/10/20	
Fluoride, Total	ND		0.20	mg/l	2	07/10/20	
Sulfate as SO4	**1.5**		1.0	mg/l	2	07/10/20	
Anions by IC, EPA Method 300.1							
Method: EPA 300.1			**Instr:** LC08				
Batch ID: W0G0041 — **Preparation:** _NONE (LC)			**Prepared:** 07/01/20 12:47				**Analyst:** jna
Bromate	ND		5.0	ug/l	1	07/02/20	
Chlorite	ND		10	ug/l	1	07/02/20	
Surrogate(s)							
Dichloroacetate	*100%*	*Conc: 500*	*90-115*			*07/02/20*	
Carbamates and Urea Pesticides							
Method: EPA 531.2			**Instr:** LC10				
Batch ID: W0G0155 — **Preparation:** _NONE (LC)			**Prepared:** 07/06/20 11:34				**Analyst:** jna
3-Hydroxycarbofuran	ND		10	ug/l	5	07/07/20	M-05
Aldicarb	ND		10	ug/l	5	07/07/20	M-05
Aldicarb sulfone	ND		10	ug/l	5	07/07/20	M-05
Aldicarb sulfoxide	ND		10	ug/l	5	07/07/20	M-05
Carbaryl	ND		10	ug/l	5	07/07/20	M-05
Carbofuran	ND		10	ug/l	5	07/07/20	M-05
Methiocarb	ND		10	ug/l	5	07/07/20	M-05

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Project Manager: Frank Almaguer

Reported: 08/21/2020 15:59

Sample Results (Continued)

Sample: Finished Water — 0F30024-01 (Water)

Sampled: 06/30/20 10:00 by ATS (Continued)

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
Carbamates and Urea Pesticides (Continued)							
Method: EPA 531.2			**Instr:** LC10				
Batch ID: W0G0155	**Preparation:** _NONE (LC)		**Prepared:** 07/06/20 11:34				**Analyst:** jna
Methomyl	ND		10	ug/l	5	07/07/20	M-05
Oxamyl	ND		10	ug/l	5	07/07/20	M-05
Propoxur (Baygon)	ND		10	ug/l	5	07/07/20	M-05
Surrogate(s)							
BDMC	*117%*	*Conc: 58.5*	*70-130*			*07/07/20*	*M-05*
Chlorinated Acids Herbicides by GC/ECD							
Method: EPA 515.4			**Instr:** GC08				
Batch ID: W0G0176	**Preparation:** EPA 515.4/Micro Ext. Drtz		**Prepared:** 07/07/20 08:15				**Analyst:** amw
2,4,5-T	ND		0.20	ug/l	1	07/13/20	
2,4,5-TP (Silvex)	ND		0.20	ug/l	1	07/13/20	
2,4-D	ND		0.40	ug/l	1	07/13/20	
2,4-DB	ND		2.0	ug/l	1	07/13/20	
3,5-Dichlorobenzoic acid	ND		1.0	ug/l	1	07/13/20	
Acifluorfen	ND		0.40	ug/l	1	07/13/20	
Bentazon	ND		2.0	ug/l	1	07/13/20	
Dalapon	ND		0.40	ug/l	1	07/13/20	
DCPA	ND		0.10	ug/l	1	07/13/20	
Dicamba	ND		0.60	ug/l	1	07/13/20	
Dichloroprop	ND		0.30	ug/l	1	07/13/20	
Dinoseb	ND		0.40	ug/l	1	07/13/20	
Pentachlorophenol	ND		0.20	ug/l	1	07/13/20	
Picloram	ND		0.60	ug/l	1	07/13/20	
Surrogate(s)							
2,4-DCAA	*97%*	*Conc: 9.67*	*70-130*			*07/13/20*	
Chlorinated Pesticides and/or PCBs by GC/ECD							
Method: EPA 508			**Instr:** GC07				
Batch ID: W0G0230	**Preparation:** EPA 508/L-L SF		**Prepared:** 07/07/20 10:20				**Analyst:** AMW
4,4´-DDD	ND		0.010	ug/l	1	07/21/20	
4,4´-DDE	ND		0.010	ug/l	1	07/21/20	
4,4´-DDT	ND		0.010	ug/l	1	07/21/20	
Aldrin	ND		0.010	ug/l	1	07/21/20	
alpha-BHC	ND		0.010	ug/l	1	07/21/20	
Aroclor 1016	ND		0.10	ug/l	1	07/21/20	
Aroclor 1221	ND		0.10	ug/l	1	07/21/20	
Aroclor 1232	ND		0.10	ug/l	1	07/21/20	
Aroclor 1242	ND		0.10	ug/l	1	07/21/20	

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Sample Results

(Continued)

Sample: Finished Water — 0F30024-01 (Water)

Sampled: 06/30/20 10:00 by ATS

(Continued)

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
Chlorinated Pesticides and/or PCBs by GC/ECD (Continued)							
Method: EPA 508			**Instr:** GC07				
Batch ID: W0G0230 — **Preparation:** EPA 508/L-L SF			**Prepared:** 07/07/20 10:20				**Analyst:** AMW
Aroclor 1248	ND		0.10	ug/l	1	07/21/20	
Aroclor 1254	ND		0.10	ug/l	1	07/21/20	
Aroclor 1260	ND		0.10	ug/l	1	07/21/20	
beta-BHC	ND		0.010	ug/l	1	07/21/20	
Chlordane (tech)	ND		0.10	ug/l	1	07/21/20	
Chlorothalonil	ND		0.050	ug/l	1	07/21/20	
delta-BHC	ND		0.010	ug/l	1	07/21/20	
Dieldrin	ND		0.010	ug/l	1	07/21/20	
Endosulfan I	ND		0.010	ug/l	1	07/21/20	
Endosulfan II	ND		0.010	ug/l	1	07/21/20	
Endosulfan sulfate	ND		0.010	ug/l	1	07/21/20	
Endrin	ND		0.010	ug/l	1	07/21/20	
Endrin aldehyde	ND		0.010	ug/l	1	07/21/20	
gamma-BHC (Lindane)	ND		0.010	ug/l	1	07/21/20	
Heptachlor	ND		0.010	ug/l	1	07/21/20	
Heptachlor epoxide	ND		0.010	ug/l	1	07/21/20	
Hexachlorobenzene	ND		0.050	ug/l	1	07/21/20	
Hexachlorocyclopentadiene	ND		0.050	ug/l	1	07/21/20	
Methoxychlor	ND		0.010	ug/l	1	07/21/20	
PCBs, Total	ND		0.50	ug/l	1	07/21/20	
Propachlor	ND		0.050	ug/l	1	07/21/20	
Toxaphene	ND		1.0	ug/l	1	07/21/20	
Trifluralin	ND		0.010	ug/l	1	07/21/20	
Surrogate(s)							
Decachlorobiphenyl	*124%*	*Conc: 0.130*	*70-130*			*07/21/20*	
Tetrachloro-meta-xylene	*66%*	*Conc: 0.0699*	*70-130*			*07/21/20*	*S-GC*
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods							
Method: _Various			**Instr:** [CALC]				
Batch ID: [CALC] — **Preparation:** [CALC]			**Prepared:** 07/01/20 11:52				**Analyst:** jna
Total Anions	**0.44**		0.17	meq/l	2	07/10/20	
Total Cations	**0.42**		0.038	meq/l	1	07/02/20	
Total Hardness as CaCO3	**1.02**		0.662	mg/l	1	07/02/20	
Method: EPA 140.1			**Instr:** _ANALYST				
Batch ID: W0F1836 — **Preparation:** _NONE (WETCHEM)			**Prepared:** 06/30/20 17:26				**Analyst:** ssi
Threshold Odor Number	**12**		1.0	T.O.N.	1	06/30/20 17:45	

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Project Number: Pure Water Testing

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Reported: 08/21/2020 15:59

Sample Results (Continued)

Sample: Finished Water — 0F30024-01 (Water)

Sampled: 06/30/20 10:00 by ATS (Continued)

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods (Continued)						
Method: EPA 180.1 — **Instr:** TURB01						
Batch ID: W0G0068 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 07/01/20 17:18 — **Analyst:** SBN						
Turbidity	ND	0.10	NTU	1	07/01/20 17:35	
Method: EPA 335.4 — **Instr:** AA01						
Batch ID: W0G0140 — **Preparation:** MIDI-Distillation — **Prepared:** 07/06/20 09:28 — **Analyst:** SAR						
Cyanide, Total	ND	5.0	ug/l	1	07/08/20	
Method: EPA 353.2 — **Instr:** AA01						
Batch ID: W0F1837 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 06/30/20 17:39 — **Analyst:** ymt						
Nitrate as N	**0.29**	0.20	mg/l	1	07/01/20 17:12	
Nitrite as N	ND	100	ug/l	1	07/01/20 17:12	
NO2+NO3 as N	**290**	200	ug/l	1	07/01/20	
Method: SM 2120B — **Instr:** _ANALYST						
Batch ID: W0F1838 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 06/30/20 17:45 — **Analyst:** ism						
Color	ND	3.0	Color Units	1	07/01/20 13:32	
Method: SM 2320B — **Instr:** AA02						
Batch ID: W0G0013 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 07/01/20 09:41 — **Analyst:** sbn						
Alkalinity as CaCO3	**8.7**	5.0	mg/l	1	07/01/20	
Bicarbonate Alkalinity as HCO3	**11**	6.1	mg/l	1	07/01/20	
Carbonate Alkalinity as CaCO3	ND	5.0	mg/l	1	07/01/20	
Hydroxide Alkalinity as CaCO3	ND	5.0	mg/l	1	07/01/20	
Method: SM 2510B — **Instr:** AA02						
Batch ID: W0G0099 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 07/02/20 11:31 — **Analyst:** sbn						
Specific Conductance (EC)	**49**	2.0	umhos/cm	1	07/02/20	
Method: SM 2540C — **Instr:** OVEN01						
Batch ID: W0F1765 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 07/01/20 11:15 — **Analyst:** ism						
Total Dissolved Solids	**19**	10	mg/l	1	07/01/20	
Method: SM 4500H+-B — **Instr:** AA02						
Batch ID: W0F1828 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 06/30/20 16:31 — **Analyst:** sbn						
pH	**6.09**	0.10	Units	1	06/30/20 17:26	*
Method: SM 5310B — **Instr:** TOC02						
Batch ID: W0G0163 — **Preparation:** SM 5310B_comb — **Prepared:** 07/06/20 13:18 — **Analyst:** jlp						
Dissolved Organic Carbon	**0.30**	0.30	mg/l	1	07/06/20	A-01
Method: SM 5540C — **Instr:** UVVIS04						
Batch ID: W0G0004 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 07/01/20 09:06 — **Analyst:** mfh						
MBAS	ND	0.050	mg/l	1	07/01/20 17:26	
Method: SM 5910B — **Instr:** UVVIS04						
Batch ID: W0G0009 — **Preparation:** _NONE (WETCHEM) — **Prepared:** 07/01/20 09:22 — **Analyst:** ssi						
UV 254	ND	0.009	1/cm	1	07/01/20 10:15	

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FINAL REPORT

Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, CA 91302

Project Number: Pure Water Testing

Project Manager: Frank Almaguer

Reported: 08/21/2020 15:59

Sample Results

(Continued)

Sample: Finished Water — Sampled: 06/30/20 10:00 by ATS

0F30024-01 (Water) (Continued)

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Diquat and Paraquat by EPA 549.2						
Method: EPA 549.2		**Instr:** LC11				
Batch ID: W0G0142 — **Preparation:** EPA 549.2/SPE		**Prepared:** 07/06/20 09:29				**Analyst:** jna
Diquat	ND	4.0	ug/l	1	07/09/20	
Endothall By EPA 548.1						
Method: EPA 548.1		**Instr:** GCMS06				
Batch ID: W0G0141 — **Preparation:** EPA 548.1/SPE		**Prepared:** 07/06/20 09:28				**Analyst:** rmr
Endothall	ND	45	ug/l	1	07/08/20	
Explosives by EPA Method 8330						
Method: EPA 8330A		**Instr:** LC11				
Batch ID: W0G0131 — **Preparation:** EPA 8330/SPE		**Prepared:** 07/06/20 08:04				**Analyst:** jna
1,3,5-Trinitrobenzene	ND	1.0	ug/l	1	07/08/20	
1,3-Dinitrobenzene	ND	1.0	ug/l	1	07/08/20	
2,4,6-Trinitrotoluene	ND	1.0	ug/l	1	07/08/20	
2,4-Dinitrotoluene	ND	1.0	ug/l	1	07/08/20	
2,6-Dinitrotoluene	ND	1.0	ug/l	1	07/08/20	
2-Amino-4,6-Dinitrotoluene	ND	1.0	ug/l	1	07/08/20	
2-Nitrotoluene	ND	1.0	ug/l	1	07/08/20	
3-Nitrotoluene	ND	1.0	ug/l	1	07/08/20	
4-Amino-2,6-Dinitrotoluene	ND	1.0	ug/l	1	07/08/20	
4-Nitrotoluene	ND	1.0	ug/l	1	07/08/20	
HMX	ND	1.0	ug/l	1	07/08/20	
Nitrobenzene	ND	1.0	ug/l	1	07/08/20	
RDX	ND	1.0	ug/l	1	07/08/20	
Tetryl	ND	1.0	ug/l	1	07/08/20	
Glycols by GC/FID						
Method: EPA 8015B		**Instr:** GC09				
Batch ID: W0F1735 — **Preparation:** _NONE (SVOC)		**Prepared:** 06/30/20 15:30				**Analyst:** rjg
Ethylene glycol	ND	10	mg/l	1	06/30/20	
Glyphosate by EPA 547						
Method: EPA 547		**Instr:** LC10				
Batch ID: W0F1710 — **Preparation:** _NONE (LC)		**Prepared:** 06/30/20 14:57				**Analyst:** jna
Glyphosate	ND	5.0	ug/l	1	06/30/20	
Haloacetic Acids (HAAs) by GC/ECD						
Method: EPA 552.3		**Instr:** GC05				
Batch ID: W0G0076 — **Preparation:** EPA 552.3/Micro Ext. Drtz		**Prepared:** 07/02/20 08:41				**Analyst:** rjg
Dibromoacetic acid (dbaa)	ND	1.0	ug/l	1	07/08/20	
Dichloroacetic acid (dcaa)	ND	1.0	ug/l	1	07/08/20	
HAA5, Total	ND	1.0	ug/l	1	07/08/20	

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Sample Results

(Continued)

Sample: Finished Water — 0F30024-01 (Water)

Sampled: 06/30/20 10:00 by ATS

(Continued)

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
Haloacetic Acids (HAAs) by GC/ECD (Continued)							
Method: EPA 552.3			**Instr:** GC05				
Batch ID: W0G0076 — **Preparation:** EPA 552.3/Micro Ext. Drtz			**Prepared:** 07/02/20 08:41				**Analyst:** rjg
Monobromoacetic acid (mbaa)	ND		1.0	ug/l	1	07/08/20	
Monochloroacetic acid (mcaa)	ND		2.0	ug/l	1	07/08/20	
Trichloroacetic acid (tcaa)	ND		1.0	ug/l	1	07/08/20	
Surrogate(s)							
2-Bromobutyric acid	*102%*	*Conc: 10.2*	*70-130*			*07/08/20*	
Low Level 1,2,3-TCP by SRL Method, P&T, GC/MS SIM							
Method: SRL 524M-TCP			**Instr:** GCMS04				
Batch ID: W0G0002 — **Preparation:** EPA 524.2 P&T			**Prepared:** 07/01/20 08:20				**Analyst:** ADM
1,2,3-Trichloropropane	ND		0.0050	ug/l	1	07/02/20	
Metals by EPA 200 Series Methods							
Method: EPA 200.7			**Instr:** ICP03				
Batch ID: W0G0033 — **Preparation:** EPA 200.2			**Prepared:** 07/01/20 11:52				**Analyst:** kvm
Boron, Total	**210**		10	ug/l	1	07/02/20	
Calcium, Total	**0.233**		0.100	mg/l	1	07/02/20	
Iron, Total	ND		10	ug/l	1	07/02/20	
Magnesium, Total	**0.106**		0.100	mg/l	1	07/02/20	
Potassium, Total	**0.71**		0.10	mg/l	1	07/02/20	
Sodium, Total	**8.7**		0.50	mg/l	1	07/02/20	
Method: EPA 200.8			**Instr:** ICPMS04				
Batch ID: W0G0423 — **Preparation:** EPA 200.2			**Prepared:** 07/09/20 11:55				**Analyst:** mtt
Aluminum, Total	**11**		5.0	ug/l	1	07/13/20	
Antimony, Total	ND		0.50	ug/l	1	07/13/20	
Arsenic, Total	ND		0.40	ug/l	1	07/10/20	
Barium, Total	ND		0.50	ug/l	1	07/13/20	
Beryllium, Total	ND		0.10	ug/l	1	07/13/20	
Cadmium, Total	ND		0.10	ug/l	1	07/10/20	
Chromium, Total	ND		0.20	ug/l	1	07/10/20	
Copper, Total	ND		0.50	ug/l	1	07/13/20	
Lead, Total	ND		0.20	ug/l	1	07/13/20	
Manganese, Total	ND		0.20	ug/l	1	07/13/20	
Nickel, Total	ND		0.80	ug/l	1	07/13/20	
Selenium, Total	ND		0.40	ug/l	1	07/10/20	
Silver, Total	ND		0.20	ug/l	1	07/13/20	
Thallium, Total	ND		0.20	ug/l	1	07/13/20	
Vanadium, Total	ND		0.50	ug/l	1	07/10/20	
Zinc, Total	ND		5.0	ug/l	1	07/13/20	

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Sample Results (Continued)

Sample: Finished Water — Sampled: 06/30/20 10:00 by ATS
0F30024-01 (Water) (Continued)

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
Metals by EPA 200 Series Methods (Continued)							
Method: EPA 200.8			**Instr:** ICPMS04				
Batch ID: W0G0423 — **Preparation:** EPA 200.2			**Prepared:** 07/09/20 11:55				**Analyst:** mtt
Method: EPA 245.1			**Instr:** HG03				
Batch ID: W0G0175 — **Preparation:** EPA 245.1			**Prepared:** 07/08/20 15:15				**Analyst:** mem
Mercury, Total	ND		0.050	ug/l	1	07/09/20	
Nitrosamines by CI GC/MS/MS, EPA 521							
Method: EPA 521			**Instr:** GCMS09				
Batch ID: W0G0130 — **Preparation:** EPA 521/SPE			**Prepared:** 07/06/20 08:02				**Analyst:** mld
N-Nitrosodiethylamine	ND		2.0	ng/l	1	07/09/20	
N-Nitrosodimethylamine	ND		2.0	ng/l	1	07/09/20	
N-Nitrosodi-n-butylamine	ND		2.0	ng/l	1	07/09/20	
N-Nitrosodi-n-propylamine	ND		2.0	ng/l	1	07/09/20	
N-Nitrosomethylethylamine	ND		2.0	ng/l	1	07/09/20	
N-Nitrosomorpholine	ND		2.0	ng/l	1	07/09/20	
N-Nitrosopiperidine	ND		2.0	ng/l	1	07/09/20	
N-Nitrosopyrrolidine	ND		2.0	ng/l	1	07/09/20	
Surrogate(s)							
NDMA-d6	*85%*	*Conc: 22.1*	*70-130*			*07/09/20*	
Organic Compounds by Tandem LC/MS/MS							
Method: LC/MS/MS			**Instr:** LCMS03				
Batch ID: W0H0124 — **Preparation:** EPA 3535/SPE			**Prepared:** 07/28/20 08:00				**Analyst:** kan
Iohexol	ND		5.0	ng/l	1	08/10/20	BS-L
Per- and Polyflourinated Alkyl Substances (PFAS) by SPE/LCMSMS							
Method: EPA 537.1			**Instr:** LCMS06				
Batch ID: W0G0516 — **Preparation:** EPA 537/SPE			**Prepared:** 07/10/20 15:31				**Analyst:** jan
11Cl-PF3OUdS	ND		1.8	ng/l	1	07/14/20	
9Cl-PF3ONS	ND		1.8	ng/l	1	07/14/20	
ADONA	ND		1.8	ng/l	1	07/14/20	
EtFOSAA	ND		1.8	ng/l	1	07/14/20	
HFPO-DA	ND		1.8	ng/l	1	07/14/20	
MeFOSAA	ND		1.8	ng/l	1	07/14/20	
PFBS	ND		1.8	ng/l	1	07/14/20	
PFDA	ND		1.8	ng/l	1	07/14/20	
PFDoA	ND		1.8	ng/l	1	07/14/20	
PFHpA	**9.9**		1.8	ng/l	1	07/14/20	B
PFHxA	ND		1.8	ng/l	1	07/14/20	
PFHxS	ND		1.8	ng/l	1	07/14/20	
PFNA	ND		1.8	ng/l	1	07/14/20	

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Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, CA 91302

Project Number: Pure Water Testing

Project Manager: Frank Almaguer

Reported: 08/21/2020 15:59

Sample Results

(Continued)

Sample: Finished Water
0F30024-01 (Water)

Sampled: 06/30/20 10:00 by ATS

(Continued)

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
Per- and Polyflourinated Alkyl Substances (PFAS) by SPE/LCMSMS (Continued)							
Method: EPA 537.1			**Instr:** LCMS06				
Batch ID: W0G0516	**Preparation:** EPA 537/SPE		**Prepared:** 07/10/20 15:31				**Analyst:** jan
PFOA	ND		1.8	ng/l	1	07/14/20	
PFOS	ND		1.8	ng/l	1	07/14/20	
PFTeDA	ND		1.8	ng/l	1	07/14/20	
PFTrDA	ND		1.8	ng/l	1	07/14/20	
PFUnA	ND		1.8	ng/l	1	07/14/20	
Surrogate(s)							
13C2-PFDA	*100%*	*Conc: 35.9*	*70-130*			*07/14/20*	
13C2-PFHxA	*114%*	*Conc: 40.7*	*70-130*			*07/14/20*	
d5-EtFOSAA	*88%*	*Conc: 31.5*	*70-130*			*07/14/20*	
HFPO-DA-13C3	*103%*	*Conc: 36.8*	*70-130*			*07/14/20*	
Perchlorate by EPA 314.0							
Method: EPA 314.0			**Instr:** LC08				
Batch ID: W0F1821	**Preparation:** _NONE		**Prepared:** 06/30/20 14:47				**Analyst:** jna
Perchlorate	ND		2.0	ug/l	1	06/30/20	
PPCPs - Pharmaceuticals by LC/MSMS-ESI-							
Method: EPA 1694M-ESI-			**Instr:** LCMS03				
Batch ID: W0G1397	**Preparation:** EPA 3535/SPE		**Prepared:** 07/28/20 08:00				**Analyst:** kan
Bisphenol A	**13**		1.0	ng/l	1	08/11/20	
Diclofenac	ND		1.0	ng/l	1	08/11/20	
Gemfibrozil	ND		1.0	ng/l	1	08/11/20	
Ibuprofen	ND		1.0	ng/l	1	08/11/20	
Iopromide	ND		5.0	ng/l	1	08/11/20	
Naproxen	ND		1.0	ng/l	1	08/11/20	
Salicylic Acid	**56**		50	ng/l	1	08/11/20	B
Triclosan	**4.5**		2.0	ng/l	1	08/11/20	
PPCPs - Pharmaceuticals by LC/MSMS-ESI+							
Method: EPA 1694M-ESI+			**Instr:** LCMS03				
Batch ID: W0G1399	**Preparation:** EPA 3535/SPE		**Prepared:** 07/28/20 08:00				**Analyst:** kan
Acetaminophen	ND		20	ng/l	1	08/10/20	
Amoxicillin	ND		400	ng/l	1	08/10/20	I-05, R-01
Atenolol	ND		1.0	ng/l	1	08/10/20	
Atorvastatin	**4.7**		1.0	ng/l	1	08/10/20	
Azithromycin	**43**		10	ng/l	1	08/10/20	B
Caffeine	ND		1.0	ng/l	1	08/10/20	B
Carbamazepine	ND		1.0	ng/l	1	08/10/20	
Ciprofloxacin	**100**		5.0	ng/l	1	08/10/20	B, BS-H

Las Virgenes Municipal Water District 4232 Las Virgenes Road Calabasas, CA 91302	**Project Number:** Pure Water Testing **Project Manager:** Frank Almaguer	**Reported:** 08/21/2020 15:59

Sample Results (Continued)

Sample: Finished Water — Sampled: 06/30/20 10:00 by ATS

0F30024-01 (Water) (Continued)

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
PPCPs - Pharmaceuticals by LC/MSMS-ESI+ (Continued)						
Method: EPA 1694M-ESI+		**Instr:** LCMS03				
Batch ID: W0G1399 **Preparation:** EPA 3535/SPE		**Prepared:** 07/28/20 08:00				**Analyst:** kan
Cotinine	ND	2.0	ng/l	1	08/10/20	
DEET	**3.0**	1.0	ng/l	1	08/10/20	
Diazepam	ND	1.0	ng/l	1	08/10/20	
Fluoxetine	**8.3**	1.0	ng/l	1	08/10/20	
Meprobamate	ND	1.0	ng/l	1	08/10/20	
Methadone	ND	1.0	ng/l	1	08/10/20	
Phenytoin (Dilantin)	ND	65	ng/l	1	08/10/20	BS-L, I-05, R-01
Primidone	ND	1.0	ng/l	1	08/10/20	
Sucralose	**270**	5.0	ng/l	1	08/10/20	B, BS-04
Sulfamethoxazole	ND	1.0	ng/l	1	08/10/20	
TCEP	ND	5.0	ng/l	1	08/10/20	R-01
TCPP	**140**	1.0	ng/l	1	08/10/20	E-01
TDCPP	ND	42	ng/l	1	08/10/20	R-01
Trimethoprim	ND	1.0	ng/l	1	08/10/20	
Radiological Parameters by APHA/EPA Methods						
Method: EPA 200.8		**Instr:** ICPMS04				
Batch ID: W0G0675 **Preparation:** EPA 200.2		**Prepared:** 07/09/20 11:55				**Analyst:** mtt
Uranium Rad	ND	0.13	pCi/L	1	07/13/20	
Method: EPA 900.0		**Instr:** RAD02				
Batch ID: W0G0146 **Preparation:** _NONE (RADIOCHEM)		**Prepared:** 07/06/20 10:01				**Analyst:** mem
Gross Alpha	**0.48**		pCi/L	1	07/07/20	
Uncertainty: 0.259 **MDA:** 0.392						
Gross Beta	**0.88**		pCi/L	1	07/07/20	
Uncertainty: 0.539 **MDA:** 0.878						
Semivolatile Organic Compounds by GC/MS						
Method: EPA 525.2		**Instr:** GCMS16				
Batch ID: W0G0136 **Preparation:** EPA 525.2/SPE		**Prepared:** 07/06/20 09:10				**Analyst:** rmr
Alachlor	ND	0.10	ug/l	1	07/22/20	
Atrazine	ND	0.10	ug/l	1	07/22/20	
Benzo (a) pyrene	ND	0.10	ug/l	1	07/22/20	
Bis(2-ethylhexyl)adipate	ND	5.0	ug/l	1	07/22/20	
Bis(2-ethylhexyl)phthalate	ND	3.0	ug/l	1	07/22/20	
Bromacil	ND	0.50	ug/l	1	07/22/20	
Butachlor	ND	0.10	ug/l	1	07/22/20	
Captan	ND	1.0	ug/l	1	07/22/20	
Chlorpropham	ND	0.10	ug/l	1	07/22/20	

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Las Virgenes Municipal Water District
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Reported: 08/21/2020 15:59

Sample Results (Continued)

Sample: Finished Water — 0F30024-01 (Water)

Sampled: 06/30/20 10:00 by ATS (Continued)

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
Semivolatile Organic Compounds by GC/MS (Continued)							
Method: EPA 525.2			**Instr:** GCMS16				
Batch ID: W0G0136 — **Preparation:** EPA 525.2/SPE			**Prepared:** 07/06/20 09:10				**Analyst:** rmr
Cyanazine	ND		0.10	ug/l	1	07/22/20	
Diazinon	ND		0.10	ug/l	1	07/22/20	
Dimethoate	ND		0.20	ug/l	1	07/22/20	
Diphenamid	ND		0.10	ug/l	1	07/22/20	
Disulfoton	ND		0.10	ug/l	1	07/22/20	
EPTC	ND		0.10	ug/l	1	07/22/20	
Metolachlor	ND		0.10	ug/l	1	07/22/20	
Metribuzin	ND		0.10	ug/l	1	07/22/20	
Molinate	ND		0.10	ug/l	1	07/22/20	
Prometon	ND		0.10	ug/l	1	07/22/20	
Prometryn	ND		0.10	ug/l	1	07/22/20	
Simazine	ND		0.10	ug/l	1	07/22/20	
Terbacil	ND		2.0	ug/l	1	07/22/20	
Thiobencarb	ND		0.10	ug/l	1	07/22/20	
Trithion	ND		0.10	ug/l	1	07/22/20	
Surrogate(s)							
1,3-Dimethyl-2-nitrobenzene	*103%*	*Conc: 5.16*	*70-130*			*07/22/20*	
Perylene-d12	*78%*	*Conc: 3.91*	*50-120*			*07/22/20*	
Triphenyl phosphate	*110%*	*Conc: 5.50*	*70-130*			*07/22/20*	
Semivolatile Organics - Low Level by Tandem GC/MS/MS							
Method: EPA 1613B			**Instr:** GCMS19				
Batch ID: W0G0914 — **Preparation:** EPA 3510/L-L SF			**Prepared:** 07/17/20 14:09				**Analyst:** EFC
2,3,7,8-TCDD (Dioxin)	ND		5.00	pg/l	1	07/23/20	
Volatile Organic Compounds by P&T and GC/MS							
Method: EPA 524.2			**Instr:** GCMS14				
Batch ID: W0G0128 — **Preparation:** EPA 524.2 P&T			**Prepared:** 07/06/20 12:00				**Analyst:** cam
Epichlorohydrin	ND		20	ug/l	1	07/06/20	O-20
Tert-butyl alcohol	ND		2.0	ug/l	1	07/06/20	
Surrogate(s)							
1,2-Dichlorobenzene-d4	*91%*	*Conc: 9.12*	*70-130*			*07/06/20*	
4-Bromofluorobenzene	*95%*	*Conc: 9.46*	*70-130*			*07/06/20*	
Volatile Organics by P&T and GC/MS							
Method: EPA 524.3			**Instr:** GCMS04				
Batch ID: W0G0107 — **Preparation:** EPA 524.2 P&T			**Prepared:** 07/02/20 13:16				**Analyst:** adm
1,2-Dibromo-3-chloropropane	ND		0.010	ug/l	1	07/03/20	
1,2-Dibromoethane (EDB)	ND		0.020	ug/l	1	07/03/20	

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Certificate of Analysis

FINAL REPORT

Las Virgenes Municipal Water District
4232 Las Virgenes Road
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Project Number: Pure Water Testing

Project Manager: Frank Almaguer

Reported: 08/21/2020 15:59

Sample Results

(Continued)

Sample: Finished Water — Sampled: 06/30/20 10:00 by ATS

0F30024-01 (Water) — (Continued)

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier

Volatile Organics by P&T and GC/MS (Continued)

Method: EPA 524.3 **Instr:** GCMS04

Batch ID: W0G0107 **Preparation:** EPA 524.2 P&T **Prepared:** 07/02/20 13:16 **Analyst:** adm

Sample: Finished Water — Sampled: 06/30/20 10:00 by ATS

0F30024-01RE1 (Water)

Anions by IC, EPA Method 300.1

Method: EPA 300.1 **Instr:** LC08

Batch ID: W0G0041 **Preparation:** _NONE (LC) **Prepared:** 07/01/20 12:47 **Analyst:** jna

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
Chlorate	**1100**		50	ug/l	5	07/02/20	
Surrogate(s)							
Dichloroacetate	*100%*	*Conc: 501*	*90-115*			*07/02/20*	

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Las Virgenes Municipal Water District
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Project Number: Pure Water Testing

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Reported: 08/21/2020 15:59

Sample Results

(Continued)

Sample: Field Blank — 0F30024-02 (Water)

Sampled: 06/30/20 9:30 by

Analyte	Result		MRL	Units	Dil	Analyzed	Qualifier
Per- and Polyflourinated Alkyl Substances (PFAS) by SPE/LCMSMS							
Method: EPA 537.1			**Instr:** LCMS06				
Batch ID: W0G0516 — **Preparation:** EPA 537/SPE			**Prepared:** 07/10/20 15:31				**Analyst:** jan
11Cl-PF3OUdS	ND		1.7	ng/l	1	07/14/20	
9Cl-PF3ONS	ND		1.7	ng/l	1	07/14/20	
ADONA	ND		1.7	ng/l	1	07/14/20	
EtFOSAA	ND		1.7	ng/l	1	07/14/20	
HFPO-DA	ND		1.7	ng/l	1	07/14/20	
MeFOSAA	ND		1.7	ng/l	1	07/14/20	
PFBS	ND		1.7	ng/l	1	07/14/20	
PFDA	ND		1.7	ng/l	1	07/14/20	
PFDoA	ND		1.7	ng/l	1	07/14/20	
PFHpA	**10**		1.7	ng/l	1	07/14/20	B
PFHxA	ND		1.7	ng/l	1	07/14/20	
PFHxS	ND		1.7	ng/l	1	07/14/20	
PFNA	ND		1.7	ng/l	1	07/14/20	
PFOA	ND		1.7	ng/l	1	07/14/20	
PFOS	ND		1.7	ng/l	1	07/14/20	
PFTeDA	ND		1.7	ng/l	1	07/14/20	
PFTrDA	ND		1.7	ng/l	1	07/14/20	
PFUnA	ND		1.7	ng/l	1	07/14/20	
Surrogate(s)							
13C2-PFDA	*120%*	*Conc: 40.4*	*70-130*			*07/14/20*	
13C2-PFHxA	*125%*	*Conc: 42.0*	*70-130*			*07/14/20*	
d5-EtFOSAA	*107%*	*Conc: 35.9*	*70-130*			*07/14/20*	
HFPO-DA-13C3	*112%*	*Conc: 37.9*	*70-130*			*07/14/20*	
Volatile Organics by P&T and GC/MS							
Method: EPA 524.3			**Instr:** GCMS04				
Batch ID: W0G0107 — **Preparation:** EPA 524.2 P&T			**Prepared:** 07/02/20 13:16				**Analyst:** adm
1,2-Dibromo-3-chloropropane	ND		0.010	ug/l	1	07/03/20	
1,2-Dibromoethane (EDB)	ND		0.020	ug/l	1	07/03/20	

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Las Virgenes Municipal Water District
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Project Number: Pure Water Testing

Project Manager: Frank Almaguer

Reported: 08/21/2020 15:59

Sample Results LA Testing - EMSL Analytical, Inc. CA-ELAP #2283, Non-NELAP

Sample: Finished Water
0F30024-01 (Water)

Sampled: 06/30/20 10:00 by ATS

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
EPA 100.2						
Method: EPA 100.2	**Batch ID:** 322011638	**Prepared:** 07/01/20 11:45				**Analyst:** _SUB
Asbestos	ND	0.20	MFL	1	07/10/20	

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Sample Results Pace Analytical Services, Inc.

(Continued)

Sample: Finished Water
0F30024-01 (Water)

Sampled: 06/30/20 10:00 by ATS

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
EPA 903.1						
Method: EPA 903.1 — **Batch ID:** 404026 — **Prepared:** 07/10/20 00:00 — **Analyst:** MK1						
Radium-226	**0.508**		pCi/L dry	1	07/17/20	
Uncertainty: 0.431 **MDA:** 0.590						
EPA 904.0						
Method: EPA 904.0 — **Batch ID:** 404025 — **Prepared:** 07/10/20 00:00 — **Analyst:** VAL						
Radium-228	**0.519**		pCi/L dry	1	07/16/20	
Uncertainty: 0.438 **MDA:** 0.903						
EPA 905.0						
Method: EPA 905.0 — **Batch ID:** 405208 — **Prepared:** 07/15/20 00:00 — **Analyst:** JJY						
Strontium-90	**-0.203**		pCi/L dry	1	07/20/20	
Uncertainty: 0.377 **MDA:** 0.769						
EPA 906.0						
Method: EPA 906.0 — **Batch ID:** 404450 — **Prepared:** 07/10/20 00:00 — **Analyst:** CLA						
Tritium	**-77.3**		pCi/L dry	1	07/11/20	
Uncertainty: 127 **MDA:** 232						

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Quality Control Results

EPA 903.1

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: 404026 - EPA 903.1										
DUP (30370902001DUP)				**Prepared: 07/10/20**	**Analyzed: 07/17/20**					
Radium-226	39.6		pCi/L dry					29	0.32	
Uncertainty: 3.01	**MDA:** 0.437									
MS (30370941001MS)	**Source: 30370941001**			**Prepared: 07/10/20**	**Analyzed: 07/17/20**					
Radium-226	10.1		pCi/L dry	9.56	0.341	102	0.71-1.36			
Uncertainty: 1.5	**MDA:** 0.879									
LCS (LCS54959)				**Prepared: 07/10/20**	**Analyzed: 07/17/20**					
Radium-226	3.99		pCi/L dry	4.77		84	0.73-1.35			
Uncertainty: 0.892	**MDA:** 0.609									

Quality Control Results

EPA 904.0

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: 404025 - EPA 904.0										
DUP (30370902001DUP)				**Prepared: 07/10/20**	**Analyzed: 07/16/20**					
Radium-228	35.2		pCi/L dry					9	36	
Uncertainty: 1.84	**MDA:** 0.996									
MS (30370958001MS)	**Source: 30370958001**			**Prepared: 07/10/20**	**Analyzed: 07/16/20**					
Radium-228	9.37		pCi/L dry	9.7	0.0757	96	60-135			
Uncertainty: 0.888	**MDA:** 0.815									
LCS (LCS54958)				**Prepared: 07/10/20**	**Analyzed: 07/16/20**					
Radium-228	5.39		pCi/L dry	4.87		111	60-135			
Uncertainty: 0.744	**MDA:** 0.907									

Quality Control Results

EPA 905.0

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: 405208 - EPA 905.0										
MS (30371686001MS)	**Source: 30371686001**			**Prepared: 07/15/20**	**Analyzed: 07/20/20**					
Strontium-90	71.5		pCi/L dry	12.7	61	83	65-130			
Uncertainty: 0.93	**MDA:** 0.222									
MS (30372512001MS)	**Source: 30372512001**			**Prepared: 07/15/20**	**Analyzed: 07/21/20**					
Strontium-90	20.2		pCi/L dry	25.9	-0.084	78	65-130			
Uncertainty: 1.66	**MDA:** 1.06									
LCS (LCS55071)				**Prepared: 07/15/20**	**Analyzed: 07/21/20**					
Strontium-90	4.93		pCi/L dry	6.45		77	65-130			
Uncertainty: 0.578	**MDA:** 0.463									
LCS Dup (LCSD55071)				**Prepared: 07/15/20**	**Analyzed: 07/21/20**					
Strontium-90	4.91		pCi/L dry	6.48		76	65-130	1	25	
Uncertainty: 0.588	**MDA:** 0.509									

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Reported: 08/21/2020 15:59

Quality Control Results (Continued)

EPA 906.0

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: 404450 - EPA 906.0										
MS (30370818001MS)	**Source: 30370818001**		**Prepared: 07/10/20**	**Analyzed: 07/11/20**						
Tritium	3570		pCi/L dry	3610	-39.6	100	75-125			
Uncertainty: 273	**MDA:** 233									
MS (30370824001MS)	**Source: 30370824001**		**Prepared: 07/10/20**	**Analyzed: 07/11/20**						
Tritium	3500		pCi/L dry	4030	59.9	86	75-125			
Uncertainty: 270	**MDA:** 232									
LCS (LCS55010)			**Prepared: 07/10/20**	**Analyzed: 07/11/20**						
Tritium	1710		pCi/L dry	2020		85	75-125			
Uncertainty: 211	**MDA:** 231									
LCS Dup (LCSD55010)			**Prepared: 07/10/20**	**Analyzed: 07/11/20**						
Tritium	1860		pCi/L dry	2010		93	75-125	9	25	
Uncertainty: 217	**MDA:** 232									

Quality Control Results (Continued)

1,4-Dioxane by SPE/GCMS SIM, EPA Method 522

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0F1841 - EPA 522										
Blank (W0F1841-BLK1)			**Prepared: 07/01/20**	**Analyzed: 07/02/20**						
1,4-Dioxane	ND	0.070	ug/l							
Surrogate(s)										
1,4-Dioxane-d8	*8.71*		*ug/l*	*10.0*		*87*	*70-130*			
LCS (W0F1841-BS1)			**Prepared: 07/01/20**	**Analyzed: 07/02/20**						
1,4-Dioxane	0.0690	0.070	ug/l	0.0600		115	50-150			
Surrogate(s)										
1,4-Dioxane-d8	*10.3*		*ug/l*	*10.0*		*103*	*70-130*			
LCS Dup (W0F1841-BSD1)			**Prepared: 07/01/20**	**Analyzed: 07/02/20**						
1,4-Dioxane	0.0646	0.070	ug/l	0.0600		108	50-150	7	30	
Surrogate(s)										
1,4-Dioxane-d8	*9.66*		*ug/l*	*10.0*		*97*	*70-130*			

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Quality Control Results (Continued)

Acrylamide low levels by EPA Method 8316

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0592 - EPA 8316										
Blank (W0G0592-BLK1)				**Prepared & Analyzed: 07/13/20**						
Acrylamide	ND	0.10	ug/l							
LCS (W0G0592-BS1)				**Prepared & Analyzed: 07/13/20**						
Acrylamide	1.06	0.10	ug/l	1.00		106	80-120			
Matrix Spike (W0G0592-MS1)	**Source: 0F30024-01**			**Prepared & Analyzed: 07/13/20**						
Acrylamide	0.925	0.10	ug/l	1.00	ND	92	80-120			
Matrix Spike Dup (W0G0592-MSD1)	**Source: 0F30024-01**			**Prepared & Analyzed: 07/13/20**						
Acrylamide	1.13	0.10	ug/l	1.00	ND	113	80-120	20	20	

Quality Control Results (Continued)

Aldehydes and Carbonyl Compounds by GC/ECD

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0132 - EPA 556										
Blank (W0G0132-BLK1)				**Prepared: 07/06/20 Analyzed: 07/10/20**						
Formaldehyde	ND	2.0	ug/l							
Surrogate(s)										
2,4,5-TFAP	*20.3*		*ug/l*	*20.0*		*101*	*70-130*			
LCS (W0G0132-BS1)				**Prepared: 07/06/20 Analyzed: 07/10/20**						
Formaldehyde	19.8	2.0	ug/l	20.0		99	70-130			
Surrogate(s)										
2,4,5-TFAP	*20.1*		*ug/l*	*20.0*		*100*	*70-130*			
LCS Dup (W0G0132-BSD1)				**Prepared: 07/06/20 Analyzed: 07/10/20**						
Formaldehyde	19.6	2.0	ug/l	20.0		98	70-130	0.7	30	
Surrogate(s)										
2,4,5-TFAP	*20.6*		*ug/l*	*20.0*		*103*	*70-130*			

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Anions by IC, EPA Method 300.0

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0250 - EPA 300.0										
Blank (W0G0250-BLK1)				**Prepared: 07/07/20**	**Analyzed: 07/10/20**					
Chloride, Total	ND	0.50	mg/l							
Fluoride, Total	ND	0.10	mg/l							
Sulfate as SO4	ND	0.50	mg/l							
LCS (W0G0250-BS1)				**Prepared: 07/07/20**	**Analyzed: 07/10/20**					
Chloride, Total	5.21	0.50	mg/l	5.00		104	90-110			
Fluoride, Total	0.962	0.10	mg/l	1.00		96	90-110			
Sulfate as SO4	5.07	0.50	mg/l	5.00		101	90-110			
Matrix Spike (W0G0250-MS1)	**Source: 0F30027-04**			**Prepared: 07/07/20**	**Analyzed: 07/10/20**					
Chloride, Total	146	5.0	mg/l	50.0	90.2	112	76-118			
Fluoride, Total	11.0	1.0	mg/l	10.0	0.809	102	86-107			
Sulfate as SO4	239	5.0	mg/l	50.0	173	132	78-111			MS-01
Matrix Spike (W0G0250-MS2)	**Source: 0G01049-02**			**Prepared: 07/07/20**	**Analyzed: 07/10/20**					
Chloride, Total	9.91	0.50	mg/l	5.00	2.43	150	76-118			MS-01
Fluoride, Total	1.20	0.10	mg/l	1.00	0.153	105	86-107			
Sulfate as SO4	39.2	0.50	mg/l	5.00	19.5	396	78-111			MS-01
Matrix Spike Dup (W0G0250-MSD1)	**Source: 0F30027-04**			**Prepared: 07/07/20**	**Analyzed: 07/10/20**					
Chloride, Total	145	5.0	mg/l	50.0	90.2	109	76-118	1	20	
Fluoride, Total	10.4	1.0	mg/l	10.0	0.809	96	86-107	6	20	
Sulfate as SO4	228	5.0	mg/l	50.0	173	109	78-111	5	20	
Matrix Spike Dup (W0G0250-MSD2)	**Source: 0G01049-02**			**Prepared: 07/07/20**	**Analyzed: 07/10/20**					
Chloride, Total	9.92	0.50	mg/l	5.00	2.43	150	76-118	0.007	20	MS-01
Fluoride, Total	1.11	0.10	mg/l	1.00	0.153	96	86-107	8	20	
Sulfate as SO4	36.2	0.50	mg/l	5.00	19.5	334	78-111	8	20	MS-01

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Quality Control Results

(Continued)

Anions by IC, EPA Method 300.1

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0041 - EPA 300.1										
Blank (W0G0041-BLK1)				**Prepared & Analyzed: 07/01/20**						
Bromate	ND	5.0	ug/l							
Chlorate	ND	10	ug/l							
Chlorite	ND	10	ug/l							
Surrogate(s)										
Dichloroacetate	*552*		*ug/l*	*500*		*110*	*90-115*			
Dichloroacetate	*552*		*ug/l*	*500*		*110*	*90-115*			
Dichloroacetate	*552*		*ug/l*	*500*		*110*	*90-115*			
LCS (W0G0041-BS1)				**Prepared & Analyzed: 07/01/20**						
Bromate	101	5.0	ug/l	100		101	85-115			
Chlorate	106	10	ug/l	100		106	85-115			
Chlorite	85.4	10	ug/l	100		85	85-115			
Surrogate(s)										
Dichloroacetate	*550*		*ug/l*	*500*		*110*	*90-115*			
Dichloroacetate	*550*		*ug/l*	*500*		*110*	*90-115*			
Dichloroacetate	*550*		*ug/l*	*500*		*110*	*90-115*			
Matrix Spike (W0G0041-MS1)	**Source: 0F08086-04**			**Prepared & Analyzed: 07/01/20**						
Bromate	76.3	5.0	ug/l	100	ND	76	64-133			
Chlorate	176	10	ug/l	100	443	NR	76-120			MS-01
Chlorite	95.9	10	ug/l	100	ND	96	78-129			
Surrogate(s)										
Dichloroacetate	*519*		*ug/l*	*500*		*104*	*90-115*			
Dichloroacetate	*519*		*ug/l*	*500*		*104*	*90-115*			
Dichloroacetate	*519*		*ug/l*	*500*		*104*	*90-115*			
Matrix Spike (W0G0041-MS2)	**Source: 0F08072-14**			**Prepared & Analyzed: 07/01/20**						
Bromate	74.5	5.0	ug/l	100	ND	74	64-133			
Chlorate	493	10	ug/l	100	101	392	76-120			MS-01
Chlorite	71.9	10	ug/l	100	ND	72	78-129			MS-01
Surrogate(s)										
Dichloroacetate	*516*		*ug/l*	*500*		*103*	*90-115*			
Dichloroacetate	*516*		*ug/l*	*500*		*103*	*90-115*			
Dichloroacetate	*516*		*ug/l*	*500*		*103*	*90-115*			
Matrix Spike Dup (W0G0041-MSD1)	**Source: 0F08086-04**			**Prepared & Analyzed: 07/01/20**						
Bromate	74.0	5.0	ug/l	100	ND	74	64-133	3	20	
Chlorate	182	10	ug/l	100	443	NR	76-120	3	20	MS-01
Chlorite	86.5	10	ug/l	100	ND	87	78-129	10	20	
Surrogate(s)										
Dichloroacetate	*499*		*ug/l*	*500*		*100*	*90-115*			
Dichloroacetate	*499*		*ug/l*	*500*		*100*	*90-115*			
Dichloroacetate	*499*		*ug/l*	*500*		*100*	*90-115*			
Matrix Spike Dup (W0G0041-MSD2)	**Source: 0F08072-14**			**Prepared: 07/01/20 Analyzed: 07/02/20**						

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(Continued)

Anions by IC, EPA Method 300.1 (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0041 - EPA 300.1 (Continued)										
Matrix Spike Dup (W0G0041-MSD2)	**Source: 0F08072-14**			**Prepared: 07/01/20**	**Analyzed: 07/02/20**					
Bromate	69.4	5.0	ug/l	100	ND	69	64-133	7	20	
Chlorate	473	10	ug/l	100	101	372	76-120	4	20	MS-01
Chlorite	73.8	10	ug/l	100	ND	74	78-129	3	20	MS-01
Surrogate(s)										
Dichloroacetate	*496*		*ug/l*	*500*		*99*	*90-115*			
Dichloroacetate	*496*		*ug/l*	*500*		*99*	*90-115*			
Dichloroacetate	*496*		*ug/l*	*500*		*99*	*90-115*			

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Carbamates and Urea Pesticides

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0155 - EPA 531.2										
Blank (W0G0155-BLK1)				**Prepared & Analyzed: 07/06/20**						
3-Hydroxycarbofuran	ND	2.0	ug/l							
Aldicarb	ND	2.0	ug/l							
Aldicarb sulfone	ND	2.0	ug/l							
Aldicarb sulfoxide	ND	2.0	ug/l							
Carbaryl	ND	2.0	ug/l							
Carbofuran	ND	2.0	ug/l							
Methiocarb	ND	2.0	ug/l							
Methomyl	ND	2.0	ug/l							
Oxamyl	ND	2.0	ug/l							
Propoxur (Baygon)	ND	2.0	ug/l							
Surrogate(s)										
BDMC	*12.8*		*ug/l*	*10.0*		*128*	*70-130*			
LCS (W0G0155-BS1)				**Prepared & Analyzed: 07/06/20**						
3-Hydroxycarbofuran	8.57	2.0	ug/l	10.0		86	70-130			
Aldicarb	9.63	2.0	ug/l	10.0		96	70-130			
Aldicarb sulfone	9.24	2.0	ug/l	10.0		92	70-130			
Aldicarb sulfoxide	10.2	2.0	ug/l	10.0		102	70-130			
Carbaryl	10.3	2.0	ug/l	10.0		103	70-130			
Carbofuran	9.83	2.0	ug/l	10.0		98	70-130			
Methiocarb	9.48	2.0	ug/l	10.0		95	70-130			
Methomyl	9.50	2.0	ug/l	10.0		95	70-130			
Oxamyl	9.72	2.0	ug/l	10.0		97	70-130			
Propoxur (Baygon)	9.98	2.0	ug/l	10.0		100	70-130			
Surrogate(s)										
BDMC	*12.3*		*ug/l*	*10.0*		*123*	*70-130*			
Matrix Spike (W0G0155-MS1)	**Source: 0F26060-01**			**Prepared & Analyzed: 07/06/20**						
3-Hydroxycarbofuran	9.15	2.0	ug/l	10.0	ND	92	70-130			
Aldicarb	10.2	2.0	ug/l	10.0	ND	102	70-130			
Aldicarb sulfone	9.98	2.0	ug/l	10.0	ND	100	70-130			
Aldicarb sulfoxide	10.1	2.0	ug/l	10.0	ND	101	70-130			
Carbaryl	10.2	2.0	ug/l	10.0	ND	102	70-130			
Carbofuran	10.4	2.0	ug/l	10.0	ND	104	70-130			
Methiocarb	9.22	2.0	ug/l	10.0	ND	92	70-130			
Methomyl	10.3	2.0	ug/l	10.0	ND	103	70-130			
Oxamyl	10.1	2.0	ug/l	10.0	ND	101	70-130			
Propoxur (Baygon)	9.87	2.0	ug/l	10.0	ND	99	70-130			
Surrogate(s)										
BDMC	*12.4*		*ug/l*	*10.0*		*124*	*70-130*			
Matrix Spike Dup (W0G0155-MSD1)	**Source: 0F26060-01**			**Prepared & Analyzed: 07/06/20**						
3-Hydroxycarbofuran	9.71	2.0	ug/l	10.0	ND	97	70-130	6	30	

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Carbamates and Urea Pesticides (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0155 - EPA 531.2 (Continued)										
Matrix Spike Dup (W0G0155-MSD1)	**Source: 0F26060-01**			**Prepared & Analyzed: 07/06/20**						
Aldicarb	10.3	2.0	ug/l	10.0	ND	103	70-130	0.7	30	
Aldicarb sulfone	10.8	2.0	ug/l	10.0	ND	108	70-130	8	30	
Aldicarb sulfoxide	10.5	2.0	ug/l	10.0	ND	105	70-130	3	30	
Carbaryl	10.6	2.0	ug/l	10.0	ND	106	70-130	4	30	
Carbofuran	10.5	2.0	ug/l	10.0	ND	105	70-130	0.3	30	
Methiocarb	10.5	2.0	ug/l	10.0	ND	105	70-130	13	30	
Methomyl	10.5	2.0	ug/l	10.0	ND	105	70-130	2	30	
Oxamyl	9.74	2.0	ug/l	10.0	ND	97	70-130	4	30	
Propoxur (Baygon)	9.86	2.0	ug/l	10.0	ND	99	70-130	0.2	30	
Surrogate(s)										
BDMC	*12.3*		*ug/l*	*10.0*		*123*	*70-130*			

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Quality Control Results

(Continued)

Chlorinated Acids Herbicides by GC/ECD

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0176 - EPA 515.4										
Blank (W0G0176-BLK1)				**Prepared: 07/07/20 Analyzed: 07/13/20**						
2,4,5-T	ND	0.20	ug/l							
2,4,5-TP (Silvex)	ND	0.20	ug/l							
2,4-D	ND	0.40	ug/l							
2,4-DB	ND	2.0	ug/l							
3,5-Dichlorobenzoic acid	ND	1.0	ug/l							
Acifluorfen	ND	0.40	ug/l							
Bentazon	ND	2.0	ug/l							
Dalapon	ND	0.40	ug/l							
DCPA	ND	0.10	ug/l							
Dicamba	ND	0.60	ug/l							
Dichloroprop	ND	0.30	ug/l							
Dinoseb	ND	0.40	ug/l							
Pentachlorophenol	ND	0.20	ug/l							
Picloram	ND	0.60	ug/l							
Surrogate(s)										
2,4-DCAA	*9.49*		*ug/l*	*10.0*		*95*	*70-130*			
LCS (W0G0176-BS1)				**Prepared: 07/07/20 Analyzed: 07/13/20**						
2,4,5-T	3.67	0.20	ug/l	4.00		92	70-130			
2,4,5-TP (Silvex)	3.79	0.20	ug/l	4.00		95	70-130			
2,4-D	7.41	0.40	ug/l	8.00		93	70-130			
2,4-DB	16.1	2.0	ug/l	16.0		100	70-130			
3,5-Dichlorobenzoic acid	8.20	1.0	ug/l	8.00		102	70-130			
Acifluorfen	4.09	0.40	ug/l	4.00		102	70-130			
Bentazon	15.1	2.0	ug/l	16.0		94	70-130			
Dalapon	9.11	0.40	ug/l	8.00		114	70-130			
DCPA	4.04	0.10	ug/l	4.00		101	70-130			
Dicamba	7.32	0.60	ug/l	8.00		92	70-130			
Dichloroprop	7.86	0.30	ug/l	8.00		98	70-130			
Dinoseb	3.79	0.40	ug/l	4.00		95	70-130			
Pentachlorophenol	4.05	0.20	ug/l	4.00		101	70-130			
Picloram	4.13	0.60	ug/l	4.00		103	70-130			
Surrogate(s)										
2,4-DCAA	*10.1*		*ug/l*	*10.0*		*101*	*70-130*			
Matrix Spike (W0G0176-MS1)	**Source: 0F26060-01**			**Prepared: 07/07/20 Analyzed: 07/13/20**						
2,4,5-T	3.69	0.20	ug/l	4.00	ND	92	70-130			
2,4,5-TP (Silvex)	3.78	0.20	ug/l	4.00	ND	94	70-130			
2,4-D	7.42	0.40	ug/l	8.00	ND	93	70-130			
2,4-DB	15.9	2.0	ug/l	16.0	ND	99	70-130			
3,5-Dichlorobenzoic acid	8.34	1.0	ug/l	8.00	ND	104	70-130			

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Chlorinated Acids Herbicides by GC/ECD (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0176 - EPA 515.4 (Continued)										
Matrix Spike (W0G0176-MS1)	**Source: 0F26060-01**			**Prepared: 07/07/20**	**Analyzed: 07/13/20**					
Acifluorfen	4.06	0.40	ug/l	4.00	ND	101	70-130			
Bentazon	14.7	2.0	ug/l	16.0	ND	92	70-130			
Dalapon	8.94	0.40	ug/l	8.00	ND	112	70-130			
DCPA	4.01	0.10	ug/l	4.00	ND	100	70-130			
Dicamba	7.36	0.60	ug/l	8.00	ND	92	70-130			
Dichloroprop	7.84	0.30	ug/l	8.00	ND	98	70-130			
Dinoseb	3.77	0.40	ug/l	4.00	ND	94	70-130			
Pentachlorophenol	4.05	0.20	ug/l	4.00	ND	101	70-130			
Picloram	4.16	0.60	ug/l	4.00	ND	104	70-130			
Surrogate(s)										
2,4-DCAA	*10.3*		*ug/l*	*10.0*		*103*	*70-130*			
Matrix Spike Dup (W0G0176-MSD1)	**Source: 0F26060-01**			**Prepared: 07/07/20**	**Analyzed: 07/13/20**					
2,4,5-T	3.85	0.20	ug/l	4.00	ND	96	70-130	4	30	
2,4,5-TP (Silvex)	3.77	0.20	ug/l	4.00	ND	94	70-130	0.3	30	
2,4-D	7.46	0.40	ug/l	8.00	ND	93	70-130	0.6	30	
2,4-DB	16.0	2.0	ug/l	16.0	ND	100	70-130	0.7	30	
3,5-Dichlorobenzoic acid	8.64	1.0	ug/l	8.00	ND	108	70-130	3	30	
Acifluorfen	4.22	0.40	ug/l	4.00	ND	106	70-130	4	30	
Bentazon	14.4	2.0	ug/l	16.0	ND	90	70-130	2	30	
Dalapon	8.80	0.40	ug/l	8.00	ND	110	70-130	2	30	
DCPA	4.04	0.10	ug/l	4.00	ND	101	70-130	0.6	30	
Dicamba	7.29	0.60	ug/l	8.00	ND	91	70-130	1	30	
Dichloroprop	7.80	0.30	ug/l	8.00	ND	97	70-130	0.6	30	
Dinoseb	3.77	0.40	ug/l	4.00	ND	94	70-130	0.2	30	
Pentachlorophenol	4.02	0.20	ug/l	4.00	ND	100	70-130	0.7	30	
Picloram	4.23	0.60	ug/l	4.00	ND	106	70-130	2	30	
Surrogate(s)										
2,4-DCAA	*10.0*		*ug/l*	*10.0*		*100*	*70-130*			

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Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, CA 91302

Project Number: Pure Water Testing

Project Manager: Frank Almaguer

Reported: 08/21/2020 15:59

Quality Control Results

(Continued)

Chlorinated Pesticides and/or PCBs by GC/ECD

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0230 - EPA 508										
Blank (W0G0230-BLK1)				**Prepared: 07/07/20 Analyzed: 07/18/20**						
4,4´-DDD	ND	0.010	ug/l							
4,4´-DDE	ND	0.010	ug/l							
4,4´-DDT	ND	0.010	ug/l							
Aldrin	ND	0.010	ug/l							
alpha-BHC	ND	0.010	ug/l							
Aroclor 1016	ND	0.10	ug/l							
Aroclor 1221	ND	0.10	ug/l							
Aroclor 1232	ND	0.10	ug/l							
Aroclor 1242	ND	0.10	ug/l							
Aroclor 1248	ND	0.10	ug/l							
Aroclor 1254	ND	0.10	ug/l							
Aroclor 1260	ND	0.10	ug/l							
beta-BHC	ND	0.010	ug/l							
Chlordane (tech)	ND	0.10	ug/l							
Chlorothalonil	ND	0.050	ug/l							
delta-BHC	ND	0.010	ug/l							
Dieldrin	ND	0.010	ug/l							
Endosulfan I	ND	0.010	ug/l							
Endosulfan II	ND	0.010	ug/l							
Endosulfan sulfate	ND	0.010	ug/l							
Endrin	ND	0.010	ug/l							
Endrin aldehyde	ND	0.010	ug/l							
gamma-BHC (Lindane)	ND	0.010	ug/l							
Heptachlor	ND	0.010	ug/l							
Heptachlor epoxide	ND	0.010	ug/l							
Hexachlorobenzene	ND	0.050	ug/l							
Hexachlorocyclopentadiene	ND	0.050	ug/l							
Methoxychlor	ND	0.010	ug/l							
PCBs, Total	ND	0.50	ug/l							
Propachlor	ND	0.050	ug/l							
Toxaphene	ND	1.0	ug/l							
Trifluralin	ND	0.010	ug/l							
Surrogate(s)										
Decachlorobiphenyl	*0.102*		*ug/l*	*0.100*		*102*	*70-130*			
Tetrachloro-meta-xylene	*0.0880*		*ug/l*	*0.100*		*88*	*70-130*			
Blank (W0G0230-BLK2)				**Prepared: 07/07/20 Analyzed: 07/21/20**						
4,4´-DDD	ND	0.010	ug/l							QC-2
4,4´-DDE	ND	0.010	ug/l							QC-2
4,4´-DDT	ND	0.010	ug/l							QC-2

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Quality Control Results

(Continued)

Chlorinated Pesticides and/or PCBs by GC/ECD (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0230 - EPA 508 (Continued)										
Blank (W0G0230-BLK2)				**Prepared: 07/07/20 Analyzed: 07/21/20**						
Aldrin	ND	0.010	ug/l							QC-2
alpha-BHC	ND	0.010	ug/l							QC-2
Aroclor 1016	ND	0.10	ug/l							QC-2
Aroclor 1221	ND	0.10	ug/l							QC-2
Aroclor 1232	ND	0.10	ug/l							QC-2
Aroclor 1242	ND	0.10	ug/l							QC-2
Aroclor 1248	ND	0.10	ug/l							QC-2
Aroclor 1254	ND	0.10	ug/l							QC-2
Aroclor 1260	ND	0.10	ug/l							QC-2
beta-BHC	ND	0.010	ug/l							QC-2
Chlordane (tech)	ND	0.10	ug/l							QC-2
Chlorothalonil	ND	0.050	ug/l							QC-2
delta-BHC	ND	0.010	ug/l							QC-2
Dieldrin	ND	0.010	ug/l							QC-2
Endosulfan I	ND	0.010	ug/l							QC-2
Endosulfan II	ND	0.010	ug/l							QC-2
Endosulfan sulfate	ND	0.010	ug/l							QC-2
Endrin	ND	0.010	ug/l							QC-2
Endrin aldehyde	ND	0.010	ug/l							QC-2
gamma-BHC (Lindane)	ND	0.010	ug/l							QC-2
Heptachlor	ND	0.010	ug/l							QC-2
Heptachlor epoxide	ND	0.010	ug/l							QC-2
Hexachlorobenzene	ND	0.050	ug/l							QC-2
Hexachlorocyclopentadiene	ND	0.050	ug/l							QC-2
Methoxychlor	ND	0.010	ug/l							QC-2
PCBs, Total	ND	0.50	ug/l							QC-2
Propachlor	ND	0.050	ug/l							QC-2
Toxaphene	ND	1.0	ug/l							QC-2
Trifluralin	ND	0.010	ug/l							QC-2
Surrogate(s)										
Decachlorobiphenyl	*0.109*		*ug/l*	*0.100*		*109*	*70-130*			QC-2
Tetrachloro-meta-xylene	*0.0872*		*ug/l*	*0.100*		*87*	*70-130*			QC-2
LCS (W0G0230-BS1)				**Prepared: 07/07/20 Analyzed: 07/18/20**						
4,4´-DDD	0.0828	0.010	ug/l	0.100		83	77-137			
4,4´-DDE	0.0851	0.010	ug/l	0.100		85	69-129			
4,4´-DDT	0.0913	0.010	ug/l	0.100		91	82-142			
Aldrin	0.0820	0.010	ug/l	0.100		82	56-116			
alpha-BHC	0.0823	0.010	ug/l	0.100		82	62-122			
beta-BHC	0.0892	0.010	ug/l	0.100		89	65-125			

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Quality Control Results

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Chlorinated Pesticides and/or PCBs by GC/ECD (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0230 - EPA 508 (Continued)										
LCS (W0G0230-BS1)				**Prepared: 07/07/20 Analyzed: 07/18/20**						
delta-BHC	0.0937	0.010	ug/l	0.100		94	72-132			
Dieldrin	0.0803	0.010	ug/l	0.100		80	57-117			
Endosulfan I	0.0718	0.010	ug/l	0.100		72	57-117			
Endosulfan II	0.0781	0.010	ug/l	0.100		78	62-122			
Endosulfan sulfate	0.0869	0.010	ug/l	0.100		87	72-132			
Endrin	0.0909	0.010	ug/l	0.100		91	58-118			
Endrin aldehyde	0.101	0.010	ug/l	0.100		101	58-118			
gamma-BHC (Lindane)	0.0830	0.010	ug/l	0.100		83	59-119			
Heptachlor	0.0879	0.010	ug/l	0.100		88	68-128			
Heptachlor epoxide	0.0845	0.010	ug/l	0.100		84	57-117			
Methoxychlor	0.0914	0.010	ug/l	0.100		91	75-135			
Surrogate(s)										
Decachlorobiphenyl	*0.0967*		*ug/l*	*0.100*		*97*	*70-130*			
Tetrachloro-meta-xylene	*0.0726*		*ug/l*	*0.100*		*73*	*70-130*			
LCS (W0G0230-BS2)				**Prepared: 07/07/20 Analyzed: 07/21/20**						
4,4´-DDD	0.0889	0.010	ug/l	0.100		89	77-137			QC-2
4,4´-DDE	0.0905	0.010	ug/l	0.100		90	69-129			QC-2
4,4´-DDT	0.0978	0.010	ug/l	0.100		98	82-142			QC-2
Aldrin	0.0875	0.010	ug/l	0.100		87	56-116			QC-2
alpha-BHC	0.0956	0.010	ug/l	0.100		96	62-122			QC-2
beta-BHC	0.0959	0.010	ug/l	0.100		96	65-125			QC-2
delta-BHC	0.101	0.010	ug/l	0.100		101	72-132			QC-2
Dieldrin	0.0854	0.010	ug/l	0.100		85	57-117			QC-2
Endosulfan I	0.0764	0.010	ug/l	0.100		76	57-117			QC-2
Endosulfan II	0.0829	0.010	ug/l	0.100		83	62-122			QC-2
Endosulfan sulfate	0.0832	0.010	ug/l	0.100		83	72-132			QC-2
Endrin	0.102	0.010	ug/l	0.100		102	58-118			QC-2
Endrin aldehyde	0.104	0.010	ug/l	0.100		104	58-118			QC-2
gamma-BHC (Lindane)	0.0956	0.010	ug/l	0.100		96	59-119			QC-2
Heptachlor	0.0933	0.010	ug/l	0.100		93	68-128			QC-2
Heptachlor epoxide	0.0896	0.010	ug/l	0.100		90	57-117			QC-2
Methoxychlor	0.0922	0.010	ug/l	0.100		92	75-135			QC-2
Surrogate(s)										
Decachlorobiphenyl	*0.106*		*ug/l*	*0.100*		*106*	*70-130*			QC-2
Tetrachloro-meta-xylene	*0.0763*		*ug/l*	*0.100*		*76*	*70-130*			QC-2
LCS Dup (W0G0230-BSD1)				**Prepared: 07/07/20 Analyzed: 07/18/20**						
4,4´-DDD	0.0965	0.010	ug/l	0.100		97	77-137	15	20	
4,4´-DDE	0.0943	0.010	ug/l	0.100		94	69-129	10	20	
4,4´-DDT	0.104	0.010	ug/l	0.100		104	82-142	13	20	

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Quality Control Results

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Chlorinated Pesticides and/or PCBs by GC/ECD (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0230 - EPA 508 (Continued)										
LCS Dup (W0G0230-BSD1)				**Prepared: 07/07/20 Analyzed: 07/18/20**						
Aldrin	0.0903	0.010	ug/l	0.100		90	56-116	10	20	
alpha-BHC	0.0965	0.010	ug/l	0.100		96	62-122	16	20	
beta-BHC	0.0971	0.010	ug/l	0.100		97	65-125	8	20	
delta-BHC	0.103	0.010	ug/l	0.100		103	72-132	9	20	
Dieldrin	0.0888	0.010	ug/l	0.100		89	57-117	10	20	
Endosulfan I	0.0788	0.010	ug/l	0.100		79	57-117	9	20	
Endosulfan II	0.0889	0.010	ug/l	0.100		89	62-122	13	20	
Endosulfan sulfate	0.103	0.010	ug/l	0.100		103	72-132	17	20	
Endrin	0.101	0.010	ug/l	0.100		101	58-118	10	20	
Endrin aldehyde	0.123	0.010	ug/l	0.100		123	58-118	20	20	Q-08
gamma-BHC (Lindane)	0.0967	0.010	ug/l	0.100		97	59-119	15	20	
Heptachlor	0.0966	0.010	ug/l	0.100		97	68-128	9	20	
Heptachlor epoxide	0.0924	0.010	ug/l	0.100		92	57-117	9	20	
Methoxychlor	0.111	0.010	ug/l	0.100		111	75-135	19	20	
Surrogate(s)										
Decachlorobiphenyl	*0.103*		*ug/l*	*0.100*		*103*	*70-130*			
Tetrachloro-meta-xylene	*0.0741*		*ug/l*	*0.100*		*74*	*70-130*			
LCS Dup (W0G0230-BSD2)				**Prepared: 07/07/20 Analyzed: 07/21/20**						
4,4´-DDD	0.0932	0.010	ug/l	0.100		93	77-137	5	20	QC-2
4,4´-DDE	0.0908	0.010	ug/l	0.100		91	69-129	0.3	20	QC-2
4,4´-DDT	0.0997	0.010	ug/l	0.100		100	82-142	2	20	QC-2
Aldrin	0.0876	0.010	ug/l	0.100		88	56-116	0.1	20	QC-2
alpha-BHC	0.0942	0.010	ug/l	0.100		94	62-122	1	20	QC-2
beta-BHC	0.0947	0.010	ug/l	0.100		95	65-125	1	20	QC-2
delta-BHC	0.0997	0.010	ug/l	0.100		100	72-132	1	20	QC-2
Dieldrin	0.0855	0.010	ug/l	0.100		86	57-117	0.1	20	QC-2
Endosulfan I	0.0762	0.010	ug/l	0.100		76	57-117	0.2	20	QC-2
Endosulfan II	0.0854	0.010	ug/l	0.100		85	62-122	3	20	QC-2
Endosulfan sulfate	0.0889	0.010	ug/l	0.100		89	72-132	7	20	QC-2
Endrin	0.102	0.010	ug/l	0.100		102	58-118	0.1	20	QC-2
Endrin aldehyde	0.113	0.010	ug/l	0.100		113	58-118	8	20	QC-2
gamma-BHC (Lindane)	0.0944	0.010	ug/l	0.100		94	59-119	1	20	QC-2
Heptachlor	0.0918	0.010	ug/l	0.100		92	68-128	2	20	QC-2
Heptachlor epoxide	0.0891	0.010	ug/l	0.100		89	57-117	0.6	20	QC-2
Methoxychlor	0.0990	0.010	ug/l	0.100		99	75-135	7	20	QC-2
Surrogate(s)										
Decachlorobiphenyl	*0.0993*		*ug/l*	*0.100*		*99*	*70-130*			QC-2
Tetrachloro-meta-xylene	*0.0704*		*ug/l*	*0.100*		*70*	*70-130*			QC-2

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Quality Control Results

(Continued)

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0F1765 - SM 2540C										
Blank (W0F1765-BLK1)				**Prepared: 06/29/20 Analyzed: 07/01/20**						
Total Dissolved Solids	ND	10	mg/l							
LCS (W0F1765-BS1)				**Prepared: 06/29/20 Analyzed: 07/01/20**						
Total Dissolved Solids	816	10	mg/l	824		99	96-102			
Duplicate (W0F1765-DUP1)	**Source: 0F26058-01**			**Prepared: 06/29/20 Analyzed: 07/01/20**						
Total Dissolved Solids	1310	10	mg/l		1330			2	10	
Duplicate (W0F1765-DUP2)	**Source: 0F29059-01**			**Prepared: 06/29/20 Analyzed: 07/01/20**						
Total Dissolved Solids	34800	50	mg/l		34000			2	10	
Batch: W0F1828 - SM 4500H+-B										
LCS (W0F1828-BS1)				**Prepared & Analyzed: 06/30/20**						
pH	9.09	0.10	Units	9.18		99	98.8-101			
Duplicate (W0F1828-DUP1)	**Source: 0F22022-01**			**Prepared & Analyzed: 06/30/20**						
pH	7.03	0.10	Units		6.93			1	3.1	
Batch: W0F1836 - EPA 140.1										
Blank (W0F1836-BLK1)				**Prepared & Analyzed: 06/30/20**						
Threshold Odor Number	ND	1.0	T.O.N.							
Duplicate (W0F1836-DUP1)	**Source: 0F22012-03**			**Prepared & Analyzed: 06/30/20**						
Threshold Odor Number	1.0	1.0	T.O.N.		1.0			0	20	
Batch: W0F1837 - EPA 353.2										
Blank (W0F1837-BLK1)				**Prepared: 06/30/20 Analyzed: 07/01/20**						
Nitrate as N	ND	0.20	mg/l							
Nitrite as N	ND	100	ug/l							
NO2+NO3 as N	ND	200	ug/l							
LCS (W0F1837-BS1)				**Prepared: 06/30/20 Analyzed: 07/01/20**						
Nitrate as N	0.996	0.20	mg/l	1.00		100	90-110			
Nitrite as N	1010	100	ug/l	1000		101	90-110			
NO2+NO3 as N	996	200	ug/l	1000		100	90-110			
Matrix Spike (W0F1837-MS1)	**Source: 0F22003-07**			**Prepared: 06/30/20 Analyzed: 07/01/20**						
Nitrate as N	6.19	0.20	mg/l	2.00	4.22	99	90-110			
Nitrite as N	1010	100	ug/l	1000	ND	101	90-110			
NO2+NO3 as N	6190	200	ug/l	2000	4220	98	90-110			
Matrix Spike (W0F1837-MS2)	**Source: 0F30041-01**			**Prepared: 06/30/20 Analyzed: 07/01/20**						
Nitrate as N	6.77	0.20	mg/l	2.00	4.81	98	90-110			
Nitrite as N	1010	100	ug/l	1000	ND	101	90-110			
NO2+NO3 as N	6770	200	ug/l	2000	4810	98	90-110			
Matrix Spike Dup (W0F1837-MSD1)	**Source: 0F22003-07**			**Prepared: 06/30/20 Analyzed: 07/01/20**						
Nitrate as N	6.19	0.20	mg/l	2.00	4.22	99	90-110	0	20	
Nitrite as N	1010	100	ug/l	1000	ND	101	90-110	0	20	
NO2+NO3 as N	6190	200	ug/l	2000	4220	98	90-110	0	20	

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Quality Control Results

(Continued)

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0F1837 - EPA 353.2 (Continued)										
Matrix Spike Dup (W0F1837-MSD1)	**Source: 0F22003-07**			**Prepared: 06/30/20**	**Analyzed: 07/01/20**					
Matrix Spike Dup (W0F1837-MSD2)	**Source: 0F30041-01**			**Prepared: 06/30/20**	**Analyzed: 07/01/20**					
Nitrate as N	6.79	0.20	mg/l	2.00	4.81	99	90-110	0.3	20	
Nitrite as N	1000	100	ug/l	1000	ND	100	90-110	1	20	
NO2+NO3 as N	6790	200	ug/l	2000	4810	99	90-110	0.3	20	
Batch: W0F1838 - SM 2120B										
LCS (W0F1838-BS1)				**Prepared: 06/30/20**	**Analyzed: 07/01/20**					
Color	10.0	3.0	Color Units	10.0		100	95-105			
Duplicate (W0F1838-DUP1)	**Source: 0F30035-08**			**Prepared: 06/30/20**	**Analyzed: 07/01/20**					
Color	ND	3.0	Color Units		ND				10	
Duplicate (W0F1838-DUP2)	**Source: 0F30035-10**			**Prepared: 06/30/20**	**Analyzed: 07/01/20**					
Color	ND	3.0	Color Units		ND				10	
Batch: W0G0004 - SM 5540C										
Blank (W0G0004-BLK1)				**Prepared & Analyzed: 07/01/20**						
MBAS	ND	0.050	mg/l							
LCS (W0G0004-BS1)				**Prepared & Analyzed: 07/01/20**						
MBAS	0.191	0.050	mg/l	0.200		95	82-115			
Matrix Spike (W0G0004-MS1)	**Source: 0F30045-01**			**Prepared & Analyzed: 07/01/20**						
MBAS	0.204	0.050	mg/l	0.200	ND	102	74-123			
Matrix Spike Dup (W0G0004-MSD1)	**Source: 0F30045-01**			**Prepared & Analyzed: 07/01/20**						
MBAS	0.200	0.050	mg/l	0.200	ND	100	74-123	2	20	
Batch: W0G0009 - SM 5910B										
Blank (W0G0009-BLK1)				**Prepared & Analyzed: 07/01/20**						
UV 254	ND	0.009	1/cm							
LCS (W0G0009-BS1)				**Prepared & Analyzed: 07/01/20**						
UV 254	0.088	0.009	1/cm	0.0880		100	90-110			
Duplicate (W0G0009-DUP1)	**Source: 0F30024-01**			**Prepared & Analyzed: 07/01/20**						
UV 254	ND	0.009	1/cm		ND				10	
Batch: W0G0013 - SM 2320B										
Blank (W0G0013-BLK1)				**Prepared & Analyzed: 07/01/20**						
Alkalinity as CaCO3	ND	5.0	mg/l							
Bicarbonate Alkalinity as HCO3	ND	6.1	mg/l							
Carbonate Alkalinity as CaCO3	ND	5.0	mg/l							
Hydroxide Alkalinity as CaCO3	ND	5.0	mg/l							
LCS (W0G0013-BS1)				**Prepared & Analyzed: 07/01/20**						
Alkalinity as CaCO3	252	5.0	mg/l	250		101	94-108			
Duplicate (W0G0013-DUP1)	**Source: 0F26062-01**			**Prepared & Analyzed: 07/01/20**						
Alkalinity as CaCO3	317	5.0	mg/l		315			0.7	15	

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Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0013 - SM 2320B (Continued)										
Duplicate (W0G0013-DUP1)	**Source: 0F26062-01**			**Prepared & Analyzed: 07/01/20**						
Bicarbonate Alkalinity as HCO3	387	6.1	mg/l		384			0.7	15	
Carbonate Alkalinity as CaCO3	ND	5.0	mg/l		ND				15	
Hydroxide Alkalinity as CaCO3	ND	5.0	mg/l		ND				15	
Batch: W0G0068 - EPA 180.1										
Blank (W0G0068-BLK1)				**Prepared & Analyzed: 07/01/20**						
Turbidity	ND	0.10	NTU							
LCS (W0G0068-BS1)				**Prepared & Analyzed: 07/01/20**						
Turbidity	10.2	0.10	NTU	10.0		102	90-110			
LCS (W0G0068-BS2)				**Prepared & Analyzed: 07/01/20**						
Turbidity	1.98	0.10	NTU	2.00		99	90-110			
Duplicate (W0G0068-DUP1)	**Source: 0F12003-01**			**Prepared & Analyzed: 07/01/20**						
Turbidity	0.100	0.10	NTU		0.100			0	10	
Batch: W0G0099 - SM 2510B										
Blank (W0G0099-BLK1)				**Prepared & Analyzed: 07/02/20**						
Specific Conductance (EC)	ND	2.0	umhos/cm							
LCS (W0G0099-BS1)				**Prepared & Analyzed: 07/02/20**						
Specific Conductance (EC)	441	2.0	umhos/cm	445		99	95-105			
Duplicate (W0G0099-DUP1)	**Source: 0F12004-01**			**Prepared & Analyzed: 07/02/20**						
Specific Conductance (EC)	650	2.0	umhos/cm		647			0.5	5	
Batch: W0G0140 - EPA 335.4										
Blank (W0G0140-BLK1)				**Prepared: 07/06/20 Analyzed: 07/08/20**						
Cyanide, Total	ND	5.0	ug/l							
LCS (W0G0140-BS1)				**Prepared: 07/06/20 Analyzed: 07/08/20**						
Cyanide, Total	94.7	5.0	ug/l	100		95	90-110			
Matrix Spike (W0G0140-MS1)	**Source: 0G01005-01**			**Prepared: 07/06/20 Analyzed: 07/08/20**						
Cyanide, Total	190	5.0	ug/l	200	ND	95	90-110			
Matrix Spike Dup (W0G0140-MSD1)	**Source: 0G01005-01**			**Prepared: 07/06/20 Analyzed: 07/08/20**						
Cyanide, Total	195	5.0	ug/l	200	ND	98	90-110	3	20	
Batch: W0G0163 - SM 5310B										
Blank (W0G0163-BLK1)				**Prepared & Analyzed: 07/06/20**						
Dissolved Organic Carbon	ND	0.30	mg/l							
LCS (W0G0163-BS1)				**Prepared & Analyzed: 07/06/20**						
Dissolved Organic Carbon	1.07	0.30	mg/l	1.00		107	85-115			
Matrix Spike (W0G0163-MS1)	**Source: 0F24064-02**			**Prepared & Analyzed: 07/06/20**						
Dissolved Organic Carbon	6.66	0.30	mg/l	5.00	2.57	82	74-120			
Matrix Spike Dup (W0G0163-MSD1)	**Source: 0F24064-02**			**Prepared & Analyzed: 07/06/20**						
Dissolved Organic Carbon	6.64	0.30	mg/l	5.00	2.57	81	74-120	0.2	20	

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Quality Control Results (Continued)

Diquat and Paraquat by EPA 549.2

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0142 - EPA 549.2										
Blank (W0G0142-BLK1)				**Prepared: 07/06/20**	**Analyzed: 07/09/20**					
Diquat	ND	4.0	ug/l							
LCS (W0G0142-BS1)				**Prepared: 07/06/20**	**Analyzed: 07/09/20**					
Diquat	18.2	4.0	ug/l	20.0		91	70-130			
Matrix Spike (W0G0142-MS1)	**Source: 0F30024-01**			**Prepared: 07/06/20**	**Analyzed: 07/09/20**					
Diquat	18.3	4.0	ug/l	20.0	ND	91	46-122			
Matrix Spike (W0G0142-MS2)	**Source: 0G06111-01**			**Prepared: 07/06/20**	**Analyzed: 07/09/20**					
Diquat	2.58	4.0	ug/l	20.0	ND	13	46-122			MS-01
Matrix Spike Dup (W0G0142-MSD1)	**Source: 0F30024-01**			**Prepared: 07/06/20**	**Analyzed: 07/09/20**					
Diquat	17.0	4.0	ug/l	20.0	ND	85	46-122	7	30	
Matrix Spike Dup (W0G0142-MSD2)	**Source: 0G06111-01**			**Prepared: 07/06/20**	**Analyzed: 07/09/20**					
Diquat	2.17	4.0	ug/l	20.0	ND	11	46-122	17	30	MS-01

Quality Control Results (Continued)

Endothall By EPA 548.1

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0141 - EPA 548.1										
Blank (W0G0141-BLK1)				**Prepared: 07/06/20**	**Analyzed: 07/08/20**					
Endothall	ND	45	ug/l							
LCS (W0G0141-BS1)				**Prepared: 07/06/20**	**Analyzed: 07/08/20**					
Endothall	75.5	45	ug/l	100		76	31-117			
Matrix Spike (W0G0141-MS1)	**Source: 0F30024-01**			**Prepared: 07/06/20**	**Analyzed: 07/08/20**					
Endothall	111	90	ug/l	200	ND	56	0.1-109			
Matrix Spike Dup (W0G0141-MSD1)	**Source: 0F30024-01**			**Prepared: 07/06/20**	**Analyzed: 07/08/20**					
Endothall	97.1	90	ug/l	200	ND	49	0.1-109	14	30	

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Quality Control Results

(Continued)

Explosives by EPA Method 8330

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0131 - EPA 8330A										
Blank (W0G0131-BLK1)				**Prepared: 07/06/20 Analyzed: 07/08/20**						
1,3,5-Trinitrobenzene	ND	1.0	ug/l							
1,3-Dinitrobenzene	ND	1.0	ug/l							
2,4,6-Trinitrotoluene	ND	1.0	ug/l							
2,4-Dinitrotoluene	ND	1.0	ug/l							
2,6-Dinitrotoluene	ND	1.0	ug/l							
2-Amino-4,6-Dinitrotoluene	ND	1.0	ug/l							
2-Nitrotoluene	ND	1.0	ug/l							
3-Nitrotoluene	ND	1.0	ug/l							
4-Amino-2,6-Dinitrotoluene	ND	1.0	ug/l							
4-Nitrotoluene	ND	1.0	ug/l							
HMX	ND	1.0	ug/l							
Nitrobenzene	ND	1.0	ug/l							
RDX	ND	1.0	ug/l							
Tetryl	ND	1.0	ug/l							
LCS (W0G0131-BS1)				**Prepared: 07/06/20 Analyzed: 07/08/20**						
1,3,5-Trinitrobenzene	2.79	1.0	ug/l	3.25		86	70-130			
1,3-Dinitrobenzene	2.57	1.0	ug/l	3.25		79	70-130			
2,4,6-Trinitrotoluene	2.53	1.0	ug/l	3.25		78	70-130			
2,4-Dinitrotoluene	2.36	1.0	ug/l	3.25		73	70-130			
2,6-Dinitrotoluene	2.66	1.0	ug/l	3.25		82	70-130			
2-Amino-4,6-Dinitrotoluene	3.01	1.0	ug/l	3.25		93	70-130			
2-Nitrotoluene	2.39	1.0	ug/l	3.25		73	70-130			
3-Nitrotoluene	2.79	1.0	ug/l	3.25		86	70-130			
4-Amino-2,6-Dinitrotoluene	2.64	1.0	ug/l	3.25		81	70-130			
4-Nitrotoluene	2.32	1.0	ug/l	3.25		71	70-130			
HMX	2.94	1.0	ug/l	3.25		91	70-130			
Nitrobenzene	2.41	1.0	ug/l	3.25		74	70-130			
RDX	3.01	1.0	ug/l	3.25		93	70-130			
Tetryl	2.46	1.0	ug/l	3.25		76	70-130			
LCS Dup (W0G0131-BSD1)				**Prepared: 07/06/20 Analyzed: 07/08/20**						
1,3,5-Trinitrobenzene	3.02	1.0	ug/l	3.25		93	70-130	8	25	
1,3-Dinitrobenzene	2.59	1.0	ug/l	3.25		80	70-130	0.9	25	
2,4,6-Trinitrotoluene	2.72	1.0	ug/l	3.25		84	70-130	7	25	
2,4-Dinitrotoluene	2.60	1.0	ug/l	3.25		80	70-130	9	25	
2,6-Dinitrotoluene	2.75	1.0	ug/l	3.25		85	70-130	3	25	
2-Amino-4,6-Dinitrotoluene	3.08	1.0	ug/l	3.25		95	70-130	2	25	
2-Nitrotoluene	2.46	1.0	ug/l	3.25		76	70-130	3	25	
3-Nitrotoluene	2.78	1.0	ug/l	3.25		86	70-130	0.5	25	
4-Amino-2,6-Dinitrotoluene	3.07	1.0	ug/l	3.25		95	70-130	15	25	

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Quality Control Results (Continued)

Explosives by EPA Method 8330 (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0131 - EPA 8330A (Continued)										
LCS Dup (W0G0131-BSD1)				**Prepared: 07/06/20 Analyzed: 07/08/20**						
4-Nitrotoluene	2.36	1.0	ug/l	3.25		73	70-130	2	25	
HMX	2.98	1.0	ug/l	3.25		92	70-130	1	25	
Nitrobenzene	2.36	1.0	ug/l	3.25		73	70-130	2	25	
RDX	3.10	1.0	ug/l	3.25		95	70-130	3	25	
Tetryl	2.61	1.0	ug/l	3.25		80	70-130	6	25	

Quality Control Results (Continued)

Glycols by GC/FID

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0F1735 - EPA 8015B										
Blank (W0F1735-BLK1)				**Prepared & Analyzed: 06/30/20**						
Ethylene glycol	ND	10	mg/l							
LCS (W0F1735-BS1)				**Prepared & Analyzed: 06/30/20**						
Ethylene glycol	76.6	10	mg/l	100		77	70-130			
Matrix Spike (W0F1735-MS1)	**Source: 0F26019-01**			**Prepared & Analyzed: 06/30/20**						
Ethylene glycol	75.0	10	mg/l	100	ND	75	57-127			
Matrix Spike Dup (W0F1735-MSD1)	**Source: 0F26019-01**			**Prepared & Analyzed: 06/30/20**						
Ethylene glycol	92.5	10	mg/l	100	ND	92	57-127	21	25	

Quality Control Results (Continued)

Glyphosate by EPA 547

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0F1710 - EPA 547										
Blank (W0F1710-BLK1)				**Prepared & Analyzed: 06/30/20**						
Glyphosate	ND	5.0	ug/l							
LCS (W0F1710-BS1)				**Prepared & Analyzed: 06/30/20**						
Glyphosate	25.3	5.0	ug/l	25.0		101	70-130			
Matrix Spike (W0F1710-MS1)	**Source: 0F26060-01**			**Prepared & Analyzed: 06/30/20**						
Glyphosate	23.5	5.0	ug/l	25.0	ND	94	41-149			
Matrix Spike Dup (W0F1710-MSD1)	**Source: 0F26060-01**			**Prepared & Analyzed: 06/30/20**						
Glyphosate	24.8	5.0	ug/l	25.0	ND	99	41-149	5	30	

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Quality Control Results (Continued)

Haloacetic Acids (HAAs) by GC/ECD

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0076 - EPA 552.3										
Blank (W0G0076-BLK1)				**Prepared: 07/02/20**	**Analyzed: 07/07/20**					
Dibromoacetic acid (dbaa)	ND	1.0	ug/l							
Dichloroacetic acid (dcaa)	ND	1.0	ug/l							
HAA5, Total	ND	1.0	ug/l							
Monobromoacetic acid (mbaa)	ND	1.0	ug/l							
Monochloroacetic acid (mcaa)	ND	2.0	ug/l							
Trichloroacetic acid (tcaa)	ND	1.0	ug/l							
Surrogate(s)										
2-Bromobutyric acid	*10.4*		*ug/l*	*10.0*		*104*	*70-130*			
LCS (W0G0076-BS1)				**Prepared: 07/02/20**	**Analyzed: 07/07/20**					
Dibromoacetic acid (dbaa)	10.9	1.0	ug/l	10.0		109	70-130			
Dichloroacetic acid (dcaa)	10.9	1.0	ug/l	10.0		109	70-130			
Monobromoacetic acid (mbaa)	10.8	1.0	ug/l	10.0		108	70-130			
Monochloroacetic acid (mcaa)	10.7	2.0	ug/l	10.0		107	70-130			
Trichloroacetic acid (tcaa)	11.0	1.0	ug/l	10.0		110	70-130			
Surrogate(s)										
2-Bromobutyric acid	*10.5*		*ug/l*	*10.0*		*105*	*70-130*			
Matrix Spike (W0G0076-MS1)	**Source: 0G01035-01**			**Prepared: 07/02/20**	**Analyzed: 07/08/20**					
Dibromoacetic acid (dbaa)	13.6	1.0	ug/l	10.0	2.11	115	70-130			
Dichloroacetic acid (dcaa)	13.8	1.0	ug/l	10.0	1.55	122	70-130			
Monobromoacetic acid (mbaa)	9.67	1.0	ug/l	10.0	ND	97	70-130			
Monochloroacetic acid (mcaa)	10.4	2.0	ug/l	10.0	ND	104	70-130			
Trichloroacetic acid (tcaa)	13.0	1.0	ug/l	10.0	1.27	118	70-130			
Surrogate(s)										
2-Bromobutyric acid	*10.5*		*ug/l*	*10.0*		*105*	*70-130*			
Matrix Spike Dup (W0G0076-MSD1)	**Source: 0G01035-01**			**Prepared: 07/02/20**	**Analyzed: 07/08/20**					
Dibromoacetic acid (dbaa)	13.8	1.0	ug/l	10.0	2.11	116	70-130	1	30	
Dichloroacetic acid (dcaa)	14.3	1.0	ug/l	10.0	1.55	127	70-130	3	30	
Monobromoacetic acid (mbaa)	11.2	1.0	ug/l	10.0	ND	112	70-130	14	30	
Monochloroacetic acid (mcaa)	10.5	2.0	ug/l	10.0	ND	105	70-130	2	30	
Trichloroacetic acid (tcaa)	13.5	1.0	ug/l	10.0	1.27	122	70-130	3	30	
Surrogate(s)										
2-Bromobutyric acid	*10.2*		*ug/l*	*10.0*		*102*	*70-130*			

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Quality Control Results

(Continued)

Low Level 1,2,3-TCP by SRL Method, P&T, GC/MS SIM

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0002 - SRL 524M-TCP										
Blank (W0G0002-BLK1)				**Prepared: 07/01/20 Analyzed: 07/02/20**						
1,2,3-Trichloropropane	ND	0.0050	ug/l							
LCS (W0G0002-BS1)				**Prepared & Analyzed: 07/01/20**						
1,2,3-Trichloropropane	0.00578	0.0050	ug/l	0.00500		116	80-120			
LCS Dup (W0G0002-BSD1)				**Prepared: 07/01/20 Analyzed: 07/02/20**						
1,2,3-Trichloropropane	0.00541	0.0050	ug/l	0.00500		108	80-120	7	20	
Duplicate (W0G0002-DUP1)	**Source: 0F22101-02**			**Prepared: 07/01/20 Analyzed: 07/02/20**						
1,2,3-Trichloropropane	0.00478	0.0050	ug/l		0.00480			0.4	20	

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Quality Control Results

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Metals by EPA 200 Series Methods

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0033 - EPA 200.7										
Blank (W0G0033-BLK1)				**Prepared: 07/01/20**	**Analyzed: 07/02/20**					
Boron, Total	ND	10	ug/l							
Calcium, Total	ND	0.100	mg/l							
Iron, Total	ND	10	ug/l							
Magnesium, Total	ND	0.100	mg/l							
Potassium, Total	ND	0.10	mg/l							
Sodium, Total	ND	0.50	mg/l							
LCS (W0G0033-BS1)				**Prepared: 07/01/20**	**Analyzed: 07/02/20**					
Boron, Total	203	10	ug/l	200		101	85-115			
Calcium, Total	49.8	0.100	mg/l	50.2		99	85-115			
Iron, Total	196	10	ug/l	200		98	85-115			
Magnesium, Total	49.6	0.100	mg/l	50.2		99	85-115			
Potassium, Total	51.7	0.10	mg/l	50.2		103	85-115			
Sodium, Total	49.6	0.50	mg/l	50.2		99	85-115			
Matrix Spike (W0G0033-MS1)	**Source: 0F22022-01**			**Prepared: 07/01/20**	**Analyzed: 07/02/20**					
Boron, Total	332	10	ug/l	200	127	102	70-130			
Calcium, Total	137	0.100	mg/l	50.2	92.4	89	70-130			
Iron, Total	198	10	ug/l	200	ND	99	70-130			
Magnesium, Total	67.6	0.100	mg/l	50.2	18.2	98	70-130			
Potassium, Total	60.3	0.10	mg/l	50.2	5.39	109	70-130			
Sodium, Total	80.2	0.50	mg/l	50.2	29.3	101	70-130			
Matrix Spike Dup (W0G0033-MSD1)	**Source: 0F22022-01**			**Prepared: 07/01/20**	**Analyzed: 07/02/20**					
Boron, Total	336	10	ug/l	200	127	105	70-130	1	30	
Calcium, Total	139	0.100	mg/l	50.2	92.4	92	70-130	1	30	
Iron, Total	202	10	ug/l	200	ND	101	70-130	2	30	
Magnesium, Total	68.9	0.100	mg/l	50.2	18.2	101	70-130	2	30	
Potassium, Total	61.6	0.10	mg/l	50.2	5.39	112	70-130	2	30	
Sodium, Total	81.5	0.50	mg/l	50.2	29.3	104	70-130	2	30	
Batch: W0G0175 - EPA 245.1										
Blank (W0G0175-BLK1)				**Prepared: 07/08/20**	**Analyzed: 07/09/20**					
Mercury, Total	ND	0.050	ug/l							B-07
LCS (W0G0175-BS1)				**Prepared: 07/08/20**	**Analyzed: 07/09/20**					
Mercury, Total	1.04	0.050	ug/l	1.00		104	85-115			
Matrix Spike (W0G0175-MS1)	**Source: 0F30024-01**			**Prepared: 07/08/20**	**Analyzed: 07/09/20**					
Mercury, Total	1.05	0.050	ug/l	1.00	ND	105	70-130			
Matrix Spike (W0G0175-MS2)	**Source: 0G01049-01**			**Prepared: 07/08/20**	**Analyzed: 07/09/20**					
Mercury, Total	1.04	0.050	ug/l	1.00	ND	104	70-130			
Matrix Spike Dup (W0G0175-MSD1)	**Source: 0F30024-01**			**Prepared: 07/08/20**	**Analyzed: 07/09/20**					
Mercury, Total	1.06	0.050	ug/l	1.00	ND	106	70-130	1	20	

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Quality Control Results (Continued)

Metals by EPA 200 Series Methods (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0175 - EPA 245.1 (Continued)										
Matrix Spike Dup (W0G0175-MSD2)	**Source: 0G01049-01**			**Prepared: 07/08/20**	**Analyzed: 07/09/20**					
Mercury, Total	1.05	0.050	ug/l	1.00	ND	105	70-130	2	20	
Batch: W0G0423 - EPA 200.8										
Blank (W0G0423-BLK1)				**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Aluminum, Total	ND	5.0	ug/l							
Antimony, Total	ND	0.50	ug/l							
Arsenic, Total	ND	0.40	ug/l							
Barium, Total	ND	0.50	ug/l							
Beryllium, Total	ND	0.10	ug/l							
Cadmium, Total	ND	0.10	ug/l							
Chromium, Total	ND	0.20	ug/l							
Copper, Total	ND	0.50	ug/l							
Lead, Total	ND	0.20	ug/l							
Manganese, Total	ND	0.20	ug/l							
Nickel, Total	ND	0.80	ug/l							
Selenium, Total	ND	0.40	ug/l							
Silver, Total	ND	0.20	ug/l							
Thallium, Total	ND	0.20	ug/l							
Vanadium, Total	ND	0.50	ug/l							
Zinc, Total	ND	5.0	ug/l							
LCS (W0G0423-BS1)				**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Aluminum, Total	53.6	5.0	ug/l	50.0		107	85-115			
Antimony, Total	48.2	0.50	ug/l	50.0		96	85-115			
Arsenic, Total	51.6	0.40	ug/l	50.0		103	85-115			
Barium, Total	49.1	0.50	ug/l	50.0		98	85-115			
Beryllium, Total	47.3	0.10	ug/l	50.0		95	85-115			
Cadmium, Total	50.3	0.10	ug/l	50.0		101	85-115			
Chromium, Total	50.6	0.20	ug/l	50.0		101	85-115			
Copper, Total	51.5	0.50	ug/l	50.0		103	85-115			
Lead, Total	49.1	0.20	ug/l	50.0		98	85-115			
Manganese, Total	50.9	0.20	ug/l	50.0		102	85-115			
Nickel, Total	50.2	0.80	ug/l	50.0		100	85-115			
Selenium, Total	50.8	0.40	ug/l	50.0		102	85-115			
Silver, Total	51.1	0.20	ug/l	50.0		102	85-115			
Thallium, Total	49.2	0.20	ug/l	50.0		98	85-115			
Vanadium, Total	49.7	0.50	ug/l	50.0		99	85-115			
Zinc, Total	50.6	5.0	ug/l	50.0		101	85-115			
Matrix Spike (W0G0423-MS1)	**Source: 0G08072-03**			**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Aluminum, Total	93.2	5.0	ug/l	50.0	53.0	80	70-130			
Antimony, Total	47.1	0.50	ug/l	50.0	0.0482	94	70-130			

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Metals by EPA 200 Series Methods (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0423 - EPA 200.8 (Continued)										
Matrix Spike (W0G0423-MS1)	**Source: 0G08072-03**			**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Arsenic, Total	50.4	0.40	ug/l	50.0	0.289	100	70-130			
Barium, Total	135	0.50	ug/l	50.0	87.3	96	70-130			
Beryllium, Total	46.6	0.10	ug/l	50.0	ND	93	70-130			
Cadmium, Total	48.0	0.10	ug/l	50.0	ND	96	70-130			
Chromium, Total	60.3	0.20	ug/l	50.0	12.2	96	70-130			
Copper, Total	113	0.50	ug/l	50.0	68.7	88	70-130			
Lead, Total	46.1	0.20	ug/l	50.0	0.187	92	70-130			
Manganese, Total	56.8	0.20	ug/l	50.0	10.3	93	70-130			
Nickel, Total	51.4	0.80	ug/l	50.0	6.95	89	70-130			
Selenium, Total	48.5	0.40	ug/l	50.0	0.877	95	70-130			
Silver, Total	46.6	0.20	ug/l	50.0	ND	93	70-130			
Thallium, Total	46.5	0.20	ug/l	50.0	ND	93	70-130			
Vanadium, Total	75.6	0.50	ug/l	50.0	29.2	93	70-130			
Zinc, Total	49.2	5.0	ug/l	50.0	2.83	93	70-130			
Matrix Spike Dup (W0G0423-MSD1)	**Source: 0G08072-03**			**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Aluminum, Total	90.1	5.0	ug/l	50.0	53.0	74	70-130	3	30	
Antimony, Total	47.7	0.50	ug/l	50.0	0.0482	95	70-130	1	30	
Arsenic, Total	50.8	0.40	ug/l	50.0	0.289	101	70-130	0.8	30	
Barium, Total	134	0.50	ug/l	50.0	87.3	93	70-130	1	30	
Beryllium, Total	46.9	0.10	ug/l	50.0	ND	94	70-130	0.7	30	
Cadmium, Total	48.4	0.10	ug/l	50.0	ND	97	70-130	0.9	30	
Chromium, Total	59.4	0.20	ug/l	50.0	12.2	95	70-130	1	30	
Copper, Total	113	0.50	ug/l	50.0	68.7	89	70-130	0.6	30	
Lead, Total	46.1	0.20	ug/l	50.0	0.187	92	70-130	0.07	30	
Manganese, Total	56.9	0.20	ug/l	50.0	10.3	93	70-130	0.1	30	
Nickel, Total	52.0	0.80	ug/l	50.0	6.95	90	70-130	1	30	
Selenium, Total	49.7	0.40	ug/l	50.0	0.877	98	70-130	2	30	
Silver, Total	47.2	0.20	ug/l	50.0	ND	94	70-130	1	30	
Thallium, Total	46.1	0.20	ug/l	50.0	ND	92	70-130	0.8	30	
Vanadium, Total	74.1	0.50	ug/l	50.0	29.2	90	70-130	2	30	
Zinc, Total	49.0	5.0	ug/l	50.0	2.83	92	70-130	0.4	30	

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Nitrosamines by CI GC/MS/MS, EPA 521

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0130 - EPA 521										
Blank (W0G0130-BLK1)				**Prepared: 07/06/20**	**Analyzed: 07/08/20**					
N-Nitrosodiethylamine	ND	2.0	ng/l							
N-Nitrosodimethylamine	ND	2.0	ng/l							
N-Nitrosodi-n-butylamine	ND	2.0	ng/l							
N-Nitrosodi-n-propylamine	ND	2.0	ng/l							
N-Nitrosomethylethylamine	ND	2.0	ng/l							
N-Nitrosomorpholine	ND	2.0	ng/l							
N-Nitrosopiperidine	ND	2.0	ng/l							
N-Nitrosopyrrolidine	ND	2.0	ng/l							
Surrogate(s)										
NDMA-d6	*24.0*		*ng/l*	*25.0*		*96*	*70-130*			
LCS (W0G0130-BS1)				**Prepared: 07/06/20**	**Analyzed: 07/09/20**					
N-Nitrosodiethylamine	2.97	2.0	ng/l	4.00		74	70-130			
N-Nitrosodimethylamine	3.24	2.0	ng/l	4.00		81	70-130			
N-Nitrosodi-n-butylamine	2.91	2.0	ng/l	4.00		73	70-130			
N-Nitrosodi-n-propylamine	2.86	2.0	ng/l	4.00		71	70-130			
N-Nitrosomethylethylamine	3.08	2.0	ng/l	4.00		77	70-130			
N-Nitrosomorpholine	3.14	2.0	ng/l	4.00		78	70-130			
N-Nitrosopiperidine	3.26	2.0	ng/l	4.00		81	70-130			
N-Nitrosopyrrolidine	3.73	2.0	ng/l	4.00		93	70-130			
Surrogate(s)										
NDMA-d6	*26.7*		*ng/l*	*25.0*		*107*	*70-130*			
LCS Dup (W0G0130-BSD1)				**Prepared: 07/06/20**	**Analyzed: 07/08/20**					
N-Nitrosodiethylamine	3.19	2.0	ng/l	4.00		80	70-130	7	30	
N-Nitrosodimethylamine	3.57	2.0	ng/l	4.00		89	70-130	10	30	
N-Nitrosodi-n-butylamine	3.04	2.0	ng/l	4.00		76	70-130	5	30	
N-Nitrosodi-n-propylamine	3.30	2.0	ng/l	4.00		83	70-130	14	30	
N-Nitrosomethylethylamine	3.27	2.0	ng/l	4.00		82	70-130	6	30	
N-Nitrosomorpholine	3.64	2.0	ng/l	4.00		91	70-130	15	30	
N-Nitrosopiperidine	3.31	2.0	ng/l	4.00		83	70-130	2	30	
N-Nitrosopyrrolidine	3.80	2.0	ng/l	4.00		95	70-130	2	30	
Surrogate(s)										
NDMA-d6	*26.7*		*ng/l*	*25.0*		*107*	*70-130*			

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(Continued)

Organic Compounds by Tandem LC/MS/MS

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0H0124 - LC/MS/MS										
Blank (W0H0124-BLK1)				**Prepared: 07/28/20**	**Analyzed: 08/10/20**					
Iohexol	ND	5.0	ng/l							
LCS (W0H0124-BS1)				**Prepared: 07/28/20**	**Analyzed: 08/10/20**					
Iohexol	10.4	5.0	ng/l	50.0		21	50-150			BS-L
LCS Dup (W0H0124-BSD1)				**Prepared: 07/28/20**	**Analyzed: 08/10/20**					
Iohexol	19.3	5.0	ng/l	50.0		39	50-150	60	30	BS-L

Quality Control Results

(Continued)

Per- and Polyflourinated Alkyl Substances (PFAS) by SPE/LCMSMS

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0516 - EPA 537.1										
Blank (W0G0516-BLK1)				**Prepared: 07/10/20 Analyzed: 07/14/20**						
11Cl-PF3OUdS	ND	2.0	ng/l							
9Cl-PF3ONS	ND	2.0	ng/l							
ADONA	ND	2.0	ng/l							
EtFOSAA	ND	2.0	ng/l							
HFPO-DA	ND	2.0	ng/l							
MeFOSAA	ND	2.0	ng/l							
PFBS	ND	2.0	ng/l							
PFDA	ND	2.0	ng/l							
PFDoA	ND	2.0	ng/l							
PFHpA	52.9	2.0	ng/l							B
PFHxA	3.97	2.0	ng/l							B
PFHxS	ND	2.0	ng/l							
PFNA	ND	2.0	ng/l							
PFOA	ND	2.0	ng/l							
PFOS	ND	2.0	ng/l							
PFTeDA	ND	2.0	ng/l							
PFTrDA	ND	2.0	ng/l							
PFUnA	ND	2.0	ng/l							
Surrogate(s)										
13C2-PFDA	*31.7*		*ng/l*	*40.0*		*79*	*70-130*			
13C2-PFHxA	*43.9*		*ng/l*	*40.0*		*110*	*70-130*			
d5-EtFOSAA	*26.4*		*ng/l*	*40.0*		*66*	*70-130*			*S-11*
HFPO-DA-13C3	*44.0*		*ng/l*	*40.0*		*110*	*70-130*			
LCS (W0G0516-BS1)				**Prepared: 07/10/20 Analyzed: 07/14/20**						
11Cl-PF3OUdS	1.84	2.0	ng/l	2.00		92	50-150			
9Cl-PF3ONS	2.17	2.0	ng/l	2.00		108	50-150			
ADONA	2.32	2.0	ng/l	2.00		116	50-150			
EtFOSAA	2.22	2.0	ng/l	2.00		111	50-150			
HFPO-DA	2.62	2.0	ng/l	2.00		131	50-150			
MeFOSAA	2.21	2.0	ng/l	2.00		111	50-150			
PFBS	2.64	2.0	ng/l	2.00		132	50-150			
PFDA	2.32	2.0	ng/l	2.00		116	50-150			
PFDoA	2.19	2.0	ng/l	2.00		109	50-150			
PFHpA	17.8	2.0	ng/l	2.00		888	50-150			BS-H
PFHxA	3.50	2.0	ng/l	2.00		175	50-150			BS-H
PFHxS	2.43	2.0	ng/l	2.00		121	50-150			
PFNA	2.57	2.0	ng/l	2.00		128	50-150			
PFOA	2.67	2.0	ng/l	2.00		134	50-150			
PFOS	2.53	2.0	ng/l	2.00		126	50-150			

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Quality Control Results (Continued)

Per- and Polyflourinated Alkyl Substances (PFAS) by SPE/LCMSMS (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0516 - EPA 537.1 (Continued)										
LCS (W0G0516-BS1)				**Prepared: 07/10/20 Analyzed: 07/14/20**						
PFTeDA	1.43	2.0	ng/l	2.00		72	50-150			
PFTrDA	1.55	2.0	ng/l	2.00		77	50-150			
PFUnA	1.99	2.0	ng/l	2.00		100	50-150			
Surrogate(s)										
13C2-PFDA	*42.7*		*ng/l*	*40.0*		*107*	*70-130*			
13C2-PFHxA	*46.4*		*ng/l*	*40.0*		*116*	*70-130*			
d5-EtFOSAA	*40.4*		*ng/l*	*40.0*		*101*	*70-130*			
HFPO-DA-13C3	*45.9*		*ng/l*	*40.0*		*115*	*70-130*			

Quality Control Results (Continued)

Perchlorate by EPA 314.0

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0F1821 - EPA 314.0										
Blank (W0F1821-BLK1)				**Prepared & Analyzed: 06/30/20**						
Perchlorate	ND	2.0	ug/l							
LCS (W0F1821-BS1)				**Prepared & Analyzed: 06/30/20**						
Perchlorate	8.83	2.0	ug/l	10.0		88	85-115			
Matrix Spike (W0F1821-MS1)	**Source: 0F22022-01**			**Prepared & Analyzed: 06/30/20**						
Perchlorate	8.89	2.0	ug/l	10.0	ND	89	80-120			
Matrix Spike Dup (W0F1821-MSD1)	**Source: 0F22022-01**			**Prepared & Analyzed: 06/30/20**						
Perchlorate	8.75	2.0	ug/l	10.0	ND	87	80-120	2	15	

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PPCPs - Pharmaceuticals by LC/MSMS-ESI-

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G1397 - EPA 1694M-ESI-										
Blank (W0G1397-BLK1)				**Prepared: 07/28/20 Analyzed: 08/10/20**						
Bisphenol A	ND	1.0	ng/l							
Diclofenac	ND	1.0	ng/l							
Gemfibrozil	ND	1.0	ng/l							
Ibuprofen	ND	1.0	ng/l							
Iopromide	ND	5.0	ng/l							
Naproxen	ND	1.0	ng/l							
Salicylic Acid	168	50	ng/l							B
Triclosan	ND	2.0	ng/l							
LCS (W0G1397-BS1)				**Prepared: 07/28/20 Analyzed: 08/10/20**						
Bisphenol A	9.14	1.0	ng/l	10.0		91	53-168			
Diclofenac	9.79	1.0	ng/l	10.0		98	37-218			
Gemfibrozil	8.89	1.0	ng/l	10.0		89	76-122			
Ibuprofen	9.43	1.0	ng/l	10.0		94	67-139			
Iopromide	5.36	5.0	ng/l	50.0		11	0.1-163			
Naproxen	9.54	1.0	ng/l	10.0		95	64-138			
Salicylic Acid	165	50	ng/l	100		165	56-229			
Triclosan	9.10	2.0	ng/l	10.0		91	76-139			
LCS Dup (W0G1397-BSD1)				**Prepared: 07/28/20 Analyzed: 08/10/20**						
Bisphenol A	10.6	1.0	ng/l	10.0		106	53-168	15	30	
Diclofenac	10.4	1.0	ng/l	10.0		104	37-218	6	30	
Gemfibrozil	9.73	1.0	ng/l	10.0		97	76-122	9	30	
Ibuprofen	9.43	1.0	ng/l	10.0		94	67-139	0.01	30	
Iopromide	12.1	5.0	ng/l	50.0		24	0.1-163	77	30	Q-12
Naproxen	10.7	1.0	ng/l	10.0		107	64-138	11	30	
Salicylic Acid	159	50	ng/l	100		159	56-229	3	30	
Triclosan	9.27	2.0	ng/l	10.0		93	76-139	2	30	

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Quality Control Results (Continued)

PPCPs - Pharmaceuticals by LC/MSMS-ESI+

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G1399 - EPA 1694M-ESI+										
Blank (W0G1399-BLK1)				**Prepared: 07/28/20 Analyzed: 08/10/20**						
Acetaminophen	ND	20	ng/l							
Amoxicillin	ND	10	ng/l							
Atenolol	4.71	1.0	ng/l							B
Atorvastatin	ND	1.0	ng/l							
Azithromycin	18.9	10	ng/l							B
Caffeine	6.76	1.0	ng/l							B
Carbamazepine	ND	1.0	ng/l							
Ciprofloxacin	146	5.0	ng/l							B
Cotinine	2.80	2.0	ng/l							B
DEET	ND	1.0	ng/l							
Diazepam	ND	1.0	ng/l							
Fluoxetine	ND	1.0	ng/l							
Galaxolide (HHCB)	14.8	10	ng/l							B-06
Meprobamate	ND	1.0	ng/l							
Methadone	ND	1.0	ng/l							
Oxybenzone	ND	1.0	ng/l							
Phenytoin (Dilantin)	ND	5.0	ng/l							A-01a
Praziquantel	ND	1.0	ng/l							
Primidone	ND	1.0	ng/l							
Quinoline	1.47	1.0	ng/l							B-06
Sucralose	318	5.0	ng/l							B
Sulfamethoxazole	ND	1.0	ng/l							
TCEP	ND	1.0	ng/l							
TCPP	ND	1.0	ng/l							
TDCPP	ND	1.0	ng/l							
Trimethoprim	ND	1.0	ng/l							
LCS (W0G1399-BS1)				**Prepared: 07/28/20 Analyzed: 08/10/20**						
Acetaminophen	75.9	20	ng/l	200		38	66-156			BS-04
Amoxicillin	212	10	ng/l	100		212	14-167			BS-04
Atenolol	10.1	1.0	ng/l	10.0		101	56-164			
Atorvastatin	10.4	1.0	ng/l	10.0		104	0.1-173			
Azithromycin	76.4	10	ng/l	100		76	52-166			
Caffeine	10.5	1.0	ng/l	10.0		105	55-152			
Carbamazepine	9.77	1.0	ng/l	10.0		98	60-135			
Ciprofloxacin	100	5.0	ng/l	50.0		200	51-168			BS-H
Cotinine	14.3	2.0	ng/l	10.0		143	68-155			
DEET	12.6	1.0	ng/l	10.0		126	45-135			
Diazepam	8.27	1.0	ng/l	10.0		83	58-127			
Fluoxetine	8.44	1.0	ng/l	10.0		84	55-150			

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PPCPs - Pharmaceuticals by LC/MSMS-ESI+ (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G1399 - EPA 1694M-ESI+ (Continued)										
LCS (W0G1399-BS1)				**Prepared: 07/28/20 Analyzed: 08/10/20**						
Galaxolide (HHCB)	33.1	10	ng/l	50.0		66	50-150			
Meprobamate	14.8	1.0	ng/l	10.0		148	11-166			
Methadone	8.17	1.0	ng/l	10.0		82	62-137			
Oxybenzone	10.4	1.0	ng/l	10.0		104	50-150			
Phenytoin (Dilantin)	4.63	5.0	ng/l	10.0		46	69-138			BS-L
Praziquantel	8.39	1.0	ng/l	10.0		84	50-150			
Primidone	8.80	1.0	ng/l	10.0		88	54-147			
Quinoline	11.7	1.0	ng/l	10.0		117	50-150			
Sucralose	63.5	5.0	ng/l	50.0		127	50-150			
Sulfamethoxazole	9.69	1.0	ng/l	10.0		97	60-133			
TCEP	7.35	1.0	ng/l	10.0		73	25-149			
TCPP	8.12	1.0	ng/l	10.0		81	24-149			
TDCPP	6.85	1.0	ng/l	10.0		68	20-158			
Trimethoprim	9.32	1.0	ng/l	10.0		93	67-139			
LCS Dup (W0G1399-BSD1)				**Prepared: 07/28/20 Analyzed: 08/10/20**						
Acetaminophen	196	20	ng/l	200		98	66-156	88	30	A-01c
Amoxicillin	145	10	ng/l	100		145	14-167	38	30	A-01b
Atenolol	13.8	1.0	ng/l	10.0		138	56-164	31	30	BS-04
Atorvastatin	10.4	1.0	ng/l	10.0		104	0.1-173	0.3	30	
Azithromycin	79.4	10	ng/l	100		79	52-166	4	30	
Caffeine	11.5	1.0	ng/l	10.0		115	55-152	9	30	
Carbamazepine	9.90	1.0	ng/l	10.0		99	60-135	1	30	
Ciprofloxacin	112	5.0	ng/l	50.0		224	51-168	11	30	BS-H
Cotinine	24.6	2.0	ng/l	10.0		246	68-155	53	30	BS-04
DEET	13.1	1.0	ng/l	10.0		131	45-135	4	30	
Diazepam	9.12	1.0	ng/l	10.0		91	58-127	10	30	
Fluoxetine	9.69	1.0	ng/l	10.0		97	55-150	14	30	
Galaxolide (HHCB)	76.2	10	ng/l	50.0		152	50-150	79	30	BS-04
Meprobamate	15.7	1.0	ng/l	10.0		157	11-166	6	30	
Methadone	10.3	1.0	ng/l	10.0		103	62-137	23	30	
Oxybenzone	7.52	1.0	ng/l	10.0		75	50-150	32	30	Q-12
Phenytoin (Dilantin)	3.20	5.0	ng/l	10.0		32	69-138	37	30	BS-L
Praziquantel	9.82	1.0	ng/l	10.0		98	50-150	16	30	
Primidone	8.92	1.0	ng/l	10.0		89	54-147	1	30	
Quinoline	12.2	1.0	ng/l	10.0		122	50-150	4	30	
Sucralose	81.2	5.0	ng/l	50.0		162	50-150	24	30	BS-04
Sulfamethoxazole	10.1	1.0	ng/l	10.0		101	60-133	4	30	
TCEP	6.72	1.0	ng/l	10.0		67	25-149	9	30	
TCPP	6.65	1.0	ng/l	10.0		67	24-149	20	30	

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Quality Control Results (Continued)

PPCPs - Pharmaceuticals by LC/MSMS-ESI+ (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G1399 - EPA 1694M-ESI+ (Continued)										
LCS Dup (W0G1399-BSD1)				**Prepared: 07/28/20**	**Analyzed: 08/10/20**					
TDCPP	8.44	1.0	ng/l	10.0		84	20-158	21	30	
Trimethoprim	9.80	1.0	ng/l	10.0		98	67-139	5	30	

Quality Control Results (Continued)

Radiological Parameters by APHA/EPA Methods

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0146 - EPA 900.0										
Blank (W0G0146-BLK1)				**Prepared: 07/06/20**	**Analyzed: 07/07/20**					
Gross Alpha	0.42		pCi/L							
Uncertainty: 0.283 **MDA:** 0.451										
Gross Beta	-1.6		pCi/L							
Uncertainty: 0.508 **MDA:** 0.79										
LCS (W0G0146-BS1)				**Prepared: 07/06/20**	**Analyzed: 07/07/20**					
Gross Alpha	11		pCi/L	12.0		91	64-139			
Uncertainty: 0.73 **MDA:** 0.521										
Gross Beta	14		pCi/L	16.0		88	77-138			
Uncertainty: 0.772 **MDA:** 0.644										
Matrix Spike (W0G0146-MS1)	**Source: 0G01005-01**			**Prepared: 07/06/20**	**Analyzed: 07/07/20**					
Gross Alpha	7.3		pCi/L	12.0	0.40	58	70-130			MS-01
Uncertainty: 0.682 **MDA:** 0.544										
Gross Beta	14		pCi/L	16.0	1.4	80	70-130			
Uncertainty: 0.775 **MDA:** 0.687										
Matrix Spike Dup (W0G0146-MSD1)	**Source: 0G01005-01**			**Prepared: 07/06/20**	**Analyzed: 07/07/20**					
Gross Alpha	7.5		pCi/L	12.0	0.40	59	70-130	2	30	MS-01
Uncertainty: 0.685 **MDA:** 0.513										
Gross Beta	17		pCi/L	16.0	1.4	95	70-130	15	30	
Uncertainty: 0.819 **MDA:** 0.669										
Batch: W0G0675 - EPA 200.8										
Blank (W0G0675-BLK1)				**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Uranium Rad	ND	0.13	pCi/L							
LCS (W0G0675-BS1)				**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Uranium Rad	32.1	0.13	pCi/L	33.5		96	85-115			
Matrix Spike (W0G0675-MS1)	**Source: 0G08072-03RE1**			**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Uranium Rad	31.5	0.13	pCi/L	33.5	0.131	94	70-130			
Matrix Spike Dup (W0G0675-MSD1)	**Source: 0G08072-03RE1**			**Prepared: 07/09/20**	**Analyzed: 07/13/20**					
Uranium Rad	31.7	0.13	pCi/L	33.5	0.131	94	70-130	0.5	30	

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Quality Control Results

(Continued)

Semivolatile Organic Compounds by GC/MS

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0136 - EPA 525.2										
Blank (W0G0136-BLK1)				**Prepared: 07/06/20 Analyzed: 07/22/20**						
Alachlor	ND	0.10	ug/l							
Atrazine	ND	0.10	ug/l							
Benzo (a) pyrene	ND	0.10	ug/l							
Bis(2-ethylhexyl)adipate	ND	5.0	ug/l							
Bis(2-ethylhexyl)phthalate	ND	3.0	ug/l							
Bromacil	ND	0.50	ug/l							
Butachlor	ND	0.10	ug/l							
Captan	ND	1.0	ug/l							
Chlorpropham	ND	0.10	ug/l							
Cyanazine	ND	0.10	ug/l							
Diazinon	ND	0.10	ug/l							
Dimethoate	ND	0.20	ug/l							
Diphenamid	ND	0.10	ug/l							
Disulfoton	ND	0.10	ug/l							
EPTC	ND	0.10	ug/l							
Metolachlor	ND	0.10	ug/l							
Metribuzin	ND	0.10	ug/l							
Molinate	ND	0.10	ug/l							
Prometon	ND	0.10	ug/l							
Prometryn	ND	0.10	ug/l							
Simazine	ND	0.10	ug/l							
Terbacil	ND	2.0	ug/l							
Thiobencarb	ND	0.10	ug/l							
Trithion	ND	0.10	ug/l							
Surrogate(s)										
1,3-Dimethyl-2-nitrobenzene	*4.97*		*ug/l*	*5.00*		*99*	*70-130*			
Perylene-d12	*4.14*		*ug/l*	*5.00*		*83*	*50-120*			
Triphenyl phosphate	*4.64*		*ug/l*	*5.00*		*93*	*70-130*			
LCS (W0G0136-BS1)				**Prepared: 07/06/20 Analyzed: 07/22/20**						
Alachlor	5.92	0.10	ug/l	5.00		118	70-130			
Atrazine	5.82	0.10	ug/l	5.00		116	70-130			
Benzo (a) pyrene	4.40	0.10	ug/l	5.00		88	60-130			
Bis(2-ethylhexyl)adipate	5.17	5.0	ug/l	5.00		103	70-130			
Bis(2-ethylhexyl)phthalate	5.10	3.0	ug/l	5.00		102	70-130			
Bromacil	5.02	0.50	ug/l	5.00		100	70-130			
Butachlor	5.19	0.10	ug/l	5.00		104	70-130			
Captan	5.49	1.0	ug/l	5.00		110	70-130			
Chlorpropham	5.60	0.10	ug/l	5.00		112	70-130			
Cyanazine	5.26	0.10	ug/l	5.00		105	70-130			

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Quality Control Results

(Continued)

Semivolatile Organic Compounds by GC/MS (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0136 - EPA 525.2 (Continued)										
LCS (W0G0136-BS1)				**Prepared: 07/06/20**	**Analyzed: 07/22/20**					
Diazinon	4.60	0.10	ug/l	5.00		92	50-120			
Dimethoate	4.48	0.20	ug/l	5.00		90	50-120			
Diphenamid	5.83	0.10	ug/l	5.00		117	70-130			
Disulfoton	3.88	0.10	ug/l	5.00		78	50-120			
EPTC	5.63	0.10	ug/l	5.00		113	70-130			
Metolachlor	5.54	0.10	ug/l	5.00		111	60-130			
Metribuzin	4.75	0.10	ug/l	5.00		95	50-120			
Molinate	5.50	0.10	ug/l	5.00		110	70-130			
Prometon	2.09	0.10	ug/l	5.00		42	15-120			
Prometryn	3.90	0.10	ug/l	5.00		78	30-120			
Simazine	5.12	0.10	ug/l	5.00		102	60-130			
Terbacil	5.77	2.0	ug/l	5.00		115	70-130			
Thiobencarb	5.51	0.10	ug/l	5.00		110	70-130			
Trithion	5.31	0.10	ug/l	5.00		106	70-130			
Surrogate(s)										
1,3-Dimethyl-2-nitrobenzene	*4.91*		*ug/l*	*5.00*		*98*	*70-130*			
Perylene-d12	*4.83*		*ug/l*	*5.00*		*97*	*50-120*			
Triphenyl phosphate	*5.49*		*ug/l*	*5.00*		*110*	*70-130*			
Matrix Spike (W0G0136-MS1)	**Source: 0G01005-01**			**Prepared: 07/06/20**	**Analyzed: 07/22/20**					
Alachlor	5.94	0.10	ug/l	5.00	ND	119	70-130			
Atrazine	6.10	0.10	ug/l	5.00	ND	122	70-130			
Benzo (a) pyrene	4.62	0.10	ug/l	5.00	ND	92	60-130			
Bis(2-ethylhexyl)adipate	5.30	5.0	ug/l	5.00	ND	106	70-130			
Bis(2-ethylhexyl)phthalate	5.15	3.0	ug/l	5.00	ND	103	70-130			
Bromacil	5.23	0.50	ug/l	5.00	ND	105	70-130			
Butachlor	5.40	0.10	ug/l	5.00	ND	108	70-130			
Captan	5.66	1.0	ug/l	5.00	ND	113	70-130			
Chlorpropham	6.03	0.10	ug/l	5.00	ND	121	70-130			
Cyanazine	5.38	0.10	ug/l	5.00	ND	108	70-130			
Diazinon	4.82	0.10	ug/l	5.00	ND	96	50-120			
Dimethoate	5.62	0.20	ug/l	5.00	ND	112	50-120			
Diphenamid	5.80	0.10	ug/l	5.00	ND	116	70-130			
Disulfoton	4.34	0.10	ug/l	5.00	ND	87	50-120			
EPTC	5.62	0.10	ug/l	5.00	ND	112	70-130			
Metolachlor	5.62	0.10	ug/l	5.00	ND	112	60-130			
Metribuzin	5.16	0.10	ug/l	5.00	ND	103	50-120			
Molinate	5.62	0.10	ug/l	5.00	ND	112	70-130			
Prometon	3.03	0.10	ug/l	5.00	ND	61	15-120			
Prometryn	4.19	0.10	ug/l	5.00	ND	84	30-120			

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Quality Control Results

(Continued)

Semivolatile Organic Compounds by GC/MS (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0136 - EPA 525.2 (Continued)										
Matrix Spike (W0G0136-MS1)	**Source: 0G01005-01**			**Prepared: 07/06/20**	**Analyzed: 07/22/20**					
Simazine	5.32	0.10	ug/l	5.00	ND	106	60-130			
Terbacil	6.15	2.0	ug/l	5.00	ND	123	70-130			
Thiobencarb	5.57	0.10	ug/l	5.00	ND	111	70-130			
Trithion	5.36	0.10	ug/l	5.00	ND	107	70-130			
Surrogate(s)										
1,3-Dimethyl-2-nitrobenzene	*5.09*		*ug/l*	*5.00*		*102*	*70-130*			
Perylene-d12	*4.75*		*ug/l*	*5.00*		*95*	*50-120*			
Triphenyl phosphate	*5.49*		*ug/l*	*5.00*		*110*	*70-130*			
Matrix Spike Dup (W0G0136-MSD1)	**Source: 0G01005-01**			**Prepared: 07/06/20**	**Analyzed: 07/22/20**					
Alachlor	5.95	0.10	ug/l	5.00	ND	119	70-130	0.1	30	
Atrazine	5.65	0.10	ug/l	5.00	ND	113	70-130	8	30	
Benzo (a) pyrene	4.55	0.10	ug/l	5.00	ND	91	60-130	1	30	
Bis(2-ethylhexyl)adipate	5.29	5.0	ug/l	5.00	ND	106	70-130	0.1	30	
Bis(2-ethylhexyl)phthalate	5.17	3.0	ug/l	5.00	ND	103	70-130	0.4	30	
Bromacil	5.47	0.50	ug/l	5.00	ND	109	70-130	5	30	
Butachlor	5.42	0.10	ug/l	5.00	ND	108	70-130	0.4	30	
Captan	5.65	1.0	ug/l	5.00	ND	113	70-130	0.1	30	
Chlorpropham	5.78	0.10	ug/l	5.00	ND	116	70-130	4	30	
Cyanazine	5.27	0.10	ug/l	5.00	ND	105	70-130	2	30	
Diazinon	4.91	0.10	ug/l	5.00	ND	98	50-120	2	30	
Dimethoate	5.00	0.20	ug/l	5.00	ND	100	50-120	12	30	
Diphenamid	5.76	0.10	ug/l	5.00	ND	115	70-130	0.8	30	
Disulfoton	4.24	0.10	ug/l	5.00	ND	85	50-120	2	30	
EPTC	5.63	0.10	ug/l	5.00	ND	113	70-130	0.1	30	
Metolachlor	5.69	0.10	ug/l	5.00	ND	114	60-130	1	30	
Metribuzin	5.09	0.10	ug/l	5.00	ND	102	50-120	1	30	
Molinate	5.53	0.10	ug/l	5.00	ND	111	70-130	2	30	
Prometon	2.85	0.10	ug/l	5.00	ND	57	15-120	6	30	
Prometryn	4.38	0.10	ug/l	5.00	ND	88	30-120	4	30	
Simazine	5.29	0.10	ug/l	5.00	ND	106	60-130	0.5	30	
Terbacil	5.66	2.0	ug/l	5.00	ND	113	70-130	8	30	
Thiobencarb	5.49	0.10	ug/l	5.00	ND	110	70-130	1	30	
Trithion	5.52	0.10	ug/l	5.00	ND	110	70-130	3	30	
Surrogate(s)										
1,3-Dimethyl-2-nitrobenzene	*4.95*		*ug/l*	*5.00*		*99*	*70-130*			
Perylene-d12	*4.79*		*ug/l*	*5.00*		*96*	*50-120*			
Triphenyl phosphate	*5.59*		*ug/l*	*5.00*		*112*	*70-130*			

Quality Control Results

(Continued)

Semivolatile Organics - Low Level by Tandem GC/MS/MS

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0914 - EPA 1613B										
Blank (W0G0914-BLK1)				**Prepared: 07/17/20 Analyzed: 07/23/20**						
2,3,7,8-TCDD (Dioxin)	ND	5.00	pg/l							
LCS (W0G0914-BS1)				**Prepared: 07/17/20 Analyzed: 07/23/20**						
2,3,7,8-TCDD (Dioxin)	4.54	5.00	pg/l	5.00		91	50-148			
LCS Dup (W0G0914-BSD1)				**Prepared: 07/17/20 Analyzed: 07/23/20**						
2,3,7,8-TCDD (Dioxin)	4.89	5.00	pg/l	5.00		98	50-148	7	20	

Quality Control Results

(Continued)

Volatile Organic Compounds by P&T and GC/MS

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0128 - EPA 524.2										
Blank (W0G0128-BLK1)				**Prepared & Analyzed: 07/06/20**						
Acrylonitrile	ND	2.0	ug/l							
Epichlorohydrin	ND	20	ug/l							
Tert-butyl alcohol	ND	2.0	ug/l							
Surrogate(s)										
1,2-Dichlorobenzene-d4	*9.78*		*ug/l*	*10.0*		*98*	*70-130*			
1,2-Dichlorobenzene-d4	*9.78*		*ug/l*	*10.0*		*98*	*70-130*			
4-Bromofluorobenzene	*9.87*		*ug/l*	*10.0*		*99*	*70-130*			
4-Bromofluorobenzene	*9.87*		*ug/l*	*10.0*		*99*	*70-130*			
LCS (W0G0128-BS1)				**Prepared & Analyzed: 07/06/20**						
Epichlorohydrin	52.1	20	ug/l	50.0		104	70-130			
Tert-butyl alcohol	23.0	2.0	ug/l	20.0		115	70-130			
Surrogate(s)										
1,2-Dichlorobenzene-d4	*10.2*		*ug/l*	*10.0*		*102*	*70-130*			
1,2-Dichlorobenzene-d4	*10.2*		*ug/l*	*10.0*		*102*	*70-130*			
4-Bromofluorobenzene	*10.3*		*ug/l*	*10.0*		*103*	*70-130*			
4-Bromofluorobenzene	*10.3*		*ug/l*	*10.0*		*103*	*70-130*			
LCS Dup (W0G0128-BSD1)				**Prepared & Analyzed: 07/06/20**						
Epichlorohydrin	56.3	20	ug/l	50.0		113	70-130	8	30	
Tert-butyl alcohol	21.8	2.0	ug/l	20.0		109	70-130	5	30	
Surrogate(s)										
1,2-Dichlorobenzene-d4	*10.0*		*ug/l*	*10.0*		*100*	*70-130*			
1,2-Dichlorobenzene-d4	*10.0*		*ug/l*	*10.0*		*100*	*70-130*			
4-Bromofluorobenzene	*10.1*		*ug/l*	*10.0*		*101*	*70-130*			
4-Bromofluorobenzene	*10.1*		*ug/l*	*10.0*		*101*	*70-130*			

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Quality Control Results

(Continued)

Volatile Organics by P&T and GC/MS

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W0G0107 - EPA 524.3										
Blank (W0G0107-BLK1)				**Prepared: 07/02/20 Analyzed: 07/03/20**						
1,2-Dibromo-3-chloropropane	ND	0.010	ug/l							
1,2-Dibromoethane (EDB)	ND	0.020	ug/l							
LCS (W0G0107-BS1)				**Prepared: 07/02/20 Analyzed: 07/03/20**						
1,2-Dibromo-3-chloropropane	0.0513	0.010	ug/l	0.0500		103	70-130			
1,2-Dibromoethane (EDB)	0.0521	0.020	ug/l	0.0500		104	70-130			
LCS Dup (W0G0107-BSD1)				**Prepared: 07/02/20 Analyzed: 07/03/20**						
1,2-Dibromo-3-chloropropane	0.0471	0.010	ug/l	0.0500		94	70-130	9	30	
1,2-Dibromoethane (EDB)	0.0498	0.020	ug/l	0.0500		100	70-130	5	30	

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Notes and Definitions

Item	Definition
*	The recommended holding time for this analysis is only 15 minutes. The sample was analyzed as soon as it was possible but it was received and analyzed past holding time.
A-01	filtered acidified to ph<2 in lab 07/06/20 9:30am jlp
A-01a	MRL was raised because of low sensitivity.
A-01b	The analyte failed RPD criteria due to high recovery in the BS & was reported based on the BSD passing recovery criteria.
A-01c	The analyte failed RPDcriteria due to low recovery in the BS & was reported based on the BSD passing recovery criteria.
B	Blank contamination. The analyte was found in the associated blank as well as in the sample.
B-06	This analyte was found in the method blank, which was possibly contaminated during sample preparation. The batch was accepted since this analyte was either not detected or more than 10 times of the blank value for all the samples in the batch.
B-07	This analyte was found in the method blank at levels above the MDL but below the reporting limit.
BS-04	The recovery of this analyte in LCS or LCSD was outside control limit. Sample was accepted based on the remaining LCS, LCSD or LCS-LL.
BS-H	The recovery of this analyte in the BS/LCS was over the control limit. Sample result is suspect.
BS-L	The recovery of this analyte in the BS/LCS was below the control limit. Sample result is suspect.
E-01	The concentration indicated for this analyte is an estimated value above the calibration range.
I-05	Low internal standard recovery possibly due to matrix interference. The result is suspect.
M-05	Due to the nature of matrix interferences, sample was diluted prior to analysis. The MDL and MRL were raised due to the dilution.
MS-01	The spike recovery for this QC sample is outside of established control limits possibly due to sample matrix interference.
O-20	As per vial label, this sample was received with HCl preservation, however sample pH was found to be >2 after VOC analysis possibly due to matrix effect or loss of acid during sampling.
Q-08	High bias in the QC sample does not affect sample result since analyte was not detected or below the reporting limit.
Q-12	The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on the percent recoveries and/or other acceptable QC data.
QC-2	This QC sample was reanalyzed to complement samples that require re-analysis on different date. See analysis date.
R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
S-11	Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.
S-GC	Surrogate recovery outside of control limits due to a possible matrix effect. The data was accepted based on valid recovery of the remaining surrogate.
%REC	Percent Recovery
Dil	Dilution
dry	Sample results reported on a dry weight basis
MDA	Minimum Detectable Activity
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ)
ND	A result of ND for odor corresponds to No Odor Observed
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
RPD	Relative Percent Difference
Source	Sample that was matrix spiked or duplicated.

Any remaining sample(s) will be disposed of one month from the final report date unless other arrangements are made in advance.

All results are expressed on wet weight basis unless otherwise specified.

All samples collected by Weck Laboratories have been sampled in accordance to laboratory SOP Number MIS002.

LA Testing

520 Mission Street South Pasadena, CA 91030
Phone/Fax: (323) 254-9960 / (323) 254-9982
http://www.LATesting.com / pasadenalab@latesting.com

LA Testing Order ID: 322011638
Customer ID: 32WECK62
Customer PO:
Project ID:

Attn: Regina Giancola
Weck Laboratories, Inc.
14859 East Clark Avenue
City of Industry, CA 91745-1396

Phone: (626) 336-2139
Fax: (626) 336-2634
Received: 07/01/2020
Analyzed: 07/10/2020

Proj: 0F30024

Test Report: Determination of Asbestos Structures >10μm in Drinking Water Performed by the 100.2 Method (EPA 600/R-94/134)

					ASBESTOS				
Sample ID Client / EMSL	***Sample Filtration Date/Time***	***Original Sample Vol. Filtered (ml)***	***Effective Filter Area (mm²)***	***Area Analyzed (mm²)***	*Asbestos Types*	*Fibers Detected*	*Analytical Sensitivity*	*Concentration*	*Confidence Limits*
							MFL (million fibers per liter)		
0F30024-01/Finished Water 322011638-0001	7/1/2020 11:45 AM	100	1288	0.0640	None Detected	ND	0.20	<0.20	0.00 - 0.74
Collection Date/Time:	*06/30/2020 10:00 AM*								

Analyst(s)
Kyeong Corbin (1)

Jerry Drapala Ph.D, Laboratory Manager
or Other Approved Signatory

Any questions please contact Jerry Drapala.

Initial report from: 07/10/2020 13:20:06

Sample collection and containers provided by the client, acceptable bottle blank level is defined as ≤0.01MFL>10um. ND=None Detected. This report relates only to those items tested. This report may not be reproduced, except in full, without written permission by LA Testing. Samples received in good condition unless otherwise noted.

Samples analyzed by LA Testing South Pasadena, CA CA ELAP 2283

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

July 24, 2020

Regina Giancola
Weck Laboratories, Inc.
14859 East Clark Avenue
City of Industry, CA 91745

RE: Project: 0F30024
Pace Project No.: 30370940

Dear Regina Giancola:

Enclosed are the analytical results for sample(s) received by the laboratory on July 06, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Greensburg

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jacquelyn Collins
jacquelyn.collins@pacelabs.com
(724)850-5612
Project Manager

Enclosures

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project: 0F30024
Pace Project No.: 30370940

Pace Analytical Services Pennsylvania

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 9526
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

SAMPLE SUMMARY

Project: 0F30024
Pace Project No.: 30370940

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30370940001	**0F30024-01**	Drinking Water	06/30/20 10:00	07/06/20 09:40

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

SAMPLE ANALYTE COUNT

Project: 0F30024
Pace Project No.: 30370940

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30370940001	**0F30024-01**	EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA
		EPA 905.0	JJY	1	PASI-PA
		EPA 906.0	CLA	1	PASI-PA

PASI-PA = Pace Analytical Services - Greensburg

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 0F30024
Pace Project No.: 30370940

Sample: 0F30024-01 **Lab ID: 30370940001** Collected: 06/30/20 10:00 Received: 07/06/20 09:40 Matrix: Drinking Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**0.508 ± 0.431 (0.590) C:NA T:85%**	pCi/L	07/17/20 15:47	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**0.519 ± 0.438 (0.903) C:71% T:81%**	pCi/L	07/16/20 14:22	15262-20-1	
	Pace Analytical Services - Greensburg					
Strontium-90	EPA 905.0	**-0.203 ± 0.377 (0.769) C:102% T:NA**	pCi/L	07/20/20 19:04	10098-97-2	
	Pace Analytical Services - Greensburg					
Tritium	EPA 906.0	**-77.3 ± 127 (232) C:NA T:NA**	pCi/L	07/11/20 19:06	10028-17-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: 0F30024
Pace Project No.: 30370940

QC Batch:	404025	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228
		Laboratory:	Pace Analytical Services - Greensburg

Associated Lab Samples: 30370940001

METHOD BLANK: 1955145 Matrix: Water

Associated Lab Samples: 30370940001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.259 ± 0.328 (0.695) C:75% T:88%	pCi/L	07/16/20 14:22	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: 0F30024
Pace Project No.: 30370940

QC Batch: 404450
QC Batch Method: EPA 906.0
Analysis Method: EPA 906.0
Analysis Description: 906.0 Tritium
Laboratory: Pace Analytical Services - Greensburg
Associated Lab Samples: 30370940001

METHOD BLANK: 1957302 Matrix: Water
Associated Lab Samples: 30370940001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Tritium	-2.49 ± 131 (232) C:NA T:NA	pCi/L	07/11/20 11:57	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: 0F30024
Pace Project No.: 30370940

QC Batch:	404026	Analysis Method:	EPA 903.1
QC Batch Method:	EPA 903.1	Analysis Description:	903.1 Radium-226
		Laboratory:	Pace Analytical Services - Greensburg

Associated Lab Samples: 30370940001

METHOD BLANK: 1955146 Matrix: Water

Associated Lab Samples: 30370940001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	-0.0508 ± 0.386 (0.806) C:NA T:80%	pCi/L	07/17/20 15:23	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: 0F30024
Pace Project No.: 30370940

QC Batch:	405208	Analysis Method:	EPA 905.0
QC Batch Method:	EPA 905.0	Analysis Description:	905.0 Strontium 89/90
		Laboratory:	Pace Analytical Services - Greensburg

Associated Lab Samples: 30370940001

METHOD BLANK: 1960906 Matrix: Water

Associated Lab Samples: 30370940001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Strontium-90	-0.0910 ± 0.106 (0.222) C:104% T:NA	pCi/L	07/20/20 19:08	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project: 0F30024
Pace Project No.: 30370940

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: For Safe Drinking Water Act (SDWA) analyses, the reported Unc. Is the calculated Count Uncertainty (95% confidence interval) using a coverage factor of 1.96. For all other matrices (non-SDWA), the reported Unc. is the calculated Expanded Uncertainty (aka Combined Standard Uncertainty, CSU), reported at the 95% confidence interval using a coverage factor of 1.96.

Gamma Spec: The Unc. reported for all gamma-spectroscopy analyses (EPA 901.1), is the calculated Expanded Uncertainty (CSU) at the 95.4% confidence interval, using a coverage factor of 2.0.

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

WECK LABORATORIES, INC.

Subcontract Order

Subcontracted Laboratory:

Pace Analytical Services - Greensburg PA
1638 Roseytown Road Ste 2
Greensburg, PA 15601
Phone: (724) 850-5600
Fax: (724) 850-5601

Turn Around Time: Normal unless noted in comments
Project Manager: Regina M. Giancola
Project Name: Pure Water Testing
Project Number: Pure Water Testing
Sampler Employed by: ______________

Work Order: 0F30024

Analysis	Expires	Comments
Sample ID: 0F30024-01/Finished Water		**Sampled:** 06/30/2020 10:00
Sample comment:		**Matrix:**Water **Sampled By:** ATS
Tritium (EPA 906.0) - sub	12/27/2020 10:00	
Strontium-90 (EPA 905.0) - sub	12/27/2020 10:00	001
Radium-228 (EPA 904.0) - sub	12/27/2020 10:00	
Radium-226 (EPA 903.1) - sub	12/27/2020 10:00	

Containers Supplied:

WO# : 30370940

30370940

RM

Remarks / Special Comments:

Sample Condition
Temperature: ______
Preserved: Yes / No
Evidence Seal Intact: Yes / No
Container Attacked: Yes / No
Preserved at Lab: Yes / No

Zhuanglian	7/01/20 13:30	Fedex	
Relinqished By	Date / Time	Received By	Date / Time
		Heather Gross	7-6-20 9:40
Relinqished By	Date / Time	Received By	Date / Time

Page 1 of 1

Pittsburgh Lab Sample Condition Upon Receipt

#_30370940

Pace Analytical

Client Name: Weck

Project # ____

Label	BLM
LIMS Login	BLM

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other ____

Tracking #: 7708 5439 1206

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Thermometer Used N/A Type of Ice: Wet Blue None

Cooler Temperature Observed Temp ____ °C Correction Factor: ____ °C Final Temp: ____ °C

Temp should be above freezing to 6°C

pH paper Lot# 10D5191

Date and Initials of person examining contents: HG 7-6-20

Comments:	Yes	No	N/A	
Chain of Custody Present:	✓			1.
Chain of Custody Filled Out:	✓			2.
Chain of Custody Relinquished:	✓			3.
Sampler Name & Signature on COC:		✓		4.
Sample Labels match COC:		✓		5. no time on samples
-Includes date/time/ID Matrix: DW HG 7-6-20				
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used:		✓		
Containers Intact:	✓			11.
Orthophosphate field filtered			✓	12.
Hex Cr Aqueous sample field filtered			✓	13.
Organic Samples checked for dechlorination:			✓	14.
Filtered volume received for Dissolved tests			✓	15.
All containers have been checked for preservation. exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix	✓			16. ph<2
All containers meet method preservation requirements.	✓			Initial when completed HG / Date/time of preservation
				Lot # of added preservative
Headspace in VOA Vials (>6mm):			✓	17.
Trip Blank Present:			✓	18.
Trip Blank Custody Seals Present			✓	
Rad Samples Screened < 0.5 mrem/hr	✓			Initial when completed: HG / Date: 7-6-20

Client Notification/ Resolution:

~~Person Contacted:~~ ____ ~~Date/Time:~~ ____ ~~Contacted By:~~ ____

Comments/ Resolution: ____

☐ **A check in this box indicates that additional information has been stored in ereports.**

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

J:\QAQC\Master\Document Management\Sample Mgt\Sample Condition Upon Receipt Pittsburgh (C056-9 5April2019)

Appendix C

PRELIMINARY RO CONCENTRATE NPDES COMPLIANCE ANALYSIS

PRELIMINARY RO CONCENTRATE NPDES COMPLIANCE ANALYSIS

Reverse osmosis (RO) concentrate presents potential challenges to National Pollutant Discharge Elimination System (NPDES) discharge compliance to a future brine line disposal. This analysis, which is preliminary and must be expanded by the Las Virgenes - Triunfo Joint Powers Authority (JPA's) program management team, is intended to define important parameters to measure in RO concentrate.

C.1 Concentrate Chemical Constituent and Toxicity Analysis

C.1.1 Regulatory Requirements

This test plan assumes that RO concentrate will ultimately need to comply with the Calleguas Municipal Water District (CMWD) Salinity Management Pipeline (SMP) NPDES permit water quality requirements for disposal, which requires both chemical constituent compliance and toxicity compliance. With specific water quality requirements indicated in Table 4 of Order R4-2014-0033 NPDES No. CA0064521 (Appendix E within this report), discharges into the SMP need to comply with Discharge Point 001 (Initial Dilution Ratio = 72:1) water quality requirements with compliance measured at Monitoring Location EFF-001. If the ultimate brine disposal location changes (i.e., to the City of Thousand Oaks Hill Canyon Wastewater Treatment Plant instead of the CMWD SMP) or the dilution ratio changes, this analysis will need to be revised to take into account the alternate disposal location NPDES permit and/or dilution ratio.

In addition to NPDES compliance, ocean discharges need to comply with the State Water Resources Control Board (SWRCB) Water Quality Control Plan for the Ocean Waters of California (Ocean Plan). The Ocean Plan is reviewed every three years to guarantee that its Water Quality Objectives (WQOs) are adequate to prevent degradation of marine species and to protect public health. The most recent amendment to the Ocean Plan (Resolution 2015-0033) was adopted on May 6, 2015 and was put into effect January 28, 2016. If a conflict exists between the Ocean Plan WQOs and the NPDES Permit effluent limits, the more stringent provision shall apply. Effluent limits are determined using the following equation:

$$Ce = Co + Dm \times (Co - Cs)$$

Where:

- Ce = effluent concentration limit (micrograms per liter [µg/L]).
- Co = concentration (WQO) to be met at the completion of initial dilution (µg/L).
- Cs = background seawater concentration (µg/L), based on Table 6 of the Ocean Plan.
- Dm = minimum probable initial dilution expressed as parts seawater per part wastewater, assumed to be a maximum of 75 per the CMWD SMP NPDES permit.

Tables C-1 through C-4 summarize the CMWD SMP NPDES and Ocean Plan permit effluent limits.

C.1.2 RO Concentrate Characterization Data and Calculations

To characterize the RO concentrate from the Demonstration Facility and future AWPF, Carollo Engineers, Inc. (Carollo) compiled average and maximum pollutant concentrations from Tapia Water Reclamation Facility (WRF) effluent, based on annual reports (January 2014 through

April 2019). In cases where the pollutant concentration in an analyzed sample was reported as non-detect (ND), a value equal to one half of the method detection limit (MDL) was substituted for the pollutant concentration in order to calculate average pollutant concentrations for the dataset.

To determine the theoretical concentrations of pollutants in the RO concentrate, the calculated average and maximum pollutant concentrations were multiplied by a factor of 6.5. This factor simulates the concentrating effects of brine rejection from the RO membranes, and corresponds with a 97 percent removal efficiency and 85 percent recovery. If 85 percent of the full scale Advanced Water Purification Facility (AWPF) RO feed flow, 6.0 million gallons per day (mgd), passes through membranes as permeate, the remaining 15 percent (0.9 mgd) is rejected as brine. Assuming a 97 percent removal efficiency means that 97 percent of the pollutants that were in the feed water remain in the RO concentrate. The concentration of pollutants in the RO concentrate is increased from the concentration of pollutants in the feed water due to the reduction in flow from 6.0 to 0.9 mgd. The following calculation demonstrates how the factor of 6.5 was calculated:

$$Kb = Ff/Fb$$

Where:

- Kb = brine concentrating factor.
- Ff = RO feed water flow (mgd).
- Fb = RO brine flow (mgd).

Figure 3 illustrates the calculation tool used to calculate the RO concentrate pollutant concentration factor assuming a 1 mg/L feed water pollutant concentration. Note that this calculation is based upon a feed of 6 mgd to the AWPF. As the JPA's seasonal and annual production flow becomes clearer, this analysis should be revisited by the JPA's program management team.

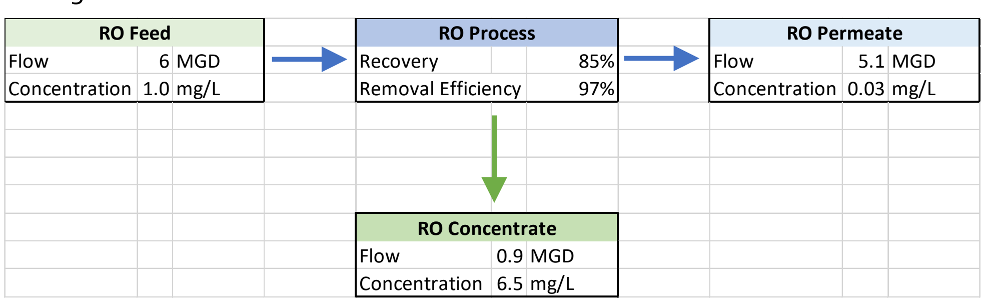


Figure C.1 Calculation Tool for Theoretical RO Concentrate Pollutant Concentrations

By multiplying the Tapia WRF January 2014 through April 2019 average pollutant concentrations by 6.5, a theoretical RO concentrate average concentration was calculated for each pollutant. Table C-1 through Table C-4 show the theoretical RO concentrate pollutant concentrations compared with the effluent limits for each pollutant. Parameters in red require additional sampling either because adequate information was not available or because this desktop analysis indicates they may exceed effluent limits based on the assumed 97 percent removal efficiency through the RO system. Actual removal efficiencies will differ for each constituent and will be verified through additional sampling of the Demonstration Facility RO concentrate.

The designation "NM" in Table C-1 through Table C-4 signifies "not measured" and "N/A" signifies "not applicable."

Table C.1 Comparison of Projected RO Concentrate Pollutant Concentrations with NPDES Permit with Ocean Plan WQO Limits – Technology-Based and Bacteriological

Parameter	Units	MDL	Method	Average Monthly Concentration in Tapia Effluent	Projected Average Concentration in AWPF RO Concentrate	Average Monthly NPDES Permit Effluent Limit (mg/L)	30-Day Average Ocean Plan WQO-Based Effluent Limit (mg/L)
Biochemical Oxygen Demand (BOD)	mg/L	2.0	SM 5210 B	3.30	21	30	Note(1)
Total Suspended Solids (TSS)	mg/L	1.0	SM 2540 D	2.0	13	60	Note(2)
Grease and Oil	mg/L	1.3	EPA 1664B	NM	Note(3)	25	25
Settleable Solids	mL/L	0.2	EPA 160.5	NM	Note(3)	1.0	1.0
Turbidity	NTU	0.024	SM 2130 B	NM	Note(3)	75	75
pH	s.u.	0	EPA 150.2	7.2	Note(4)	6.0 to 9.0	6.0 to 9.0
Total coliform	MPN/100 mL	0	EPA 1604	NM	Note(5)	1,100(6)	1,100(6)
Fecal coliform	MPN/100 mL	0	EPA 1604	NM	Note(5)	200(6)	200(6)
Enterococcus	MPN/100 mL	0	EPA 1600	NM	Note(5)	100(6)	100(6)

Notes:

(1) Instead of a numerical WQO for BOD, the Ocean Plan's Chemical Characteristics standards include a provision that dissolved oxygen in the receiving water shall not be depressed more than 10 percent from that which occurs naturally as a result of discharge.

(2) For suspended solids, the Ocean Plan includes a removal target rather than a TSS effluent limit: dischargers shall, as a 30-day average, remove 75 percent of suspended solids from the influent stream before discharging wastewaters to the ocean.

(3) Upstream pretreatment processes at Tapia WRF and at the future AWPF will maintain RO concentrate levels below these regulated thresholds.

(4) pH in RO concentrate will be controlled as necessary at the future AWPF to remain within the acceptable range.

(5) The future AWPF will disinfect RO concentrate as necessary in order to minimize bacteria levels below regulatory threshold.

(6) Calculated as a 30-day geometric mean using the result of the five most recent samples.

Table C.2 Comparison of Projected RO Concentrate Pollutant Concentrations with NPDES Permit with Ocean Plan WQO Limits – Protection of Marine Aquatic Life

Parameter	Units	MDL	Method	Average Monthly Concentration in Tapia Effluent	Projected Average Concentration in AWPF RO Concentrate	6-Month Median NPDES Permit Effluent Limit	6-Month Median Ocean Plan WQO (C_O)	Background Seawater Concentr-ation (C_S)	6-Month Median Ocean Plan Effluent Limit (C_e) Dm = 72
Arsenic	µg/L	0.074	EPA 200.8	1.8	12.0	370	8	3	368
Cadmium	µg/L	0.041	EPA 200.8	0.2	1.2	73	1		73
Chromium VI	µg/L	0.0048	EPA 218.6	0.2	1.4	150	2		146
Copper	µg/L	0.13	EPA 200.8	3.5	23	75	3	2	75
Lead	µg/L	0.031	EPA 218.6	0.3	2	150	2		146
Mercury	µg/L	0.017	EPA 245.1	0.3	2	2.9	0.04	0.0005	2.9
Nickel	µg/L	0.045	EPA 200.8	3.4	22.2	370	5		365
Selenium	µg/L	0.14	EPA 7741A	0.9	5.6	1,100	15		1,095
Silver	µg/L	0.062	EPA 200.8	0.8	5.1	40	0.7	0.16	40
Zinc	µg/L	0.94	EPA 200.8	37	241	880	20	8	884
Cyanide	µg/L	2.7	EPA 335.4	6.4	42	73	1		73
Total Chlorine Residual	µg/L	2	SM 4500Cl-G	1,943	ND(1)	150	2		146
Ammonia as N	µg/L	0.048	EPA 350.1	0.8	5.2	44,000	600		43,800
Phenolic Compounds (non-chlorinated)(2)	µg/L	4.47	EPA 625	2.24	14	2,200	30		2,190
Chlorinated Phenolics(3)	µg/L	1.18	EPA 625	0.59	3.8	73	1		73
Endosulfan	µg/L	0.017	EPA 608	0.0085	0.06	0.66	0.009		0.66
Endrin	µg/L	0.028	EPA 608	0.01	0.09	0.15	0.002		0.15
HCH(4)	µg/L	0.0095	EPA 608	0.0048	0.03	0.29	0.004		0.29
Radioactivity(5)	pCi/L	Varies	EPA 900	15	100	Not to exceed limits specified in Title 22 California Code of Regulations (CCR) § 64443			

Notes:
(1) Chlorine residual in RO concentrate will be quenched with sodium bisulfite prior to discharge.
(2) Non-chlorinated phenolic compounds represent the sum of 2-nitrophenol; phenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; and 4-nitrophenol.
(3) Chlorinated phenolic compounds represent the sum of 2-chlorophenol; 2,4-dichlorophenol; 2,4,6-trichlorophenol; 4-chloro-3-methylphenol; and pentachlorophenol.
(4) HCH is the sum of alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.
(5) Title 22 CCR § 64443 specifies Maximum Contaminant Limits (MCLs) for beta/photon emitters, Strontium-90, and Tritium. The 4 millirems/year MCL for beta/photon emitters has an equivalent gross beta particle activity concentration of 4 picocurie/liter (pCi/L). Similarly, Strontium-90 is 8 pCi/L, and C-4 ritium is 20,000 pCi/L. A screening-level of 50 pCi/L gross beta particle activity is used in this characterization to indicate whether further testing for specific radionuclides is deemed necessary.

Table C.3 Comparison of Projected RO Concentrate Pollutant Concentrations with NPDES Permit with Ocean Plan WQO Limits – Protection of Human Health (Non-Carcinogens)

Parameter	MDL	Method	Average Monthly Concentration in Tapia Effluent	Projected Average Concentration in AWPF RO Concentrate	30-Day Average NPDES Permit Effluent Limit (µg/L)	30-Day Average Ocean Plan WQO-Based Effluent Limit (µg/L)	30-Day Average Ocean Plan Effluent Limit (C_e) Dm = 72
Acrolein	2.2	EPA 624	1.1	7.1	16,000	220	16,060
Antimony	0.045	EPA 200.8	0.0225	0.1	88,000	1,200	87,600
Bis(2-Chloroethoxy) Methane	0.25	EPA 625	0.125	0.8	N/A	4.4	321
Bis(2-Chloroisopropyl) Ether	0.27	EPA 625	0.14	0.9	N/A	1,200	87,600
Chlorobenzene	0.21	EPA 624	0.11	0.7	42,000	570	41,610
Chromium (III)	0.035	EPA 218.6, EPA 200.8	0.08	0.54	14,000,000	190,000	13,870,000
Di-n-Butyl Phthalate	0.24	EPA 625	0.12	0.8	N/A	3,500	255,500
Dichlorobenzenes(1)	1.08	EPA 625	1	3.5	N/A	5,100	372,300
Diethyl Phthalate	0.15	EPA 625	0.075	0.5	N/A	33,000	2,409,000
Dimethyl Phthalate	0.18	EPA 625	0.09	0.6	N/A	820,000	59,860,000
4,6-Dinitro-2-Methylphenol	1.7	EPA 625	0.85	5.52	N/A	220	16,060
2,4-Dinitrophenol	1.6	EPA 625	0.80	5.20	N/A	4.0	292
Ethylbenzene	0.17	EPA 624	0.09	0.55	300,000	4,100	299,300
Fluoranthene	0.22	EPA 625	0.11	0.715	N/A	15	1,095
Hexachlorocyclopenta-diene	1.5	EPA 625	0.75	4.87	4,200	58	4,234

Parameter	MDL	Method	Average Monthly Concentration in Tapia Effluent	Projected Average Concentration in AWPF RO Concentrate	30-Day Average NPDES Permit Effluent Limit (µg/L)	30-Day Average Ocean Plan WQO-Based Effluent Limit (µg/L)	30-Day Average Ocean Plan Effluent Limit (C_e) Dm = 72
Nitrobenzene	0.36	EPA 625	0.18	1.17	360	4.9	358
Thallium	0.014	EPA 200.8	0.007	0.0	150	2	146
Toluene	0.22	EPA 624	0.11	0.71	6,200,000	85,000	6,205,000
Tributyltin	0.0012	Krone, et al, 1989	NM	N/A	0.10	0.0014	0.10
1,1,1-Trichloroethane	0.38	EPA 624	0.19	1.23	39,000,000	540,000	39,420,000

Note:
(1) Dichlorobenzenes is the sum of 1,2- and 1,3-dichlorobenzene.

Table C.4 Comparison of Projected RO Concentrate Pollutant Concentrations with NPDES Permit with Ocean Plan WQO Limits – Protection of Human Health (Carcinogens)

Parameter	MDL	Method	Average Monthly Concentration in Tapia Effluent	Projected Average Concentration in AWPF RO Concentrate	30-Day Average NPDES Permit Effluent Limit (µg/L)	30-Day Average Ocean Plan WQO-Based Effluent Limit (µg/L)	30-Day Average Ocean Plan Effluent Limit (C_e) Dm = 72
Acrylonitrile	1.8	EPA 624	0.9	5.8	7	0.10	7.3
Aldrin	0.0015	EPA 608	0.00075	0.0049	0.0016	0.000022	0.0016
Benzene	0.23	EPA 624	0.115	0.7	430	5.9	431
Benzidine	3.7	EPA 625	1.9	12	N/A	0.000069	0.0050
Beryllium	0.033	EPA 200.8	0.017	0.1	1.4	0.033	2.41
Bis (2-chloroethyl) ether	0.27	EPA 625	0.14	0.9	N/A	0.045	3.29
Bis (2-ethylhexyl) phthalate	2.3	EPA 625	15	99	N/A	3.5	256
Carbon Tetrachloride	0.33	EPA 624	0.17	1.1	66	0.90	66
Chlordane	0.05	EPA 608	0.025	0.2	0.0017	0.000023	0.0017
Chlorodibromome-thane	0.38	EPA 624	13	84	630	8.6	628
Chloroform	0.25	EPA 624	35	225	9,500	130	9,490
DDT	0.005	EPA 608	0.0025	0.016	0.012	0.00017	0.012
1,4-Dichlorobenzene	0.55	EPA 625	0.28	1.8	N/A	18	1,314
3,3-Dichlorobenzidine	1.2	EPA 625	0.6	3.9	N/A	0.0081	0.59
1,2-Dichloroethane	0.24	EPA 624	0.12	0.8	2,000	28	2,044

Parameter	MDL	Method	Average Monthly Concentration in Tapia Effluent	Projected Average Concentration in AWPF RO Concentrate	30-Day Average NPDES Permit Effluent Limit (µg/L)	30-Day Average Ocean Plan WQO-Based Effluent Limit (µg/L)	30-Day Average Ocean Plan Effluent Limit (C_e) Dm = 72
1,1-Dichloroethylene	0.12	EPA 624	0.06	0.4	66	0.9	65.7
Dichlorobromomethane	0.28	EPA 624	27	176	1,400	6.2	452.6
Dichloromethane (Methylene Chloride)	0.25	EPA 624	0.13	0.8	33,000	450	32,850
1,3-Dichloropropene	0.32	EPA 624	0.16	1.0	650	8.9	650
Dieldrin	0.0021	EPA 608	0.00105	0.0068	0.0029	0.00004	0.0029
2,4-Dinitrotoluene	0.18	EPA 625	0.09	0.6	N/A	2.6	190
1,2-Diphenylhydrazine	0.25	EPA 625	0.125	0.8	N/A	0.16	12
Halomethanes(1)	Note(1)	EPA 624	2.2	14.2	9,600	130	9,490
Heptachlor	0.0017	EPA 608	0.00085	0.0055	0.0037	0.00005	0.0037
Heptachlor Epoxide	0.0019	EPA 608	0.00095	0.0062	0.0015	0.00002	0.0015
Hexachlorobenzene	0.49	EPA 625	0.25	1.6	0.015	0.00021	0.015
Hexachlorobutadiene	0.47	EPA 625	0.24	1.5	1,000	14	1,022
Hexachloroethane	0.52	EPA 625	0.26	1.7	180	2.5	183
Isophorone	0.21	EPA 625	0.11	0.7	53,000	730	53,290
N-nitrosodimethylamine	0.14	EPA 625	0.07	0.5	530	7.3	533
N-nitrosdi-N-propylamine	0.26	EPA 625	0.13	0.8	28	0.38	28

Parameter	MDL	Method	Average Monthly Concentration in Tapia Effluent	Projected Average Concentration in AWPF RO Concentrate	30-Day Average NPDES Permit Effluent Limit (µg/L)	30-Day Average Ocean Plan WQO-Based Effluent Limit (µg/L)	30-Day Average Ocean Plan Effluent Limit (C_e) Dm = 72
N-nitrosodiphenylamine	0.19	EPA 625	0.095	0.6	180	2.5	183
Polynuclear Aromatic Hydrocarbons (PAHs)(2)	Note(2)	EPA 625	0.005	0.04	N/A	0.0088	0.64
Polychlorinated Biphenyls (PCBs)(3)	Note(3)	EPA 625	0.19	1.2	0.0014	0.000019	0.0014
TCDD Equivalents(4)	Note(4)	EPA 1613B	0.00000087	0.0000057	0.00000028	0.0000000039	0.00000028
1,1,2,2-Tetrachloroethane	0.18	EPA 624	0.09	0.6	170	2.3	168
Tetrachloroethylene	0.11	EPA 624	0.06	0.4	150	2.0	146
Toxaphene	0.035	EPA 608	0.018	0.11	0.015	0.00021	0.015
Trichloroethylene	0.27	EPA 624	0.14	0.9	2,000	27	1,971
1,1,2-Trichloroethane	0.25	EPA 624	0.125	0.8	690	9.4	686
2,4,6-Trichlorophenol	0.22	EPA 625	0.11	0.7	N/A	0.29	21
Vinyl Chloride	0.33	EPA 624	0.17	1.1	N/A	36	2,628

Notes:

(1) Halomethanes shall mean the sum of bromoform (MDL = 0.32 µg/L), bromomethane (methyl bromide, MDL = 0.47 µg/L), and chloromethane (methyl chloride, MDL = 0.26 µg/L).

(2) PAHs shall mean the sum of acenaphthylene (MDL = 0.52 nanograms per liter [ng/L]); anthracene (MDL = 0.91 ng/L); 1,2-benzanthracene (MDL = 0.79 ng/L); 3,4-benzofluoranthene (MDL = 1.6 ng/L); benzo(k)fluoranthene (MDL = 0.52 ng/L); 1,12-benzoperylene (MDL = 0.9 ng/L); benzo(a)pyrene (MDL = 0.58 ng/L); chrysene (MDL = 0.52 ng/L); dibenzo(a,h)anthracene (MDL = 1.2 ng/L); fluorene (MDL = 0.75 ng/L); indeno(1,2,3-cd)pyrene (MDL = 0.99 ng/L); phenanthrene (MDL = 0.96 ng/L); and pyrene (MDL = 0.68 ng/L).

(3) PCBs shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016 (MDL = 0.022 µg/L), Aroclor-1221 (MDL = 0.084 µg/L), Arolclor-1232 (MDL = 0.064 µg/L), Aroclor-1242 (MDL = 0.07 µg/L), Aroclor-1248 (MDL = 0.049 µg/L), Aroclor-1254 (MDL = 0.068 µg/L), and Aroclor 1260 (MDL = 0.02 µg/L).

(4) TCDD Equivalents shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors. USEPA method 1613 may be used to analyze dioxin and furan congeners. MDLs are assumed to be as follows: 0.543 picogram per liter [pg/L] for 2,3,7,8-tetra CDD, 0.771 pg/L for 2,3,7,8-penta CDD, 1.05 pg/L for 2,3,7,8-hexa CDDs, 1.18 pg/L for 2,3,7,8-hepta CDD, 2.26 pg/L for octa CDD, 0.449 pg/L for 2,3,7,8-tetra CDF, 1.05 pg/L for 1,2,3,7,8 penta CDF, 1.08 pg/L for 2,3,4,7,8-penta CDF, 0.545 pg/L for 2,3,7,8-hexa CDFs, 0.654 pg/L for 2,3,7,8-hepta CDFs, and 1.22 pg/L for octa CDF.

C.2 Recommended Chemical Constituent Sampling

Additional sampling is required to gather data on Tributyltin because none was available from historical Tapia WRF effluent data. Based on the comparisons in Table C-1 through Table C-4, 14 pollutants had theoretical RO concentrate levels that exceeded the NPDES and/or Ocean Plan effluent limitations. Of these exceedances, 13 were calculated based solely on ND results (using half of the MDL and concentrating by a factor of 6.5). Only 1 exceedance, gross beta, was a true exceedance. Table C-5 lists the pollutants that require additional testing, including those that may exceed effluent limitations in the RO concentrate. Each parameter will be sampled three times each quarter during the first year of testing to develop a robust dataset of at least 12 samples per pollutant.

C.3 Recommended Chronic Toxicity Testing

In addition to the parameters listed in these tables, CMWD SMP NPDES and Ocean Plan have effluent limits of 2.46 acute toxic units (TUa) for acute toxicity and 73 chronic toxic units (TUc) for chronic toxicity. Because Dm is less than 100 for this project, chronic toxicity testing (more stringent) is required instead of acute. Chronic toxicity (TUc) is calculated as follows:

$$TUc = 100/NOEL$$

No Observed Effect Level (NOEL) is the maximum percent effluent or receiving water that causes no observable effect on a test organism, as determined by the result of a critical life stage toxicity test listed in Ocean Plan Appendix III, Table III-1.

Toxicity testing for ocean discharge as seen in the Calleguas SMP NPDES permit uses the most sensitive of the following organisms:

1. Topsmelt (Atherinops affinis - survival and growth).
2. Purple sea urchin (Strongylocentrotus purpuratus - growth and fertilization).
3. Sand dollar (Dendraster excentricus - growth and fertilization).
4. Red abalone (Haliotis rufescens - shell development).
5. Giant kelp (Macrocystis pyrifera - germination and growth).

Testing shall be conducted in accordance with species and test methods in Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms (EPA/600/R-95/136, 1995). **Chlorine and ammonia shall be removed from the effluent sample prior to toxicity testing**. A total of eight chronic toxicity samples will be collected, as follows:

Q1: Once on each of the sensitive species (total of 5 tests).
Q2: Once on the most sensitive species based on Q1 testing (total of 1 test).
Q3: Once on the most sensitive species based on Q1 testing (total of 1 test).
Q4: Once on the most sensitive species based on Q1 testing (total of 1 test).

Topsmelt has been determined to be the most sensitive to RO concentrate based upon recent RO concentrate work in Pismo Beach, California and is therefore likely to be the most sensitive carried forward in Q2 through Q4. If a sample fails its toxicity test, the test will be repeated again at a different dilution. Dilution water will be lab grade water or saline water to simulate the combined discharge of RO concentrate and its diluent, the sum of which is required to meet the toxicity requirement.

Table C.5 Effluent Limit Exceedances Based on Theoretical RO Concentrate

Pollutant	Units	Projected Average Concentration in AWPF RO Concentrate	NPDES and/or Ocean Plan Effluent Limit	MDL	Rational for Additional Testing
Gross Beta	pCi/L	100	50	Varies	Projected RO concentrate too high
Tributyltin	µg/L	N/A	0.1	0.0012	No tertiary effluent data available
Aldrin	µg/L	0.0026	0.0016	0.00079	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
Benzidine	µg/L	4.5	0.0050	1.4	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
Beryllium	µg/L	1.6	1.4	0.5	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
Chlordane	µg/L	0.1	0.0017	0.026	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
DDT	µg/L	0.016	0.012	0.005	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
3,3-Dichlorobenzidine	µg/L	1.8	0.59	0.54	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
Dieldrin	µg/L	0.0032	0.0029	0.00097	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
Heptachlor Epoxide	µg/L	0.0022	0.0015	0.00069	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
Hexachlorobenzene	µg/L	0.5	0.015	0.15	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit

Pollutant	Units	Projected Average Concentration in AWPF RO Concentrate	NPDES and/or Ocean Plan Effluent Limit	MDL	Rational for Additional Testing
PCBs(1)	µg/L	1.0	0.0014	Note (1)	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
TCDD Equivalents(2)	µg/L	0.000023	0.00000028	Note (2)	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit
Toxaphene	µg/L	0.11	0.015	0.035	Available tertiary effluent data was non-detect but MDL too high to confirm RO concentrate lower than regulatory limit

Notes:

(1) PCBs shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016 (MDL = 0.05 µg/L), Aroclor-1221 (MDL = 0.063 µg/L), Arolclor-1232 (MDL = 0.05 µg/L), Aroclor-1242 (MDL = 0.05 µg/L), Aroclor-1248 (MDL = 0.02 µg/L), Aroclor-1254 (MDL = 0.05 µg/L), and Aroclor 1260 (MDL = 0.015 µg/L).

(2) TCDD Equivalents shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors. USEPA method 1613 may be used to analyze dioxin and furan congeners. MDLs are assumed to be as follows: 0.887 pg/L for 2,3,7,8-tetra CDD, 2.56 pg/L for 2,3,7,8-penta CDD, 13.1 pg/L for 2,3,7,8-hexa CDDs, 5.15 pg/L for 2,3,7,8-hepta CDD, 8.5 pg/L for octa CDD, 0.733 pg/L for 2,3,7,8-tetra CDF, 2.96 pg/L for 1,2,3,7,8 penta CDF, 5.4 pg/L for 2,3,4,7,8-penta CDF, 4.7 pg/L for 2,3,7,8-hexa CDFs, 5.74 pg/L for 2,3,7,8-hepta CDFs, and 11.7 pg/L for octa CDF.

Appendix D

DAILY PERFORMANCE LOGS

OPERATION CHECKLISTS

This document contains the daily and weekly checklists for normal operation of the Pure Water Demonstration Plant.

Safety

- The pure water demonstration plant is a sophisticated facility that uses electrical potentials, pressurized gases and fluids, elevated equipment, motorized equipment and hazardous chemicals during the course of normal operations and maintenance that are capable of causing serious injury or death.
- The plant uses chemicals that can be corrosive and oxidizing to many materials.
- Always follow safety practices when working around potential hazards such as electricity, high-pressure gasses, high-pressure fluids, elevated equipment, machinery and corrosive chemicals.
- Always read the chemical safety data sheet (SDS) and use personal protective equipment when working with chemicals.

Daily Checks

The following activities should be carried out daily and the checklist prepared at the end of this document filled out:

- Inspection of skids, chemical tank levels, dosing pumps and ancillary equipment.
- Cross check of Critical Control Points and Operational Control Points.
- Fill out daily checks.
- Download and review data trends for parameters listed in daily checks.

Weekly Checks

The following activities should be carried out up to two times per week and the checklist prepared at the end of this document filled out.

- Take and analyze grab samples to confirm meter readings.
- Analyze grab samples.
- Fill out weekly checklists.
- Take and ship grab samples for external laboratory analysis - See Lab sampling Checklists Doc.

Additional Information

- Startup SOP.
- Operation SOP.
- Chemical Dosing SOP.
- Lab Sampling Checklists.

Checklists

Checklists are provided to assist with daily and weekly checks on the following pages. Print these as needed. Scan and store checklists as part of plant records.

Table 1 Daily Check List MF/UF System

Las Virgenes Municipal Water District Demonstration Pilot Ultra Filtration Daily Checklist					
Operator:			**Date and Time:**		
Parameter	**HMI Tag**	**Sample Location**			**Target**
System Operating (y/n)	-				y
Leaks On Skid? (y/n)	-				n
Feed Pressure Gauge (psi)	PG-11248				> 20
Filtrate Tank Level (%)	LI-36260				-
Feed Temperature (°F)	TI-14078				
Turbidity	**Feed** [AI-10209]	**UF1 Filtrate** [AI-31009-1]	**UF2 Filtrate** [AI-31009-2]	**UF3 Filtrate** [AI-31009-3]	
Turbidity Flowrate (gph)					8 - 10
Flowrate adjustment (y/n)					-
Turbidity (NTU) (Record Value *after* adjusting turbidity flowrate)					Feed < 10, Filtrate < 0.2
TMP (psi)		**UF1**	**UF2**	**UF3**	UF1: < 30.5 UF2: < 45 UF3: < 43.5
	on HMI				
Feed Pressure (psi)		PI-31045-1	PI-31045-2	PI-31045-3	5 - 25
Filtrate Pressure (psi)		PI-31509-1	PI-31509-2	PI-31509-3	1.5 - 2
Flux [J] (gfd)	above FI-31032				
Production Volume (gal)	on HMI				
UF Filtrate SDI-15 (twice per week)	Onsite Test				< 3
Time & Date of Last MIT	PROD/BW /MIT SETTINGS				-
Last MIT Start (psi)					-
Last MIT End (psi)					-
Last LRV					> 4
Filtrate Ammonia (mg/L)	AI-36210				> 0.5
Filtrate Total Cl_2 (mg/L)	AI-31094				2 - 3
Filtrate ORP (mV)	AI-31093				< 460 mV
Filtrate pH	AI-31090				7 - 8
Reason for shutdown, alarms and notes:					

Be sure MF/UF is in production mode when you write down the turbidity meter flowrate, flows and pressures number. Otherwise data will not be representative.

Table 2 Daily Check List RO System

Las Virgenes Municipal Water District Demonstration Pilot Reverse Osmosis Daily Checklist						
Operator:			**Date and Time:**			
Parameter	**Sample Location**					**Target**
System Operating (y/n)						y
Chemical Feed Pump Flow (gph)	**Antiscalant** P-85300		**Sulfuric Acid** P-85500			-
Leaks On Skid? (y/n)						n
Operating Mode	2 Stage or 3 Stage					-
Recovery (%)						80
Feed Temperature (°F)	TI-40005					-
Feed pH	AIT-40008					< 6.5
Feed Free Cl_2 (mg/L)	AIT-40004					< 0.1
Feed ORP (mV)	AIT-40005					< 560
TOC Flowrate (gph)	**RO Feed**		**RO Permeate**			1 - 3
	FI-40074:		FI-41874:			
Flowrate adjustment (y/n)						-
TOC (mg/L)	AIT-40010:		AIT-41810:			
Conductivity (µS/cm)	**Feed** AIT-40006	**S1** AIT-41092	**S2** AIT-41292	**S3** AIT-41392	**Permeate** AIT-41892	Permeate < 50
Pressure (psi)	**S1 Feed** PT-41095	**S2 Feed** PT-41245	**S2 Conc.** PT-41345	**S3 Feed** PT-41347	**S3 Conc.** PT-41945	-
	S1 Permeate PG-41054	**S2 Permeate** PG-41254	**Combined Permeate** PG-41854			
						10-15
Flow (gpm)	**S1 Perm.** FIT-41074	**S2 Perm.** FIT-41274	**S3 Perm.** FIT-41374	**Permeate** FQI-41874	**Conc.** FIT-41974	-

Las Virgenes Municipal Water District Demonstration Pilot Reverse Osmosis Daily Checklist				
Differential Pressure (psi)	**Stage 1** DPI-41039	**Stage 2** DPI-41239	**Stage 3** DPI-41339	-
Cartridge Filter Pressure (psi)	**Inlet** PG-40048		**Outlet** PG-40248	-
Reason for shutdown, alarms and notes:	* FCV-41076 should be closed and stage 1 permeate flow (FIT-41074) should be 0 for 2 stage operation, which is the current mode of operation for July and into August.			

Table 3 Daily Check List UVAOP System

<table>
<tr><th colspan="8">Las Virgenes Municipal Water District Demonstration Pilot UVAOP Daily Checklist</th></tr>
<tr><td colspan="4">Operator:</td><td colspan="4">Date and Time:</td></tr>
<tr><td>Parameter</td><td colspan="6">Sample Location</td><td>Target</td></tr>
<tr><td>System Operating (y/n)</td><td colspan="6"></td><td>y</td></tr>
<tr><td>Leaks On Skid? (y/n)</td><td colspan="6"></td><td>n</td></tr>
<tr><td>Flush Air Release Valve (On UV Reactor) (y/n)</td><td colspan="6"></td><td>y</td></tr>
<tr><td>UV Dose (mJ/cm^2)</td><td colspan="6"></td><td>> 1500</td></tr>
<tr><td>UV Intensity (mW/cm^2)</td><td colspan="6"></td><td>-</td></tr>
<tr><td>Power (%)</td><td colspan="6"></td><td>50 - 100 %</td></tr>
<tr><td>Inlet Flow (gpm)</td><td colspan="6"></td><td>6 - 8 gpm</td></tr>
<tr><td>Lamp Hours (h)</td><td colspan="6"></td><td>< 14,000</td></tr>
<tr><td>Operating Hours (h)</td><td colspan="6"></td><td></td></tr>
<tr><td>UV Inlet pH</td><td colspan="6"></td><td>< 6</td></tr>
<tr><td rowspan="2">UVT (%)</td><td colspan="2">HMI</td><td colspan="2">Inlet</td><td colspan="2">Outlet</td><td rowspan="2">> 95</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td rowspan="2">Free Cl_2 (mg/L)</td><td colspan="3">Inlet</td><td colspan="3">Outlet</td><td rowspan="2">Inlet: 2 - 3
Outlet: 0.5 - 1</td></tr>
<tr><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td rowspan="2">Total Cl_2 (mg/L)</td><td colspan="3">Inlet</td><td colspan="3">Outlet</td><td rowspan="2">Outlet: <4</td></tr>
<tr><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td colspan="8">Reason for shutdown, alarms and notes:</td></tr>
</table>

Table 4 Daily Chemical Tank Check List

Daily Chemical Checks					
Operator:			**Date and Time:**		
Chemicals on UV Skid	**Volume Onsite (gal)**	**Pump Flow (gph)**	**Pump Backpressure (psi)**	**Refill?**	**Tank Level**
CLR (Calcium Lime Rust) on Both UVT Meters			N/A	Y / N	Level: [Target: >50%]
Chemicals on RO Skid					
Sulfuric Acid Tank - RO Feed [T-85400]			N/A	Y / N	Level: [Target: >5 gal]
Anti-scalant Tank - RO Feed [T-85200]			N/A	Y / N	Level: [Target: >3 gal]
Chemicals in Chemical Room					
NaOCl Tank - UF CIP [T-83400]				Y / N	Level: [Target: 5 - 10 gal]
NaOH Tank - CIP [T-84200]				Y / N	Level: [Target: > 5 gal]
NaOCl Tank - UF Feed [T-81400]				Y / N	Level: [Target: >10 gal]
NaOCl Tank - UVAOP Feed [T-89000]				Y / N	Level: [Target: 5 - 20 gal]
Calcium Thiosulfate Tank [T-84000]				Y / N	Level: [Target: > 5 gal]
Ammonium Sulfate Tank [T-80000]				Y / N	Level: [Target: >10 gal]
Citric Acid Tank - CIP [T-83600]				Y / N	Level: [Target: > 5 gal]
Sulfuric Acid Tank - CIP [T-81000]				Y / N	Level: [Target: > 5 gal]

Notes:
Reorder Sodium Hypochlorite when 1 drum is left
Reorder Ammonium Sulfate when 1 drum is left
Reorder Sulfuric Acid when drum is empty
Other chemicals should be reordered when approaching their lower fill value indicated by an orange display on the dosing pump.
When topping up sodium hypochlorite tanks, rotate solution from [T-83400] and [T-89000] into [T-81400] to maintain solution freshness feeding the UV and for UF maintenance cleans.
Only fill T-83400 to approximately 10 gal and T-89000 to 15 - 20 gal to maintain solution freshness.
When filling ammonium sulfate [T, fill half with RO permeate and half with ammonium sulfate so that final solution strength is 20 wt% ammonium sulfate.
Please note any leaks, overflowing or tank damage.

Table 5 Weekly Checklist Instrument Verification

<table>
<tr><th colspan="61">Weekly Instrument Verification</th></tr>
<tr><td>Operator</td><td colspan="60">Date and Time</td></tr>
<tr><td>Parameter</td><td colspan="60">Sample Location</td></tr>
<tr><td rowspan="2">pH</td><td colspan="20">UF Filtrate Combined</td><td colspan="20">RO Feed</td><td colspan="20">UVAOP Feed</td></tr>
<tr><td colspan="20">Grab:
Online:
[AI-31090]</td><td colspan="20">Grab:
Online:
[AI-40008]</td><td colspan="20">Grab:
Online:
[pH-001]</td></tr>
<tr><td rowspan="2">Turbidity (NTU)</td><td colspan="15">UF Feed</td><td colspan="15">UF Filtrate 1</td><td colspan="15">UF Filtrate 2</td><td colspan="15">UF Filtrate 3</td></tr>
<tr><td colspan="15">Grab:
Online:
[AI-10209]</td><td colspan="15">Grab:
Online:
[AI-31009-1]</td><td colspan="15">Grab:
Online:
[AI-31009-2]</td><td colspan="15">Grab:
Online:
[AI-31009-3]</td></tr>
<tr><td rowspan="2">Conductivity (µS/cm)</td><td colspan="12">RO Feed</td><td colspan="12">RO Permeate Stage 1</td><td colspan="12">RO Permeate Stage 2</td><td colspan="12">RO Permeate Stage 3</td><td colspan="12">RO Permeate Combined</td></tr>
<tr><td colspan="12">Grab:
Online:
[AI-40006]</td><td colspan="12">Grab:
Online:
[AI-41092]</td><td colspan="12">Grab:
Online:
[AI-41292]</td><td colspan="12">Grab:
Online:
[AI-41392]</td><td colspan="12">Grab:
Online:
[AI-41892]</td></tr>
<tr><td rowspan="2">Total Chlorine (mg/L)</td><td colspan="20">UF Filtrate Combined</td><td colspan="20">UVAOP Inlet</td><td colspan="20">UVAOP Outlet</td></tr>
<tr><td colspan="20">Grab:
Online:
[AI-31094]</td><td colspan="20">Grab:
Online:
[TCl-001]</td><td colspan="20">Grab:
Online:
[TCl-002]</td></tr>
<tr><td rowspan="2">Free Chlorine (mg/L)</td><td colspan="20">RO Feed</td><td colspan="20">UVAOP Inlet</td><td colspan="20">UVAOP Outlet</td></tr>
<tr><td colspan="20">Grab:
Online:
[AI-40004]</td><td colspan="20">Grab:
Online:
[FCl-001]</td><td colspan="20">Grab:
Online:
[FCl-002]</td></tr>
<tr><td rowspan="2">ORP (mV)</td><td colspan="30">UF Filtrate Combined</td><td colspan="30">RO Feed</td></tr>
<tr><td colspan="15">Grab:</td><td colspan="15">Online:
[AI-31093]</td><td colspan="15">Grab:</td><td colspan="15">Online:
[AI-40005]</td></tr>
<tr><td rowspan="2">UVT (%)</td><td colspan="30">UVAOP Inlet</td><td colspan="30">UVAOP Outlet</td></tr>
<tr><td colspan="15">Grab:</td><td colspan="15">Online:</td><td colspan="15">Grab:</td><td colspan="15">Online:</td></tr>
<tr><td rowspan="2">TOC (mg/L)</td><td colspan="30">RO Feed</td><td colspan="30">RO Permeate Combined</td></tr>
<tr><td colspan="15">Grab:
(offsite lab)</td><td colspan="15">Online:
[AI-40010]</td><td colspan="15">Grab:
(offsite lab)</td><td colspan="15">Online:
[AI-41810]</td></tr>
<tr><td>Ammonia (mg/L)</td><td colspan="10">UF Filtrate Combined</td><td colspan="25">Grab:</td><td colspan="25">Online:
[AI-40005]</td></tr>
<tr><td colspan="61">Notes:</td></tr>
</table>

Table 6 Weekly Grab Samples for ONSITE Analysis

Weekly Grab Samples for ONSITE analysis							
Date & Time			**Operator**				
Parameter			**Sample Location**				
	UF Feed	**UF Filtrate (combined)**	**RO Feed**	**RO Permeate**	**RO Concentrate**	**UV Inlet**	**UV Outlet**
pH							
Turbidity (NTU)							
Conductivity (µS/cm)							
ORP (mV)							
Ammonia							
Free Cl_2 (mg/L)							
Total Cl_2 (mg/L)							
Monochloramine (mg/L)							
TOC (mg/L) [SM 5310 B] Offsite			X*	X*			
UVT (%)							
Dissolved Oxygen (mg/L)							
Notes:	* X = Samples are collected for offsite lab analysis						

Appendix E

CALLEGUAS MUNICIPAL WATER DISTRICT SALINITY MANAGEMENT PIPELINE NPDES PERMIT

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 • Fax (213) 576-6640
http://www.waterboards.ca.gov/losangeles/

ORDER R4-2014-0033
NPDES NO. CA0064521

WASTE DISCHARGE REQUIREMENTS FOR CALLEGUAS MUNICIPAL WATER DISTRICT REGIONAL SALINITY MANAGEMENT PIPELINE

The following Discharger is subject to waste discharge requirements (WDR's) set forth in this Order:

Table 1. Discharger Information

Discharger	Calleguas Municipal Water District
Name of Facility	Regional Salinity Management Pipeline (RSMP)
Facility Address	2100 Olsen Road
	Thousand Oaks, CA 91360-6800
	Ventura County

Table 2. Discharge Location

Discharge Point	Effluent Description	Discharge Point Latitude	Discharge Point Longitude	Receiving Water
001	Treated wastewater and concentrate from brackish groundwater desalter plants and wastewater treatment facilities	34° 08' 34.75" N	119° 11' 33.72" W	Pacific Ocean at Port Hueneme Beach

Table 3. Administrative Information

This Order was adopted on:	**March 6, 2014**
This Order shall become effective on:	**May 1, 2014**
This Order shall expire on:	**April 30, 2019**
The Discharger shall file a Report of Waste Discharge as an application for reissuance of WDR's in accordance with title 23, California Code of Regulations, and an application for reissuance of a National Pollutant Discharge Elimination System (NPDES) permit no later than:	**November 22, 2018**
The U.S. Environmental Protection Agency (U.S. EPA) and the California Regional Water Quality Control Board, Los Angeles Region have classified this discharge as follows:	**Major discharge**

I, Samuel Unger, Executive Officer, do hereby certify that this Order with all attachments is a full, true, and correct copy of the Order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on the date indicated above.

Samuel Unger

Samuel Unger, Executive Officer

Contents

Tables

Attachments

I. FACILITY INFORMATION

Information describing the Regional Salinity Management Pipeline (Facility or RSMP) is summarized in Table 1 and in sections I and II of the Fact Sheet (Attachment F). Section I of the Fact Sheet also includes information regarding the Facility's permit application.

II. FINDINGS

The California Regional Water Quality Control Board, Los Angeles Region (hereinafter Los Angeles Regional Water Board), finds:

A. **Legal Authorities.** This Order serves as WDR's pursuant to article 4, chapter 4, division 7 of the California Water Code (commencing with section 13260). This Order is also issued pursuant to section 402 of the federal Clean Water Act (CWA) and implementing regulations adopted by the U.S. EPA and chapter 5.5, division 7 of the Water Code (commencing with section 13370). It shall serve as an NPDES permit for point source discharges from this facility to surface waters.

B. **Background and Rationale for Requirements.** The Los Angeles Regional Water Board developed the requirements in this Order based on information submitted as part of the application, through monitoring and reporting programs, and other available information. The Fact Sheet (Attachment F), which contains background information and rationale for the requirements in this Order, is hereby incorporated into and constitutes Findings for this Order. Attachments A through E and G through H are also incorporated into this Order.

C. **Notification of Interested Parties.** The Los Angeles Regional Water Board has notified the Discharger and interested agencies and persons of its intent to prescribe WDR's for the discharge and has provided them with an opportunity to submit their written comments and recommendations. Details of the notification are provided in the Fact Sheet.

D. **Consideration of Public Comment.** The Los Angeles Regional Water Board, in a public meeting, heard and considered all comments pertaining to the discharge. Details of the Public Hearing are provided in the Fact Sheet.

THEREFORE, IT IS HEREBY ORDERED, that this Order supersedes Order R4-2008-0014 except for enforcement purposes, and, in order to meet the provisions contained in division 7 of the Water Code (commencing with section 13000) and regulations adopted thereunder, and the provisions of the CWA and regulations and guidelines adopted thereunder, the Discharger shall comply with the requirements in this Order. This action in no way prevents the Los Angeles Regional Water Board from taking enforcement action for past violations of the previous Order.

III. DISCHARGE PROHIBITIONS

A. Wastes discharged shall be limited to a maximum of 17.52 MGD of treated effluent from wastewater treatment plants and concentrate generated at brackish groundwater desalter plants or wastewater treatment facilities throughout the Calleguas Creek Watershed through Discharge Point 001. The discharge of wastes from accidental spills or other sources is prohibited.

B. Discharges of water, materials, thermal wastes, elevated temperature wastes, toxic wastes, deleterious substances, or wastes other than those authorized by this Order, to a storm drain system, the Pacific Ocean, or other waters of the State, are prohibited.

C. Neither the treatment nor the discharge of pollutants shall create pollution, contamination, or a nuisance as defined by section 13050 of the Water Code.

D. Wastes discharged shall not contain any substances in concentrations toxic to human, animal, plant, or aquatic life.

E. The discharge shall not cause a violation of any applicable water quality standards for receiving waters adopted by the Regional Water Board or the California State Water Resources Control Board (State Water Board) as required by the Federal CWA and regulations adopted thereunder. If more stringent applicable water quality standards are promulgated pursuant to section 303 of the Federal CWA, and amendments thereto, the Regional Water Board will revise and modify this Order in accordance with such more stringent standards.

F. The discharge of any radiological, chemical, or biological warfare agent into the waters of the state is prohibited under Water Code section 13375.

G. Any discharge of wastes at any point(s) other than specifically described in this Order is prohibited, and constitutes a violation of this Order.

IV. EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

A. Effluent Limitations – Discharge Point 001

1. Final Effluent Limitations – Discharge Point 001
(Initial Dilution Ratio = 72:1)

a. The Discharger shall maintain compliance with the following effluent limitations at Discharge Point 001, with compliance measured at Monitoring Location EFF-001 as described in the Monitoring and Reporting Program, Attachment E:

Table 4. Effluent Limitations

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Biochemical Oxygen Demand (BOD), 5-day @ 20°C	mg/L	30	45	--	--	--
	lbs/day[1]	4,400	6,600		--	--
Oil and Grease	mg/L	25	40	--	75	--
	lbs/day[1]	3,700	5,800	--	11,000	--
pH	s.u.	6.0 - 9.0				
Settleable Solids	ml/L	1.0	1.5	--	3.0	--
Total Suspended Solids (TSS)	mg/L	60	--	--	--	--
	lbs/day[1]	8,800	--	--	--	--
Turbidity	NTU	75	100	--	225	--
Total Residual Chlorine	µg/L	--	--	580	4,400	150
	lbs/day[1]	--	--	85	640	22
Ammonia as N	µg/L	--	--	180,000	440,000	44,000
	lbs/day[1]	--	--	26,000	64,000	6,400
Chronic Toxicity [2]	Pass or Fail, % Effect	Pass [3]		Pass or % Effect <50	--	--
Total coliform	MPN/100ml	[4]				
Fecal coliform	MPN/100ml	[4]				
Enterococcus	MPN/100ml	[4]				

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Antimony, Total Recoverable	µg/L	88,000	--	--	--	--
	lbs/day[1]	13,000	--	--	--	--
Arsenic, Total Recoverable	µg/L	--	--	2100	5,600	370
	lbs/day[1]	--	--	310	820	54
Beryllium, Total Recoverable	µg/L	2.4	--	--	--	--
	lbs/day[1]	0.35	--	--	--	--
Cadmium, Total Recoverable	µg/L	--	--	290	730	73
	lbs/day[1]	--	--	42	110	11
Chromium (III) , Total Recoverable	µg/L	1.4E+07	--	--	--	--
	lbs/day[1]	2.0E+06	--	--	--	--
Chromium (VI) , Total Recoverable	µg/L	--	--	580	1,500	150
	lbs/day[1]	--	--	85	210	22
Copper, Total Recoverable	µg/L	--	--	730	2,000	75
	lbs/day[1]	--	--	110	290	11
Lead, Total Recoverable	µg/L	--	--	580	1500	150
	lbs/day[1]	--	--	85	220	22
Mercury, Total Recoverable	µg/L	--	--	12	29	2.9
	lbs/day[1]	--	--	1.8	4.2	0.42
Nickel, Total Recoverable	µg/L	--	--	1,500	3,700	370
	lbs/day[1]	--	--	220	530	53
Selenium, Total Recoverable	µg/L	--	--	4,400	11,000	1,100
	lbs/day[1]	--	--	640	1600	160
Silver, Total Recoverable	µg/L	--	--	190	500	40
	lbs/day[1]	--	--	28	73	5.8
Thallium, Total Recoverable	µg/L	150	--	--	--	--
	lbs/day[1]	22	--	--	--	--
Zinc, Total Recoverable	µg/L	--	--	5,300	14,000	880
	lbs/day[1]	--	--	770	2,000	130
Cyanide	µg/L	--	--	290	730	73
	lbs/day[1]	--	--	42	110	11
Phenolic Compounds (non-chlorinated) [5]	µg/L	--	--	8,800	22,000	2,200
	lbs/day[1]	--	--	1,300	3,200	320
Chlorinated Phenolics [6]	µg/L	--	--	290	730	73
	lbs/day[1]	--	--	42	110	11
TCDD Equivalents [7]	µg/L	2.8E-07	--	--	--	--
	lbs/day[1]	4.1E-08	--	--	--	--
Acrolein	µg/L	16,000	--	--	--	--
	lbs/day[1]	2,300	--	--	--	--

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Acrylonitrile	µg/L	7.3	--	--	--	--
	lbs/day[1]	1.1	--	--	--	--
Benzene	µg/L	430	--	--	--	--
	lbs/day[1]	63	--	--	--	--
Carbon Tetrachloride	µg/L	66	--	--	--	--
	lbs/day[1]	9.6	--	--	--	--
Chlorobenzene	µg/L	42,000	--	--	--	--
	lbs/day[1]	6,100	--	--	--	--
Chlorodibromomethane	µg/L	630	--	--	--	--
	lbs/day[1]	92	--	--	--	--
Chloroform	µg/L	9,500	--	--	--	--
	lbs/day[1]	1,400	--	--	--	--
Dichlorobromomethane	µg/L	450	--	--	--	--
	lbs/day[1]	66	--	--	--	--
1,2-Dichloroethane	µg/L	2,000	--	--	--	--
	lbs/day[1]	290	--	--	--	--
1,1-Dichloroethylene	µg/L	66	--	--	--	--
	lbs/day[1]	9.6	--	--	--	--
1,3-Dichloropropylene	µg/L	650	--	--	--	--
	lbs/day[1]	95	--	--	--	--
Ethylbenzene	µg/L	3.0E+5	--	--	--	--
	lbs/day[1]	44,000	--	--	--	--
Halomethanes [8]	µg/L	9,500	--	--	--	--
	lbs/day[1]	1,400	--	--	--	--
Dichloromethane	µg/L	33,000	--	--	--	--
	lbs/day[1]	4,800	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/L	170	--	--	--	--
	lbs/day[1]	25	--	--	--	--
Tetrachloroethylene	µg/L	150	--	--	--	--
	lbs/day[1]	22	--	--	--	--
Toluene	µg/L	6.2E+06	--	--	--	--
	lbs/day[1]	9.1E+05	--	--	--	--
1,1,1-Trichloroethane	µg/L	3.9E+07	--	--	--	--
	lbs/day[1]	5.7E+06	--	--	--	--
1,1,2-Trichloroethane	µg/L	690	--	--	--	--
	lbs/day[1]	100	--	--	--	--
Trichloroethylene	µg/L	2,000	--	--	--	--
	lbs/day[1]	290	--	--	--	--

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Vinyl Chloride	µg/L	2,600	--	--	--	--
	lbs/day[1]	380	--	--	--	--
4,6-Dinitro-2-Methylphenol	µg/L	16,000	--	--	--	--
	lbs/day[1]	2,300	--	--	--	--
2,4-Dinitrophenol	µg/L	290	--	--	--	--
	lbs/day[1]	42	--	--	--	--
2,4,6-Trichlorophenol	µg/L	21	--	--	--	--
	lbs/day[1]	3.1	--	--	--	--
Benzidine	µg/L	0.0050	--	--	--	--
	lbs/day[1]	0.00073	--	--	--	--
Polynuclear Aromatic Hydrocarbons (PAHs) [9]	µg/L	0.64	--	--	--	--
	lbs/day[1]	0.094	--	--	--	--
Bis(2-chloroethoxy)Methane	µg/L	320	--	--	--	--
	lbs/day[1]	47	--	--	--	--
Bis(2-chloroethyl)Ether	µg/L	3.3	--	--	--	--
	lbs/day[1]	0.48	--	--	--	--
Bis(2-chloroisopropyl)Ether	µg/L	88,000	--	--	--	--
	lbs/day[1]	13,000	--	--	--	--
Bis(2-ethylhexyl)Phthalate	µg/L	260	--	--	--	--
	lbs/day[1]	38	--	--	--	--
Dichlorobenzenes	µg/L	3.7E+05	--	--	--	--
	lbs/day[1]	54,000	--	--	--	--
1,4-Dichlorobenzene	µg/L	1300	--	--	--	--
	lbs/day[1]	190	--	--	--	--
3,3’-Dichlorobenzidine	µg/L	0.59	--	--	--	--
	lbs/day[1]	0.086	--	--	--	--
Diethyl Phthalate	µg/L	2.4E+06	--	--	--	--
	lbs/day[1]	3.5E+05	--	--	--	--
Dimethyl Phthalate	µg/L	6.0E+07	--	--	--	--
	lbs/day[1]	8.8E+06	--	--	--	--
Di-n-Butyl Phthalate	µg/L	2.6E+05	--	--	--	--
	lbs/day[1]	38,000	--	--	--	--
2,4-Dinitrotoluene	µg/L	190	--	--	--	--
	lbs/day[1]	28	--	--	--	--
1,2-Diphenylhydrazine	µg/L	12	--	--	--	--
	lbs/day[1]	1.8	--	--	--	--
Fluoranthene	µg/L	1,100	--	--	--	--
	lbs/day[1]	160	--	--	--	--

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Hexachlorobenzene	µg/L	0.015	--	--	--	--
	lbs/day[1]	0.0022	--	--	--	--
Hexachlorobutadiene	µg/L	1,000	--	--	--	--
	lbs/day[1]	150	--	--	--	--
Hexachlorocyclopentadiene	µg/L	4,200	--	--	--	--
	lbs/day[1]	610	--	--	--	--
Hexachloroethane	µg/L	180	--	--	--	--
	lbs/day[1]	26	--	--	--	--
Isophorone	µg/L	53,000	--	--	--	--
	lbs/day[1]	7,700	--	--	--	--
Nitrobenzene	µg/L	360	--	--	--	--
	lbs/day[1]	53	--	--	--	--
N-Nitrosodimethylamine	µg/L	530	--	--	--	--
	lbs/day[1]	77	--	--	--	--
N-Nitrosodi-N-propylamine	µg/L	28	--	--	--	--
	lbs/day[1]	4.1	--	--	--	--
N-Nitrosodiphenylamine	µg/L	180	--	--	--	--
	lbs/day[1]	26	--	--	--	--
Aldrin	µg/L	0.0016	--	--	--	--
	lbs/day[1]	0.00023	--	--	--	--
HCH [10]	µg/L	--	--	0.58	0.88	0.29
	lbs/day[1]	--	--	0.085	0.13	0.042
Chlordane	µg/L	0.0017	--	--	--	--
	lbs/day[1]	0.00025	--	--	--	--
DDT [11]	µg/L	0.012	--	--	--	--
	lbs/day[1]	0.0018	--	--	--	--
Dieldrin	µg/L	0.0029	--	--	--	--
	lbs/day[1]	0.00042	--	--	--	--
Endosulfan	µg/L	--	--	1.3	2.0	0.66
	lbs/day[1]	--	--	0.19	0.29	0.096
Endrin	µg/L	--	--	0.29	0.44	0.15
	lbs/day[1]	--	--	0.042	0.064	0.022
Heptachlor	µg/L	0.0037	--	--	--	--
	lbs/day[1]	0.00054	--	--	--	--
Heptachlor Epoxide	µg/L	0.0015	--	--	--	--
	lbs/day[1]	0.00022	--	--	--	--
Polychlorinated Biphenyls (PCBs) [12]	µg/L	0.0014	--	--	--	--
	lbs/day[1]	0.00020	--	--	--	--

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Toxaphene	µg/L	0.015	--	--	--	--
	lbs/day[1]	0.0022	--	--	--	--
Tributyltin	µg/L	0.10	--	--	--	--
	lbs/day[1]	0.015	--	--	--	--
Radioactivity	Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, §30253 of the California Code of Regulations. Reference to §30253 is prospective, including future changes to any incorporated provisions of federal law, as the changes take effect.					

1. The mass-based effluent limitations are based on the facility design flow rate of 17.52 MGD.

   Mass-based effluent limitation (lbs/day) = C * Q * 8.34

   Where: C = concentration-based effluent limitation (mg/L)

   Q = maximum discharge flow rate (MGD)

2. “Pass” or “Fail” for Median Monthly Effluent Limitation (MMEL). “Pass” or “Fail” and “% Effect” for Maximum Daily Effluent Limitation (MDEL). The MMEL for chronic toxicity shall only apply when there is a discharge more than one day in a calendar month period. During such calendar months, exactly three independent toxicity tests are required when one toxicity test results in “Fail”.
3. This is a Median Monthly Effluent Limitation.
4. Bacteria limitations:
   a. 30-day Geometric Mean – The geometric mean shall be calculated using the results of five most recent samples.
      i. Total coliform density shall not exceed 1,000/100 ml;
      ii. Fecal coliform density shall not exceed 200/100 ml; and
      iii. Enterococcus density shall not exceed 35/100 ml.
   b. Single Sample Maximum (SSM)
      i. Total coliform density shall not exceed 10,000/100 ml;
      ii. Fecal coliform density shall not exceed 400/100 ml;
      iii. Enterococcus density shall not exceed 104/100 ml; and
      iv. Total coliform density shall not exceed 1,000/100 ml, when the fecal coliform/total coliform ratio exceeds 0.1.

   If a single sample exceeds any of the single sample maximum (SSM) standards, repeat sampling shall be conducted to determine the extent and persistence of the exceedance. Repeat sampling shall be conducted within 24 hours of receiving analytical results and continued until the sample result is less than the SSM standard.

   When repeat sampling is required because of an exceedance of any one single sample density, values from all samples collected during that 30-day period will be used to calculate the geometric mean.
5. Non-chlorinated phenolic compounds represent the sum of 2-nitrophenol; phenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; and 4-nitrophenol.
6. Chlorinated phenolic compounds represent the sum of 2-chlorophenol; 2,4-dichlorophenol; 2,4,6-trichlorophenol; 4-chloro-3-methylphenol; and pentachlorophenol.
7. TCDD Equivalents shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below. USEPA method 1613 may be used to analyze dioxin and furan congeners.

   Dioxin-TEQ (TCDD Equivalents) = Σ (C_x x TEF_x)

   Where:

   C_x = concentration of dioxin or furan congener x

   TEF_x = TEF for congener x

Toxicity Equivalency Factors

Isomer Group	Toxicity Equivalency Factor (TEF)
2,3,7,8-tetra CDD	1.0
2,3,7,8-penta CDD	0.5
2,3,7,8-hexa CDDs	0.1
2,3,7,8-hepta CDD	0.01
Octa CDD	0.001
2,3,7,8 tetra CDF	0.1
1,2,3,7,8 penta CDF	0.05
2,3,4,7,8 penta CDF	0.5
2,3,7,8 hexa CDFs	0.1
2,3,7,8 hepta CDFs	0.01
Octa CDF	0.001

8. Halomethanes shall mean the sum of bromoform, bromomethane (methyl bromide), and chloromethane (methyl chloride).
9. PAHs shall mean the sum of acenaphthylene; anthracene; 1,2-benzanthracene; 3,4-benzofluoranthene; benzo(k)fluoranthene; 1,12-benzoperylene; benzo(a)pyrene; chrysene; dibenzo(a,h)anthracene; fluorine; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene.
10. HCH shall mean the sum of alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.
11. DDT shall mean the sum of 4,4'-DDT, 2,4'-DDT, 4,4'-DDE, 2,4'-DDE, 4,4'-DDD, and 2,4'-DDD.
12. PCBs shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Arolclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260.

b. Temperature Limitations

i. The temperature of wastes discharged shall not exceed the natural temperature of receiving waters by more than 20º F.

ii. The temperature of wastes discharged shall not result in increases in the natural water temperature exceeding 4º F at (a) the shoreline, (b) the surface of any ocean substrate, or (c) the ocean surface beyond 1,000 feet from the discharge system. The surface temperature limitation shall be maintained at least 50 percent of the duration of any complete tidal cycle.

B. Land Discharge Specifications – Not Applicable

C. Recycling Specifications – Not Applicable

V. RECEIVING WATER LIMITATIONS

Receiving water limitations are based on water quality objectives contained in the California Ocean Plan, as most recently amended effective August 19, 2013 ("Ocean Plan"), and are a required part of this Order. Unless specifically excepted by this Order, the discharge, by itself or jointly with any other discharge(s), shall not cause violation of the following water quality objectives. Compliance with these objectives shall be determined by samples collected at stations representative of the area within the waste field where initial dilution is completed (i.e., outside the zone of initial dilution).

A. Bacterial Characteristics

1. Water Contact Standards

Both the State Water Board and the California Department of Public Health (CDPH) have established standards to protect water contact recreation in coastal waters from bacterial contamination. Subsection a of this section contains bacterial objectives adopted by the State Water Board for ocean waters used for water contact recreation. Subsection b describes the bacteriological standards adopted by CDPH for coastal waters adjacent to public beaches and public water contact sports areas in ocean waters.

a. State/Regional Water Board Water Contact Standards

In marine water designated for water contact recreation (REC-1), the waste discharged shall not cause the following bacterial standards to be exceeded in the receiving water outside the initial dilution zone.

Geometric Mean Limits

i. Total coliform density shall not exceed 1,000/100 ml;
ii. Fecal coliform density shall not exceed 200/100 ml; and
iii. Enterococcus density shall not exceed 35/100 ml.

Single Sample Maximum (SSM)

i. Total coliform density shall not exceed 10,000/100 ml;
ii. Fecal coliform density shall not exceed 400/100 ml;
iii. Enterococcus density shall not exceed 104/100 ml; and
iv. Total coliform density shall not exceed 1,000/100 ml, when the fecal coliform/total coliform ratio exceeds 0.1.

b. CDPH Standards

CDPH has established minimum protective bacteriological standards for coast water adjacent to public beaches and for public water-contact sports areas in ocean waters. These standards are found in the California Code of Regulations, title 17, section 7958, and they are identical to the objectives contained in subsection a. above. When a public beach or public water-contact sports area fails to meet these standards, CDPH or the local public health officer may post with warning signs or otherwise restrict use of the public beach or public water-contact sports area until the standards are met. The CDPH regulations impose more frequent monitoring and more stringent posting and closure requirements on certain high-use public beaches that are located adjacent to a storm drain that flows in the summer.

For beaches not covered under AB 411 regulations, CDPH imposes the same standards as contained in Title 17 and requires weekly sampling but allows the county health officer more discretion in making posting and closure decisions.

2. Shellfish Harvesting Standards

At all areas where shellfish may be harvested for human consumption, as determined by the Los Angeles Regional Water Board, the waste discharged shall not cause the following bacterial standards to be exceeded:

a. The median total coliform density for any 6-month period shall not exceed 70 per 100 ml, and not more than 10 percent of the samples during any 6-month period shall exceed 230 per 100 ml.

3. Implementation Provisions for Bacterial Characteristics

a. At a minimum, monthly samples shall be collected from each sampling location. The geometric mean values should be calculated using the five most recent sample results. If sampling occurs more frequently than monthly, all samples taken during the previous 30-day period shall be used to calculate the geometric mean.

b. If a single sample exceeds any of the single sample maximum (SSM) standards, repeat sampling at that location shall be conducted to determine the extent and persistence of the exceedance. Repeat sampling shall be conducted within 24 hours of receiving analytical results and continued until the sample result is less than the SSM standard or until the Los Angeles Regional Water Board requires the Discharger or appropriate agency to conduct a sanitary survey to determine the source of the high bacterial densities. A sanitary survey shall also be required if three out of four samples taken during any 30-day period exceed any SSM standard, or if 75 percent of the samples from more frequent testing during any 30-day period exceed any SSM standard.

When repeat sampling is required because of an exceedance of any one single sample density, values from all samples collected during that 30-day period will be used to calculate the geometric mean.

c. It is state policy that the geometric mean bacterial objectives are strongly preferred for use in water body assessment decisions, for example, in developing the CWA Section 303(d) List of impaired waters, because the geometric mean objectives are a more reliable measure of long-term water body conditions. In making assessment decisions on bacterial quality, SSM data must be considered together with any available geometric mean data. The use of only SSM bacterial data is generally inappropriate unless there is a limited data set, the water is subject to short-term spikes in bacterial concentrations, or other circumstances justify the use of only SSM data.

B. Physical Characteristics

1. Floating particulates and grease and oil shall not be visible as a result of wastes discharged.
2. The discharge of waste shall not alter the color of the receiving waters; create a visual contrast with the natural appearance of the water; nor cause aesthetically undesirable discoloration of the ocean surface.
3. Natural light shall not be significantly reduced at any point outside the initial dilution zone as the result of the discharge of waste.
4. The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded.

C. Chemical Characteristics

1. The dissolved oxygen concentration shall not at any time be depressed more than 10 percent from that which occurs naturally, as the result of the discharge of oxygen demanding waste materials; excluding effects of naturally induced upwelling.
2. The pH shall not be changed at any time more than 0.2 units from that which occurs naturally.
3. The dissolved sulfide concentration of waters in and near sediments shall not be significantly increased above that present under natural conditions.
4. The concentration of substances set forth in Chapter II, Table 1 of the Ocean Plan, shall not be increased in marine sediments to levels that would degrade indigenous biota.
5. The concentration of organic materials in marine sediments shall not be increased to levels that would degrade marine life.

6. Nutrient materials shall not cause objectionable aquatic growths or degrade indigenous biota.

7. Numerical water quality objectives established in Chapter II, Table 1 of the California Ocean Plan shall not be exceeded outside of the zone of initial dilution as a result of discharges from the Facility.

D. Biological Characteristics

1. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded.

2. The natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption shall not be altered.

3. The concentration of organic materials in fish, shellfish, or other marine resources used for human consumption shall not bioaccumulate to levels that are harmful to human health.

E. Radioactivity

1. Discharge of radioactive waste shall not degrade marine life.

VI. PROVISIONS

A. Standard Provisions

1. **Federal Standard Provisions.** The Discharger shall comply with all Standard Provisions included in Attachment D of this Order.

2. **Regional Water Board Standard Provisions.** The Discharger shall comply with the following provisions. In the event that there is any conflict, duplication, or overlap between provisions specified by this Order, the more stringent provision shall apply:

   a. This Order may be modified, revoked, reissued, or terminated in accordance with the provisions of 40 C.F.R.sections 122.44, 122.62, 122.63, 122.64, 125.62 and 125.64. Causes for taking such actions include, but are not limited to: failure to comply with any condition of this Order; endangerment to human health or the environment resulting from the permitted activity; or acquisition of newly-obtained information which would have justified the application of different conditions if known at the time of Order adoption. The filing of a request by the Discharger for an Order modification, revocation, and issuance or termination, or a notification of planned changes or anticipated noncompliance does not stay any condition of this Order.

   b. The Discharger must comply with the lawful requirements of municipalities, counties, drainage districts, and other local agencies regarding discharges of storm water to storm drain systems or other water courses under their jurisdiction; including applicable requirements in the municipal storm water management program developed to comply with NPDES permits issued by the Regional Water Board to local agencies.

   c. Discharge of wastes to any point other than specifically described in this Order and permit is prohibited and constitutes a violation thereof.

   d. The Discharger shall comply with all applicable effluent limitations, national standards of performance, toxic effluent standards, and all federal regulations established pursuant to sections 301, 302, 303(d), 304, 306, 307, 316, 318, 405, and 423 of the Federal CWA and amendments thereto.

e. These requirements do not exempt the operator of the facility from compliance with any other laws, regulations, or ordinances which may be applicable; they do not legalize this waste disposal facility, and they leave unaffected any further restraints on the disposal of wastes at this site which may be contained in other statutes or required by other agencies.

f. Oil or oily material, chemicals, refuse, or other pollutionable materials shall not be stored or deposited in areas where they may be picked up by rainfall and carried off of the property and/or discharged to surface waters. Any such spill of such materials shall be contained and removed immediately.

g. A copy of these waste discharge specifications shall be maintained at the control room where the operation of the RSMP is overseen, so as to be available at all times to operating personnel.

h. After notice and opportunity for a hearing, this Order may be terminated or modified for cause, including, but not limited to:

i. Violation of any term or condition contained in this Order;
ii. Obtaining this Order by misrepresentation, or failure to disclose all relevant facts;
iii. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

i. If there is any storage of hazardous or toxic materials or hydrocarbons at this facility and if the facility is not manned at all times, a 24-hour emergency response telephone number shall be prominently posted where it can easily be read from the outside.

j. The Discharger shall notify the Regional Water Board not later than 120 days in advance of implementation of any plans to alter production capacity of the product line of the manufacturing, producing or processing facility by more than ten percent. Such notification shall include estimates of proposed production rate, the type of process, and projected effects on effluent quality. Notification shall include submittal of a new Report of Waste Discharge appropriate filing fee.

k. The Discharger shall file with the Regional Water Board a report of waste discharge at least 120 days before making any material change or proposed change in the character, location or volume of the discharge.

l. All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Regional Water Board as soon as they know or have reason to believe that they have begun or expect to begin to use or manufacture an intermediate or final product or byproduct of any toxic pollutant that was not reported on their application.

m. In the event of any change in name, ownership, or control of the facility, the discharger shall notify this Regional Water Board of the change and shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to the Regional Water Board.

n. The Water Code provides that any person who violates a waste discharge requirement or a provision of the Water Code is subject to civil penalties of up to $5,000 per day, $10,000 per day, or $25,000 per day of violation, or when the violation involves the discharge of pollutants, is subject to civil penalties of up to $10 per gallon per day or $25 per gallon per day of violation; or some combination thereof, depending on the violation, or upon the combination of violations.

o. Violation of any of the provisions of the NPDES program or of any of the provisions of this Order may subject the violator to any of the penalties described herein, or any combination thereof, at the discretion of the prosecuting authority; except that only one kind of penalty may be applied for each kind of violation.

p. The discharge of any product registered under the Federal Insecticide, Fungicide, and Rodenticide Act to any waste stream which may ultimately be released to waters of the United States, is prohibited unless specifically authorized elsewhere in this permit or another NPDES permit. This requirement is not applicable to products used for lawn and agricultural purposes.

q. The discharge of any waste resulting from the combustion of toxic or hazardous wastes to any waste stream that ultimately discharges to waters of the United States is prohibited, unless specifically authorized elsewhere in this permit.

r. The Discharger shall notify the Executive Officer in writing no later than 6 months prior to the planned discharge of any chemical, other than the products previously reported to the Executive Officer, which may be toxic to aquatic life. Such notification shall include:

i. Name and general composition of the chemical,
ii. Frequency of use,
iii. Quantities to be used,
iv. Proposed discharge concentrations, and
v. USEPA registration number, if applicable.

s. Failure to comply with provisions or requirements of this Order, or violation of other applicable laws or regulations governing discharges from this facility, may subject the Discharger to administrative or civil liabilities, criminal penalties, and/or other enforcement remedies to ensure compliance. Additionally, certain violations may subject the Discharger to civil or criminal enforcement from appropriate local, state, or federal law enforcement entities.

t. In the event the Discharger does not comply or will be unable to comply for any reason, with any prohibition, maximum daily effluent limitation, average weekly effluent limitation, average monthly effluent limitation, instantaneous maximum/minimum effluent limitations, six-month median effluent limitation or receiving water limitation of this Order, the Discharger shall notify the Los Angeles Regional Water Board by telephone (213) 576-6600 within 24 hours of having knowledge of such noncompliance, and shall confirm this notification in writing within five days, unless the Los Angeles Regional Water Board waives confirmation. The written notification shall state the nature, time, duration, and cause of noncompliance, and shall describe the measures being taken to remedy the current noncompliance and, prevent recurrence including, where applicable, a schedule of implementation. Other noncompliance requires written notification as above at the time of the normal monitoring report.

B. Monitoring and Reporting Program (MRP) Requirements

The Discharger shall comply with the MRP, and future revisions thereto, in Attachment E.

C. Special Provisions

1. Reopener Provisions

a. This Order may be reopened for modification to include an effluent limitation if monitoring establishes that the discharge causes, has the reasonable potential to cause, or contributes to an excursion above the Ocean Plan Table 1 water quality objective.

b. If more stringent applicable water quality standards are promulgated or approved pursuant to section 303 of the Federal CWA, and amendments thereto, the Regional Water Board will revise and modify this Order in accordance with such more stringent standards.

c. This Order may be reopened and modified, in accordance with the provisions set forth in Parts 122 and 124, to include requirements for the implementation of the watershed management approach or to include new minimum levels (MLs).

d. This Order may be reopened and modified to revise effluent limitations as a result of future Ocean Plan Amendments, such as an update of the objectives or the adoption of a TMDL.

e. This Order may be reopened upon submission by the Discharger of adequate information, as determined by the Regional Water Board, to provide for modifications to dilution credits or the mixing zone, as may be appropriate.

f. This Order may be reopened and modified, revoked, and reissued or terminated in accordance with the provisions of 40 CFR sections 122.24, 122.62 to 122.64, 125.62, and 125.64. Causes for taking such actions include, but are not limited to, failure to comply with any condition of this Order and permit, or endangerment to human health or the environment resulting from the permitted activity.

g. This Order may be modified, or revoked and reissued, based on the results of Magnuson-Stevens Conservation and Management Act and/or Endangered Species Act section 7 consultations with the National Marine Fisheries Service and/or the U.S. Fish and Wildlife Service.

2. Special Studies, Technical Reports and Additional Monitoring Requirements

a. **Initial Investigation Toxicity Reduction Evaluation (TRE) Workplan.** The Discharger shall submit to the Regional Water Board an Initial Investigation TRE workplan (1-2 pages) within **90 days** of the effective date of this permit. This plan shall describe the steps the permittee intends to follow in the event that toxicity is detected. See section V of the Monitoring and Reporting Program (Attachment E) for an overview of Toxicity Reduction Evaluation (TRE) requirements.

b. **Mixing Zone Study Work Plan.** The Discharger shall develop and submit to the Los Angeles Regional Water Board for review a work plan detailing how the Discharger will conduct a Mixing Zone Study, within **90 days** after the adoption of this permit. The study should include monitoring upstream of the discharge point, directly above the discharge location, at the boundary of the Zone of Initial Dilution as defined using the modeling results, and outside the Zone of Initial Dilution for the list of constituents included in Attachment E, Section VIII.A.1

c. **Sediment Loading Study Work Plan.** The Discharger shall develop and submit to the Los Angeles Regional Water Board for review a plan detailing how the Discharger will conduct a sediment loading study, within **90 days** after the adoption of this permit. The study is to monitor the concentrations of constituents present in the sediment inside and outside of the mixing zone. The sampling must target all constituents present in the discharge that bioaccumulate in the tissue of aquatic life that may be present in the area.

3. **Best Management Practices and Pollution Prevention**

The Discharger shall develop and submit, within **90 days** of the effective date of this Order:

a. **An updated Storm Water Pollution Prevention Plan (SWPPP)**

The SWPPP shall describe site-specific management practices for minimizing contamination of storm water runoff and for preventing contaminated storm water runoff from being discharged directly to waters of the State. Further, the SWPPP should address erosion and sediment control practices in areas affected by construction and land disturbance activities. The SWPPP shall be developed in accordance with the requirements in Attachment G.

b. **An updated Best Management Practice Plan (BMPP)**

The BMPP shall entail site-specific procedures implemented and/or to be implemented to prevent the discharge of pollutants in non-storm water discharges. The BMPP shall be site-specific and shall cover all areas of the Facility including connectors and pumping stations. Further, BMPs should address reducing or eliminating pollutants in storm water discharges from construction and land disturbance activities.

The Discharger shall implement their SWPPP and BMPP within 10 days of the approval by the Executive Officer or **no later than 90 days** after submission to the Los Angeles Regional Water Board, whichever comes first. The plans shall be reviewed annually and revised, if necessary, at the same time. Updated information shall be submitted within 30 days of revision.

4. **Construction, Operation and Maintenance Specifications**

a. The Discharger shall at all times properly operate and maintain all facilities and systems installed or used to achieve compliance with this Order.

5. **Other Special Provisions – Not Applicable**

6. **Compliance Schedules – Not Applicable**

VII. COMPLIANCE DETERMINATION

A. Compliance with Effluent Limitations expressed as Single Constituents

If the concentration of the pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reported Minimum Level (see Reporting Requirement I.G. of the MRP), then the Discharger is out of compliance.

B. Compliance with Effluent Limitations expressed as Sum of Several Constituents

Dischargers are out of compliance with an effluent limitation which applies to the sum of a group of chemicals (e.g., PCB’s) if the sum of the individual pollutant concentrations is greater than the effluent limitation. Individual pollutants of the group will be considered to have a concentration of zero if the constituent is reported as “Not Detected” (ND) or “Detected, but Not Quantified” (DNQ).

C. **Multiple Sample Data Reduction**

The concentration of the pollutant in the effluent may be estimated from the result of a single sample analysis or by a measure of central tendency (arithmetic mean, geometric mean, median, etc.) of multiple sample analyses when all sample results are quantifiable (i.e., greater than or equal to the reported Minimum Level). When one or more sample results are reported as ND or DNQ, the central tendency concentration of the pollutant shall be the median (middle) value of the multiple samples, where DNQ is lower than a quantified value and ND is lower than DNQ. If, in an even number of samples, one or both of the middle values is ND or DNQ, the median will be the lower of the two middle values.

D. **Average Monthly Effluent Limitation (AMEL)**

If the average of daily discharges over a calendar month exceeds the AMEL for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for each day of that month for that parameter (e.g., resulting in 31 days of non-compliance in a 31-day month). However, an alleged violation of the AMEL will be considered one violation for the purpose of assessing mandatory minimum penalties. The average of daily discharges over a calendar month that exceeds the AMEL for a parameter will be considered out of compliance for that month only. If only a single sample (daily discharge) is taken over a calendar month and the analytical result for that sample exceeds the AMEL, the Discharger will be considered out of compliance for that month. If no sample (daily discharge) is taken over a calendar month, no compliance determination can be made for that month with respect to effluent violation determination, but compliance determination can be made for that month with respect to reporting violation determination.

In determining compliance with the AMEL, the following provisions shall also apply to all constituents:

1. If the analytical result of a single sample, monitored monthly, quarterly, semiannually, or annually, does not exceed the AMEL for that constituent, the Discharger has demonstrated compliance with the AMEL for that month;

2. If the analytical result of a single sample, monitored monthly, quarterly, semiannually, or annually, exceeds the AMEL for any constituent, the Discharger shall collect four additional samples at approximately equal intervals during the month. All five analytical results shall be reported in the monitoring report for that month, or 45 days after results for the additional samples were received, whichever is later.

   When all sample results are greater than or equal to the reported Minimum Level (see Reporting Requirement I.G. of the MRP), the numerical average of the analytical results of these five samples will be used for compliance determination.

   When one or more sample results are reported as “Not-Detected (ND)” or “Detected, but Not Quantified (DNQ)” (see Reporting Requirement I.G. of the MRP), the median value of these four samples shall be used for compliance determination. If one or both of the middle values is ND or DNQ, the median shall be the lower of the two middle values.

   In the event of noncompliance with an AMEL, the sampling frequency for that constituent shall be increased to weekly and shall continue at this level until compliance with the AMEL has been demonstrated.

3. If only one sample was obtained for the month or more than a monthly period and the result exceeds the AMEL, then the Discharger is in violation of the AMEL.

E. **Average Weekly Effluent Limitation (AWEL)**

If the average of daily discharges over a calendar week exceeds the AWEL for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for each day of that week for that parameter (e.g., resulting in seven days of non-compliance). However, an alleged violation of the AWEL will be considered one violation for the purpose of assessing mandatory minimum penalties. The average of daily discharges over a calendar week that exceeds the AWEL for a parameter will be considered out of compliance for that week only. If only a single sample (daily discharge) is taken over a calendar week and the analytical result for that sample exceeds the AWEL, the Discharger will be considered out of compliance for that week. If no sample (daily discharge) is taken over a calendar week, no compliance determination can be made for that week with respect to effluent violation determination, but compliance determination can be made for that week with respect to reporting violation determination.

A calendar week will begin on Sunday and end on Saturday. Partial calendar weeks at the end of the calendar month will be carried forward to the next month in order to calculate and report a consecutive seven-day average value on Saturday.

F. **Maximum Daily Effluent Limitation (MDEL)**

If a daily discharge on a calendar day exceeds the MDEL for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for that day for that parameter. If no sample (daily discharge) is taken over a calendar day, no compliance determination can be made for that day with respect to an effluent violation determination, but compliance determination can be made for that day with respect to reporting violation determination.

G. **Instantaneous Minimum Effluent Limitation**

If the analytical result of a single grab sample is lower than the instantaneous minimum effluent limitation for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for that single sample for that parameter. Non-compliance for each single grab sample will be considered separately (e.g., the analytical results of two grab samples taken over a calendar day that are lower than the instantaneous minimum effluent limitation would result in two instances of non-compliance with the instantaneous minimum effluent limitation).

H. **Instantaneous Maximum Effluent Limitation**

If the analytical result of a single grab sample exceeds (is higher than) the instantaneous maximum effluent limitation for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for that single sample for that parameter. Non-compliance for each single grab sample will be considered separately (e.g., the analytical results of two grab samples taken over a calendar day that both are higher than the instantaneous maximum effluent limitation would result in two instances of non-compliance with the instantaneous maximum effluent limitation).

I. **Six-Month Median Effluent Limitation**

If the median of daily discharges over any 180-day period exceeds the six-month median effluent limitation for a given parameter, an alleged violation will be flagged and the discharger will be considered out of compliance for each day of that 180-day period for that parameter. The next assessment of compliance will occur after the next sample is taken. If only a single sample is taken during a given 180-day period and the analytical result for that sample exceeds the six-month median, the discharger will be considered out of compliance for the 180-day period. For any 180-period during which no sample is taken, no compliance determination can be made for the six-month median limitation.

The six-month median shall apply as a moving median of daily values for any 180-day period in which daily values represent flow weighted average concentrations within a 24-hour period. For intermittent discharges, the daily value shall be considered to equal zero for days on which no discharge occurred. If only one sample is collected during the time period associated with the 6-month median water quality objective, the single measurement shall be used to determine compliance with the effluent limitation for the entire time period.

J. **Median Monthly Effluent Limitation (MMEL)**

If the median of daily discharges over a calendar month exceeds the MMEL for a given parameter, an alleged violation will be flagged and the Discharger will be considered out of compliance for each day of that month for that parameter (e.g., resulting in 31 days of non-compliance in a 31-day month). However, an alleged violation of the MMEL will be considered one violation for the purpose of assessing State mandatory minimum penalties. If no sample (daily discharge) is taken over a calendar month, no compliance determination can be made for that month with respect to effluent violation determination, but compliance determination can be made for that month with respect to reporting violation determination.

K. **Chronic Toxicity**

The discharge is subject to determination of “Pass” or “Fail” and “Percent Effect” from a single-effluent concentration chronic toxicity test at the discharge IWC using the Test of Significant Toxicity (TST) approach described in *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, 2010), Appendix A, Figure A-1, and Table A-1. The null hypothesis (H_o) for the TST approach is: Mean discharge IWC response ≤0.75 × Mean control response. A test result that rejects this null hypothesis is reported as “Pass”. A test result that does not reject this null hypothesis is reported as “Fail”. The relative “Percent Effect” at the discharge IWC is defined and reported as: ((Mean control response – Mean discharge IWC response) ÷ Mean control response)) × 100.

The Maximum Daily Effluent Limitation (MDEL) for chronic toxicity is exceeded and a violation will be flagged when a chronic toxicity test, analyzed using the TST approach, results in “Fail” and the “Percent Effect” is ≥0.50.

The Median Monthly Effluent Limitation (MMEL) for chronic toxicity is exceeded and a violation will be flagged when the median of no more than three independent chronic toxicity tests, conducted within the same calendar month and analyzed using the TST approach, results in “Fail”. The MMEL for chronic toxicity shall only apply when there is a discharge more than one day in a calendar month period. During such calendar months, exactly three independent toxicity tests are required when one toxicity test results in “Fail”.

L. **Mass and Concentration Limitations**

Compliance with mass effluent limitations and concentration effluent limitations for the same parameter shall be determined separately. When the concentration for a parameter in a sample is reported as ND or DNQ, the corresponding mass emission rate determined using that sample concentration shall also be reported as ND or DNQ.

M. **Bacterial Standards and Analyses**

The geometric mean used for determining compliance with bacterial standards is calculated using the following equation:

$$\text{Geometric Mean} = (C_1 \times C_2 \times \ldots \times C_n)^{1/n}$$

where n is the number of days samples were collected during the period and C is the concentration of bacteria (MPN/100 mL or CFU/100 mL) found on each day of sampling.

For bacterial analyses, sample dilutions should be performed so the expected range of values is bracketed (for example, with multiple tube fermentation method or membrane filtration method, 2 to 16,000 per 100 mL for total and fecal coliform, at a minimum, and 1 to 1000 per 100 mL for *Enterococcus*). The detection method used for each analysis shall be reported with the results of the analysis.

Detection methods used for coliforms (total and fecal) and *Enterococcus* shall be those presented in Table 1A of 40 CFR section 136 (revised May 18, 2012), unless alternate methods have been approved by USEPA pursuant to 40 CFR section 136, or improved methods have been determined by the Executive Officer and/or USEPA.

ATTACHMENT A – DEFINITIONS

Acute Toxicity

a. Acute Toxicity
Expressed in Toxic Units Acute (TUa)

$$TUa = \frac{100}{96\text{-hr LC } 50\%}$$

b. Lethal Concentration 50% (LC 50)
LC 50 (percent waste giving 50% survival of test organisms) shall be determined by static or continuous flow bioassay techniques using standard marine test species as specified in Ocean Plan Appendix III. If specific identifiable substances in wastewater can be demonstrated by the discharger as being rapidly rendered harmless upon discharge to the marine environment, but not as a result of dilution, the LC 50 may be determined after the test samples are adjusted to remove the influence of those substances.

When it is not possible to measure the 96-hour LC 50 due to greater than 50 percent survival of the test species in 100 percent waste, the toxicity concentration shall be calculated by the expression:

$$TUa = \frac{\log (100 - S)}{1.7}$$

where:
S = percentage survival in 100% waste. If S > 99, TUa shall be reported as zero.

Areas of Special Biological Significance (ASBS)

Those areas designated by the State Water Resources Control Board (State Water Board) as ocean areas requiring protection of species or biological communities to the extent that alteration of natural water quality is undesirable. All Areas of Special Biological Significance are also classified as a subset of STATE WATER QUALITY PROTECTION AREAS.

Average Monthly Effluent Limitation (AMEL)

The highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Effluent Limitation (AWEL)

The highest allowable average of daily discharges over a calendar week (Sunday through Saturday), calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Best Management Practices (BMPs)

BMPs are methods, measures, or practices designed and selected to reduce or eliminate the discharge of pollutants to surface waters from point and nonpoint source discharges including storm water. BMPs include structural and non-structural control, and operation maintenance procedures, which can be applied before, during, and/or after pollution-producing activities.

Chlorinated Phenolic Compounds

Chlorinated Phenolic Compounds shall mean, at a minimum, the sum of 2-Chlorophenol, 2,4-Dichlorophenol, 4-Chloro-3-methylphenol, 2,4,6-Trichlorophenol, and Pentachlorophenol.

Chlordane

Shall mean the sum of chlordane-alpha, chlordane-gamma, chlordene-alpha, chlordene-gamma, nonachlor-alpha, nonachlor-gamma, and oxychlordane.

Chronic Toxicity

This parameter shall be used to measure the acceptability of waters for supporting a healthy marine biota until improved methods are developed to evaluate biological response.

a. Chronic Toxicity (TUc)
Expressed as Toxic Units Chronic (TUc)

$$TUc = \frac{100}{NOEL}$$

b. No Observed Effect Level (NOEL)

The NOEL is expressed as the maximum percent effluent or receiving water that causes no observable effect on a test organism, as determined by the result of a critical life stage toxicity test listed in Ocean Plan Appendix II.

Coefficient of Variation (CV)

CV is a measure of the data variability and is calculated as the estimated standard deviation divided by the arithmetic mean of the observed values.

Composite Sample

Composite Sample, for flow rate measurements, means the arithmetic mean of no fewer than eight individual measurements taken at equal intervals for 24 hours or for the duration of discharge, whichever is shorter.

Composite sample, for other than flow rate measurement, means:

a No fewer than eight individual sample portions taken at equal time intervals for 24 hours, or the duration of the discharge, whichever is shorter. The volume of each individual sample portion shall be directly proportional to the discharge flow rate at the time of sampling; or,

b No fewer than eight individual sample portions taken of equal time volume taken over a 24 hour period. The time interval between each individual sample portion shall vary such that the volume of the discharge between each individual sample portion remains constant.

The compositing period shall equal the specified sampling period, or 24 hours, if no period is specified.

For a composite sample, if the duration of the discharge is less than 24 hours but greater than 8 hours, at least eight flow-weighted individual sample portions shall be taken during the duration of the discharge and composited. For a discharge duration of 8 hours or less, eight individual “grab samples” may be substituted and composited.

The composite sample result shall be reported for the calendar day during which composite sampling ends.

Daily Discharge

Daily Discharge is defined as either: (1) the total mass of the constituent discharged over the calendar day (12:00 am through 11:59 pm) or any 24-hour period that reasonably represents a calendar day for purposes of sampling (as specified in the permit), for a constituent with limitations expressed in units of mass or; (2) the unweighted arithmetic mean measurement of the constituent over the day for a constituent with limitations expressed in other units of measurement (e.g., concentration).

The daily discharge may be determined by the analytical results of a composite sample taken over the course of one day (a calendar day or other 24-hour period defined as a day) or by the arithmetic mean of analytical results from one or more grab samples taken over the course of the day.

For composite sampling, if 1 day is defined as a 24-hour period other than a calendar day, the analytical result for the 24-hour period will be considered as the result for the calendar day in which the 24-hour period ends.

DDT

Shall mean the sum of 4,4’DDT, 2,4’DDT, 4,4’DDE, 2,4’DDE, 4,4’DDD, and 2,4’DDD.

Degrade (Degradation)

Degradation shall be determined by comparison of the waste field and reference site(s) for characteristic species diversity, population density, contamination, growth anomalies, debility, or supplanting of normal species by undesirable plant and animal species. Degradation occurs if there are significant differences in any of three major biotic groups, namely, demersal fish, benthic invertebrates, or attached algae. Other groups may be evaluated where benthic species are not affected, or are not the only ones affected.

Detected, but Not Quantified (DNQ)

Sample results that are less than the reported Minimum Level, but greater than or equal to the laboratory’s MDL. Sample results reported as DNQ are estimated concentrations.

Dichlorobenzenes

Shall mean the sum of 1,2- and 1,3-dichlorobenzene.

Downstream Ocean Waters

Waters downstream with respect to ocean currents.

Dredged Material

Any material excavated or dredged from the navigable waters of the United States, including material otherwise referred to as “spoil.”

Enclosed Bays

Indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

Endosulfan

The sum of endosulfan-alpha and -beta and endosulfan sulfate.

Estuaries and Coastal Lagoons

Estuaries and Coastal Lagoons are waters at the mouths of streams that serve as mixing zones for fresh and ocean waters during a major portion of the year. Mouths of streams that are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and salt water occurs in the open coastal waters. The waters described by this definition include but are not limited to the Sacramento-San Joaquin Delta as defined by Section 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

Grab Sample

Grab Sample means an individual sample collected during a period of time not to exceed 15 minutes. Grab samples shall be collected during normal peak loading conditions for the parameter of interest, which may or may not occur during hydraulic peaks.

Halomethanes

Halomethanes shall mean the sum of bromoform, bromomethane (methyl bromide) and chloromethane (methyl chloride).

HCH

HCH shall mean the sum of the alpha, beta, gamma (lindane) and delta isomers of hexachlorocyclohexane.

Initial Dilution

The process that results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge.

For a submerged buoyant discharge, characteristic of most municipal and industrial wastes that are released from the submarine outfalls, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise in the water column and first begins to spread horizontally.

For shallow water submerged discharges, surface discharges, and non-buoyant discharges, characteristic of cooling water wastes and some individual discharges, turbulent mixing results primarily from the momentum of discharge. Initial dilution, in these cases, is considered to be completed when the momentum induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Los Angeles Regional Water Board, whichever results in the lower estimate for initial dilution.

Instantaneous Maximum Effluent Limitation

The highest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous maximum limitation).

Instantaneous Minimum Effluent Limitation

The lowest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous minimum limitation).

Kelp Beds

For purposes of the bacteriological standards of the Ocean Plan, are significant aggregations of marine algae of the genera Macrocystis and Nereocystis. Kelp beds include the total foliage canopy of Macrocystis and Nereocystis plants throughout the water column.

Mariculture

The culture of plants and animals in marine waters independent of any pollution source.

Material

(a) In common usage: (1) the substance or substances of which a thing is made or composed (2) substantial; (b) For purposes of the Ocean Plan relating to waste disposal, dredging and the disposal of dredged material and fill, MATERIAL means matter of any kind or description which is subject to regulation as waste, or any material dredged from the navigable waters of the United States. See also, DREDGED MATERIAL.

Maximum Daily Effluent Limitation (MDEL)

The highest allowable daily discharge of a pollutant.

Median

The middle measurement in a set of data. The median of a set of data is found by first arranging the measurements in order of magnitude (either increasing or decreasing order). If the number of measurements (n) is odd, then the median = $X_{(n+1)/2}$. If n is even, then the median = $(X_{n/2} + X_{(n/2)+1})/2$ (i.e., the midpoint between the $n/2$ and $n/2+1$).

Method Detection Limit (MDL)

The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, as defined in 40 C.F.R. part 136, Attachment B.

Minimum Level (ML)

The concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes, and processing steps have been followed.

Mixing Zone

Mixing Zone is a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall water body.

Natural Light

Reduction of natural light may be determined by the Los Angeles Regional Water Board by measurement of light transmissivity or total irradiance, or both, according to the monitoring needs of the Los Angeles Regional Water Board.

Not Detected (ND)

Those sample results less than the laboratory's MDL.

Ocean Waters

The territorial marine waters of the state as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons. If a discharge outside the territorial waters of the state could affect the quality of the waters of the state, the discharge may be regulated to assure no violation of the Ocean Plan will occur in ocean waters.

PAHs (polynuclear aromatic hydrocarbons)

The sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenzo[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

PCBs (polychlorinated biphenyls)

The sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254 and Aroclor-1260.

Persistent Pollutants

Persistent pollutants are substances for which degradation or decomposition in the environment is nonexistent or very slow.

Pollutant Minimization Program (PMP)

PMP means waste minimization and pollution prevention actions that include, but are not limited to, product substitution, waste stream recycling, alternative waste management methods, and education of the public and businesses. The goal of the PMP shall be to reduce all potential sources of a priority pollutant(s) through pollutant minimization (control) strategies, including pollution prevention measures as appropriate, to maintain the effluent concentration at or below the water quality-based effluent limitation. Pollution prevention measures may be particularly appropriate for persistent bioaccumulative priority pollutants where there is evidence that beneficial uses are being impacted. The Regional Water Board may consider cost effectiveness when establishing the requirements of a PMP. The completion and implementation of a Pollution Prevention Plan, if required pursuant to Water Code section 13263.3(d), shall be considered to fulfill the PMP requirements.

Reported Minimum Level

The reported ML (also known as the Reporting Level or RL) is the ML (and its associated analytical method) chosen by the Discharger for reporting and compliance determination from the MLs included in this Order, including an additional factor if applicable as discussed herein. The MLs included in this Order correspond to approved analytical methods for reporting a sample result that are selected by the Los Angeles Regional Water Board either from Appendix II of the Ocean Plan in accordance with section III.C.5.a. of the Ocean Plan or established in accordance with section III.C.5.b. of the Ocean Plan. The ML is based on the proper application of method-based analytical procedures for sample preparation and the absence of any matrix interferences. Other factors may be applied to the ML depending on the specific sample preparation steps employed. For example, the treatment typically applied in cases where there are matrix-effects is to dilute the sample or sample aliquot by a factor of ten. In such cases, this additional factor must be applied to the ML in the computation of the reported ML.

Shellfish

Organisms identified by the California Department of Public Health as shellfish for public health purposes (i.e., mussels, clams and oysters).

Significant Difference

Defined as a statistically significant difference in the means of two distributions of sampling results at the 95 percent confidence level.

Six-Month Median Effluent Limitation

The highest allowable moving median of all daily discharges for any 180-day period.

State Water Quality Protection Areas (SWQPAs)

Non-terrestrial marine or estuarine areas designated to protect marine species or biological communities from an undesirable alteration in natural water quality. All AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS) that were previously designated by the State Water Board in Resolution No.s 74-28, 74-32, and 75-61 are now also classified as a subset of State Water Quality Protection Areas and require special protections afforded by the Ocean Plan.

TCDD Equivalents

The sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below.

Isomer Group	Toxicity Equivalence Factor
2,3,7,8-tetra CDD	1.0
2,3,7,8-penta CDD	0.5
2,3,7,8-hexa CDDs	0.1
2,3,7,8-hepta CDD	0.01
octa CDD	0.001
2,3,7,8 tetra CDF	0.1
1,2,3,7,8 penta CDF	0.05
2,3,4,7,8 penta CDF	0.5
2,3,7,8 hexa CDFs	0.1
2,3,7,8 hepta CDFs	0.01
octa CDF	0.001

Toxicity Reduction Evaluation (TRE)

A study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices, and best management practices. A Toxicity Identification Evaluation (TIE) may be required as part of the TRE, if appropriate. (A TIE is a set of procedures to identify the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests.)

Waste

As used in the Ocean Plan, waste includes a Discharger's total discharge, of whatever origin, i.e., gross, not net, discharge.

Water Quality-Based Effluent Limit (WQBEL)

A value determined by selecting the most stringent of the effluent limits calculated using all applicable water quality criteria (e.g., aquatic life, human health, and wildlife) for a specific point source to a specific receiving water for a given pollutant.

Water Quality Criteria

Comprised of numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by USEPA or States for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal.

Water Quality Standard

A law or regulation that consists of the beneficial use or uses of a waterbody, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an antidegradation statement.

Whole Effluent Toxicity (WET)

The total toxic effect of an effluent measured directly with a toxicity test.

Zone of Initial Dilution (ZID)

Zone of Initial Dilution (ZID) means, for purposes of designating monitoring stations, the region within a horizontal distance equal to a specified water depth (usually depth of outfall or average depth of diffuser) from any point of the diffuser or end of the outfall and the water column above and below that region, including the underlying seabed.

Water Recycling

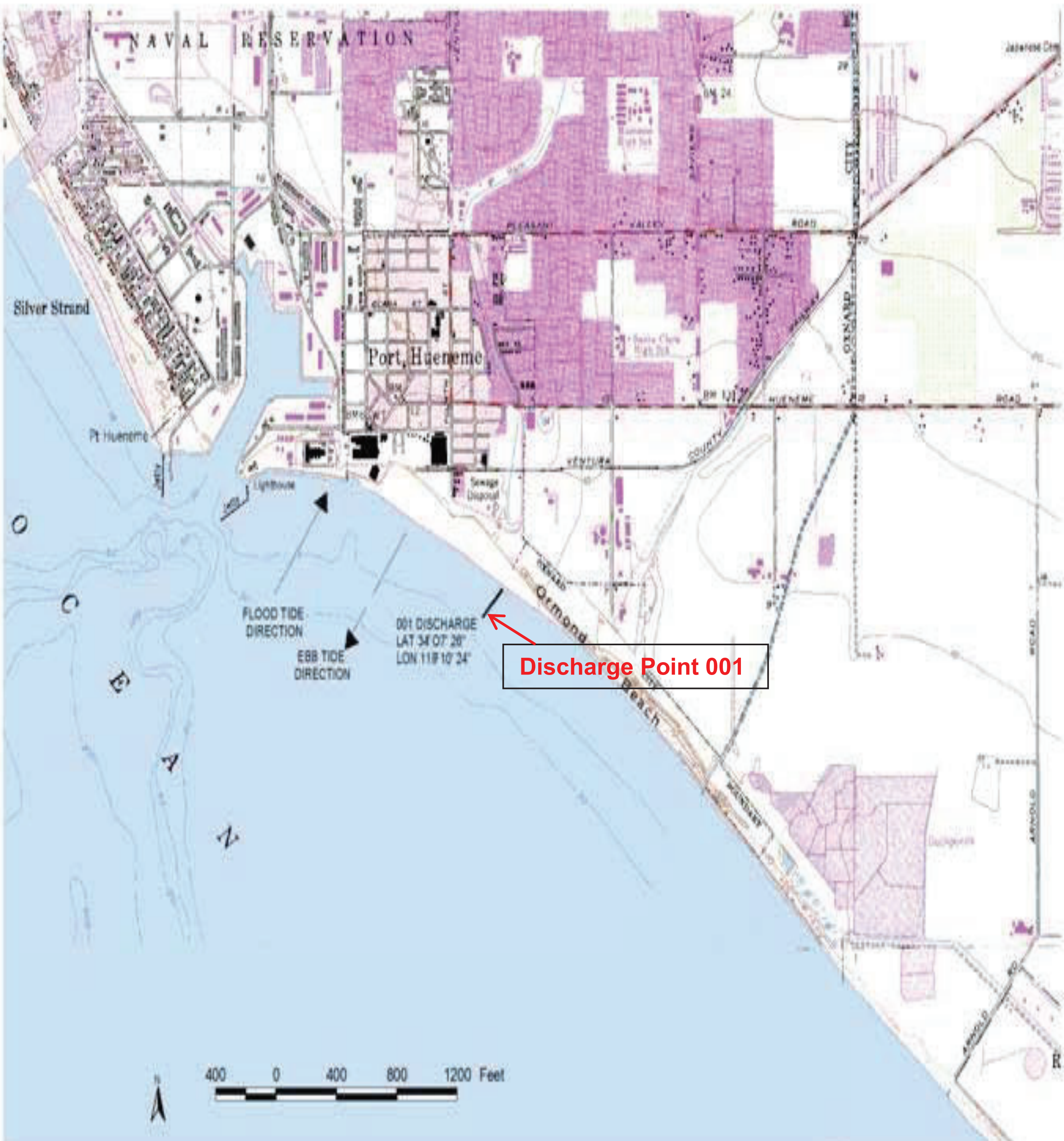
The treatment of wastewater to render it suitable for reuse, the transportation of treated wastewater to the place of use, and the actual use of treated wastewater for a direct beneficial use or controlled use that would not otherwise occur.

ACRONYMS AND ABBREVIATIONS

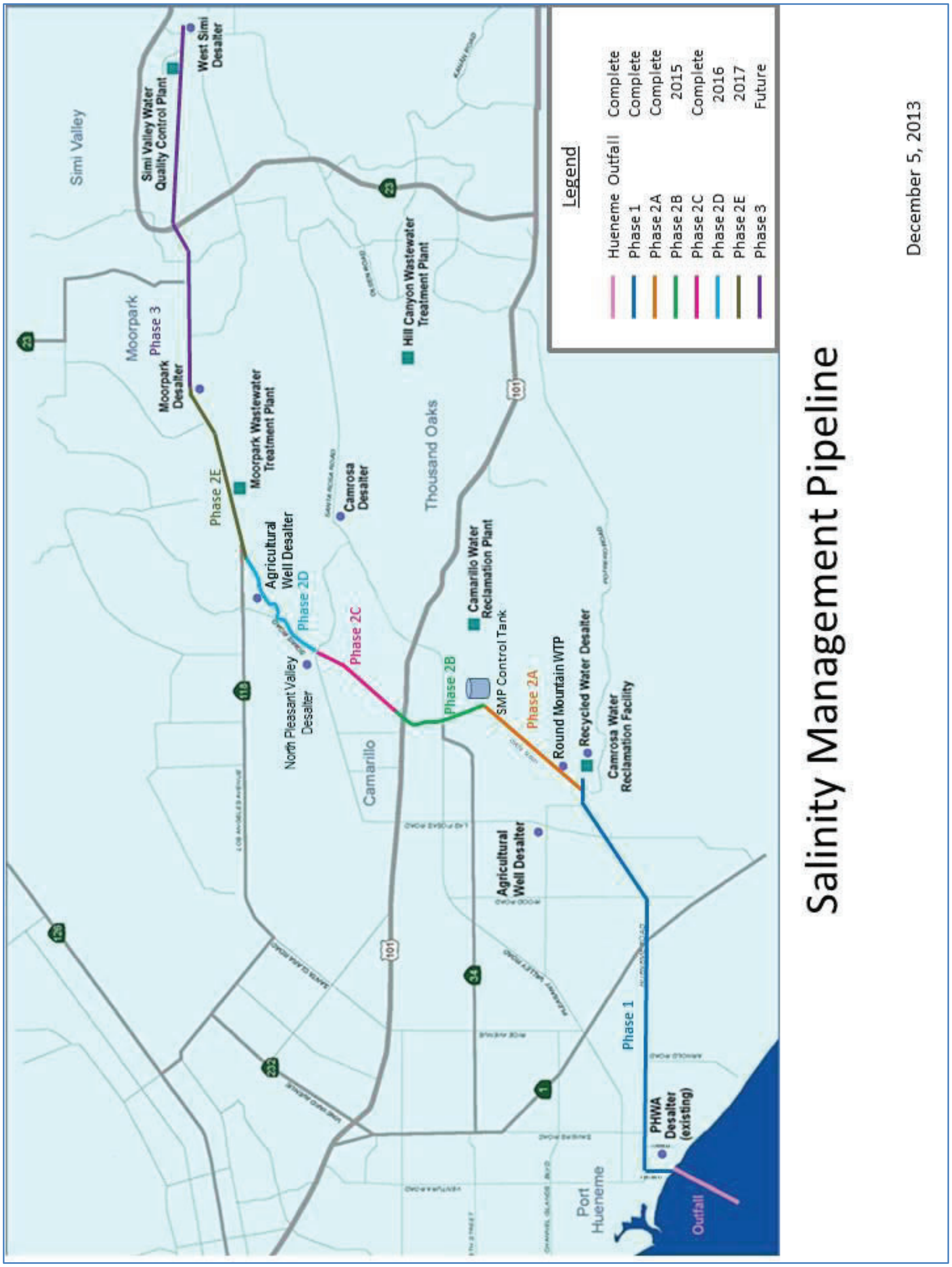
AMEL	Average Monthly Effluent Limitation
B	Background Concentration
BAT	Best Available Technology Economically Achievable
Basin Plan	Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practices
BMPP	Best Management Practices Plan
BPJ	Best Professional Judgment
BOD	Biochemical Oxygen Demand 5-day @ 20 °C
BPT	Best Practicable Treatment Control Technology
C	Water Quality Objective
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CTR	California Toxics Rule
CV	Coefficient of Variation
CWA	Clean Water Act
CWC	California Water Code
Discharger	Calleguas Municipal Water District
DMR	Discharge Monitoring Report
DNQ	Detected But Not Quantified
ELAP	California Department of Public Health Environmental Laboratory Accreditation Program
ELG	Effluent Limitations, Guidelines and Standards
Facility	Regional Salinity Management Pipeline (RSMP)
g/kg	grams per kilogram
gpd	gallons per day
IC	Inhibition Coefficient
IC_{15}	Concentration at which the organism is 15% inhibited
IC_{25}	Concentration at which the organism is 25% inhibited
IC_{40}	Concentration at which the organism is 40% inhibited
IC_{50}	Concentration at which the organism is 50% inhibited
LA	Load Allocations
LOEC	Lowest Observed Effect Concentration
µg/L	micrograms per Liter
mg/L	milligrams per Liter
MDEL	Maximum Daily Effluent Limitation
MEC	Maximum Effluent Concentration
MGD	Million Gallons Per Day
ML	Minimum Level
MRP	Monitoring and Reporting Program
ND	Not Detected
ng/L	nanograms per liter
NOEC	No Observable Effect Concentration
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NTR	National Toxics Rule
OAL	Office of Administrative Law

PAHs	Polynuclear Aromatic Hydrocarbons
pg/L	picograms per liter
PMEL	Proposed Maximum Daily Effluent Limitation
PMP	Pollutant Minimization Plan
POTW	Publicly Owned Treatment Works
ppm	parts per million
ppb	parts per billion
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
Ocean Plan	Water Quality Control Plan for Ocean Waters of California
Los Angeles Regional Water Board	California Regional Water Quality Control Board, Los Angeles Region
RPA	Reasonable Potential Analysis
SCP	Spill Contingency Plan
SIP	State Implementation Policy (Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California)
SMR	Self-Monitoring Reports
State Water Board	California State Water Resources Control Board
SWPPP	Storm Water Pollution Prevention Plan
TAC	Test Acceptability Criteria
Thermal Plan	Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Water and Enclosed Bays and Estuaries of California
TIE	Toxicity Identification Evaluation
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TRE	Toxicity Reduction Evaluation
TSD	Technical Support Document
TSS	Total Suspended Solid
TU_c	Chronic Toxicity Unit
USEPA	United States Environmental Protection Agency
WDR	Waste Discharge Requirements
WET	Whole Effluent Toxicity
WLA	Waste Load Allocations
WQBELs	Water Quality-Based Effluent Limitations
WQS	Water Quality Standards
%	Percent

ATTACHMENT B – MAP



ATTACHMENT C – FLOW SCHEMATIC



ATTACHMENT D – STANDARD PROVISIONS

I. STANDARD PROVISIONS – PERMIT COMPLIANCE

A. Duty to Comply

1. The Discharger must comply with all of the conditions of this Order. Any noncompliance constitutes a violation of the Clean Water Act (CWA) and the California Water Code and is grounds for enforcement action, for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application. (40 C.F.R. § 122.41(a).)
2. The Discharger shall comply with effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants and with standards for sewage sludge use or disposal established under Section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions, even if this Order has not yet been modified to incorporate the requirement. (40 C.F.R. § 122.41(a)(1).)

B. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a Discharger in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Order. (40 C.F.R. § 122.41(c).)

C. Duty to Mitigate

The Discharger shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this Order that has a reasonable likelihood of adversely affecting human health or the environment. (40 C.F.R. § 122.41(d).)

D. Proper Operation and Maintenance

The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Discharger to achieve compliance with the conditions of this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by a Discharger only when necessary to achieve compliance with the conditions of this Order. (40 C.F.R. § 122.41(e).)

E. Property Rights

1. This Order does not convey any property rights of any sort or any exclusive privileges. (40 C.F.R. § 122.41(g).)
2. The issuance of this Order does not authorize any injury to persons or property or invasion of other private rights, or any infringement of state or local law or regulations. (40 C.F.R. § 122.5(c).)

F. Inspection and Entry

The Discharger shall allow the Los Angeles Regional Water Board, State Water Board, U.S. EPA, and/or their authorized representatives (including an authorized contractor acting as their representative), upon the presentation of credentials and other documents, as may be required by law, to (40 C.F.R. § 122.41(i); Wat. Code, § 13383):

1. Enter upon the Discharger's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order (40 C.F.R. § 122.41(i)(1));

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order (40 C.F.R. § 122.41(i)(2));

3. Inspect and photograph, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order (40 C.F.R. § 122.41(i)(3)); and

4. Sample or monitor, at reasonable times, for the purposes of assuring Order compliance or as otherwise authorized by the CWA or the Water Code, any substances or parameters at any location. (40 C.F.R. § 122.41(i)(4).)

G. Bypass

1. Definitions

   a. “Bypass” means the intentional diversion of waste streams from any portion of a treatment facility. (40 C.F.R. § 122.41(m)(1)(i).)

   b. “Severe property damage” means substantial physical damage to property, damage to the treatment facilities, which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production. (40 C.F.R. § 122.41(m)(1)(ii).)

2. Bypass not exceeding limitations. The Discharger may allow any bypass to occur which does not cause exceedances of effluent limitations, but only if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions listed in Standard Provisions – Permit Compliance I.G.3, I.G.4, and I.G.5 below. (40 C.F.R. § 122.41(m)(2).)

3. Prohibition of bypass. Bypass is prohibited, and the Los Angeles Regional Water Board may take enforcement action against a Discharger for bypass, unless (40 C.F.R. § 122.41(m)(4)(i)):

   a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage (40 C.F.R. § 122.41(m)(4)(i)(A));

   b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance (40 C.F.R. § 122.41(m)(4)(i)(B)); and

   c. The Discharger submitted notice to the Los Angeles Regional Water Board as required under Standard Provisions – Permit Compliance I.G.5 below. (40 C.F.R. § 122.41(m)(4)(i)(C).)

4. The Los Angeles Regional Water Board may approve an anticipated bypass, after considering its adverse effects, if the Los Angeles Regional Water Board determines that it will meet the three conditions listed in Standard Provisions – Permit Compliance I.G.3 above. (40 C.F.R. § 122.41(m)(4)(ii).)

5. Notice

   a. Anticipated bypass. If the Discharger knows in advance of the need for a bypass, it shall submit a notice, if possible at least 10 days before the date of the bypass. (40 C.F.R. § 122.41(m)(3)(i).)

b. Unanticipated bypass. The Discharger shall submit notice of an unanticipated bypass as required in Standard Provisions - Reporting V.E below (24-hour notice). (40 C.F.R. § 122.41(m)(3)(ii).)

H. Upset

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the Discharger. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. (40 C.F.R. § 122.41(n)(1).)

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of Standard Provisions – Permit Compliance I.H.2 below are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review. (40 C.F.R. § 122.41(n)(2).)
2. Conditions necessary for a demonstration of upset. A Discharger who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that (40 C.F.R. § 122.41(n)(3)):
   a. An upset occurred and that the Discharger can identify the cause(s) of the upset (40 C.F.R. § 122.41(n)(3)(i));
   b. The permitted facility was, at the time, being properly operated (40 C.F.R. § 122.41(n)(3)(ii));
   c. The Discharger submitted notice of the upset as required in Standard Provisions – Reporting V.E.2.b below (24-hour notice) (40 C.F.R. § 122.41(n)(3)(iii)); and
   d. The Discharger complied with any remedial measures required under Standard Provisions – Permit Compliance I.C above. (40 C.F.R. § 122.41(n)(3)(iv).)
3. Burden of proof. In any enforcement proceeding, the Discharger seeking to establish the occurrence of an upset has the burden of proof. (40 C.F.R. § 122.41(n)(4).)

II. STANDARD PROVISIONS – PERMIT ACTION

A. General

This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Discharger for modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any Order condition. (40 C.F.R. § 122.41(f).)

B. Duty to Reapply

If the Discharger wishes to continue an activity regulated by this Order after the expiration date of this Order, the Discharger must apply for and obtain a new permit. (40 C.F.R. § 122.41(b).)

C. Transfers

This Order is not transferable to any person except after notice to the Los Angeles Regional Water Board. The Los Angeles Regional Water Board may require modification or revocation and reissuance of the Order to change the name of the Discharger and incorporate such other requirements as may be necessary under the CWA and the Water Code. (40 C.F.R. § 122.41(l)(3); § 122.61.)

III. STANDARD PROVISIONS – MONITORING

A. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. (40 C.F.R. § 122.41(j)(1).)

B. Monitoring results must be conducted according to test procedures under 40 C.F.R. part 136 or, in the case of sludge use or disposal, approved under 40 C.F.R. part 136 unless otherwise specified in 40 C.F.R. part 503 unless other test procedures have been specified in this Order. (40 C.F.R. § 122.41(j)(4); § 122.44(i)(1)(iv).)

IV. STANDARD PROVISIONS – RECORDS

A. Except for records of monitoring information required by this Order related to the Discharger's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 C.F.R. part 503), the Discharger shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Order, and records of all data used to complete the application for this Order, for a period of at least three (3) years from the date of the sample, measurement, report or application. This period may be extended by request of the Los Angeles Regional Water Board Executive Officer at any time. (40 C.F.R. § 122.41(j)(2).)

B. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements (40 C.F.R. § 122.41(j)(3)(i));
2. The individual(s) who performed the sampling or measurements (40 C.F.R. § 122.41(j)(3)(ii));
3. The date(s) analyses were performed (40 C.F.R. § 122.41(j)(3)(iii));
4. The individual(s) who performed the analyses (40 C.F.R. § 122.41(j)(3)(iv));
5. The analytical techniques or methods used (40 C.F.R. § 122.41(j)(3)(v)); and
6. The results of such analyses. (40 C.F.R. § 122.41(j)(3)(vi).)

C. Claims of confidentiality for the following information will be denied (40 C.F.R. § 122.7(b)):

1. The name and address of any permit applicant or Discharger (40 C.F.R. § 122.7(b)(1)); and
2. Permit applications and attachments, permits and effluent data. (40 C.F.R. § 122.7(b)(2).)

V. STANDARD PROVISIONS – REPORTING

A. Duty to Provide Information

The Discharger shall furnish to the Los Angeles Regional Water Board, State Water Board, or U.S. EPA within a reasonable time, any information which the Los Angeles Regional Water Board, State Water Board, or U.S. EPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order or to determine compliance with this Order. Upon request, the Discharger shall also furnish to the Los Angeles Regional Water

Board, State Water Board, or U.S. EPA copies of records required to be kept by this Order. (40 C.F.R. § 122.41(h); Wat. Code, § 13267.)

B. Signatory and Certification Requirements

1. All applications, reports, or information submitted to the Los Angeles Regional Water Board, State Water Board, and/or U.S. EPA shall be signed and certified in accordance with Standard Provisions – Reporting V.B.2, V.B.3, V.B.4, and V.B.5 below. (40 C.F.R. § 122.41(k).)
2. All permit applications shall be signed by either a principal executive officer or ranking elected official. For purposes of this provision, a principal executive officer of a federal agency includes: (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of U.S. EPA). (40 C.F.R. § 122.22(a)(3).).
3. All reports required by this Order and other information requested by the Los Angeles Regional Water Board, State Water Board, or U.S. EPA shall be signed by a person described in Standard Provisions – Reporting V.B.2 above, or by a duly authorized representative of that person. A person is a duly authorized representative only if:
   - **a.** The authorization is made in writing by a person described in Standard Provisions – Reporting V.B.2 above (40 C.F.R. § 122.22(b)(1));
   - **b.** The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) (40 C.F.R. § 122.22(b)(2)); and
   - **c.** The written authorization is submitted to the Los Angeles Regional Water Board and State Water Board. (40 C.F.R. § 122.22(b)(3).)
4. If an authorization under Standard Provisions – Reporting V.B.3 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Standard Provisions – Reporting V.B.3 above must be submitted to the Los Angeles Regional Water Board and State Water Board prior to or together with any reports, information, or applications, to be signed by an authorized representative. (40 C.F.R. § 122.22(c).)
5. Any person signing a document under Standard Provisions – Reporting V.B.2 or V.B.3 above shall make the following certification:

   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." (40 C.F.R. § 122.22(d).)

C. Monitoring Reports

1. Monitoring results shall be reported at the intervals specified in the Monitoring and Reporting Program (Attachment E) in this Order. (40 C.F.R. § 122.41(l)(4).)
2. Monitoring results must be reported on a Discharge Monitoring Report (DMR) form or forms provided or specified by the Los Angeles Regional Water Board or State Water Board for reporting results of monitoring of sludge use or disposal practices. (40 C.F.R. § 122.41(l)(4)(i).)
3. If the Discharger monitors any pollutant more frequently than required by this Order using test procedures approved under 40 C.F.R. part 136, or another method required for an industry-specific waste stream under 40 C.F.R. subchapters N or O, the results of such monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Los Angeles Regional Water Board. (40 C.F.R. § 122.41(l)(4)(ii).)
4. Calculations for all limitations, which require averaging of measurements, shall utilize an arithmetic mean unless otherwise specified in this Order. (40 C.F.R. § 122.41(l)(4)(iii).)

D. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Order, shall be submitted no later than 14 days following each schedule date. (40 C.F.R. § 122.41(l)(5).)

E. Twenty-Four Hour Reporting

1. The Discharger shall report any noncompliance that may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the Discharger becomes aware of the circumstances. A written submission shall also be provided within five (5) days of the time the Discharger becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. (40 C.F.R. § 122.41(l)(6)(i).)
2. The following shall be included as information that must be reported within 24 hours under this paragraph (40 C.F.R. § 122.41(l)(6)(ii)):
   - **a.** Any unanticipated bypass that exceeds any effluent limitation in this Order. (40 C.F.R. § 122.41(l)(6)(ii)(A).)
   - **b.** Any upset that exceeds any effluent limitation in this Order. (40 C.F.R. § 122.41(l)(6)(ii)(B).)
3. The Los Angeles Regional Water Board may waive the above-required written report under this provision on a case-by-case basis if an oral report has been received within 24 hours. (40 C.F.R. § 122.41(l)(6)(iii).)

F. Planned Changes

The Discharger shall give notice to the Los Angeles Regional Water Board as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required under this provision only when (40 C.F.R. § 122.41(l)(1)):

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in section 122.29(b) (40 C.F.R. § 122.41(l)(1)(i)); or
2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are subject neither to effluent limitations in this Order nor to notification requirements under section 122.42(a)(1) (see Additional Provisions—Notification Levels VII.A.1). (40 C.F.R. § 122.41(l)(1)(ii).)
3. The alteration or addition results in a significant change in the Discharger's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan. (40 C.F.R.§ 122.41(l)(1)(iii).)

G. Anticipated Noncompliance

The Discharger shall give advance notice to the Los Angeles Regional Water Board or State Water Board of any planned changes in the permitted facility or activity that may result in noncompliance with this Order's requirements. (40 C.F.R. § 122.41(l)(2).)

H. Other Noncompliance

The Discharger shall report all instances of noncompliance not reported under Standard Provisions – Reporting V.C, V.D, and V.E above at the time monitoring reports are submitted. The reports shall contain the information listed in Standard Provision – Reporting V.E above. (40 C.F.R. § 122.41(l)(7).)

I. Other Information

When the Discharger becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Los Angeles Regional Water Board, State Water Board, or U.S. EPA, the Discharger shall promptly submit such facts or information. (40 C.F.R. § 122.41(l)(8).)

VI. STANDARD PROVISIONS – ENFORCEMENT

The Los Angeles Regional Water Board is authorized to enforce the terms of this permit under several provisions of the Water Code, including, but not limited to, sections 13385, 13386, and 13387.

VII. ADDITIONAL PROVISIONS – NOTIFICATION LEVELS

A. Non-Municipal Facilities

Existing manufacturing, commercial, mining, and silvicultural Dischargers shall notify the Los Angeles Regional Water Board as soon as they know or have reason to believe (40 C.F.R. § 122.42(a)):

1. That any activity has occurred or will occur that would result in the discharge, on a routine or frequent basis, of any toxic pollutant that is not limited in this Order, if that discharge will exceed the highest of the following "notification levels" (40 C.F.R. § 122.42(a)(1)):
   - **a.** 100 micrograms per liter (μg/L) (40 C.F.R. § 122.42(a)(1)(i));

b. 200 µg/L for acrolein and acrylonitrile; 500 µg/L for 2,4-dinitrophenol and 2-methyl-4,6-dinitrophenol; and 1 milligram per liter (mg/L) for antimony (40 C.F.R. § 122.42(a)(1)(ii));

c. Five (5) times the maximum concentration value reported for that pollutant in the Report of Waste Discharge (40 C.F.R. § 122.42(a)(1)(iii)); or

d. The level established by the Los Angeles Regional Water Board in accordance with section 122.44(f). (40 C.F.R. § 122.42(a)(1)(iv).)

2. That any activity has occurred or will occur that would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant that is not limited in this Order, if that discharge will exceed the highest of the following “notification levels" (40 C.F.R. § 122.42(a)(2)):

a. 500 micrograms per liter (µg/L) (40 C.F.R. § 122.42(a)(2)(i));

b. 1 milligram per liter (mg/L) for antimony (40 C.F.R. § 122.42(a)(2)(ii));

c. Ten (10) times the maximum concentration value reported for that pollutant in the Report of Waste Discharge (40 C.F.R. § 122.42(a)(2)(iii)); or

d. The level established by the Los Angeles Regional Water Board in accordance with section 122.44(f). (40 C.F.R. § 122.42(a)(2)(iv).)

B. Publicly-Owned Treatment Works (POTWs)

All POTWs shall provide adequate notice to the Los Angeles Regional Water Board of the following (40 C.F.R. § 122.42(b)):

1. Any new introduction of pollutants into the POTW from an indirect discharger that would be subject to sections 301 or 306 of the CWA if it were directly discharging those pollutants (40 C.F.R. § 122.42(b)(1)); and
2. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of adoption of the Order. (40 C.F.R. § 122.42(b)(2).)
3. Adequate notice shall include information on the quality and quantity of effluent introduced into the POTW as well as any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW. (40 C.F.R. § 122.42(b)(3).)

ATTACHMENT E – MONITORING AND REPORTING PROGRAM (MRP NO. 9404)

Contents

Tables

ATTACHMENT E – MONITORING AND REPORTING PROGRAM (MRP) NO. 9404

The Code of Federal Regulations (40 C.F.R. § 122.48) requires that all NPDES permits specify monitoring and reporting requirements. Water Code sections 13267 and 13383 also authorize the <Los Angeles Regional Water Board to require technical and monitoring reports. This MRP establishes monitoring and reporting requirements that implement federal and California regulations.

I. GENERAL MONITORING PROVISIONS

A. An effluent sampling station shall be established for the point of discharge (Discharge Point 001 [Latitude 34° 08′ 34.75″ North, Longitude 119° 11′ 33.72″ West]) and shall be located where representative samples of that effluent can be obtained.

B. Effluent samples shall be taken downstream of any treatment works and prior to mixing with the receiving waters.

C. The Los Angeles Regional Water Board shall be notified in writing of any change in the sampling stations once established or in the methods for determining the quantities of pollutants in the individual waste streams.

D. Pollutants shall be analyzed using the analytical methods described in 40 CFR sections 136.3, 136.4, and 136.5 (revised May 18, 2012); or, where no methods are specified for a given pollutant, by methods approved by this Regional Water Board or the State Water Resources Control Board (State Water Board). Laboratories analyzing effluent samples and receiving water samples shall be certified by the California Department of Public Health Environmental Laboratory Accreditation Program (ELAP) or approved by the Executive Officer and must include quality assurance/quality control (QA/QC) data in their reports. A copy of the laboratory certification shall be provided each time a new certification and/or renewal of the certification is obtained from ELAP.

E. For any analyses performed for which no procedure is specified in the U.S. Environmental Protection Agency (USEPA) guidelines or in the MRP, the constituent or parameter analyzed and the method or procedure used must be specified in the monitoring report.

F. Each monitoring report must affirm in writing that "all analyses were conducted at a laboratory certified for such analyses by the Department of Public Health or approved by the Executive Officer and in accordance with current USEPA guideline procedures or as specified in this MRP".

G. The monitoring reports shall specify the analytical method used, the Method Detection Limit (MDL), and the Minimum Level (ML) for each pollutant. For the purpose of reporting compliance with numerical limitations, performance goals, and receiving water limitations, analytical data shall be reported by one of the. following methods, as appropriate:

1. actual numerical value for sample results greater than or equal to the ML; or
2. "Detected, but Not Quantified (DNQ)" if results are greater than or equal to the laboratory's MDL but less than the ML; or,
3. "Not-Detected (ND)" for sample results less than the laboratory's MDL with the MDL indicated for the analytical method used.

Analytical data reported as "less than" for the purpose of reporting compliance with permit limitations shall be the same or lower than the permit limit(s) established for the given parameter'.

Current MLs (Attachment H) are those published in Appendix II of the Ocean Plan. In addition, samples for metals analyses, waste seawater discharge, storm water effluent samples, reference station samples, and receiving water samples must be analyzed by the approved analytical method with the lowest MDL (currently Inductively Coupled Plasma/Mass Spectrometry) described in the Ocean Plan.

H. Where possible, the MLs employed for effluent analyses shall be lower than the permit limitations established for a given parameter. If the ML value is not below the effluent limitation, then the lowest ML value and its associated analytical method shall be selected for compliance purposes. At least once a year, the Discharger shall submit a list of the analytical methods employed for each test and associated laboratory QA/QC procedures.

The Regional Water Board, in consultation with the State Water Board Quality Assurance Program, shall establish a ML that is not contained in Attachment H to be included in the Discharger's permit in any of the following situations:

1. When the pollutant under consideration is not included in Attachment H;
2. When the Discharger and Regional Water Board agree to include in the permit a test method that is more sensitive than that specified in 40 CFR section 136 (revised May 18, 2012);
3. When the Discharger agrees to use an ML that is lower than that listed in Attachment H;
4. When the Discharger demonstrates that the calibration standard matrix is sufficiently different from that used to establish the ML in Attachment H, and proposes an appropriate ML for their matrix; or,
5. When the Discharger uses a method whose quantification practices are not consistent with the definition of an ML. Examples of such methods are the USEPA-approved method 1613 for dioxins and furans, method 1624 for volatile organic substances, and method 1625 for semi-volatile organic substances. In such cases, the Discharger, the Regional Water Board, and the State Water Board shall agree on a lowest quantifiable limit and that limit will substitute for the ML for reporting and compliance determination purposes.

I. Water/wastewater samples must be analyzed within allowable holding time limits as specified in section 136.3. All QA/QC items must be run on the same dates the samples were actually analyzed, and the results shall be reported in the Regional Water Board format, when it becomes available, and submitted with the laboratory reports. Proper chain of custody procedures must be followed, and a copy of the chain of custody shall be submitted with the report.

J. All analyses shall be accompanied by the chain of custody, including but not limited to date and time of sampling, sample identification, and name of person who performed sampling, date of analysis, name of person who performed analysis, QA/QC data, method detection limits, analytical methods, copy of laboratory certification, and a perjury statement executed by the person responsible for the laboratory.

K. The Discharger shall calibrate and perform maintenance procedures on all monitoring instruments and to insure accuracy of measurements, or shall insure that both equipment activities will be conducted.

L. The Discharger shall have, and implement, an acceptable written quality assurance (QA) plan for laboratory analyses. Unless otherwise specified in the analytical method, duplicate samples must be analyzed at a frequency of 5% (1 in 20 samples) with at least one if there are fewer than 20 samples in a batch. A batch is defined as a single analytical run encompassing no more than 24 hours from start to finish. A similar frequency shall be maintained for analyzing spiked samples.

M. When requested by the Regional Water Board or USEPA, the Discharger will participate in the NPDES discharge monitoring report QA performance study. The Discharger must have a success rate equal to or greater than 80%.

N. For parameters that both average monthly and daily maximum limits are specified and the monitoring frequency is less than four times a month, the following shall apply. If an analytical result is greater than the average monthly limit, the Discharger shall collect four additional samples at approximately equal intervals during the month, if possible, until compliance with the average monthly limit has been demonstrated. All five analytical results shall be reported in the monitoring report for that month, or 45 days after results for the additional samples were received, whichever is later. In the event of noncompliance with an average monthly effluent limitation, the sampling frequency for that constituent shall be increased to weekly and shall continue at this level until compliance with the average monthly effluent limitation has been demonstrated. The Discharger shall provide for the approval of the Executive Officer a program to ensure future compliance with the average monthly limit.

O. In the event wastes are transported to a different disposal site during the report period, the following shall be reported in the monitoring report:

1. Types of wastes and quantity of each type;
2. Name and address for each hauler of wastes (or method of transport if other than by hauling); and
3. Location of the final point(s) of disposal for each type of waste.

If no wastes are transported off-site during the reporting period, a statement to that effect shall be submitted.

P. Each monitoring report shall state whether or not there was any change in the discharge as described in the Order during the reporting period.

II. MONITORING LOCATIONS

The Discharger shall establish the following monitoring locations to demonstrate compliance with the effluent limitations, discharge specifications, and other requirements in this Order:

Table E-1. Monitoring Station Locations

Discharge Point Name	Monitoring Location Name	Monitoring Location Description
001	EFF-001	Effluent discharged from the Facility (RSMP) [Latitude 34° 08' 34.75" N, Longitude 119° 11' 33.72" W]
---	RSW-001	Center line of mixing zone (within Zone of Initial Dilution)
---	RSW-002	Edge of establishing mixing zone area (Edge of Zone of Initial Dilution) (47 feet from the outfall at a depth of approximately 10 feet)*
---	RSW-003	Outside Zone of Initial Dilution (100 feet from the outfall at a depth of approximately 10 feet)*
---	RSW-004	Upstream of discharge location to the Pacific Ocean (along Oxnard's 4500 transect)*

* The proposed monitoring locations were selected based on the modeling results. These monitoring locations may be modified pending the results of the Mixing Zone Study.

The North latitude and West longitude information in Table E-1 are approximate for administrative purposes.

III. INFLUENT MONITORING REQUIREMENTS – NOT APPLICABLE

IV. EFFLUENT MONITORING REQUIREMENTS

A. Monitoring Location EFF-001

1. The Discharger shall monitor wastewater discharge at EFF-001 as follows. If more than one analytical test method is listed for a given parameter, the Discharger must select from the listed methods and corresponding Minimum Level:

Table E-2. Effluent Monitoring

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Flow	MGD	Recorder	Continuous [2]	[1]
Temperature	°F	Grab	1/Month	[1]
pH	pH unit	Grab	1/Month	[1]
Total Coliform	MPN/100 ml	Grab	1/Month	[1]
Fecal Coliform	MPN/100 ml	Grab	1/Month	[1]
Enterococcus	MPN/100 ml	Grab	1/Month	[1]
Dissolved Oxygen	mg/L	Grab	1/Month	[1]
Ammonia as N [3]	µg/L	Grab	1/Month	[1]
Total Residual Chlorine [3]	µg/L	Grab	1/Month	[1]
Chronic Toxicity [5]	Pass or Fail, % Effect	Grab	1/Month	[1]
Biochemical Oxygen Demand (BOD), 5-day @ 20°C [3]	mg/L	Grab	1/Quarter	[1]
Oil and Grease [2,3]	mg/L	Grab	1/Quarter	[1]
Settleable Solids	ml/L	Grab	1/Quarter	[1]
Total Suspended Solids (TSS) [3]	mg/L	Grab	1/Quarter	[1]
Turbidity	NTU	Grab	1/Quarter	[1]
Antimony, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Arsenic, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Beryllium Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Cadmium, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Chromium (III) , Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Chromium (VI) , Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Copper, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Lead, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Mercury, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Nickel, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Selenium, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Silver, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Thallium, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Zinc, Total Recoverable [3]	µg/L	Grab	1/Month [4]	[1]
Cyanide [3]	µg/L	Grab	1/Month [4]	[1]
Phenolic Compounds (non-chlorinated) [3,6]	µg/L	Grab	1/Month [4]	[1]
Chlorinated Phenolics [3,7]	µg/L	Grab	1/Month [4]	[1]
TCDD Equivalents [3,8]	µg/L	Grab	1/Month [4]	[1]
Acrolein [3]	µg/L	Grab	1/Month [4]	[1]
Acrylonitrile [3]	µg/L	Grab	1/Month [4]	[1]
Benzene [3]	µg/L	Grab	1/Month [4]	[1]
Carbon Tetrachloride [3]	µg/L	Grab	1/Month [4]	[1]
Chlorobenzene [3]	µg/L	Grab	1/Month [4]	[1]
Chlorodibromomethane [3]	µg/L	Grab	1/Month [4]	[1]
Chloroform [3]	µg/L	Grab	1/Month [4]	[1]
Dichlorobromomethane [3]	µg/L	Grab	1/Month [4]	[1]
1,2-Dichloroethane [3]	µg/L	Grab	1/Month [4]	[1]
1,1-Dichloroethylene [3]	µg/L	Grab	1/Month [4]	[1]
1,3-Dichloropropylene [3]	µg/L	Grab	1/Month [4]	[1]
Ethylbenzene [3]	µg/L	Grab	1/Month [4]	[1]
Halomethanes [3,9]	µg/L	Grab	1/Month [4]	[1]
Dichloromethane [3]	µg/L	Grab	1/Month [4]	[1]
1,1,2,2-Tetrachloroethane [3]	µg/L	Grab	1/Month [4]	[1]
Tetrachloroethylene [3]	µg/L	Grab	1/Month [4]	[1]
Toluene [3]	µg/L	Grab	1/Month [4]	[1]
1,1,1-Trichloroethane [3]	µg/L	Grab	1/Month [4]	[1]
1,1,2-Trichloroethane [3]	µg/L	Grab	1/Month [4]	[1]
Trichloroethylene [3]	µg/L	Grab	1/Month [4]	[1]
Vinyl Chloride [3]	µg/L	Grab	1/Month [4]	[1]
4,6-Dinitro-2-Methylphenol [3]	µg/L	Grab	1/Month [4]	[1]
2,4-Dinitrophenol [3]	µg/L	Grab	1/Month [4]	[1]
2,4,6-Trichlorophenol [3]	µg/L	Grab	1/Month [4]	[1]
Benzidine [3]	µg/L	Grab	1/Month [4]	[1]
PAHs [3,10]	µg/L	Grab	1/Month [4]	[1]
Bis(2-chloroethoxy)Methane [3]	µg/L	Grab	1/Month [4]	[1]
Bis(2-chlorotethyl)Ether [3]	µg/L	Grab	1/Month [4]	[1]
Bis(2-chloroisopropyl)Ether [3]	µg/L	Grab	1/Month [4]	[1]
Bis(2-ethylhexyl)Phthalate [3]	µg/L	Grab	1/Month [4]	[1]
Dichlorobenzenes [3]	µg/L	Grab	1/Month [4]	[1]
1,4-Dichlorobenzene [3]	µg/L	Grab	1/Month [4]	[1]

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
3,3'-Dichlorobenzidine [3]	µg/L	Grab	1/Month [4]	[1]
Diethyl Phthalate [3]	µg/L	Grab	1/Month [4]	[1]
Dimethyl Phthalate [3]	µg/L	Grab	1/Month [4]	[1]
Di-n-Butyl Phthalate [3]	µg/L	Grab	1/Month [4]	[1]
2,4-Dinitrotoluene [3]	µg/L	Grab	1/Month [4]	[1]
1,2-Diphenylhydrazine [3]	µg/L	Grab	1/Month [4]	[1]
Fluoranthene [3]	µg/L	Grab	1/Month [4]	[1]
Hexachlorobenzene [3]	µg/L	Grab	1/Month [4]	[1]
Hexachlorobutadiene [3]	µg/L	Grab	1/Month [4]	[1]
Hexachlorocyclopentadiene [3]	µg/L	Grab	1/Month [4]	[1]
Hexachloroethane [3]	µg/L	Grab	1/Month [4]	[1]
Isophorone [3]	µg/L	Grab	1/Month [4]	[1]
Nitrobenzene [3]	µg/L	Grab	1/Month [4]	[1]
N-Nitrosodimethylamine [3]	µg/L	Grab	1/Month [4]	[1]
N-Nitrosodi-N-propylamine [3]	µg/L	Grab	1/Month [4]	[1]
N-Nitrosodiphenylamine [3]	µg/L	Grab	1/Month [4]	[1]
Aldrin [3]	µg/L	Grab	1/Month [4]	[1]
HCH [3,11]	µg/L	Grab	1/Month [4]	[1]
Chlordane [3]	µg/L	Grab	1/Month [4]	[1]
DDT [3,12]	µg/L	Grab	1/Month [4]	[1]
Dieldrin [3]	µg/L	Grab	1/Month [4]	[1]
Endosulfan [3]	µg/L	Grab	1/Month [4]	[1]
Endrin [3]	µg/L	Grab	1/Month [4]	[1]
Heptachlor [3]	µg/L	Grab	1/Month [4]	[1]
Heptachlor Epoxide [3]	µg/L	Grab	1/Month [4]	[1]
PCBs [3,13]	µg/L	Grab	1/Month [4]	[1]
Toxaphene [3]	µg/L	Grab	1/Month [4]	[1]
Tributyltin [3]	µg/L	Grab	1/Month [4]	[1]
Radioactivity [14] (Including gross alpha, gross beta, combined radium-226 and radium-228, tritium, strontium-90 and uranium)	pCi/L	Grab	2/Year	[1]

1. Pollutants shall be analyzed using the analytical methods described in Part 136. For priority pollutants, the methods must meet the lowest minimum levels (MLs) specified in Appendix II of the Ocean Plan (2012) that is required to demonstrate compliance. Where no methods are specified for a given pollutant, the methods must be approved by this Los Angeles Regional Water Board or the State Water Board.
2. When continuous monitoring is required, the total daily flow (24-hour basis) shall be reported.
3. The mass emission (lbs/day) for the discharge shall be calculated and reported using the actual concentration and the actual flow rate measured at the time of discharge, using the formula:

   M = 8.34 x C x Q

   Where: M = mass discharge for a pollutant, lbs/day
   C = actual concentration for a pollutant, mg/L
   Q = actual discharge flow rate, MGD

4. Upon the commencement of discharges from the RSMP, if after 2 years all monitoring results for this constituent are reported as non-detect, using detection limits that are sufficiently sensitive to demonstrate compliance with effluent limitations, the sampling frequency for this constituent may be reduced to once per quarter. However, if after the reduction in monitoring frequency for this constituent is allowed, monitoring results are reported at concentrations greater than the applicable effluent limitation, the monitoring frequency for this constituent reverts to monthly until at least four consecutive samples demonstrate compliance with the effluent limitation.
5. Refer to section V, Whole Effluent Toxicity Testing Requirements. “Pass” or “Fail” for Median Monthly Effluent Limitation (MMEL). “Pass” or “Fail” and “% Effect” for Maximum Daily Effluent Limitation (MDEL). The MMEL for chronic toxicity shall only apply when there is a discharge more than one day in a calendar month period. During such calendar months, exactly three independent toxicity tests are required when one toxicity test results in “Fail”.
6. Non-chlorinated phenolic compounds represent the sum of 2-nitrophenol; phenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; and 4-nitrophenol.
7. Chlorinated phenolic compounds represent the sum of 2-chlorophenol; 2,4-dichlorophenol; 2,4,6-trichlorophenol; 4-chloro-3-methylphenol; and pentachlorophenol.
8. TCDD Equivalents shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below. USEPA method 1613 may be used to analyze dioxin and furan congeners.

Dioxin-TEQ (TCDD Equivalents) = $\Sigma\ (C_x \times TEF_x)$

Where:

C_x = concentration of dioxin or furan congener x

TEF_x = TEF for congener x

Toxicity Equivalence Factors

Isomer Group	Toxicity Equivalence Factor (TEF)
2,3,7,8-tetra CDD	1.0
2,3,7,8-penta CDD	0.5
2,3,7,8-hexa CDDs	0.1
2,3,7,8-hepta CDD	0.01
Octa CDD	0.001
2,3,7,8 tetra CDF	0.1
1,2,3,7,8 penta CDF	0.05
2,3,4,7,8 penta CDF	0.5
2,3,7,8 hexa CDFs	0.1
2,3,7,8 hepta CDFs	0.01

9. Halomethanes shall mean the sum of bromoform, bromomethane (methyl bromide), and chloromethane (methyl chloride).
10. PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo(k)fluoranthene, 1,12-benzoperylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene.
11. HCH shall mean the sum of alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.
12. DDT shall mean the sum of 4,4'-DDT, 2,4'-DDT, 4,4'-DDE, 2,4'-DDE, 4,4'-DDD and 2,4'-DDD.
13. PCBs shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254 and Aroclor-1260.
14. Analyze these radiochemicals by the following USEPA methods:

    Method 900.0 for gross alpha and gross beta; Method 903.0 or 903.1 for radium-226;

    Method 904.0 for radium-228; Method 906.0 for tritium;

    Method 905.0 for strontium-90; Method 908.0 for uranium.

    Analysis for combined radium-226 & 228 shall be conducted only if gross alpha results for the same sample exceed 15 pCi/L or beta greater than 50 pCi/L. If radium-226 & 228 exceeds 5 pCi/L, analyze for tritium, strontium-90 and uranium.

V. WHOLE EFFLUENT TOXICITY TESTING REQUIREMENTS

A. Chronic Toxicity Testing

1. **Discharge In-stream Waste Concentration (IWC) for Chronic Toxicity**

   The chronic toxicity IWC for this discharge is **1.37 percent** [1/(72+1)] effluent. For receiving water monitoring, the IWC shall be 100% of the sample collected at the specified station location for receiving water monitoring.

2. **Sample Volume and Holding Time**

   The total sample volume shall be determined by the specific toxicity test method used. Sufficient sample volume shall be collected to perform the required toxicity test. For the receiving water, sufficient sample volume shall be collected for subsequent TIE studies, if necessary, at each sampling event. All toxicity tests shall be conducted as soon as possible following sample collection. No more than 36 hours shall elapse before the conclusion of sample collection and test initiation.

3. **Chronic Marine and Estuarine Species and Test Methods**

   If effluent samples are collected from outfalls discharging to receiving waters with salinity ≥1 ppt, the Discharger shall conduct the following chronic toxicity tests on effluent samples—at the in-stream waste concentration for the discharge—in accordance with species and test methods in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136, 1995). Artificial sea salts shall be used to increase sample salinity. In no case shall these species be substituted with another test species unless written authorization from the Executive Officer is received.

   a. A static renewal toxicity test with the topsmelt, *Atherinops affinis* (Larval Survival and Growth Test Method 1006.01).

   b. A static non-renewal toxicity test with the purple sea urchin, *Strongylocentrotus purpuratus*, and the sand dollar, *Dendraster excentricus* (Fertilization Test Method 1008.0), or a static non-renewal toxicity test with the red abalone, *Haliotis rufescens* (Larval Shell Development Test Method).

   c. A static non-renewal toxicity test with the giant kelp, *Macrocystis pyrifera* (Germination and Growth Test Method 1009.0).

4. **Chronic Freshwater Species and Test Methods**

   If effluent samples are collected from outfalls discharging to receiving waters with salinity <1 ppt, the Discharger shall conduct the following chronic toxicity tests on effluent samples—at the in-stream waste concentration for the discharge—in accordance with species and test methods in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA/821/R-02/013, 2002; Table IA, 40 CFR section 136). In no case shall these species be substituted with another test species unless written authorization from the Executive Officer is received.

   a. A static renewal toxicity test with the fathead minnow, *Pimephales promelas* (Larval Survival and Growth Test Method 1000.0).

   b. A static renewal toxicity test with the daphnid, *Ceriodaphnia dubia* (Survival and Reproduction Test Method 1002.01).

c. A static renewal toxicity test with the green alga, *Selenastrum capricornutum* (also named *Raphidocelis subcapitata*) (Growth Test Method 1003.0).

5. **Species Sensitivity Screening**

Species sensitivity screening shall be conducted during this permit's first three monthly monitorings. For each monthly sampling event, the Discharger shall collect a single effluent sample and concurrently conduct three toxicity tests using the fish, an invertebrate, and the alga species previously referenced. The species that exhibits the highest "Percent Effect" at the discharge IWC during species sensitivity screening shall be used for the routine monthly monitoring.

Species sensitivity rescreening is required every <u>24 months</u>. The Discharger shall rescreen with the fish, an invertebrate, and the alga species previously referenced and continue to monitor with the most sensitive species. If the first suite of rescreening tests demonstrates that the same species is the most sensitive then the rescreening does not need to include more than one suit of tests. If a different species is the most sensitive or if there is ambiguity, then the Discharger shall proceed with suites of screening tests for a minimum of three, but not to exceed five suites.

6. **Quality Assurance and Additional Requirements**

Quality assurance measures, instructions, and other recommendations and requirements are found in the test methods manual previously referenced. Additional requirements are specified below.

a. The discharge is subject to determination of "Pass" or "Fail" and "Percent Effect" from a single-effluent concentration chronic toxicity test at the discharge IWC using the Test of Significant Toxicity (TST) approach described in *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document* (EPA 833-R-10-003, 2010), Appendix A, Figure A-1, and Table A-1. The null hypothesis (H_o) for the TST approach is: Mean discharge IWC response ≤0.75 × Mean control response. A test result that rejects this null hypothesis is reported as "Pass". A test result that does not reject this null hypothesis is reported as "Fail". The relative "Percent Effect" at the discharge IWC is defined and reported as: ((Mean control response – Mean discharge IWC response) ÷ Mean control response)) × 100.

b. The Median Monthly Effluent Limit (MMEL) for chronic toxicity only applies when there is a discharge more than one day in a calendar month period. During such calendar months, exactly three independent toxicity tests are required when one toxicity test results in "Fail".

c. If the effluent toxicity test does not meet all test acceptability criteria (TAC) specified in the referenced test method, then the Discharger must re-sample and re-test within 14 days.

d. Dilution water and control water, including brine controls, shall be laboratory water prepared and used as specified in the test methods manual. If dilution water and control water is different from test organism culture water, then a second control using culture water shall also be used.

e. Reference toxicant tests and effluent toxicity tests shall be conducted using the same test conditions (e.g., same test duration, etc.). Monthly reference toxicant testing is sufficient.

f. All reference toxicant test results should be reviewed and reported according to EPA guidance on the evaluation of concentration-response relationships found in *Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing* (40 CFR section 136) (EPA 821-B-00-004, 2000).

g. The Discharger shall perform toxicity tests on final effluent samples. Chlorine and ammonia shall not be removed from the effluent sample prior to toxicity testing, unless explicitly authorized under this section of the Monitoring and Reporting Program and the rationale is explained in the Fact Sheet (Attachment F).

7. **Preparation of Initial Investigation TRE Work Plan**

The Discharger shall prepare or update and submit a generic Initial Investigation TRE Work Plan (1-2 pages) within **90 days** of the permit effective date, to be ready to respond to toxicity events. The Discharger shall review and update this work plan as necessary so it remains current and applicable to the discharge. At minimum, the work plan shall include:

a. A description of the investigation and evaluation techniques that would be used to identify potential causes and sources of toxicity, effluent variability, and treatment system efficiency.

b. A description of methods for maximizing in-house treatment system efficiency, good housekeeping practices, and a list of all chemicals used in operations at the facility.

c. If a Toxicity Identification Evaluation (TIE) is necessary, an indication of who would conduct the TIEs (i.e., an in-house expert or outside contractor).

8. **Accelerated Monitoring Schedule for Median Monthly Summary Result: "Fail" (or Maximum Daily Single Result: "Fail and % Effect ≥50").** The summary result shall be used when there is discharge more than one day in a calendar month. The single result shall be used when there is discharge of only one day in a calendar month.

Within 24 hours of the time the Discharger becomes aware of this result, the Discharger shall implement an accelerated monitoring schedule consisting of four, five-concentration toxicity tests (including the discharge IWC), conducted at approximately two week intervals, over an eight week period. If each of the accelerated toxicity tests results in "Pass", the Discharger shall return to routine monitoring for the next monitoring period. If one of the accelerated toxicity tests results in "Fail", the Discharger shall immediately implement the Toxicity Reduction Evaluation (TRE) Process conditions set forth below.

9. **Toxicity Reduction Evaluation (TRE) Process**

a. **Preparation and Implementation of Detailed TRE Work Plan.** The Discharger shall immediately initiate a TRE using, according to the type of treatment facility, EPA manual *Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants* (EPA/833/B-99/002, 1999) or EPA manual *Generalized Methodology for Conducting Industrial Toxicity Reduction Evaluations* (EPA/600/2-88/070, 1989) and, within 30 days, submit to the Executive Officer a Detailed TRE Work Plan, which shall follow the generic Initial Investigation TRE Work Plan revised as appropriate for this toxicity event. It shall include the following information, and comply with additional conditions set by the Executive Officer:

i. Further actions by the Discharger to investigate, identify, and correct the causes of toxicity.

ii. Actions the Discharger will take to mitigate the effects of the discharge and prevent the recurrence of toxicity.

iii. A schedule for these actions, progress reports, and the final report.

b. **TIE Implementation.** The Discharger may initiate a TIE as part of a TRE to identify the causes of toxicity using the same species and test method and, as guidance, EPA manuals: *Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures* (EPA/600/6-91/003, 1991); *Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600/R-92/080, 1993); *Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600/R-92/081, 1993); and *Marine Toxicity Identification Evaluation (TIE): Phase I Guidance Document* (EPA/600/R-96-054, 1996). The TIE should be conducted on the species demonstrating the most sensitive toxicity response.

c. Many recommended TRE elements parallel required or recommended efforts for source control, pollution prevention, and storm water control programs. TRE efforts should be coordinated with such efforts. As toxic substances are identified or characterized, the Discharger shall continue the TRE by determining the sources and evaluating alternative strategies for reducing or eliminating the substances from the discharge. All reasonable steps shall be taken to reduce toxicity to levels consistent with toxicity evaluation parameters.

d. The Discharger shall conduct routine effluent monitoring for the duration of the TRE process. Additional accelerated monitoring and TRE work plans are not required once a TRE is begun.

e. The Regional Water Board recognizes that toxicity may be episodic and identification of causes and reduction of sources of toxicity may not be successful in all cases. The TRE may be ended at any stage if monitoring finds there is no longer toxicity.

10. **Reporting**

The Self Monitoring Report (SMR) shall include a full laboratory report for each toxicity test. This report shall be prepared using the format and content of the test methods manual chapter called Report Preparation, including:

a. The toxicity test results for the TST approach, reported as “Pass” or “Fail” and “Percent Effect” at the chronic toxicity IWC for the discharge.

b. Water quality measurements for each toxicity test (e.g., pH, dissolved oxygen, temperature, conductivity, hardness, salinity, chlorine, ammonia).

c. TRE/TIE results. The Executive Officer shall be notified no later than 30 days from completion of each aspect of TRE/TIE analyses.

d. Statistical program (e.g., TST calculator, CETIS, etc.) output results for each toxicity test.

VI. LAND DISCHARGE MONITORING REQUIREMENTS – NOT APPLICABLE

VII. RECYCLING MONITORING REQUIREMENTS – NOT APPLICABLE

VIII. RECEIVING WATER MONITORING REQUIREMENTS

A. Monitoring Location RSW-001, RSW-002, RSW-003, and RSW-004

1. The Discharger shall monitor the Pacific Ocean (Hueneme) at **RSW-001, RSW-002, RSW-003, and RSW-004** as follows:

Table E-3. Receiving Water Monitoring Requirements

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Temperature	°F	Grab	1/Quarter	[1]
BOD, 5-day @ 20°C	mg/L	Grab	1/Quarter	[1]
Total Suspended Solids (TSS)	mg/L	Grab	1/Quarter	[1]
pH	pH unit	Grab	1/Quarter	[1]
Oil and Grease	mg/L	Grab	1/Quarter	[1]
Settleable Solids	ml/L	Grab	1/Quarter	[1]
Turbidity	NTU	Grab	1/Quarter	[1]
Chronic Toxicity [2]	Pass or Fail, % Effect	Grab	1/Monthly [12]	[1]
Dissolved Oxygen	mg/L	Grab	1/Quarter	[1]
Total Residual Chlorine	µg/L	Grab	1/Month [3]	[1]
Ammonia as N	µg/L	Grab	1/Month [3]	[1]
Total Coliform	MPN/100 ml	Grab	1/Month [3]	[1]
Fecal Coliform	MPN/100 ml	Grab	1/Month [3]	[1]
Enterococcus	MPN/100 ml	Grab	1/Month [3]	[1]
Antimony, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Arsenic, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Beryllium, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Cadmium, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Chromium (III), Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Chromium (VI), Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Copper, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Lead, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Mercury, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Nickel, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Selenium, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Silver, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Thallium, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Zinc, Total Recoverable	µg/L	Grab	1/Month [3]	[1]
Cyanide	µg/L	Grab	1/Month [3]	[1]
Phenolic Compounds (non-chlorinated) [4]	µg/L	Grab	1/Month [3]	[1]
Chlorinated Phenolics [5]	µg/L	Grab	1/Month [3]	[1]

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
TCDD Equivalents [6]	µg/L	Grab	1/Month [3]	[1]
Acrolein	µg/L	Grab	1/Month [3]	[1]
Acrylonitrile	µg/L	Grab	1/Month [3]	[1]
Benzene	µg/L	Grab	1/Month [3]	[1]
Carbon Tetrachloride	µg/L	Grab	1/Month [3]	[1]
Chlorobenzene	µg/L	Grab	1/Month [3]	[1]
Chlorodibromomethane	µg/L	Grab	1/Month [3]	[1]
Chloroform	µg/L	Grab	1/Month [3]	[1]
Dichlorobromomethane	µg/L	Grab	1/Month [3]	[1]
1,2-Dichloroethane	µg/L	Grab	1/Month [3]	[1]
1,1-Dichloroethylene	µg/L	Grab	1/Month [3]	[1]
1,3-Dichloropropylene	µg/L	Grab	1/Month [3]	[1]
Ethylbenzene	µg/L	Grab	1/Month [3]	[1]
Halomethanes [7]	µg/L	Grab	1/Month [3]	[1]
Dichloromethane	µg/L	Grab	1/Month [3]	[1]
1,1,2,2-Tetrachloroethane	µg/L	Grab	1/Month [3]	[1]
Tetrachloroethylene	µg/L	Grab	1/Month [3]	[1]
Toluene	µg/L	Grab	1/Month [3]	[1]
1,1,1-Trichloroethane	µg/L	Grab	1/Month [3]	[1]
1,1,2-Trichloroethane	µg/L	Grab	1/Month [3]	[1]
Trichloroethylene	µg/L	Grab	1/Month [3]	[1]
Vinyl Chloride	µg/L	Grab	1/Month [3]	[1]
4,6-Dinitro-2-Methylphenol	µg/L	Grab	1/Month [3]	[1]
2,4-Dinitrophenol	µg/L	Grab	1/Month [3]	[1]
2,4,6-Trichlorophenol	µg/L	Grab	1/Month [3]	[1]
Benzidine	µg/L	Grab	1/Month [3]	[1]
PAHs [8]	µg/L	Grab	1/Month [3]	[1]
Bis(2-chloroethoxy)Methane	µg/L	Grab	1/Month [3]	[1]
Bis(2-chlorotethyl)Ether	µg/L	Grab	1/Month [3]	[1]
Bis(2-chloroisopropyl)Ether	µg/L	Grab	1/Month [3]	[1]
Bis(2-ethylhexyl)Phthalate	µg/L	Grab	1/Month [3]	[1]
Dichlorobenzenes	µg/L	Grab	1/Month [3]	[1]
1,4-Dichlorobenzene	µg/L	Grab	1/Month [3]	[1]
3,3'-Dichlorobenzidine	µg/L	Grab	1/Month [3]	[1]
Diethyl Phthalate	µg/L	Grab	1/Month [3]	[1]
Dimethyl Phthalate	µg/L	Grab	1/Month [3]	[1]
Di-n-Butyl Phthalate	µg/L	Grab	1/Month [3]	[1]
2,4-Dinitrotoluene	µg/L	Grab	1/Month [3]	[1]
1,2-Diphenylhydrazine	µg/L	Grab	1/Month [3]	[1]
Fluoranthene	µg/L	Grab	1/Month [3]	[1]
Hexachlorobenzene	µg/L	Grab	1/Month [3]	[1]
Hexachlorobutadiene	µg/L	Grab	1/Month [3]	[1]
Hexachlorocyclopentadiene	µg/L	Grab	1/Month [3]	[1]

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Hexachloroethane	µg/L	Grab	1/Month [3]	[1]
Isophorone	µg/L	Grab	1/Month [3]	[1]
Nitrobenzene	µg/L	Grab	1/Month [3]	[1]
N-Nitrosodimethylamine	µg/L	Grab	1/Month [3]	[1]
N-Nitrosodi-N-propylamine	µg/L	Grab	1/Month [3]	[1]
N-Nitrosodiphenylamine	µg/L	Grab	1/Month [3]	[1]
Aldrin	µg/L	Grab	1/Month [3]	[1]
HCH [9]	µg/L	Grab	1/Month [3]	[1]
Chlordane	µg/L	Grab	1/Month [3]	[1]
DDT [10]	µg/L	Grab	1/Month [3]	[1]
Dieldrin	µg/L	Grab	1/Month [3]	[1]
Endosulfan	µg/L	Grab	1/Month [3]	[1]
Endrin	µg/L	Grab	1/Month [3]	[1]
Heptachlor	µg/L	Grab	1/Month [3]	[1]
Heptachlor Epoxide	µg/L	Grab	1/Month [3]	[1]
PCBs [11]	µg/L	Grab	1/Month [3]	[1]
Toxaphene	µg/L	Grab	1/Month [3]	[1]
Tributyltin	µg/L	Grab	1/Month [3]	[1]

1. Pollutants shall be analyzed using the analytical methods described in Part 136. For priority pollutants, the methods must meet the lowest minimum levels (MLs) specified in Appendix II of the Ocean Plan (2012) that is required to demonstrate compliance. Where no methods are specified for a given pollutant, the methods must be approved by this Los Angeles Regional Water Board or the State Water Board.
2. Refer to section V, Whole Effluent Toxicity Testing Requirements. A toxicity test sample is immediately subject to TIE procedures to identify the toxic chemical(s), if a chronic toxicity test shows "Fail and % Effect value ≥50". The Discharger shall initiate a TIE using, as guidance, EPA manuals: *Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures* (EPA/600/6-91/003, 1991); *Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600/R-92/080, 1993); *Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity* (EPA/600/R-92/081, 1993); and *Marine Toxicity Identification Evaluation (TIE): Phase I Guidance Document* (EPA/600/R-96-054, 1996). The TIE should be conducted on the species demonstrating the most sensitive toxicity response.
3. Monthly for the first year and quarterly after the first year. For RSW-003 and RSW-004, if a quarterly sample exceeds the water quality objectives in the Ocean Plan, the monitoring frequency returns to monthly for that constituent until at least four consecutive samples demonstrate compliance with the water quality objective.
4. Non-chlorinated phenolic compounds represent the sum of 2-nitrophenol; phenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; and 4-nitrophenol.
5. Chlorinated phenolic compounds represent the sum of 2-chlorophenol; 2,4-dichlorophenol; 2,4,6-trichlorophenol; 4-chloro-3-methylphenol; and pentachlorophenol.
6. TCDD Equivalents shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below. USEPA method 1613 may be used to analyze dioxin and furan congeners.

   Dioxin-TEQ (TCDD Equivalents) = Σ (C_x x TEF_x)

   Where:

   C_x = concentration of dioxin or furan congener x

   TEF_x = TEF for congener x

Toxicity Equivalence Factors

Isomer Group	Toxicity Equivalence Factor (TEF)
2,3,7,8-tetra CDD	1.0
2,3,7,8-penta CDD	0.5
2,3,7,8-hexa CDDs	0.1
2,3,7,8-hepta CDD	0.01
Octa CDD	0.001
2,3,7,8 tetra CDF	0.1
1,2,3,7,8 penta CDF	0.05
2,3,4,7,8 penta CDF	0.5
2,3,7,8 hexa CDFs	0.1
2,3,7,8 hepta CDFs	0.01

7. Halomethanes shall mean the sum of bromoform, bromomethane (methyl bromide), and chloromethane (methyl chloride).
8. PAHs shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo(k)fluoranthene, 1,12-benzoperylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene.
9. HCH shall mean the sum of alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.
10. DDT shall mean the sum of 4,4'-DDT, 2,4'-DDT, 4,4'-DDE, 2,4'-DDE, 4,4'-DDD and 2,4'-DDD.
11. PCBs shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254 and Aroclor-1260.
12. Monthly for the first year. For receiving water monitoring locations RSW-001 and RSW-002, the monitoring frequency may be decreased to quarterly after the first year. For RSW-003 and RSW-004, if the testing results are determined to be in compliance, the frequency of monitoring may be decreased to quarterly. If a quarterly sample exceeds the chronic toxicity limitation, the monitoring frequency returns to monthly until at least four consecutive samples demonstrate compliance with the prescribed effluent chronic toxicity limitation.

IX. OTHER MONITORING REQUIREMENTS

A. Visual Monitoring of the Receiving Water

The following general observations or measurements at the receiving water stations shall be reported when collecting receiving water samples.

1. Tidal stage, time, and date of monitoring.
2. General water conditions.
3. Extent of visible turbidity or color patches.
4. Appearance of oil films or grease, or floatable material.
5. Depth at each station for each sampling point.
6. Presence or absence of red tide.
7. Presence of marine life.
8. Presence and activity of the California least tern and the California brown pelican.

B. Outfall and Diffuser Inspection

1. The ocean outfall shall be externally inspected a minimum of once per year. Inspections shall include observations and photographic/videographic records of the outfall pipes and adjacent ocean bottom. The pipes shall be visually inspected by a diver, manned submarine, or remotely operated vehicle. A summary report of the inspection findings of the previous year shall be included in the first quarterly monitoring report (due by May 1 of each year). This written report, augmented with videographic and/or photographic

images, will provide a description of the observed condition of the discharge pipes from shallow water to their respective termini.

X. REPORTING REQUIREMENTS

A. General Monitoring and Reporting Requirements

1. The Discharger shall comply with all Standard Provisions (Attachment D) related to monitoring, reporting, and recordkeeping.
2. If there is no discharge during any reporting period, the report shall so state.
3. If the Discharger monitors (other than for process/operational control, startup, research, or equipment testing) any influent, effluent, or receiving water constituent more frequently than required by this Permit using approved analytical methods, the results of those analyses shall be included in the monitoring report. These results shall be reflected in the calculation of the average (or median) used in demonstrating compliance with this Order/Permit.
4. Each monitoring report shall contain a separate section titled "Summary of Non-Compliance" which discusses the compliance record and corrective actions taken or planned that may be needed to bring the discharge into full compliance with waste discharge requirements. This section shall clearly list all non-compliance with waste discharge requirements, as well as all excursions of effluent limitations.
5. The Discharger shall inform the Regional Water Board well in advance of any proposed construction activity that could potentially affect compliance with applicable requirements.
6. The Discharger shall report the results of chronic toxicity testing, TRE and TIE as required in the Attachment E, Monitoring and Reporting, section V.

B. Self-Monitoring Reports (SMR's)

1. At any time during the term of this permit, the State or Regional Water Board may notify the Discharger to electronically submit Self-Monitoring Reports (SMRs) using the State Water Board's California Integrated Water Quality System (CIWQS) Program Web site (http://www.waterboards.ca.gov/ciwqs/index.html). The CIWQS Web site will provide additional directions for SMR submittal in the event there will be service interruption for electronic submittal.

   Until such notification is given, the Discharger shall submit SMRs that are less than 10 MB by email to losangeles@waterboards.ca.gov. Documents that are 10 MB or larger should be transferred to disk and mailed to:

   California Regional Water Quality Control Board
   Los Angeles Region
   320 West 4th Street, Suite 200
   Los Angeles, CA 90013

2. The Discharger shall report in the SMR the results for all monitoring specified in this MRP under sections III through IX. The Discharger shall submit quarterly SMR's including the results of all required monitoring using U.S. EPA-approved test methods or other test methods specified in this Order. SMR's are to include all new monitoring results obtained since the last SMR was submitted. If the Discharger monitors any pollutant more frequently than required by this Order, the results of this monitoring shall be included in the calculations and reporting of the data submitted in the SMR.

3. Monitoring periods and reporting for all required monitoring shall be completed according to the following schedule:

Table E-4. Monitoring Periods and Reporting Schedule

Sampling Frequency	Monitoring Period Begins On…	Monitoring Period	SMR Due Date
Continuous	**May 1, 2014**	**All**	**Submit with quarterly SMR**
Monthly	**May 1, 2014**	**1st day of calendar month through last day of calendar month**	**Submit with quarterly SMR**
Quarterly	**May 1, 2014**	**January 1 - March 31 April 1 – June 30 July 1 – September 30 October 1 – December 31**	**May 1 August 1 November 1 February 1**
Semiannually	**July 1, 2014**	**January 1 - June 30 July 1 - December 31**	**August 1 February 1**

4. Reporting Protocols. The Discharger shall report with each sample result the applicable reported Minimum Level (reported ML, also known as the Reporting Level, or RL) and the current Method Detection Limit (MDL), as determined by the procedure in 40 C.F.R. part 136.

   The Discharger shall report the results of analytical determinations for the presence of chemical constituents in a sample using the following reporting protocols:

   a. Sample results greater than or equal to the reported ML shall be reported as measured by the laboratory (i.e., the measured chemical concentration in the sample).

   b. Sample results less than the reported ML, but greater than or equal to the laboratory's MDL, shall be reported as "Detected, but Not Quantified," or DNQ. The estimated chemical concentration of the sample shall also be reported.

   For the purposes of data collection, the laboratory shall write the estimated chemical concentration next to DNQ. The laboratory may, if such information is available, include numerical estimates of the data quality for the reported result. Numerical estimates of data quality may be percent accuracy (± a percentage of the reported value), numerical ranges (low to high), or any other means considered appropriate by the laboratory.

   c. Sample results less than the laboratory's MDL shall be reported as "Not Detected," or ND.

   d. Dischargers are to instruct laboratories to establish calibration standards so that the ML value (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the Discharger to use analytical data derived from extrapolation beyond the lowest point of the calibration curve.

5. Compliance Determination. Compliance with effluent limitations for reportable pollutants shall be determined using sample reporting protocols defined above and Attachment A of this Order. For purposes of reporting and administrative enforcement by the Los Angeles Regional Water Board and State Water Board, the Discharger shall be deemed out of

compliance with effluent limitations if the concentration of the reportable pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reported Minimum Level (ML).

6. Multiple Sample Data. When determining compliance with a measure of central tendency (arithmetic mean, geometric mean, median, etc.) of multiple sample analyses and the data set contains one or more reported determinations of “Detected, but Not Quantified” (DNQ) or “Not Detected” (ND), the Discharger shall compute the median in place of the arithmetic mean in accordance with the following procedure:

   a. The data set shall be ranked from low to high, ranking the reported ND determinations lowest, DNQ determinations next, followed by quantified values (if any). The order of the individual ND or DNQ determinations is unimportant.

   b. The median value of the data set shall be determined. If the data set has an odd number of data points, then the median is the middle value. If the data set has an even number of data points, then the median is the average of the two values around the middle unless one or both of the points are ND or DNQ, in which case the median value shall be the lower of the two middle values where DNQ is lower than a value and ND is lower than DNQ.

7. The Discharger shall submit SMR’s in accordance with the following requirements:

   a. The Discharger shall arrange all reported data in a tabular format. The data shall be summarized to clearly illustrate whether the facility is operating in compliance with interim and/or final effluent limitations. The Discharger is not required to duplicate the submittal of data that is entered in a tabular format within CIWQS. When electronic submittal of data is required and CIWQS does not provide for entry into a tabular format within the system, the Discharger shall electronically submit the data in a tabular format as an attachment.

   b. The Discharger shall attach a cover letter to the SMR. The information contained in the cover letter shall clearly identify violations of the WDR’s; discuss corrective actions taken or planned; and the proposed time schedule for corrective actions. Identified violations must include a description of the requirement that was violated and a description of the violation.

C. Discharge Monitoring Reports (DMR’s)

1. At any time during the term of this permit, the State Water Board or the Los Angeles Regional Water Board may notify the Discharger to electronically submit DMR’s. Until such notification is given specifically for the submittal of DMR’s, the Discharger shall submit DMR’s in accordance with the requirements described below.

2. DMR’s must be signed and certified as required by the standard provisions (Attachment D). The Discharger shall submit the original DMR and one copy of the DMR to the address listed below:

STANDARD MAIL	FEDEX/UPS/ OTHER PRIVATE CARRIERS
State Water Resources Control Board Division of Water Quality c/o DMR Processing Center PO Box 100 Sacramento, CA 95812-1000	State Water Resources Control Board Division of Water Quality c/o DMR Processing Center 1001 I Street, 15th Floor Sacramento, CA 95814

3. All discharge monitoring results must be reported on the official U.S. EPA pre-printed DMR forms (EPA Form 3320-1) or on self-generated forms that follow the exact same format of EPA Form 3320-1.

D. Other Reports

1. The Discharger shall report the results of any special studies, acute toxicity testing, chronic toxicity testing, and TRE/TIE required by Special Provisions – VI.C.2 and 3 of this Order. The Discharger shall submit reports in compliance with SMR reporting requirements described in subsection X.B above.

2. Within 90 days of the effective date of this permit, the Discharger is required to submit the following required by Special Provisions of this Order to the Regional Water Board:

   a. An Initial Investigation TRE workplan.
   b. An updated Storm Water Pollution Prevention Plan (SWPPP).
   c. An updated Best Management Practices Plan (BMPP).

3. Within 90 days after the adoption of the permit, the Discharger is required to submit the following required by Special Provisions of this Order to the Regional Water Board:

   a. Mixing Zone Study Work Plan.
   b. Sediment Loading Study Work Plan.

ATTACHMENT F – FACT SHEET

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ATTACHMENT F – FACT SHEET

As described in section I, the Los Angeles Regional Water Board incorporates this Fact Sheet as findings of the Los Angeles Regional Water Board supporting the issuance of this Order. This Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of this Order.

This Order has been prepared under a standardized format to accommodate a broad range of discharge requirements for Dischargers in California. Only those sections or subsections of this Order that are specifically identified as “not applicable” have been determined not to apply to this Discharger. Sections or subsections of this Order not specifically identified as “not applicable” are fully applicable to this Discharger.

I. PERMIT INFORMATION

The following table summarizes administrative information related to the facility.

Table F-1. Facility Information

WDID	4A560130001
Discharger	Calleguas Municipal Water District
Name of Facility	Regional Salinity Management Pipeline (RSMP)
Facility Address	2100 Olsen Road
	Thousand Oaks, CA 91360
	Ventura County
Facility Contact, Title and Phone	Amy Maday, Regulatory Compliance Supervisor, (805) 579-7117
Authorized Person to Sign and Submit Reports	Tony Goff, Manager of Operations and Maintenance
Mailing Address	2100 Olsen Road, Thousand Oaks, CA 91360
Billing Address	Same as above
Type of Facility	Wholesale water supplier, SIC Code 4941
Major or Minor Facility	Major
Threat to Water Quality	3
Complexity	C
Pretreatment Program	N/A
Recycling Requirements	N/A
Facility Permitted Flow	17.52 MGD (million gallons per day)
Facility Design Flow	19.1 MGD (million gallons per day)
Watershed	Ventura County Coastal
Receiving Water	Pacific Ocean
Receiving Water Type	Ocean waters

A. Calleguas Municipal Water District (hereinafter Discharger or CMWD) is a wholesale water supplier to cities and unincorporated areas in Ventura County south and east of the Santa Clara River. CMWD is in the process of constructing a pipeline (the Calleguas Regional Salinity Management Pipeline, or RSMP) that will collect and discharge treated effluent from publicly-owned treatment works (POTWs) and concentrates from brackish groundwater desalter plants and wastewater treatment facilities throughout the Calleguas Creek Watershed. CMWD is the owner and operator of the RSMP, or Facility. CMWD is hereinafter referred to as Discharger.

For the purposes of this Order, references to the "discharger" or "permittee" in applicable federal and state laws, regulations, plans, or policy are held to be equivalent to references to the Discharger herein.

B. The Facility proposes to discharge wastewater and concentrates to the Pacific Ocean, at Port Hueneme Beach, a water of the United States. The Discharger was previously regulated by Order R4-2008-0014 and National Pollutant Discharge Elimination System (NPDES) Permit No. CA0064521, which was adopted on April 3, 2008, and expired on March 10, 2013. However, as per 40 CFR section 122 the permit has been administratively extended until the Board takes action on this item. Attachment B provides a map of the area around the Facility. Attachment C provides a flow schematic of the Facility.

C. The Discharger filed a report of waste discharge and submitted an application for reissuance of its WDR's and NPDES permit on September 14, 2012. The application was deemed complete on December 12, 2013. A site visit was conducted on October 9, 2012, to observe operations and collect additional data to develop permit limitations and requirements for waste discharge.

II. FACILITY DESCRIPTION

CMWD is building the Calleguas Regional Salinity Management Pipeline (RSMP), which will extend from Simi Valley to Port Hueneme, to discharge both tertiary-treated municipal wastewaters and concentrates generated by membrane treatment of groundwater and wastewater treatment facilities to the Pacific Ocean. The operation of the RSMP will effectively reduce the current salt loadings to the Calleguas Creek Watershed by conveying saline waters and concentrate for discharge to the Pacific Ocean. Portions of the RSMP are expected to be completed and operational by the end of 2013.

The RSMP diameter varies along the length of the pipeline and is a maximum of 48 inches in internal diameter near the downstream end. Pipeline materials also vary along the pipeline and include high-density polyethylene (HDPE), polyvinyl chloride (PVC), and welded steel (WSP).

The RSMP is scheduled for construction in multiple phases as described below:

- Phase 1 was comprised of five segments (i.e., 1A, 1B, 1C, 1D, and 1E) and constructed the RSMP from Camrosa Water Reclamation Facility (WRF) to the Hueneme Outfall.
- Phase 2 is also comprised of five segments, described as follows:
  - Phases 2A, 2B, and 2C run along Lewis Road, cross Highway 101 and extend up to Somis Road.
  - Phases 2D, and 2E will run along Somis Road and then adjacent to Highway 118/Los Angeles Avenue. This phase will collect concentrate from desalters in the Somis area and wastewater from the Moorpark Wastewater Treatment Plant.
- Phase 3 extends through Moorpark and Simi Valley. This phase will collect concentrate from desalters in the Moorpark and Simi Valley areas.

CMWD indicated that Phase 1 of the RSMP, from the Camrosa Water Reclamation Facility (WRF) to the Hueneme Outfall, has been completed. Phases 2A and 2C are also completed and expected to be operational in 2013/2014. The remaining portions of Phase 2 (i.e., 2B, 2D, and 2E) are in design and expected to be online within the timeframe of the next permit cycle, by 2018. Phase 3 is still being projected for future work. CMWD anticipates discharge from the RSMP to the Hueneme Outfall will commence in 2014.

A. Description of Wastewater and Biosolids Treatment and Controls

CMWD indicated in the ROWD that the sources for the RSMP over the permit term include highly treated effluent from two POTWs and concentrate from five membrane groundwater treatment plants not yet operational. In addition, concentrate generated by an existing brackish water reclamation demonstration facility will be discharged into the RSMP.

The eight sources currently identified for discharging flow into the RSMP are as follows:

- Camarillo Water Reclamation Plant (WRP) (existing)
- Camrosa WRF (existing)
- Ventura County Waterworks District Moorpark Desalter (future)
- Agricultural Somis Desalter (future)
- Camarillo North Pleasant Valley Desalter (future)
- Camrosa Round Mountain Water Treatment Plant (WTP) (existing)
- Agricultural Desalters (future)
- Port Hueneme Water Agency (PHWA) Brackish Water Reclamation Demonstration Facility (BWRDF) (existing)

Discharges from the Camarillo WRP are currently regulated by NPDES Permit No. CA0053597. The WRP has a treatment capacity of 6.75 MGD and provides wastewater treatment consisting of primary treatment, activated sludge treatment, nitrification/denitrification, secondary clarification, tertiary filtration, chlorination, and dechlorination. A portion of the effluent is recycled for landscape and agricultural use. Effluent flow in excess of recycled water demand is discharged into Conejo Creek and varies with the seasonal demand for recycled water. CMWD estimated in the ROWD the discharge flow from the Camarillo WRP would be 3.8 MGD for 30 days out of the year.

Discharges from the Camrosa WRF are regulated by NPDES Permit No. CA0059501. The WRF has a treatment capacity of 1.5 MGD. In 2000, the average flow was 1.34 MGD. Wastewater treatment is provided through extended aeration, nitrogen removal, secondary clarification, tertiary filtration, and disinfection. The WRF does not currently dechlorinate prior to discharge; however, the WRF's operations will change to include dechlorination prior to initiating discharge to the RSMP. Effluent from the WRF is recycled for landscaping and agricultural use. The NPDES Permit allows discharge into Calleguas Creek when the volume of wastewater exceeds the recycled demand and storage pond capacity. CMWD noted in the ROWD that most years, the WRF does not discharge into Calleguas Creek, but when they do occur, discharges extend for one to two weeks in the spring. The WRF would direct excess flows to the RSMP in lieu of discharges to Calleguas Creek.

Ventura County Waterworks District plans to build a desalter west of the City of Moorpark, generally along Highway 118, to treat the groundwater in the vicinity of the City of Moorpark, which has concentrations of chloride and TDS which make it unsuitable for potable water use. A feasibility study has been completed for the desalter, groundwater modeling is underway, and operation is expected in 2017. The desalter is expected to produce a brine discharge of approximately 1.49 MGD.

Agricultural pumpers, including mutual water companies and private entities, are working together to build one or more desalters to allow them to treat the shallow groundwater in the vicinity of Somis, to make it suitable for agricultural irrigation on crops. The desalter is expected to be located east of Somis, generally along Highway 118. A feasibility study has been completed for the desalter and operation is expected to begin in 2016. The desalter is expected to produce a brine discharge of 0.79 MGD.

The City of Camarillo currently operates two wells (Wells A & B) with high salinity which are blended with imported Calleguas water to achieve drinking water quality standards. The City of Camarillo plans to install one or two additional wells in the area and treat the water from all of the wells with the proposed North Pleasant Valley (NPV) Desalter. The desalter will be in the City of Camarillo at the intersection of Las Posas Road and Lewis Road. The treatment plant pilot testing and the groundwater modeling have been completed. The operation is expected to begin in 2016. It is expected to produce a brine discharge of 2.14 MGD.

The Camrosa Round Mountain WTP is currently located at the Camrosa WRF. The Facility includes a raw water supply pipeline from the existing University Well to the treatment plant site, finished water pipeline to pressure distribution system and a concentrate disposal line to the RSMP. The project began discharging to the RSMP in January 2014. The WTP is expected to produce a maximum brine discharge of 0.16 MGD.

CMWD is also expecting discharges from various agricultural users on the Oxnard Plain who are interested in attaining sources with lower salinity concentrations than their local groundwater. Agricultural interests in the area have expressed the desire to install reverse osmosis (RO) facilities at local irrigation wells and dispose of the RO reject to the RSMP. Brine water quality would vary based on the local water sources. Brine water quality should be similar to other nearby desalters. The schedule for construction of these desalters is not known. It is anticipated to be one or more agricultural desalters with brine discharges totaling approximately 2.55 MGD.

The BWRDF is owned by the PHWA and is located along Perkins Road in the City of Oxnard. The BWRDF was constructed in 1998, with startup in January 1999. The BWRDF incorporates a combination of desalting treatment technologies, including RO and nanofiltration (NF). Currently, chloraminated water is treated through the membranes at the BWRDF. Once PHWA begins discharging its concentrate streams into the RSMP, the Agency will change its operations to ensure dechlorination occurs before discharge. It is designed to treat 4.5 MGD of influent water and creates a combined concentrate stream of approximately 1.69 MGD.

CMWD indicated that the specific discharges listed above may not be inclusive of all flows that may discharge to the RSMP during the permit term. CMWD is required to notify the Los Angeles Regional Water Board of the location, type, and connection schedule for any new discharges to the RSMP that are not set forth in the proposed Order. CMWD indicated that additional flows will be allowed to discharge to the RSMP only if:

- They consist of potable water, groundwater, concentrate resulting from membrane treatment of potable water or groundwater, or concentrate resulting from membrane treatment of tertiary treated wastewater sources specifically listed in the Order;
- The discharge does not exceed effluent and receiving water quality-based limitations established in the Order;
- The total discharge does not exceed the maximum flow rate established by the Order.

All treatment of the discharges would be complete prior to entering the RSMP. The RSMP is used solely to transport the combined effluents to the discharge point at the Hueneme Outfall.

Table F-2. Summary of the Currently Identified Sources and Discharges to the RSMP

Name of Facility	Flow (MGD)
POTWs:	
Camarillo Sanitary District WRP	3.8

Name of Facility	Flow (MGD)
Camrosa WRF	1.5
Desalters:	
VCWWD Moorpark Desalter	1.49
Somis Agricultural Desalter	0.79
Camarillo NPV Desalter	2.14
Camrosa Round Mountain Desalter	0.16
Oxnard Plain Agricultural Desalters	2.55
PHWA BWRDF	1.69
Total	14.12

B. Discharge Points and Receiving Waters

The Discharger proposes to discharge up to 19.1 MGD of treated municipal wastewaters and concentrates generated by membrane treatment of groundwater and wastewater treatment facilities, into the Pacific Ocean at Port Hueneme Beach, a water of the United States, (Latitude 34° 08’ 34.75” North, Longitude 119° 11’ 33.72” West).

CMWD is the owner and operator of the Hueneme Outfall which will solely discharge flow from the RSMP. The landside portion of the RSMP connects with the Hueneme Outfall for discharge into the Pacific Ocean at Port Hueneme Beach. The discharge point for the Hueneme Outfall will be located approximately 4,000 feet offshore. The diffuser on the Hueneme Outfall is 380 feet in length and includes 30 ports. The port openings alternate so that they are at 26 foot centers on each side, staggered with ports at the same spacing on the opposite side, giving 13 foot spacing along the diffuser. Ports are above the pipe axis, discharging typically at about 20 degrees from the horizontal. The diffuser follows the sea bed slope, falling gradually offshore, from a high point at the connection to the main pipe. Characteristics of the diffuser are summarized in Table F-3.

Table F-3. Characteristics of the Diffuser on the Hueneme Outfall

Parameter	Value
Length	5,000 feet
Conveyance piping inside diameter	30 inches
Port diameter at opening	5 inches
Port spacing	13 feet
Port vertical angle	20 degrees
Port horizontal angle	132.3 degrees
Number of ports	30
Length of diffuser section	380 feet
Ocean depth at riser	N/A
Approximate depth to the top of port	47 feet (mean lower low water)
Exit design velocity	10 feet per second
Dilution ratio	72:1

CMWD has completed theoretical modeling for the Hueneme Outfall dilution ratio. The results of the modeling were originally included in the ROWD submitted on July 15, 2007. At the time of the submittal of the ROWD in 2007, the dilution ratio of the Hueneme Outfall was determined by modeling the discharge using the USEPA-approved Visual Plumes (VP) program. Modeling runs were performed using ambient receiving water (Pacific Ocean) data collected in 2002 from the nearby Reliant Energy Ocean Outfall for salinity and temperature at various depths. Scenarios were evaluated over the range of flows expected on the RSMP, including 2, 6, 10, 14, and 19.1 MGD. The lowest dilution predicted by the VP model was 99.5:1, occurring at the highest flow rate of 19.1 MGD under 2002 summer conditions.

The modeling was updated in 2007 to use more recent (August 2006 and February 2007) receiving water data collected by the City of Oxnard. Summer and winter conditions were modeled with an assumed 19.4 MGD effluent flow in CORMIX, Visual Plumes (VP), and KOH & FAN using the updated receiving water data sets. The KOH & FAN models predicted 72:1, a lower, more conservative dilution upon reaching the surface. CORMIX predicted 94:1, and VP predicted 89:1. Discussions between RWQCB and SWRCB staff resulted in the approved dilution ratio in Calleguas' current SMP Permit (R4-2008-0014) of 72:1, the most conservative predicted by the updated models.

The State Water Board and the Los Angeles Regional Water Board reviewed the modeling and additional information provided by CMWD and granted a dilution ratio of 72:1 for discharges from the RSMP.

C. Summary of Existing Requirements and Self-Monitoring Report (SMR) Data

The RSMP has not commenced discharges yet; therefore, effluent limitations contained in the previous Order for discharges from Discharge Point 001 (Monitoring Location EFF-001) are summarized in Table F-4.

Table F-4. Historic Effluent Limitations and Monitoring Data

Parameter	Units	Effluent Limitation					
		Average Monthly	Average Weekly	Maximum Daily	Instantan. Minimum	Instantan. Maximum	6-Month Median
Biochemical Oxygen Demand (BOD), 5-day @ 20°C	mg/L	30	45	--	--	--	--
	lbs/day[1]	4,384	6,575	--	--	--	--
Total Suspended Solids (TSS)	mg/L	60	--	--	--	--	--
	lbs/day[1]	8,767	--	--	--	--	--
pH	s.u.	--	--	--	6.0	9.0	--
Oil and Grease	mg/L	25	40	--	--	--	--
	lbs/day[1]	3,653	5,845	--	--	--	--
Settleable Solids	ml/L	1.0	1.5	--	--	--	--
Turbidity	NTU	75	100	--	--	--	--
Total Residual Chlorine	µg/L	--	--	584	--	4380	146
	lbs/day[1]	--	--	85.3	--	640	21
Ammonia as N	µg/L	--	--	175,200	--	438,000	43,800
	lbs/day[1]	--	--	25,600	--	63,999	6,400
Acute Toxicity	TU_a	--	--	2.46	--	--	--
Chronic Toxicity	TU_c	--	--	73	--	--	--
Total Coliform	MPN/100 ml	[2]					
Fecal Coliform	MPN/100 ml	[2]					
Enterococcus	MPN/100 ml	[2]					
Arsenic	µg/L	--	--	2,120	--	5,624	368
	lbs/day[1]	--	--	310	--	822	54
Beryllium	µg/L	2.4	--	--	--	--	--
	lbs/day[1]	0.4	--	--	--	--	--

Parameter	Units	Effluent Limitation					
		Average Monthly	Average Weekly	Maximum Daily	Instantan. Minimum	Instantan. Maximum	6-Month Median
Cadmium	µg/L	--	--	292	--	730	73
	lbs/day[1]	--	--	43	--	107	11
Chromium (VI)	µg/L	--	--	584	--	1,460	146
	lbs/day[1]	--	--	85	--	213	21
Copper	µg/L	--	--	732	--	2,046	75
	lbs/day[1]	--	--	107	--	299	11
Lead	µg/L	--	--	584	--	1,460	146
	lbs/day[1]	--	--	85	--	213	21
Mercury	µg/L	--	--	12	--	29	3
	lbs/day[1]	--	--	2	--	4	0.4
Nickel	µg/L	--	--	1,460	--	3,650	365
	lbs/day[1]	--	--	213	--	533	53
Selenium	µg/L	--	--	4,380	--	10,950	1,095
	lbs/day[1]	--	--	640	--	1,600	160
Silver	µg/L	--	--	193	--	500	40
	lbs/day[1]	--	--	28	--	73	6
Thallium	µg/L	--	--	--	--	--	--
	lbs/day[1]	--	--	--	--	--	--
Zinc	µg/L	--	--	5,264	--	14,024	884
	lbs/day[1]	--	--	769	--	2,049	129
Cyanide	µg/L	--	--	292	--	730	73
	lbs/day[1]	--	--	43	--	107	11
Phenolic Compounds (non-chlorinated)[3]	µg/L	--	--	8,760	--	21,900	2,190
	lbs/day[1]	--	--	1,280	--	3,200	320
Chlorinated Phenolics[4]	µg/L	--	--	292	--	730	73
	lbs/day[1]	--	--	43	--	107	11
TCDD Equivalents	µg/L	2.85E-07	--	--	--	--	--
	lbs/day[1]	4.16E-08	--	--	--	--	--
Acrylonitrile	µg/L	7.3	--	--	--	--	--
	lbs/day[1]	1.1	--	--	--	--	--
Benzene	µg/L	431	--	--	--	--	--
	lbs/day[1]	63	--	--	--	--	--
Carbon Tetrachloride	µg/L	66	--	--	--	--	--
	lbs/day[1]	9.6	--	--	--	--	--
Chlorodibromomethane	µg/L	628	--	--	--	--	--
	lbs/day[1]	92	--	--	--	--	--
Dichlorobromomethane	µg/L	453	--	--	--	--	--
	lbs/day[1]	66	--	--	--	--	--
1,1-Dichloroethylene	µg/L	65.7	--	--	--	--	--
	lbs/day[1]	9.6	--	--	--	--	--
1,3-Dichloropropene	µg/L	650	--	--	--	--	--
	lbs/day[1]	95	--	--	--	--	--
1,1,2,2-Tetrachloroethane	µg/L	168	--	--	--	--	--
	lbs/day[1]	24.5	--	--	--	--	--
Tetrachloroethylene	µg/L	146	--	--	--	--	--
	lbs/day[1]	21.3	--	--	--	--	--

Parameter	Units	Effluent Limitation					
		Average Monthly	Average Weekly	Maximum Daily	Instantan. Minimum	Instantan. Maximum	6-Month Median
1,1,2-Trichloroethane	µg/L	686	--	--	--	--	--
	lbs/day[1]	100	--	--	--	--	--
Tributyltin	µg/L	0.102	--	--	--	--	--
	lbs/day[1]	0.015	--	--	--	--	--
2,4-Dinitrophenol	µg/L	292	--	--	--	--	--
	lbs/day[1]	43	--	--	--	--	--
2,4,6-Trichlorophenol	µg/L	21	--	--	--	--	--
	lbs/day[1]	3	--	--	--	--	--
Benzidine	µg/L	0.005	--	--	--	--	--
	lbs/day[1]	0.0007	--	--	--	--	--
Bis(2-Chloroethoxy)Methane	µg/L	321	--	--	--	--	--
	lbs/day[1]	47	--	--	--	--	--
Bis(2-Chloroethyl)Ether	µg/L	3	--	--	--	--	--
	lbs/day[1]	0.48	--	--	--	--	--
Bis(2-Ethylhexyl)Phthalate	µg/L	256	--	--	--	--	--
	lbs/day[1]	37	--	--	--	--	--
3,3'-Dichlorobenzidene	µg/L	0.59	--	--	--	--	--
	lbs/day[1]	0.09	--	--	--	--	--
2,4-Dinitrotoluene	µg/L	190	--	--	--	--	--
	lbs/day[1]	28	--	--	--	--	--
1,2-Diphenylhydrazine	µg/L	12	--	--	--	--	--
	lbs/day[1]	1.7	--	--	--	--	--
Hexachlorobenzene	µg/L	0.015	--	--	--	--	--
	lbs/day[1]	0.002	--	--	--	--	--
Hexachloroethane	µg/L	182	--	--	--	--	--
	lbs/day[1]	27	--	--	--	--	--
Nitrobenzene	µg/L	358	--	--	--	--	--
	lbs/day[1]	52	--	--	--	--	--
N-Nitrosodimethylamine	µg/L	533	--	--	--	--	--
	lbs/day[1]	78	--	--	--	--	--
N-Nitrosodi-n-Propylamine	µg/L	28	--	--	--	--	--
	lbs/day[1]	4	--	--	--	--	--
N-Nitrosodiphenylamine	µg/L	182	--	--	--	--	--
	lbs/day[1]	27	--	--	--	--	--
Aldrin	µg/L	0.002	--	--	--	--	--
	lbs/day[1]	0.0002	--	--	--	--	--
Chlordane	µg/L	0.002	--	--	--	--	--
	lbs/day[1]	0.0002	--	--	--	--	--
DDT[5]	µg/L	0.012	--	--	--	--	--
	lbs/day[1]	0.002	--	--	--	--	--
Dieldrin	µg/L	0.003	--	--	--	--	--
	lbs/day[1]	0.0004	--	--	--	--	--
Endosulfan	µg/L	--	--	1.314	--	1.971	0.657
	lbs/day[1]	--	--	0.192	--	0.288	0.096
Endrin	µg/L	--	--	0.292	--	0.438	0.146
	lbs/day[1]	--	--	0.043	--	0.064	0.021

Parameter	Units	Effluent Limitation					
		Average Monthly	Average Weekly	Maximum Daily	Instantan. Minimum	Instantan. Maximum	6-Month Median
Heptachlor	µg/L	0.004	--	--	--	--	--
	lbs/day[1]	0.0005	--	--	--	--	--
Heptachlor Epoxide	µg/L	0.002	--	--	--	--	--
	lbs/day[1]	0.0002	--	--	--	--	--
PAH[6]	µg/L	0.64	--	--	--	--	--
	lbs/day[1]	0.094	--	--	--	--	--
HCH[7]	µg/L	--	--	0.58	--	0.88	0.29
	lbs/day[1]	--	--	0.085	--	0.128	0.043
PCBs[8]	µg/L	0.001	--	--	--	--	--
	lbs/day[1]	0.0002	--	--	--	--	--
Toxaphene	µg/L	0.015	--	--	--	--	--
	lbs/day[1]	0.002	--	--	--	--	--
Radioactivity	Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, §30253 of the California Code of Regulations. Reference to §30253 is prospective, including future changes to any incorporated provisions of federal law, as the changes take effect.						

1. Mass-based effluent limitations are based on a discharge flow rate of 17.52 MGD. It is the total estimated contributing flows when the previous Order was issued.
2. Bacterial Limitations:
   a. 30-day Geometric Mean Limitations – The geometric mean shall be calculated using the five most recent sample results:
      i. Total coliform density shall not exceed 1,000 per 100 ml;
      ii. Fecal coliform density shall not exceed 200 per 100 ml; and
      iii. Enterococcus density shall not exceed 35 per 100 ml.
   b. Single-Sample Maximum (SSM)
      i. Total coliform density shall not exceed 10,000 per 100 ml;
      ii. Fecal coliform density shall not exceed 400 per 100 ml;
      iii. Enterococcus density shall not exceed 104 per 100/ml; and
      iv. The total coliform density shall not exceed 1,000 per 100 ml when the fecal coliform/total coliform ratio exceeds 0.1.
3. Non-chlorinated phenolic compounds represent the sum of 2-nitrophenol; phenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; and 4-nitrophenol.
4. Chlorinated phenolic compounds represent the sum of 2-chlorophenol; 2,4-dichlorophenol; 2,4,6-trichlorophenol; 4-chloro-3-methylphenol; and pentachlorophenol.
5. DDT shall mean the sum of 4,4'-DDT, 2,4'-DDT, 4,4'-DDE, 2,4'-DDE, 4,4'-DDD, and 2,4'-DDD.
6. PAHs shall mean the sum of acenaphthylene; anthracene; 1,2-benzanthracene; 3,4-benzofluoranthene; benzo(k)fluoranthene; 1,12-benzoperylene; benzo(a)pyrene; chrysene; dibenzo(a,h)anthracene; fluorine; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene.
7. HCH shall mean the sum of alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.
8. PCBs shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Arolclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260.

D. Compliance Summary

The RSMP has not commenced discharges yet; therefore, there are no compliance issues present.

E. Planned Changes

CMWD indicated that Phase 1 of the RSMP, from the Camrosa Water Reclamation Facility (WRF) to the Hueneme Outfall, has been completed. Phases 2A and 2C are also completed and expected to be operational in 2013/2014. The remaining portions of Phase 2 (i.e., 2B, 2D, and 2E) are in design and expected to be online within the timeframe of the next permit cycle, by 2018. Phase 3 is still being projected for future work. CMWD anticipates discharge from the RSMP to the Hueneme Outfall will commence in 2014.

III. APPLICABLE PLANS, POLICIES, AND REGULATIONS

The requirements contained in this Order are based on the requirements and authorities described in this section.

A. Legal Authorities

This Order serves as WDR's pursuant to article 4, chapter 4, division 7 of the California Water Code (commencing with section 13260). This Order is also issued pursuant to section 402 of the federal Clean Water Act (CWA) and implementing regulations adopted by the U.S. EPA and chapter 5.5, division 7 of the Water Code (commencing with section 13370). It shall serve as an NPDES permit for point source discharges from this facility to surface waters.

B. California Environmental Quality Act (CEQA)

Under Water Code section 13389, this action to adopt an NPDES permit is exempt from the provisions of Chapter 3 of CEQA, (commencing with section 21100) of Division 13 of the Public Resources Code.

C. State and Federal Laws, Regulations, Policies, and Plans

1. **Water Quality Control Plan.** The Los Angeles Regional Water Board adopted a Water Quality Control Plan for the Los Angeles Region (hereinafter Basin Plan) on June 13, 1994 that designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for the Pacific Ocean and all waters addressed through the plan. In addition, the Basin Plan implements State Water Resources Control Board (State Water Board) Resolution 88-63, which established state policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply. Requirements in this Order implement the Basin Plan.

   Beneficial uses applicable to the Pacific Ocean at Ventura County Coastal are as follows:

Table F-5. Basin Plan Beneficial Uses

Discharge Point	Receiving Water Name	Beneficial Use(s)
001	**Pacific Ocean at Port Hueneme Beach**	
	Nearshore Zone (The zone bounded by the shoreline and a line 1000 feet from the shoreline or the 30-foot depth contours, whichever is further from the shoreline)	Existing: Industrial Service Supply (IND); Navigation (NAV); Water Contact (REC-1) and Non-Contact (REC-2) Recreation; Commercial and Sport Fishing (COMM); Marine Habitat (MAR); Wildlife Habitat (WILD); Preservation of Biological Habitats (BIOL)[1]; Rare, Threatened or Endangered Species (RARE)[2]; Migration of Aquatic Organisms (MIGR)[3]; Spawning, Reproduction, and/or Early Development (SPWN)[3]; and Shellfish Harvesting (SHELL).
	Offshore Zone	Existing: Industrial Service Supply (IND); Navigation (NAV); Water Contact (REC-1) and Non-Contact (REC-2) Recreation; Commercial and Sport Fishing (COMM); Marine Habitat (MAR); Wildlife Habitat

Discharge Point	Receiving Water Name	Beneficial Use(s)
		(WILD); Rare, Threatened or Endangered Species (RARE)[2]; Migration of Aquatic Organisms (MIGR)[3]; Spawning, Reproduction, and/or Early Development (SPWN)[3]; and Shellfish Harvesting (SHELL).

1. Areas of Special Biological Significance (along coast from Latigo Point to Laguna Point) and Big Sycamore Canyon and Abalone Cove Ecological Reserves and Point Fermin Marine Life Refuge.
2. One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.
3. Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

2. **Thermal Plan.** The State Water Board adopted the Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California (Thermal Plan) on January 7, 1971, and amended this plan on September 18, 1975. This plan contains temperature objectives for coastal waters. Requirements of this Order implement the Thermal Plan.

3. **California Ocean Plan.** The State Water Board adopted the Water Quality Control Plan for Ocean Waters of California, California Ocean Plan (Ocean Plan) in 1972 and amended it in 1978, 1983, 1988, 1990, 1997, 2000, 2005, 2009 and 2012. The State Water Board adopted the latest amendment on October 16, 2012, and it became effective on July 1, 2013. The Ocean Plan is applicable, in its entirety, to point source discharges to the ocean. The Ocean Plan identifies beneficial uses of ocean waters of the state to be protected as summarized below:

Table F-6. Ocean Plan Beneficial Uses

Discharge Point	Receiving Water	Beneficial Uses
001	Pacific Ocean	Industrial water supply; water contact and non-contact recreation, including aesthetic enjoyment; navigation; commercial and sport fishing; mariculture; preservation and enhancement of designated Areas of Special Biological Significance (ASBS); rare and endangered species; marine habitat; fish spawning and shellfish harvesting

In order to protect the beneficial uses, the Ocean Plan establishes water quality objectives and a program of implementation. Requirements of this Order implement the Ocean Plan.

4. **Antidegradation Policy.** Federal regulation 40 C.F.R. section 131.12 requires that the state water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution 68-16. Resolution 68-16 is deemed to incorporate the federal antidegradation policy where the federal policy applies under federal law. Resolution 68-16 requires that existing water quality be maintained unless degradation is justified based on specific findings. The Los Angeles Regional Water Board's Basin Plan implements, and incorporates by reference, both the state and federal antidegradation policies. The permitted discharge must be consistent with the antidegradation provision of section 131.12 and State Water Board Resolution 68-16.

The Ocean Plan (2012) Item III.C (Implementation Provisions for Table 1) 3 includes a requirement that "Effluent limits shall be imposed in a manner prescribed by the State

Water Board such that the concentrations set forth as water quality objectives shall not be exceeded in the receiving water upon completion of initial dilution, except that objectives indicated for radioactivity shall apply directly to the undiluted waste effluent." Item III.F (Revision of Waste Discharge Requirements) 1 of the Ocean Plan states that "The Regional Boards may establish more restrictive water quality objectives and effluent limitations than those set forth in this Plan as necessary for the protection of beneficial uses of ocean waters."

The RSMP proposes to discharge treated wastewater from POTWs and concentrates generated by membrane treatment of groundwater and wastewater treatment facilities. Up to the time of drafting this permit, there are no data available to characterize the mixed wastes as they will be discharged. The analysis of the discharge is based solely on theoretical modeling of the proposed individual components of the discharge, including historical monitoring data for the wastewater treatment plants and one of the desalters and assumptions for other desalters that are not yet operating. Therefore, this Order includes effluent limitations for all of the constituents listed in the Ocean Plan. Upon commencement of discharges from the RSMP, the Los Angeles Regional Water Board may use actual discharge data to evaluate the need for effluent limitations based on water quality objectives in the Ocean Plan.

5. **Anti-Backsliding Requirements.** Sections 402(o) and 303(d)(4) of the CWA and federal regulations at 40 C.F.R. section 122.44(l) restrict backsliding in NPDES permits. These anti-backsliding provisions require that effluent limitations in a reissued permit must be as stringent as those in the previous permit, with some exceptions in which limitations may be relaxed.

6. **Endangered Species Act Requirements.** This Order does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code, §§ 2050 to 2097) or the Federal Endangered Species Act (16 U.S.C.A. §§ 1531 to 1544). This Order requires compliance with effluent limits, receiving water limits, and other requirements to protect the beneficial uses of waters of the state, including protecting rare and endangered species. The discharger is responsible for meeting all requirements of the applicable Endangered Species Act.

D. Impaired Water Bodies on CWA 303(d) List

Section 303(d) of the CWA requires states to identify specific water bodies where water quality standards are not expected to be met after implementation of technology-based effluent limitations on point sources. For all 303(d)-listed water bodies and pollutants, the Los Angeles Regional Water Board plans to develop and adopt TMDLs that will specify WLAs for point sources and load allocations (LAs) for non-point sources, as appropriate.

On November 10, 2010, the USEPA approved the State Water Board's 2010 303(d) List of Water Quality Limited Segments (hereinafter 303(d) list). The 303(d) list identifies water bodies where water quality standards are not expected to be met after implementation of technology-based effluent limitations by point sources (water quality limited water bodies).

Ormond Beach (including the area of Ormond Beach at Oxnard Drain) is on the 303(d) List for indicator bacteria. In addition, Port Hueneme Pier is listed for polychlorinated biphenyls (PCBs). Port Hueneme Harbor (Back Basins) is listed for DDT (tissue) and PCBs (tissue). Total Maximum Daily Loads (TMDLs) for these pollutants have not been completed. Completion of the TMDLs affecting Ormond Beach and Port Hueneme Pier is expected in 2015 and in 2019, respectively. The 303(d) List indicates the TMDL affecting Port Hueneme

Harbor is being addressed by an action other than a TMDL and attainment is expected in 2019.

E. Other Plans, Polices and Regulations – Not Applicable

IV. RATIONALE FOR EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. There are two principal bases for effluent limitations in the Code of Federal Regulations: 40 C.F.R. section 122.44(a) requires that permits include applicable technology-based limitations and standards; and 40 C.F.R. section 122.44(d) requires that permits include water quality-based effluent limitations to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water.

The RSMP has not commenced discharging at the time of the drafting of this Fact Sheet. The list of pollutants of concern is based on constituents that are regulated in the Ocean Plan, as well as pollutants listed in the 303(d) List for Ormond Beach, Port Hueneme Pier, and Port Hueneme Harbor (e.g., pesticides and PCBs). Further, as indicated in the permit renewal application, the combined flow from the eight sources identified for discharging into the RSMP consists of highly-treated municipal wastewater effluent and reject concentrates from treatment facilities. Pollutants of concern typically present in treated municipal wastewater would include pollutants contributing to biochemical oxygen demand (BOD), turbidity, total suspended solids, elevated temperatures, oil and grease, pH, pathogens, nutrients, and toxic parameters (e.g., metals, volatile organic compounds, and pesticides). Settleable solids is another parameter often measured in municipal wastewaters. In addition, pollutants expected to be present in the discharge of reject concentrates from groundwater treatment include parameters contributing to total dissolved solids (TDS), sulfate, chloride, sodium, and boron.

Further, pollutants in the combined discharge may contribute to toxicity in the receiving water. Whole effluent toxicity (WET) is an indicator of the combined effect of pollutants contained in the discharge. Chronic toxicity is a more stringent requirement than acute toxicity. Therefore, chronic toxicity is considered a pollutant of concern for evaluation of narrative Basin Plan Objectives and Water Quality Objectives in the Ocean Plan.

Generally, mass-based effluent limitations ensure that proper treatment, and not dilution, is employed to comply with the final effluent concentration limitations. Section 122.45(f)(1) requires that all permit limitations, standards or prohibitions be expressed in terms of mass units except under the following conditions: (1) for pH, temperature, radiation or other pollutants that cannot appropriately be expressed by mass limitations; (2) when applicable standards or limitations are expressed in terms of other units of measure; or (3) if in establishing technology-based permit limitation on a case-by-case basis limitation based on mass are infeasible because the mass or pollutant cannot be related to a measure of production. The limitations, however, must ensure that dilution will not be used as a substitute for treatment.

A. Discharge Prohibitions

The discharge prohibitions are based on the requirements of the Ocean Plan, State Water Board's plans and policies, the Water Code, and previous permit provisions, and are consistent with the requirements set for other discharges regulated by NPDES permits to the Pacific Ocean.

B. Technology-Based Effluent Limitations

1. Scope and Authority

Section 301(b) of the CWA and implementing USEPA permit regulations at 40 C.F.R. section 122.44 require that permits include conditions meeting applicable technology-based requirements at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. The discharge authorized by this Order must meet minimum federal technology-based requirements based on Best Professional Judgment (BPJ) in accordance with 40 C.F.R. section 125.3.

The CWA requires that technology-based effluent limitations be established based on several levels of controls:

a. Best practicable treatment control technology (BPT) represents the average of the best existing performance by well-operated facilities within an industrial category or subcategory. BPT standards apply to toxic, conventional, and non-conventional pollutants.

b. Best available technology economically achievable (BAT) represents the best existing performance of treatment technologies that are economically achievable within an industrial point source category. BAT standards apply to toxic and non-conventional pollutants.

c. Best conventional pollutant control technology (BCT) represents the control from existing industrial point sources of conventional pollutants including BOD, TSS, fecal coliform, pH, and oil and grease. The BCT standard is established after considering a two-part reasonableness test. The first test compares the relationship between the costs of attaining a reduction in effluent discharge and the resulting benefits. The second test examines the cost and level of reduction of pollutants from the discharge from publicly owned treatment works to the cost and level of reduction of such pollutants from a class or category of industrial sources. Effluent limitations must be reasonable under both tests.

d. New source performance standards (NSPS) represent the best available demonstrated control technology standards. The intent of NSPS guidelines is to set limitations that represent state-of-the-art treatment technology for new sources.

The CWA requires USEPA to develop effluent limitations, guidelines and standards (ELGs) representing application of BPT, BAT, BCT, and NSPS. Section 402(a)(1) of the CWA and 40 C.F.R. section 125.3 authorize the use of best professional judgment (BPJ) to derive technology-based effluent limitations on a case-by-case basis where ELGs are not available for certain industrial categories and/or pollutants of concern. Where BPJ is used, the Los Angeles Regional Water Board must consider specific factors outlined in 40 C.F.R. section 125.3.

2. Applicable Technology-Based Effluent Limitations

This Order includes technology-based effluent limitations based on BPJ in accordance with 40 C.F.R. section 125.3. The previous Order included effluent limitations for oil and grease, TSS, settleable solids, turbidity, and pH based on the effluent limitations contained in Table 2 of the Ocean Plan. The Ocean Plan indicates Table 2 effluent limitations apply only to publicly-owned treatment works and industrial discharges for which ELGs have not been established. The discharge from the RSMP is comprised in part of treated municipal wastewater; therefore, Table 2 effluent limitations are appropriate for this discharge. In addition, this Order establishes technology-based effluent limitations for BOD_5 based on BPJ, applying Secondary Treatment Standards specified in 40 C.F.R. Part 133. This Order establishes limits for oil and grease, TSS, settleable solids, turbidity, and pH based on the effluent limitations contained in Table 2 of the Ocean Plan and for BOD_5 based on EPA's Secondary Treatment Standards.

Section 402(o) of the CWA and 40 C.F.R. section 122.44(l) require that effluent limitations or conditions in reissued Orders be at least as stringent as those in the existing Orders. Table F-7 summarizes the final technology based effluent limitations:

Table F-7. Summary of Final Technology-based Effluent Limitations

Parameter	Unit	Effluent Limitations			
		Average Monthly	Average Weekly	Instantaneous Minimum	Instantaneous Maximum
BOD_5	mg/L	30	45	--	--
	lbs/day[1]	4,400	6,600	--	--
Oil and Grease	mg/L	25	40	--	75
	lbs/day[1]	3,700	5,800	--	11,000
TSS	mg/L	60	--	--	--
	lbs/day[1]	8,800	--	--	--
Settleable Solids	ml/L	1.0	1.5	--	3.0
Turbidity	NTU	75	100	--	225
pH	s.u.	--	--	6.0	9.0

1. Mass-based effluent limitations are based on the facility design flow rate of 17.52 MGD.

This Order requires the Discharger to update and continue to implement the SWPPP and BMPP to prevent contaminated wastes/materials from being discharged to waters of the State. Further discussion of the SWPPP and BMPP are provided in Attachment G.

C. Water Quality-Based Effluent Limitations (WQBELs)

1. Scope and Authority

CWA Section 301(b) and 40 C.F.R. section 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards.

Section 122.44(d)(1)(i) of 40 C.F.R. requires that permits include effluent limitations for all pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard. Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, water quality-based effluent limitations (WQBELs) must be established using: (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in section 122.44(d)(1)(vi).

The process for determining reasonable potential and calculating WQBELs when necessary is intended to protect the designated uses of the receiving water as specified in the Basin Plan, and achieve applicable water quality objectives and criteria that are contained in other state plans and policies, or any applicable water quality criteria contained in the Ocean Plan.

2. Applicable Beneficial Uses and Water Quality Criteria and Objectives

As noted in Section III.C of this Fact Sheet, the State Water Board adopted an Ocean Plan that designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the Ocean Plan. The beneficial uses applicable to the Pacific Ocean are summarized in Section III.C.1 of this Fact Sheet. The Ocean Plan includes both narrative and numeric water quality objectives applicable to the receiving water.

Table 1 of the Ocean Plan (2012) includes the following water quality objectives for toxic pollutants and whole effluent toxicity:

1) 6-month median, daily maximum, and instantaneous maximum objectives for 21 chemicals and chemical characteristics, including total residual chlorine and chronic toxicity, for the protection of marine aquatic life.
2) 30-day average objectives for 20 non-carcinogenic chemicals for the protection of human health.
3) 30-day average objectives for 42 carcinogenic chemicals for the protection of human health.
4) Daily maximum objectives for acute and chronic toxicity.

3. Determining the Need for WQBELs

The need for effluent limitations based on water quality objectives in Table 1 of the Ocean plan was evaluated in accordance with 40 CFR section 122.44(d) and guidance for statistically determining the "reasonable potential" for a discharged pollutant to exceed an objective, as outlined in the California Ocean Plan Reasonable Potential Analysis (RPA) Amendment that was adopted by the State Water Board on April 21, 2005. The statistical approach combines knowledge of effluent variability (as estimated by a coefficient-of variation) with the uncertainty due to a limited amount of effluent data to estimate a maximum effluent value at a high level of confidence. This estimated maximum effluent value is based on a lognormal distribution of daily effluent values. Projected receiving water values (based on the estimated maximum effluent value or the reported maximum effluent value and minimum probable initial dilution); can then be compared to the appropriate objective to determine the potential for an exceedance of that objective and the need for an effluent limitation.

The water quality objectives contained in the Ocean Plan for Table 1 pollutants are summarized in Table F-8 below.

Table F-8. Ocean Plan Water Quality Objectives

Parameter	6-Month Median (µg/L)	Daily Maximum (µg/L)	Instantaneous Maximum (µg/L)	30-Day Average (µg/L)
Arsenic	8	32	80	--
Cadmium	1	4	10	--
Chromium VI	2	8	20	--
Copper	3	12	30	--
Lead	2	8	20	--

Parameter	6-Month Median (µg/L)	Daily Maximum (µg/L)	Instantaneous Maximum (µg/L)	30-Day Average (µg/L)
Mercury	0.04	0.16	0.4	--
Nickel	5	20	50	--
Selenium	15	60	150	--
Silver	0.7	2.8	7	--
Zinc	20	80	200	--
Cyanide	1	4	10	--
Total Residual Chlorine	2	8	60	--
Ammonia (as N)	600	2400	6000	--
Acute Toxicity	--	0.3	--	--
Chronic Toxicity	--	1	--	--
Phenolic Compounds	30	120	300	--
Chlorinated Phenolics	1	4	10	--
Endosulfan	0.009	0.018	0.027	--
Endrin	0.002	0.004	0.006	--
HCH	0.004	0.008	0.012	--
Acrolein	--	--	--	220
Antimony	--	--	--	1,200
Bis(2-chloroethoxy)Methane	--	--	--	4.4
Bis(2-chloroisopropyl)Ether	--	--	--	1,200
Chlorobenzene	--	--	--	570
Chromium (III)	--	--	--	190,000
Di-n-butyl-phthalate	--	--	--	3,500
Dichlorobenzenes	--	--	--	5,100
Diethyl Phthalate	--	--	--	33,000
Dimethyl Phthalate	--	--	--	820,000
4,6-Dinitro-2-Methylphenol	--	--	--	220
2,4-Dinitrophenol	--	--	--	4.0
Ethylbenzene	--	--	--	4,100
Fluoranthene	--	--	--	15
Hexachlorocyclopentadiene	--	--	--	58
Nitrobenzene	--	--	--	4.9
Thallium	--	--	--	2
Toluene	--	--	--	85,000
Tributyltin	--	--	--	0.0014
1,1,1-Trichloroethane	--	--	--	540,000
Acrylonitrile	--	--	--	0.10
Aldrin	--	--	--	0.000022
Benzene	--	--	--	5.9
Benzidine	--	--	--	0.000069
Beryllium	--	--	--	0.033
Bis(2-chloroethyl)Ether	--	--	--	0.045
Bis(2-ethylhexyl)Phthalate	--	--	--	3.5
Carbon Tetrachloride	--	--	--	0.90

Parameter	6-Month Median (µg/L)	Daily Maximum (µg/L)	Instantaneous Maximum (µg/L)	30-Day Average (µg/L)
Chlordane	--	--	--	0.000023
Chlorodibromomethane	--	--	--	8.6
Chloroform	--	--	--	130
DDT	--	--	--	0.00017
1,4-Dichlorobenzene	--	--	--	18
3,3'-Dichlorobenzidine	--	--	--	0.0081
1,2-Dichloroethane	--	--	--	28
1,1-Dichloroethylene	--	--	--	0.9
Dichlorobromomethane	--	--	--	6.2
Dichloromethane	--	--	--	450
1,3-Dichloropropene	--	--	--	8.9
Dieldrin	--	--	--	0.00004
2,4-Dinitrotoluene	--	--	--	2.6
1,2-Diphenylhydrazine	--	--	--	0.16
Halomethanes	--	--	--	130
Heptachlor	--	--	--	0.00005
Heptachlor Epoxide	--	--	--	0.00002
Hexachlorobenzene	--	--	--	0.00021
Hexachlorobutadiene	--	--	--	14
Hexachloroethane	--	--	--	2.5
Isophorone	--	--	--	730
N-Nitrosodmethylamine	--	--	--	7.3
N-nitrosodi-N-propylamine	--	--	--	0.38
N-Nitrosodiphenylamine	--	--	--	2.5
PAHs	--	--	--	0.0088
PCBs	--	--	--	0.000019
TCDD equivalents	--	--	--	0.0000000039
1,1,2,2-Tetrachloroethane	--	--	--	2.3
Tetrachloroethylene	--	--	--	2.0
Toxaphene	--	--	--	0.00021
Trichloroethylene	--	--	--	27
1,1,2-Trichloroethane	--	--	--	9.4
2,4,6-Trichlorophenol	--	--	--	0.29
Vinyl Chloride	--	--	--	36
Radioactivity	Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30253 of the California Code of Regulations. Reference to Section 30253 is prospective, including future changes to any incorporated provisions of federal law, as the changes take effect.			

According to the 2012 Ocean Plan, the reasonable potential analysis (RPA) can yield three endpoints:

Endpoint 1:An effluent limitation is required and monitoring is required;

Endpoint 2: An effluent limitation is not required and the Los Angeles Regional Water Board may require monitoring; and

Endpoint 3: The RPA is inconclusive, monitoring is required, and an existing effluent limitation may be retained or a permit reopener clause may be included to allow inclusion of an effluent limitation if future monitoring warrants the inclusion.

This Order establishes new WQBELs for certain pollutants included in Table 1 of the Ocean Plan that were not established in the previous Order and it includes limits for all pollutants included in Order No. R4-2008-0014, because there are no actual data available to determine reasonable potential.

4. WQBEL Calculations

CMWD completed theoretical modeling for the Hueneme Outfall dilution ratio. The results of the modeling were originally included in the ROWD submitted and accepted on July 15, 2007. At the time of the submittal of the ROWD in 2007, the dilution ratio of the Hueneme Outfall was determined by modeling the discharge using the USEPA-approved Visual Plumes (VP) program. Modeling runs were performed using ambient receiving water (Pacific Ocean) data collected in 2002 from the nearby Reliant Energy Ocean Outfall for salinity and temperature at various depths. Scenarios were evaluated over the range of flows expected on the SMP, including 2, 6, 10, 14, and 19.1 MGD. The lowest dilution predicted by the VP model was 99.5:1, occurring at the highest flow rate of 19.1 MGD under 2002 summer conditions.

The modeling was updated in 2007 to use more recent (August 2006 and February 2007) receiving water data collected by the City of Oxnard. Summer and winter conditions were modeled with an assumed 19.4 MGD effluent flow in CORMIX, Visual Plumes (VP), and KOH & FAN using the updated receiving water data sets. The KOH & FAN models predicted 72:1, a lower, more conservative dilution upon reaching the surface. CORMIX predicted 94:1, and VP predicted 89:1. The approved dilution ratio in Calleguas' current permit (R4-2008-0014) is 72:1, the most conservative predicted by the updated models.

The State Water Board and the Los Angeles Regional Water Board reviewed the modeling and additional information provided by CMWD and granted a dilution ratio of 72:1 for discharges from the RSMP.

From the Table 1 water quality objectives of the Ocean Plan, effluent limitations are calculated according to Equation 1 of the Ocean Plan for all pollutants, except for acute toxicity (if applicable) and radioactivity:

$$Ce = Co + Dm(Co - Cs)$$

Where:

C_e = the effluent limitation (µg/L)
C_o = the water quality objective to be met at the completion of initial dilution (µg/L)
C_s = background seawater concentration (µg/L)
D_m = minimum probable initial dilution expressed as parts seawater per part wastewater

The D_m is based on observed waste flow characteristics, receiving water density structure, and the assumption that no currents of sufficient strength to influence the initial dilution process flow across the discharge structure.

The State Water Board had determined the minimum initial dilution factor, D_m, for the ocean outfall to be 72 to 1. Initial dilution is the process that results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge. As stated above, the water quality objective to be met at the completion of initial dilution is contained in Table 1 of the Ocean Plan. The values provided in Table 3 of the Ocean Plan are presented in Table F-9, below. Cs equals zero for all pollutants, except the following:

Table F-9. Background Seawater Concentrations (C_S)

Parameter	Ocean Plan Table 3 Background Concentration (µg/L)
Arsenic	3
Copper	2
Mercury	0.0005
Silver	0.16
Zinc	8

WQBELs based on the dilution provided at the outfall for all parameters in Table 1 of the Ocean Plan is developed using Equation 1 of the Ocean Plan and Ocean Plan background concentrations.

WQBELs Calculation Example

The following demonstrates how the WQBELs for arsenic, are established.

Arsenic

C_e = 8 µg/L + 72 (8 µg/L – 3) = 368 µg/L (6-Month Median)
C_e = 32 µg/L + 72 (32 µg/L – 3) = 2,120 µg/L (Daily Maximum)
C_e = 80 µg/L + 72 (80 µg/L – 3) = 5,624 µg/L (Instantaneous Maximum)

5. Temperature

The temperature limitations prescribed in the previous Order were based on specific water quality objectives for new coastal water dischargers in the Thermal Plan. Those limitations were retained in this Order

6. Whole Effluent Toxicity (WET)

Whole effluent toxicity (WET) protects the receiving water quality from the aggregate toxic effect of a mixture of pollutants in the effluent. WET tests measure the degree of response of exposed aquatic test organisms to an effluent. The WET approach allows for protection of the narrative “no toxics in toxic amounts” criterion while implementing numeric criteria for toxicity. There are two types of WET tests: acute and chronic. An acute toxicity test is conducted over a short time period and measures mortality. A chronic toxicity test is conducted over a longer period of time and may measure mortality, reproduction, and growth.

The previous permit included both the acute toxicity and the chronic toxicity limits based on water quality objectives in the Ocean Plan. To implement the USEPA toxicity policy, this Order includes the chronic toxicity limit using USEPA's 2010 Test of Significant Toxicity (TST) hypothesis testing approach. Since a chemical at a low concentration can have chronic effects but no acute effects until it reach a higher level, the acute toxicity limit is not included in the Order. The chronic toxicity effluent limitations in this Order are as stringent as necessary to protect the Ocean Plan Water Quality Objective for chronic toxicity.

7. Final WQBELs

This Order includes all effluent limitations established in Order R4-2008-0014 and establishes new effluent limitations for the remainder of pollutants for which water quality objectives exist in Table 1 of the Ocean Plan. The RSMP has not commenced discharge at the time of this permit reissuance and there are no actual discharge data available with which to evaluate reasonable potential; therefore, this Order includes effluent limitations for BOD_5 consistent with those included in Order No. R4-2008-0014 based on BPJ and EPA's Secondary Treatment Standards. This Order retains WQBELs for total residual chlorine, ammonia (as N), chronic toxicity, and other pollutants included in Order No. R4-2008-0014.

This Order establishes new WQBELs for the remaining pollutants for which water quality objectives exist, based on Table 1 of the Ocean Plan.

For radioactivity, no numeric water quality objectives are included in the Ocean Plan. Therefore, the effluent limitations for radioactivity in this Order are based on Maximum Contaminant Levels specified in Title 22, Chapter 15, Article 5, Section 64443, California Code of Regulations.

Effluent limitations for temperature and bacteria have been retained from the previous Order.

Table F-10. Summary of Water Quality-based Effluent Limitations

Parameter	Units	Effluent Limitations			
		Average Monthly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Total Residual Chlorine	µg/L	--	580	4,400	150
	lbs/day[1]	--	85	640	22
Ammonia as N	µg/L	--	180,000	440,000	44,000
	lbs/day[1]	--	26,000	64,000	6,400
Chronic Toxicity[2]	Pass or Fail, % Effect	Pass[3]	Pass or % Effect <50	--	--
Total coliform	MPN/100ml	[4]			
Fecal coliform	MPN/100ml	[4]			
Enterococcus	MPN/100ml	[4]			
Antimony	µg/L	88,000	--	--	--
	lbs/day[1]	13,000	--	--	--
Arsenic, Total Recoverable	µg/L	--	2100	5,600	370
	lbs/day[1]	--	310	820	54
Beryllium	µg/L	2.4	--	--	--
	lbs/day[1]	0.35	--	--	--
Cadmium, Total Recoverable	µg/L	--	290	730	73
	lbs/day[1]	--	42	110	11

Parameter	Units	Effluent Limitations			
		Average Monthly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Chromium (III) , Total Recoverable	µg/L	1.4E+07	--	--	--
	lbs/day[1]	2.0E+06	--	--	--
Chromium (VI) , Total Recoverable	µg/L	--	580	1,500	150
	lbs/day[1]	--	85	210	22
Copper, Total Recoverable	µg/L	--	730	2,000	75
	lbs/day[1]	--	110	290	11
Lead, Total Recoverable	µg/L	--	580	1500	150
	lbs/day[1]	--	85	220	22
Mercury	µg/L	--	12	29	2.9
	lbs/day[1]	--	1.8	4.2	0.42
Nickel, Total Recoverable	µg/L	--	1,500	3,700	370
	lbs/day[1]	--	220	530	53
Selenium, Total Recoverable	µg/L	--	4,400	11,000	1,100
	lbs/day[1]	--	640	1600	160
Silver, Total Recoverable	µg/L	--	190	500	40
	lbs/day[1]	--	28	73	5.8
Thallium	µg/L	150	--	--	--
	lbs/day[1]	22	--	--	--
Zinc, Total Recoverable	µg/L	--	5,300	14,000	880
	lbs/day[1]	--	770	2,000	130
Cyanide	µg/L	--	290	730	73
	lbs/day[1]	--	42	110	11
Phenolic Compounds (non-chlorinated) [5]	µg/L	--	8,800	22,00	2,200
	lbs/day[1]	--	1,300	3,200	320
Chlorinated Phenolics [6]	µg/L	--	290	730	73
	lbs/day[1]	--	42	110	11
TCDD Equivalents [7]	µg/L	2.8E-07	--	--	--
	lbs/day[1]	4.1E-08	--	--	--
Acrolein	µg/L	16,000	--	--	--
	lbs/day[1]	2,300	--	--	--
Acrylonitrile	µg/L	7.3	--	--	--
	lbs/day[1]	1.1	--	--	--
Benzene	µg/L	430	--	--	--
	lbs/day[1]	63	--	--	--
Carbon Tetrachloride	µg/L	66	--	--	--
	lbs/day[1]	9.6	--	--	--
Chlorobenzene	µg/L	42,000	--	--	--
	lbs/day[1]	6,100	--	--	--
Chlorodibromomethane	µg/L	630	--	--	--
	lbs/day[1]	92	--	--	--
Chloroform	µg/L	9,500	--	--	--
	lbs/day[1]	1,400	--	--	--

Parameter	Units	Effluent Limitations			
		Average Monthly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Dichlorobromomethane	µg/L	450	--	--	--
	lbs/day[1]	66	--	--	--
1,2-Dichloroethane	µg/L	2,000	--	--	--
	lbs/day[1]	290	--	--	--
1,1-Dichloroethylene	µg/L	66	--	--	--
	lbs/day[1]	9.6	--	--	--
1,3-Dichloropropylene	µg/L	650	--	--	--
	lbs/day[1]	95	--	--	--
Ethylbenzene	µg/L	3.0E+5	--	--	--
	lbs/day[1]	44,000	--	--	--
Halomethanes [8]	µg/L	9,500	--	--	--
	lbs/day[1]	1,400	--	--	--
Dichloromethane	µg/L	33,000	--	--	--
	lbs/day[1]	4,800	--	--	--
1,1,2,2-Tetrachloroethane	µg/L	170	--	--	--
	lbs/day[1]	25	--	--	--
Tetrachloroethylene	µg/L	150	--	--	--
	lbs/day[1]	22	--	--	--
Toluene	µg/L	6.2E+06	--	--	--
	lbs/day[1]	9.1E+05	--	--	--
1,1,1-Trichloroethane	µg/L	3.9E+07	--	--	--
	lbs/day[1]	5.7E+06	--	--	--
1,1,2-Trichloroethane	µg/L	690	--	--	--
	lbs/day[1]	100	--	--	--
Trichloroethylene	µg/L	2,000	--	--	--
	lbs/day[1]	290	--	--	--
Vinyl Chloride	µg/L	2,600	--	--	--
	lbs/day[1]	380	--	--	--
4,6-Dinitro-2-Methylphenol	µg/L	16,000	--	--	--
	lbs/day[1]	2,300	--	--	--
2,4-Dinitrophenol	µg/L	290	--	--	--
	lbs/day[1]	42	--	--	--
2,4,6-Trichlorophenol	µg/L	21	--	--	--
	lbs/day[1]	3.1	--	--	--
Benzidine	µg/L	0.0050	--	--	--
	lbs/day[1]	0.00073	--	--	--
Polynuclear Aromatic Hydrocarbons (PAHs) [9]	µg/L	0.64	--	--	--
	lbs/day[1]	0.094	--	--	--
Bis(2-chloroethoxy)Methane	µg/L	320	--	--	--
	lbs/day[1]	47	--	--	--
Bis(2-chlorotethyl)Ether	µg/L	3.3	--	--	--
	lbs/day[1]	0.48	--	--	--

Parameter	Units	Effluent Limitations			
		Average Monthly	Maximum Daily	Instantaneous Maximum	Six-Month Median
Bis(2-chloroisopropyl)Ether	µg/L	88,000	--	--	--
	lbs/day[1]	13,000	--	--	--
Bis(2-ethylhexyl)Phthalate	µg/L	260	--	--	--
	lbs/day[1]	38	--	--	--
Dichlorobenzenes	µg/L	3.7E+05	--	--	--
	lbs/day[1]	54,000	--	--	--
1,4-Dichlorobenzene	µg/L	1300	--	--	--
	lbs/day[1]	190	--	--	--
3,3'-Dichlorobenzidine	µg/L	0.59	--	--	--
	lbs/day[1]	0.086	--	--	--
Diethyl Phthalate	µg/L	2.4E+06	--	--	--
	lbs/day[1]	3.5E+05	--	--	--
Dimethyl Phthalate	µg/L	6.0E+07	--	--	--
	lbs/day[1]	8.8E+06	--	--	--
Di-n-Butyl Phthalate	µg/L	2.6E+05	--	--	--
	lbs/day[1]	38,000	--	--	--
2,4-Dinitrotoluene	µg/L	190	--	--	--
	lbs/day[1]	28	--	--	--
1,2-Diphenylhydrazine	µg/L	12	--	--	--
	lbs/day[1]	1.8	--	--	--
Fluoranthene	µg/L	1,100	--	--	--
	lbs/day[1]	160	--	--	--
Hexachlorobenzene	µg/L	0.015	--	--	--
	lbs/day[1]	0.0022	--	--	--
Hexachlorobutadiene	µg/L	1,000	--	--	--
	lbs/day[1]	150	--	--	--
Hexachlorocyclopentadiene	µg/L	4,200	--	--	--
	lbs/day[1]	610	--	--	--
Hexachloroethane	µg/L	180	--	--	--
	lbs/day[1]	26	--	--	--
Isophorone	µg/L	53,000	--	--	--
	lbs/day[1]	7,700	--	--	--
Nitrobenzene	µg/L	360	--	--	--
	lbs/day[1]	53	--	--	--
N-Nitrosodimethylamine	µg/L	530	--	--	--
	lbs/day[1]	77	--	--	--
N-Nitrosodi-N-propylamine	µg/L	28	--	--	--
	lbs/day[1]	4.1	--	--	--
N-Nitrosodiphenylamine	µg/L	180	--	--	--
	lbs/day[1]	26	--	--	--
Aldrin	µg/L	0.0016	--	--	--
	lbs/day[1]	0.00023	--	--	--

Parameter	Units	Effluent Limitations			
		Average Monthly	Maximum Daily	Instantaneous Maximum	Six-Month Median
HCH [10]	µg/L	--	0.58	0.88	0.29
	lbs/day[1]	--	0.085	0.13	0.042
Chlordane	µg/L	0.0017	--	--	--
	lbs/day[1]	0.00025	--	--	--
DDT [11]	µg/L	0.012	--	--	--
	lbs/day[1]	0.0018	--	--	--
Dieldrin	µg/L	0.0029	--	--	--
	lbs/day[1]	0.00042	--	--	--
Endosulfan	µg/L	--	1.3	2.0	0.66
	lbs/day[1]	--	0.19	0.29	0.096
Endrin	µg/L	--	0.29	0.44	0.15
	lbs/day[1]	--	0.042	0.064	0.022
Heptachlor	µg/L	0.0037	--	--	--
	lbs/day[1]	0.00054	--	--	--
Heptachlor Epoxide	µg/L	0.0015	--	--	--
	lbs/day[1]	0.00022	--	--	--
Polychlorinated Biphenyls (PCBs) [12]	µg/L	0.0014	--	--	--
	lbs/day[1]	0.00020	--	--	--
Toxaphene	µg/L	0.015	--	--	--
	lbs/day[1]	0.0022	--	--	--
Tributyltin	µg/L	0.10	--	--	--
	lbs/day[1]	0.015	--	--	--
Radioactivity	Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30253 of the California Code of Regulations. Reference to Section 30253 is prospective, including future changes to any incorporated provisions of federal law, as the changes take effect.				

1. The mass-based effluent limitations are based on the facility design flow rate of 17.52 MGD.
2. "Pass" or "Fail" for Median Monthly Effluent Limitation (MMEL). "Pass" or "Fail" and "% Effect" for Maximum Daily Effluent Limitation (MDEL). The MMEL for chronic toxicity shall only apply when there is a discharge more than one day in a calendar month period. During such calendar months, exactly three independent toxicity tests are required when one toxicity test results in "Fail".
3. This is a Median Monthly Effluent Limitation.
4. Bacteria limitations:
   a. 30-day Geometric Mean – The geometric mean shall be calculated using the results of five most recent samples.
      i. Total coliform density shall not exceed 1,000/100 ml;
      ii. Fecal coliform density shall not exceed 200/100 ml; and
      iii. Enterococcus density shall not exceed 35/100 ml.
   b. Single Sample Maximum (SSM)
      i. Total coliform density shall not exceed 10,000/100 ml;
      ii. Fecal coliform density shall not exceed 400/100 ml;
      iii. Enterococcus density shall not exceed 104/100 ml; and
      iv. Total coliform density shall not exceed 1,000/100 ml, when the fecal coliform/total coliform ratio exceeds 0.1.

If a single sample exceeds any of the single sample maximum (SSM) standards, repeat sampling shall be conducted to determine the extent and persistence of the exceedance. Repeat sampling shall be conducted within 24 hours of receiving analytical results and continued until the sample result is less than the SSM standard.

When repeat sampling is required because of an exceedance of any one single sample density, values from all samples collected during that 30-day period will be used to calculate the geometric mean.

5. Non-chlorinated phenolic compounds represent the sum of 2-nitrophenol; phenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; and 4-nitrophenol.
6. Chlorinated phenolic compounds represent the sum of 2-chlorophenol; 2,4-dichlorophenol; 2,4,6-trichlorophenol; 4-chloro-3-methylphenol; and pentachlorophenol.
7. TCDD Equivalents shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below. USEPA method 1613 may be used to analyze dioxin and furan congeners.

Dioxin-TEQ (TCDD Equivalents) = Σ (C_x x TEF_x)

Where:

C_x = concentration of dioxin or furan congener x

TEF_x = TEF for congener x

Toxicity Equivalency Factors

Isomer Group	Toxicity Equivalency Factor (TEF)
2,3,7,8-tetra CDD	1.0
2,3,7,8-penta CDD	0.5
2,3,7,8-hexa CDDs	0.1
2,3,7,8-hepta CDD	0.01
Octa CDD	0.001
2,3,7,8 tetra CDF	0.1
1,2,3,7,8 penta CDF	0.05
2,3,4,7,8 penta CDF	0.5
2,3,7,8 hexa CDFs	0.1
2,3,7,8 hepta CDFs	0.01
Octa CDF	0.001

8. Halomethanes shall mean the sum of bromoform, bromomethane (methyl bromide), and chloromethane (methyl chloride).
9. PAHs shall mean the sum of acenaphthylene; anthracene; 1,2-benzanthracene; 3,4-benzofluoranthene; benzo(k)fluoranthene; 1,12-benzoperylene; benzo(a)pyrene; chrysene; dibenzo(a,h)anthracene; fluorine; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene.
10. HCH shall mean the sum of alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.
11. DDT shall mean the sum of 4,4'-DDT, 2,4'-DDT, 4,4'-DDE, 2,4'-DDE, 4,4'-DDD, and 2,4'-DDD.
12. PCBs shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Arolclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260.

D. Final Effluent Limitation Considerations

Section 402(o) of the CWA and section 122.44(l) require that effluent limitations or conditions in reissued Orders be at least as stringent as those in the existing Orders based on the submitted sampling data. Technology-based effluent limitations for settleable solids, TSS, oil and grease, turbidity, and pH have been included and are based on the effluent limitations established in Table 2 of the Ocean Plan. Technology-based effluent limitations for BOD_5 are established using BPJ and applying Secondary Treatment Standards to the discharge, as it is comprised of highly-treated municipal wastewater. This Order retains WQBELs based on Ocean Plan water quality objectives for all Ocean Plan Table 1 pollutants.

Order R4-2008-0014 did not establish effluent limits for certain pollutants for which the Ocean Plan establishes water quality objectives. However, based on the lack of actual discharge data with which to evaluate reasonable potential, this Order establishes WQBELs for all pollutants regulated in the Ocean Plan. Therefore, this Order establishes new WQBELs for acrolein, antimony, bis(2-chloroisopropyl)ether, chlorobenzene, chromium (III), di-n-butyl-phthalate, dichlorobenzenes, diethyl phthalate, dimethyl phthalate, 4,6-dinitro-2-methylphenol, ethylbenzene, fluoranthene, hexachlorocyclopentadiene, toluene, 1,1,1-trichlorethane, chloroform, 1,4-dichlorobenzene, 1,2-dichloroethane, dichloromethane (methylene chloride), halomethanes, hexachlorobutadiene, isophorone, and vinyl chloride based on the water quality objectives contained in Table 1 of the Ocean Plan.

1. Anti-Backsliding Requirements

Sections 402(o) and 303(d)(4) of the CWA and federal regulations at 40 C.F.R. section 122.44(l) prohibit backsliding in NPDES permits. These anti-backsliding provisions require effluent limitations in a reissued permit to be as stringent as those in the previous permit, with some exceptions where limitations may be relaxed. All concentration-based effluent limitations in this Order are at least as stringent as the effluent limitations in the previous Order.

The mass effluent limitations in this Order were calculated based on the permitted flow of 17.52 MGD as specified in the previous Order. During this permit term, it is projected that the total discharging flows through the RSMP will be 14.12 MGD that is less than the permited flow of 17.52 MGD. The permit allows for a phased increase in the discharge flow as various sources discharging to the RSMP connect to the pipeline and begin discharging.

2. Antidegradation Policies

Section 131.12 requires that the state water quality standards include an anti-degradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution 68-16. Resolution 68-16 incorporates the federal antidegradation policy where the federal policy applies under federal law. Resolution 68-16 requires that existing water quality be maintained unless degradation is justified based on specific findings. The Los Angeles Regional Water Board's Basin Plan implements, and incorporates by reference, both the State and federal antidegradation policies.

The permitted discharge is consistent with the antidegradation provision of section 131.12 and State Water Board Resolution 68-16. This Order does not provide for an increase in the permitted flow or allow for a reduction in the level of treatment. The final limitations in this Order hold the Discharger to performance levels that will not cause or contribute to water quality impairment or degradation of water quality.

3. Stringency of Requirements for Individual Pollutants

This Order contains both technology-based and water quality-based effluent limitations for individual pollutants. The technology-based effluent limitations consist of restrictions on BOD, oil and grease, TSS, settleable solids, turbidity, and pH. Restrictions on these pollutants are discussed in section IV.B. This Order's technology-based pollutant restrictions implement the minimum, applicable federal technology-based requirements.

Water quality-based effluent limitations have been derived to implement water quality objectives that protect beneficial uses. Both the beneficial uses and the water quality objectives have been approved pursuant to federal law and are the applicable federal water quality standards. The procedures for calculating the individual water quality-based effluent limitations are based on the Ocean Plan, most recently amended, effective August 19, 2013. All beneficial uses and water quality objectives contained in the Ocean Plan were approved under state law and submitted to and approved by USEPA and are applicable water quality standards pursuant to 40 C.F.R. section 131.21(c)(2). Collectively, this Order's restrictions on individual pollutants are no more stringent than required to implement the requirements of the CWA.

Table F-11. Summary of Final Effluent Limitations

Parameter	Units	Effluent Limitations					Basis [1]
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median	
Biochemical Oxygen Demand (BOD), 5-day @ 20°C	mg/L	30	45	--	--	--	BPJ
	lbs/day[2]	4,400	6,600		--	--	
Oil and Grease	mg/L	25	40	--	75	--	OP
	lbs/day[2]	3,700	5,800	--	11,000	--	
pH	s.u.	6.0 - 9.0					OP
Settleable Solids	ml/L	1.0	1.5	--	3.0	--	OP
Total Suspended Solids (TSS)	mg/L	60	--	--	--	--	OP
	lbs/day[2]	8,800	--	--	--	--	
Turbidity	NTU	75	100	--	225	--	OP
Total Residual Chlorine	µg/L	--	--	580	4,400	150	OP
	lbs/day[2]	--	--	85	640	22	
Ammonia as N	µg/L	--	--	180,000	440,000	44,000	OP
	lbs/day[2]	--	--	26,000	64,000	6,400	
Chronic Toxicity [3]	Pass or Fail, % Effect	Pass [4]		Pass or % Effect <50	--	--	OP
Total coliform	MPN/100ml	[5]					OP
Fecal coliform	MPN/100ml	[5]					OP
Enterococcus	MPN/100ml	[5]					OP
Antimony	µg/L	88,000	--	--	--	--	OP
	lbs/day[2]	13,000	--	--	--	--	
Arsenic, Total Recoverable	µg/L	--	--	2100	5,600	370	OP
	lbs/day[2]	--	--	310	820	54	
Beryllium	µg/L	2.4	--	--	--	--	OP
	lbs/day[2]	0.35	--	--	--	--	
Cadmium, Total Recoverable	µg/L	--	--	290	730	73	OP
	lbs/day[2]	--	--	42	110	11	
Chromium (III) , Total Recoverable	µg/L	1.4E+07	--	--	--	--	OP
	lbs/day[2]	2.0E+06	--	--	--	--	
Chromium (VI) , Total Recoverable	µg/L	--	--	580	1,500	150	OP
	lbs/day[2]	--	--	85	210	22	
Copper, Total Recoverable	µg/L	--	--	730	2,000	75	OP
	lbs/day[2]	--	--	110	290	11	
Lead, Total Recoverable	µg/L	--	--	580	1500	150	OP
	lbs/day[2]	--	--	85	220	22	

Parameter	Units	Effluent Limitations					Basis [1]
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median	
Mercury	µg/L	--	--	12	29	2.9	OP
	lbs/day[2]	--	--	1.8	4.2	0.42	
Nickel, Total Recoverable	µg/L	--	--	1,500	3,700	370	OP
	lbs/day[2]	--	--	220	530	53	
Selenium, Total Recoverable	µg/L	--	--	4,400	11,000	1,100	OP
	lbs/day[2]	--	--	640	1600	160	
Silver, Total Recoverable	µg/L	--	--	190	500	40	OP
	lbs/day[2]	--	--	28	73	5.8	
Thallium	µg/L	150	--	--	--	--	OP
	lbs/day[2]	22	--	--	--	--	
Zinc, Total Recoverable	µg/L	--	--	5,300	14,000	880	OP
	lbs/day[2]	--	--	770	2,000	130	
Cyanide	µg/L	--	--	290	730	73	OP
	lbs/day[2]	--	--	42	110	11	
Phenolic Compounds (non-chlorinated) [6]	µg/L	--	--	8,800	22,00	2,200	OP
	lbs/day[2]	--	--	1,300	3,200	320	
Chlorinated Phenolics [7]	µg/L	--	--	290	730	73	OP
	lbs/day[2]	--	--	42	110	11	
TCDD Equivalents [8]	µg/L	2.8E-07	--	--	--	--	OP
	lbs/day[2]	4.1E-08	--	--	--	--	
Acrolein	µg/L	16,000	--	--	--	--	OP
	lbs/day[2]	2,300	--	--	--	--	
Acrylonitrile	µg/L	7.3	--	--	--	--	OP
	lbs/day[2]	1.1	--	--	--	--	
Benzene	µg/L	430	--	--	--	--	OP
	lbs/day[2]	63	--	--	--	--	
Carbon Tetrachloride	µg/L	66	--	--	--	--	OP
	lbs/day[2]	9.6	--	--	--	--	
Chlorobenzene	µg/L	42,000	--	--	--	--	OP
	lbs/day[2]	6,100	--	--	--	--	
Chlorodibromomethane	µg/L	630	--	--	--	--	OP
	lbs/day[2]	92	--	--	--	--	
Chloroform	µg/L	9,500	--	--	--	--	OP
	lbs/day[2]	1,400	--	--	--	--	
Dichlorobromomethane	µg/L	450	--	--	--	--	OP
	lbs/day[2]	66	--	--	--	--	
1,2-Dichloroethane	µg/L	2,000	--	--	--	--	OP
	lbs/day[2]	290	--	--	--	--	

Parameter	Units	Effluent Limitations					Basis [1]
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median	
1,1-Dichloroethylene	µg/L	66	--	--	--	--	OP
	lbs/day[2]	9.6	--	--	--	--	
1,3-Dichloropropylene	µg/L	650	--	--	--	--	OP
	lbs/day[2]	95	--	--	--	--	
Ethylbenzene	µg/L	3.0E+5	--	--	--	--	OP
	lbs/day[2]	44,000	--	--	--	--	
Halomethanes [9]	µg/L	9,500	--	--	--	--	OP
	lbs/day[2]	1,400	--	--	--	--	
Dichloromethane	µg/L	33,000	--	--	--	--	OP
	lbs/day[2]	4,800	--	--	--	--	
1,1,2,2-Tetrachloroethane	µg/L	170	--	--	--	--	OP
	lbs/day[2]	25	--	--	--	--	
Tetrachloroethylene	µg/L	150	--	--	--	--	OP
	lbs/day[2]	22	--	--	--	--	
Toluene	µg/L	6.2E+06	--	--	--	--	OP
	lbs/day[2]	9.1E+05	--	--	--	--	
1,1,1-Trichloroethane	µg/L	3.9E+07	--	--	--	--	OP
	lbs/day[2]	5.7E+06	--	--	--	--	
1,1,2-Trichloroethane	µg/L	690	--	--	--	--	OP
	lbs/day[2]	100	--	--	--	--	
Trichloroethylene	µg/L	2,000	--	--	--	--	OP
	lbs/day[2]	290	--	--	--	--	
Vinyl Chloride	µg/L	2,600	--	--	--	--	OP
	lbs/day[2]	380	--	--	--	--	
4,6-Dinitro-2-Methylphenol	µg/L	16,000	--	--	--	--	OP
	lbs/day[2]	2,300	--	--	--	--	
2,4-Dinitrophenol	µg/L	290	--	--	--	--	OP
	lbs/day[2]	42	--	--	--	--	
2,4,6-Trichlorophenol	µg/L	21	--	--	--	--	OP
	lbs/day[2]	3.1	--	--	--	--	
Benzidine	µg/L	0.0050	--	--	--	--	OP
	lbs/day[2]	0.00073	--	--	--	--	
Polynuclear Aromatic Hydrocarbons (PAHs) [10]	µg/L	0.64	--	--	--	--	OP
	lbs/day[2]	0.094	--	--	--	--	
Bis(2-chloroethoxy)Methane	µg/L	320	--	--	--	--	OP
	lbs/day[2]	47	--	--	--	--	
Bis(2-chlorotethyl)Ether	µg/L	3.3	--	--	--	--	OP
	lbs/day[2]	0.48	--	--	--	--	

Parameter	Units	Effluent Limitations					Basis [1]
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median	
Bis(2-chloroisopropyl)Ether	µg/L	88,000	--	--	--	--	OP
	lbs/day[2]	13,000	--	--	--	--	
Bis(2-ethylhexyl)Phthalate	µg/L	260	--	--	--	--	OP
	lbs/day[2]	38	--	--	--	--	
Dichlorobenzenes	µg/L	3.7E+05	--	--	--	--	OP
	lbs/day[2]	54,000	--	--	--	--	
1,4-Dichlorobenzene	µg/L	1300	--	--	--	--	OP
	lbs/day[2]	190	--	--	--	--	
3,3'-Dichlorobenzidine	µg/L	0.59	--	--	--	--	OP
	lbs/day[2]	0.086	--	--	--	--	
Diethyl Phthalate	µg/L	2.4E+06	--	--	--	--	OP
	lbs/day[2]	3.5E+05	--	--	--	--	
Dimethyl Phthalate	µg/L	6.0E+07	--	--	--	--	OP
	lbs/day[2]	8.8E+06	--	--	--	--	
Di-n-Butyl Phthalate	µg/L	2.6E+05	--	--	--	--	OP
	lbs/day[2]	38,000	--	--	--	--	
2,4-Dinitrotoluene	µg/L	190	--	--	--	--	OP
	lbs/day[2]	28	--	--	--	--	
1,2-Diphenylhydrazine	µg/L	12	--	--	--	--	OP
	lbs/day[2]	1.8	--	--	--	--	
Fluoranthene	µg/L	1,100	--	--	--	--	OP
	lbs/day[2]	160	--	--	--	--	
Hexachlorobenzene	µg/L	0.015	--	--	--	--	OP
	lbs/day[2]	0.0022	--	--	--	--	
Hexachlorobutadiene	µg/L	1,000	--	--	--	--	OP
	lbs/day[2]	150	--	--	--	--	
Hexachlorocyclopentadiene	µg/L	4,200	--	--	--	--	OP
	lbs/day[2]	610	--	--	--	--	
Hexachloroethane	µg/L	180	--	--	--	--	OP
	lbs/day[2]	26	--	--	--	--	
Isophorone	µg/L	53,000	--	--	--	--	OP
	lbs/day[2]	7,700	--	--	--	--	
Nitrobenzene	µg/L	360	--	--	--	--	OP
	lbs/day[2]	53	--	--	--	--	
N-Nitrosodimethylamine	µg/L	530	--	--	--	--	OP
	lbs/day[2]	77	--	--	--	--	
N-Nitrosodi-N-propylamine	µg/L	28	--	--	--	--	OP
	lbs/day[2]	4.1	--	--	--	--	

Parameter	Units	Effluent Limitations					Basis [1]
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Maximum	Six-Month Median	
N-Nitrosodiphenylamine	µg/L	180	--	--	--	--	OP
	lbs/day[2]	26	--	--	--	--	
Aldrin	µg/L	0.0016	--	--	--	--	OP
	lbs/day[2]	0.00023	--	--	--	--	
HCH [11]	µg/L	--	--	0.58	0.88	0.29	OP
	lbs/day[2]	--	--	0.085	0.13	0.042	
Chlordane	µg/L	0.0017	--	--	--	--	OP
	lbs/day[2]	0.00025	--	--	--	--	
DDT [12]	µg/L	0.012	--	--	--	--	OP
	lbs/day[2]	0.0018	--	--	--	--	
Dieldrin	µg/L	0.0029	--	--	--	--	OP
	lbs/day[2]	0.00042	--	--	--	--	
Endosulfan	µg/L	--	--	1.3	2.0	0.66	OP
	lbs/day[2]	--	--	0.19	0.29	0.096	
Endrin	µg/L	--	--	0.29	0.44	0.15	OP
	lbs/day[2]	--	--	0.042	0.064	0.022	
Heptachlor	µg/L	0.0037	--	--	--	--	OP
	lbs/day[2]	0.00054	--	--	--	--	
Heptachlor Epoxide	µg/L	0.0015	--	--	--	--	OP
	lbs/day[2]	0.00022	--	--	--	--	
Polychlorinated Biphenyls (PCBs) [13]	µg/L	0.0014	--	--	--	--	OP
	lbs/day[2]	0.00020	--	--	--	--	
Toxaphene	µg/L	0.015	--	--	--	--	OP
	lbs/day[2]	0.0022	--	--	--	--	
Tributyltin	µg/L	0.10	--	--	--	--	OP
	lbs/day[2]	0.015	--	--	--	--	
Radioactivity	Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30253 of the California Code of Regulations. Reference to Section 30253 is prospective, including future changes to any incorporated provisions of federal law, as the changes take effect.						OP

1. Basis for Effluent Limitations: BPJ = Best Professional Judgment. This Order establishes effluent limitations for BOD_5 because the discharge is comprised of treated municipal wastewater from POTWs. OP = 2012 Ocean Plan. MCL = Maximum Contaminant Levels specified in Title 22, Chapter 15, Article 5, Section 64443, California Code of Regulations.
2. The mass-based effluent limitations are based on the facility design flow rate of 17.52 MGD.
3. “Pass” or “Fail” for Median Monthly Effluent Limitation (MMEL). “Pass” or “Fail” and “% Effect” for Maximum Daily Effluent Limitation (MDEL). The MMEL for chronic toxicity shall only apply when there is a discharge more than one day in a calendar month period. During such calendar months, exactly three independent toxicity tests are required when one toxicity test results in “Fail”.
4. This is a Median Monthly Effluent Limitation.
5. Bacteria limitations:
   a. 30-day Geometric Mean – The geometric mean shall be calculated using the results of five most recent samples.

i. Total coliform density shall not exceed 1,000/100 ml;

ii. Fecal coliform density shall not exceed 200/100 ml; and

iii. Enterococcus density shall not exceed 35/100 ml.

b. Single Sample Maximum (SSM)

i. Total coliform density shall not exceed 10,000/100 ml;

ii. Fecal coliform density shall not exceed 400/100 ml;

iii. Enterococcus density shall not exceed 104/100 ml; and

iv. Total coliform density shall not exceed 1,000/100 ml, when the fecal coliform/total coliform ratio exceeds 0.1.

6. Non-chlorinated phenolic compounds represent the sum of 2-nitrophenol; phenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; and 4-nitrophenol.

7. Chlorinated phenolic compounds represent the sum of 2-chlorophenol; 2,4-dichlorophenol; 2,4,6-trichlorophenol; 4-chloro-3-methylphenol; and pentachlorophenol.

8. TCDD Equivalents shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below. USEPA method 1613 may be used to analyze dioxin and furan congeners.

$$\text{Dioxin-TEQ (TCDD Equivalents)} = \Sigma (C_x \times TEF_x)$$

Where:

C_x = concentration of dioxin or furan congener x

TEF_x = TEF for congener x

Toxicity Equivalency Factors

Isomer Group	Toxicity Equivalency Factor (TEF)
2,3,7,8-tetra CDD	1.0
2,3,7,8-penta CDD	0.5
2,3,7,8-hexa CDDs	0.1
2,3,7,8-hepta CDD	0.01
Octa CDD	0.001
2,3,7,8 tetra CDF	0.1
1,2,3,7,8 penta CDF	0.05
2,3,4,7,8 penta CDF	0.5
2,3,7,8 hexa CDFs	0.1
2,3,7,8 hepta CDFs	0.01
Octa CDF	0.001

9. Halomethanes shall mean the sum of bromoform, bromomethane (methyl bromide), and chloromethane (methyl chloride).

10. PAHs shall mean the sum of acenaphthylene; anthracene; 1,2-benzanthracene; 3,4-benzofluoranthene; benzo(k)fluoranthene; 1,12-benzoperylene; benzo(a)pyrene; chrysene; dibenzo(a,h)anthracene; fluorine; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene.

11. HCH shall mean the sum of alpha, beta, gamma (lindane), and delta isomers of hexachlorocyclohexane.

12. DDT shall mean the sum of 4,4'-DDT, 2,4'-DDT, 4,4'-DDE, 2,4'-DDE, 4,4'-DDD, and 2,4'-DDD.

13. PCBs shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Arolclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260.

E. Interim Effluent Limitations – Not Applicable

F. Land Discharge Specifications – Not Applicable

G. Recycling Specifications – Not Applicable

V. RATIONALE FOR RECEIVING WATER LIMITATIONS

A. Surface Water

The Ocean Plan contains numeric and narrative water quality objectives applicable to the coastal waters of California. Water quality objectives include an objective to maintain the high quality waters pursuant to federal regulations (section 131.12) and State Water Board Resolution No. 68-16. Receiving water limitations in this Order are included to ensure protection of beneficial uses of the receiving water and are based on the water quality objectives contained in the Ocean Plan.

B. Groundwater – Not Applicable

VI. RATIONALE FOR PROVISIONS

A. Standard Provisions

Standard Provisions, which apply to all NPDES permits in accordance with 40 C.F.R. section 122.41, and additional conditions applicable to specified categories of permits in accordance with 40 C.F.R. section 122.42, are provided in Attachment D to the order.

Sections 122.41(a)(1) and (b) through (n) of 40 C.F.R. establish conditions that apply to all State-issued NPDES permits. These conditions must be incorporated into the permits either expressly or by reference. If incorporated by reference, a specific citation to the regulations must be included in the Order. Section 123.25(a)(12) allows the state to omit or modify conditions to impose more stringent requirements. In accordance with 40 C.F.R. section 123.25, this Order omits federal conditions that address enforcement authority specified in 40 C.F.R. sections 122.41(j)(5) and (k)(2) because the enforcement authority under the Water Code is more stringent. In lieu of these conditions, this Order incorporates by reference Water Code section 13387(e).

B. Special Provisions

1. Reopener Provisions

These provisions are based on section 123 and the previous Order. The Regional Water Board may reopen the permit to modify permit conditions and requirements. Causes for modifications include the promulgation of new federal regulations, modification in toxicity requirements, or adoption of new regulations by the State Water Board or Regional Water Board, including revisions to the Basin Plan and/or Ocean Plan.

2. Special Studies and Additional Monitoring Requirements

a. **Initial Investigation Toxicity Reduction Evaluation Workplan.** This provision is based on section III.C.9 of the Ocean Plan.

b. **Mixing Zone Study Work Plan.** The Discharger is required to develop and submit to the Los Angeles Regional Water Board for review a work plan detailing how the Discharger will conduct a Mixing Zone Study. The Mixing Zone Study shall be designed to confirm the assumption included in the modeling of the discharge.

c. **Sediment Loading Study Work Plan.** The Discharger is required to develop and submit to the Los Angeles Regional Water Board for review a work plan detailing how the Discharger will conduct a Sediment Loading Study. The Sediment Loading Study shall be designed to monitor the concentrations of constituents present in the sediment inside and outside of the mixing zone. The sampling must target all constituents present in the discharge that bioaccumulate in the tissue of aquatic life that may be present in the area.

3. Best Management Practices and Pollution Prevention

These provisions are based on section 122.44(k) and includes the requirement to develop and implement a SWPPP, BMPP and a SPCC Plan.

4. Construction, Operation, and Maintenance Specifications

This provision is based on the requirements of section 122.41(e) and the previous Order.

VII. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

Section 122.48 of 40 C.F.R. requires that all NPDES permits specify requirements for recording and reporting monitoring results. Water Code sections 13267 and 13383 authorize the Los Angeles Regional Water Board to require technical and monitoring reports. The Monitoring and Reporting Program (MRP), Attachment E, establishes monitoring and reporting requirements that implement federal and state requirements. The following provides the rationale for the monitoring and reporting requirements contained in the MRP for this facility.

A. Influent Monitoring – Not Applicable

B. Effluent Monitoring

Monitoring for those pollutants expected to be present in discharges from Discharge Point 001 (Monitoring Location EFF-001) will be required as shown in the MRP (Attachment E). For the most part, monitoring requirements from the previous Order are included in this Order. To determine compliance with effluent limitations, the MRP retains monthly monitoring for total residual chlorine, ammonia, bacteria, and chronic toxicity. The MRP newly establishes daily monitoring for total effluent flow, to record the volume of discharge from the RSMP. In addition, the MRP requires monthly monitoring for all pollutants included in Table 1 of the Ocean Plan, to determine compliance with effluent limitations for those pollutants. The previous Order required quarterly monitoring for some of these parameters, identified in the previous MRP as “all other Table B (Table 1 in the 2012 Ocean Plan) constituents”; however, because new WQBELs are established for these parameters, monthly monitoring is required. In addition to assessing compliance with effluent limitations, routine monitoring of Table 1 parameters will provide data for evaluating reasonable potential for the new discharge to cause or contribute to an exceedance of applicable water quality objectives contained in the Ocean Plan.

Upon the commencement of discharges from the RSMP, if after 2 years all monitoring results for certain constituents are reported as non-detect, using detection limits that are sufficiently sensitive to demonstrate compliance with effluent limitations, the sampling frequency for certain constituents may be reduced to 1/Quarter. However, if after the reduction in monitoring frequency for these constituents is allowed, monitoring results are reported at concentrations greater than the applicable effluent limitation, the monitoring frequency for these constituents reverts to 1/Month.

C. Whole Effluent Toxicity Testing Requirements

Whole effluent toxicity (WET) protects the receiving water quality from the aggregate toxic effect of a mixture of pollutants in the effluent. An acute toxicity test is conducted over a short time period and measures mortality. A chronic toxicity test is conducted over a longer period of time and may measure mortality, reproduction, and growth. Chronic toxicity is a more stringent requirement that acute toxicity. A chemical at a low concentration can have chronic effects but no acute effects. For this permit, chronic toxicity in the discharge is limited and evaluated using USEPA’s 2010 TST hypothesis testing approach. The chronic toxicity effluent limitations are as stringent as necessary to protect the Ocean Plan Water Quality Objective for chronic toxicity.

Section III.C.3.c.(4) of the Ocean Plan requires dischargers to conduct chronic toxicity testing if the minimum initial dilution of the effluent is below 100:1. The Facility has an initial dilution ratio of 72 to 1. Therefore, this Order includes monitoring requirements for chronic toxicity in the MRP (Attachment E).

D. Receiving Water Monitoring

Monitoring requirements are included in the MRP (Attachment E) to determine compliance with the receiving water limitations established in Limitations and Discharge Requirements, Receiving Water Limitations, Section V.A. Receiving water monitoring requirements have been included from the previous Order with modification. This Order requires monthly monitoring for the first year. If monitoring results demonstrate compliance with water quality objectives in the Ocean Plan the frequency of monitoring for that constituent may be reduced to quarterly. If a quarterly sample exceeds the water quality objectives in the Ocean Plan, the monitoring frequency returns to monthly for that constituent until at least four consecutive samples demonstrate compliance with the water quality objective.

E. Other Monitoring Requirements

1. Outfall and Diffuser Inspection

   The annual inspection is required to ensure a periodic assessment of the integrity of the outfall pipes and ballasting system.

VIII. PUBLIC PARTICIPATION

The Los Angeles Regional Water Board has considered the issuance of WDR's that will serve as an NPDES permit for Calleguas Municipal Water District, Regional Salinity Management Pipeline. As a step in the WDR adoption process, the Los Angeles Regional Water Board staff has developed tentative WDR's and has encouraged public participation in the WDR adoption process.

A. Notification of Interested Parties

The Los Angeles Regional Water Board notified the Discharger and interested agencies and persons of its intent to prescribe WDR's for the discharge and provided them an opportunity to submit written comments and recommendations.

The public had access to the agenda and any changes in dates and locations through the Los Angeles Regional Water Board's website at:
http://www.waterboards.ca.gov/losangeles

B. Written Comments

The staff determinations are tentative. Interested persons were invited to submit written comments concerning tentative WDRs as provided through the notification process electronically at losangeles@waterboards.ca.gov with a copy to jrchen@waterboards.ca.gov.

To be fully responded to by staff and considered by the Los Angeles Regional Water Board, the written comments were due at the Regional Water Board offices by 5:00 p.m. on **February 10, 2014**.

C. Public Hearing

The Los Angeles Regional Water Board held a public hearing on the tentative WDR's during its regular Board meeting on the following date and time and at the following location:

Date: March 6, 2014

Time: 9:00 A.M
Location: City of Culver City, Council Chambers
9770 Culver Boulevard
Culver City, California

Interested persons were invited to attend. At the public hearing, the Los Angeles Regional Water Board heard testimony, pertinent to the discharge, WDR's, and permit. For accuracy of the record, important testimony was requested in writing.

Please be aware that dates and venues may change. Our Web address is http://www.waterboards.ca.gov/losangeles where you can access the current agenda for changes in dates and locations.

D. Reconsideration of Waste Discharge Requirements

Any aggrieved person may petition the State Water Board to review the decision of the Regional Water Board regarding the final WDR's. The petition must be received by the State Water Board at the following address within 30 calendar days of the Regional Water Board's action.

State Water Resources Control Board
Office of Chief Counsel
P.O. Box 100, 1001 I Street
Sacramento, CA 95812-0100

For instructions on how to file a petition for review, see:
http://www.waterboards.ca.gov/public_notices/petitions/water_quality/wqpetition_instr.shtml

E. Information and Copying

The Report of Waste Discharge, other supporting documents, and comments received are on file and may be inspected at the address above at any time between 8:30 a.m. and 4:45 p.m., Monday through Friday. Copying of documents may be arranged through the Los Angeles Regional Water Board by calling (213) 576-6600.

F. Register of Interested Persons

Any person interested in being placed on the mailing list for information regarding the WDR's and NPDES permit should contact the Los Angeles Regional Water Board, reference this facility, and provide a name, address, and phone number.

G. Additional Information

Requests for additional information or questions regarding this order should be directed to Jau Ren Chen at (213) 576-6656.

ATTACHMENT G – STORM WATER POLLUTION PREVENTION PLAN REQUIREMENTS

I. Implementation Schedule

A storm water pollution prevention plan (SWPPP) shall be developed and submitted to the Regional Water Board within 90 days following the adoption of this Order. The SWPPP shall be implemented for each facility covered by this Permit within 10 days of approval from the Regional Water Board, or 6-months from the date of the submittal of the SWPPP to the Regional Water Board (whichever comes first).

II. Objectives

The SWPPP has two major objectives: (a) to identify and evaluate sources of pollutants associated with industrial activities that may affect the quality of storm water discharges and authorized non-storm water discharges from the facility; and (b) to identify and implement site- specific best management practices (BMPs) to reduce or prevent pollutants associated with industrial activities in storm water discharges and authorized non-storm water discharges. BMPs may include a variety of pollution prevention measures or other low-cost and pollution control measures. They are generally categorized as non-structural BMPs (activity schedules, prohibitions of practices, maintenance procedures, and other low-cost measures) and as structural BMPs (treatment measures, run-off controls, over-head coverage.) To achieve these objectives, facility operators should consider the five phase process for SWPPP development and implementation as shown in Table A.

The SWPPP requirements are designed to be sufficiently flexible to meet the needs of various facilities. SWPPP requirements that are not applicable to a facility should not be included in the SWPPP.

A facility's SWPPP is a written document that shall contain a compliance activity schedule, a description of industrial activities and pollutant sources, descriptions of BMPs, drawings, maps, and relevant copies or references of parts of other plans. The SWPPP shall be revised whenever appropriate and shall be readily available for review by facility employees or Regional Water Board inspectors.

III. Planning and Organization

A. Pollution Prevention Team

The SWPPP shall identify a specific individual or individuals and their positions within the facility organization as members of a storm water pollution prevention team responsible for developing the SWPPP, assisting the facility manager in SWPPP implementation and revision, and conducting all monitoring program activities required in Attachment E of this Permit. The SWPPP shall clearly identify the Permit related responsibilities, duties, and activities of each team member. For small facilities, storm water pollution prevention teams may consist of one individual where appropriate.

B. Review Other Requirements and Existing Facility Plans

The SWPPP may incorporate or reference the appropriate elements of other regulatory requirements. Facility operators should review all local, State, and Federal requirements that impact, complement, or are consistent with the requirements of this General Permit. Facility operators should identify any existing facility plans that contain storm water pollutant control measures or relate to the requirements of this Permit. As examples, facility operators whose facilities are subject to Federal Spill Prevention Control and Countermeasures' requirements should already have instituted a plan to control spills of certain hazardous materials. Similarly, facility operators whose facilities are subject to air quality related permits and regulations may already have evaluated industrial activities that generate dust or particulates.

IV. Site Map

The SWPPP shall include a site map. The site map shall be provided on an 8-½ x 11 inch or larger sheet and include notes, legends, and other data as appropriate to ensure that the site map is clear and understandable. If necessary, facility operators may provide the required information on multiple site maps.

TABLE A
FIVE PHASES FOR DEVELOPING AND IMPLEMENTING INDUSTRIAL STORM WATER POLLUTION PREVENTION PLANS

PLANNING AND ORGANIZATION Form Pollution Prevention Team Review other plans
ASSESSMENT PHASE Develop a site map Identify potential pollutant sources Inventory of materials and chemicals List significant spills and leaks Identify non-storm water discharges Assess pollutant risks
BEST MANAGEMENT PRACTICES IDENTIFICATION PHASE Non-structural BMPs Structural BMPs Select activity and site-specific BMPs
IMPLEMENTATION PHASE Train employees Implement BMPs Conduct recordkeeping and reporting
EVALUATION / MONITORING Conduct annual site evaluation Review monitoring information Evaluate BMPs Review and revise SWPPP

The following information shall be included on the site map:

A. The facility boundaries; the outline of all storm water drainage areas within the facility boundaries; portions of the drainage area impacted by run-on from surrounding areas; and direction of flow of each drainage area, on-site surface water bodies, and areas of soil erosion. The map shall also identify nearby water bodies (such as rivers, lakes, and ponds) and municipal storm drain inlets where the facility's storm water discharges and authorized non-storm water discharges may be received.

B. The location of the storm water collection and conveyance system, associated points of discharge, and direction of flow. Include any structural control measures that affect storm water discharges, authorized non-storm water discharges, and run-on. Examples of structural control measures are catch basins, berms, detention ponds, secondary containment, oil/water separators, diversion barriers, etc.

C. An outline of all impervious areas of the facility, including paved areas, buildings, covered storage areas, or other roofed structures.

D. Locations where materials are directly exposed to precipitation and the locations where significant spills or leaks identified in Section A.6.a.iv. below have occurred.

E. Areas of industrial activity. This shall include the locations of all storage areas and storage tanks, shipping and receiving areas, fueling areas, vehicle and equipment storage/maintenance areas, material handling and processing areas, waste treatment and disposal areas, dust or particulate generating areas, cleaning and rinsing areas, and other areas of industrial activity which are potential pollutant sources.

V. List of Significant Materials

The SWPPP shall include a list of significant materials handled and stored at the site. For each material on the list, describe the locations where the material is being stored, received, shipped, and handled, as well as the typical quantities and frequency. Materials shall include raw materials, intermediate products, final or finished products, recycled materials, and waste or disposed materials.

VI. Description of Potential Pollutant Sources

A. The SWPPP shall include a narrative description of the facility's industrial activities, as identified in Section A.4.e above, associated potential pollutant sources, and potential pollutants that could be discharged in storm water discharges or authorized non-storm water discharges. At a minimum, the following items related to a facility's industrial activities shall be considered:

1. **Industrial Processes.** Describe each industrial process, the type, characteristics, and quantity of significant materials used in or resulting from the process, and a description of the manufacturing, cleaning, rinsing, recycling, disposal, or other activities related to the process. Where applicable, areas protected by containment structures and the corresponding containment capacity shall be described.

2. **Material Handling and Storage Areas.** Describe each handling and storage area, type, characteristics, and quantity of significant materials handled or stored, description of the shipping, receiving, and loading procedures, and the spill or leak prevention and response

procedures. Where applicable, areas protected by containment structures and the corresponding containment capacity shall be described.

3. **Dust and Particulate Generating Activities.** Describe all industrial activities that generate dust or particulates that may be deposited within the facility's boundaries and identify their discharge locations; the characteristics of dust and particulate pollutants; the approximate quantity of dust and particulate pollutants that may be deposited within the facility boundaries; and a description of the primary areas of the facility where dust and particulate pollutants would settle.

4. **Significant Spills and Leaks.** Describe materials that have spilled or leaked in significant quantities in storm water discharges or non-storm water discharges since April 17, 1994. Include toxic chemicals (listed in 40 C.F.R., section 302) that have been discharged to storm water as reported on USEPA Form R, and oil and hazardous substances in excess of reportable quantities (see 40 Code of Federal Regulations [C.F.R.], sections 110, 117, and 302).

   The description shall include the type, characteristics, and approximate quantity of the material spilled or leaked, the cleanup or remedial actions that have occurred or are planned, the approximate remaining quantity of materials that may be exposed to storm water or non-storm water discharges, and the preventative measures taken to ensure spill or leaks do not reoccur. Such list shall be updated as appropriate during the term of this Permit.

5. **Non-Storm Water Discharges.** Facility operators shall investigate the facility to identify all non-storm water discharges and their sources. As part of this investigation, all drains (inlets and outlets) shall be evaluated to identify whether they connect to the storm drain system.

   All non-storm water discharges shall be described. This shall include the source, quantity, frequency, and characteristics of the non-storm water discharges and associated drainage area.

   Non-storm water discharges (other boiler blowdown and boiler condensate permitted under the Order) that contain significant quantities of pollutants or that do not meet the conditions provided in Special Conditions D of the storm water general permit are prohibited by this Permit (Examples of prohibited non-storm water discharges are contact and non-contact cooling water, rinse water, wash water, etc.). Non-storm water discharges that meet the conditions provided in Special Condition D of the general storm water permit are authorized by this Permit. The SWPPP must include BMPs to prevent or reduce contact of non-storm water discharges with significant materials or equipment.

6. **Soil Erosion.** Describe the facility locations where soil erosion may occur as a result of industrial activity, storm water discharges associated with industrial activity, or authorized non-storm water discharges.

B. The SWPPP shall include a summary of all areas of industrial activities, potential pollutant sources, and potential pollutants. This information should be summarized similar to Table B. The last column of Table B, "Control Practices", should be completed in accordance with Section A.8. below.

VII. Assessment of Potential Pollutant Sources

A. The SWPPP shall include a narrative assessment of all industrial activities and potential pollutant sources as described in A.6. above to determine:

1. Which areas of the facility are likely sources of pollutants in storm water discharges and authorized non-storm water discharges, and

2. Which pollutants are likely to be present in storm water discharges and authorized non-storm water discharges. Facility operators shall consider and evaluate various factors when performing this assessment such as current storm water BMPs; quantities of significant materials handled, produced, stored, or disposed of; likelihood of exposure to storm water or authorized non-storm water discharges; history of spill or leaks; and run-on from outside sources.

B. Facility operators shall summarize the areas of the facility that are likely sources of pollutants and the corresponding pollutants that are likely to be present in storm water discharges and authorized non-storm water discharges.

Facility operators are required to develop and implement additional BMPs as appropriate and necessary to prevent or reduce pollutants associated with each pollutant source. The BMPs will be narratively described in section VIII below.

VIII. Storm Water Best Management Practices

The SWPPP shall include a narrative description of the storm water BMPs to be implemented at the facility for each potential pollutant and its source identified in the site assessment phase (Sections A.6. and 7. above). The BMPs shall be developed and implemented to reduce or prevent pollutants in storm water discharges and authorized non-storm water discharges. Each pollutant and its source may require one or more BMPs. Some BMPs may be implemented for multiple pollutants and their sources, while other BMPs will be implemented for a very specific pollutant and its source.

TABLE B

EXAMPLE
ASSESSMENT OF POTENTIAL POLLUTION SOURCES AND CORRESPONDING BEST MANAGEMENT PRACTICES SUMMARY

Area	Activity	Pollutant Source	Pollutant	Best Management Practices
Vehicle & Equipment Fueling	Fueling	Spills and leaks during delivery. Spills caused by topping off fuel tanks. Hosing or washing down fuel oil fuel area. Leaking storage tanks. Rainfall running off fuel oil, and rainfall running onto and off fueling area.	fuel oil	Use spill and overflow protection. Minimize run-on of storm water into the fueling area. Cover fueling area. Use dry cleanup methods rather than hosing down area. Implement proper spill prevention control program. Implement adequate preventative maintenance program to preventive tank and line leaks. Inspect fueling areas regularly to detect problems before they occur. Train employees on proper fueling, cleanup, and spill response techniques.

The description of the BMPs shall identify the BMPs as (1) existing BMPs, (2) existing BMPs to be revised and implemented, or (3) new BMPs to be implemented. The description shall also include a discussion on the effectiveness of each BMP to reduce or prevent pollutants in storm water discharges and authorized non-storm water discharges. The SWPPP shall provide a summary of all BMPs implemented for each pollutant source. This information should be summarized similar to Table B.

Facility operators shall consider the following BMPs for implementation at the facility:

A. Non-Structural BMPs

Non-structural BMPs generally consist of processes, prohibitions, procedures, schedule of activities, etc., that prevent pollutants associated with industrial activity from contacting with storm water discharges and authorized non-storm water discharges. They are considered low technology, cost-effective measures. Facility operators should consider all possible non-structural BMPs options before considering additional structural BMPs (see Section A.8.b. below). Below is a list of non-structural BMPs that should be considered:

1. **Good Housekeeping.** Good housekeeping generally consists of practical procedures to maintain a clean and orderly facility.

2. **Preventive Maintenance.** Preventive maintenance includes the regular inspection and maintenance of structural storm water controls (catch basins, oil/water separators, etc.) as well as other facility equipment and systems.

3. **Spill Response.** This includes spill clean-up procedures and necessary clean-up equipment based upon the quantities and locations of significant materials that may spill or leak.

4. **Material Handling and Storage.** This includes all procedures to minimize the potential for spills and leaks and to minimize exposure of significant materials to storm water and authorized non-storm water discharges.

5. **Employee Training.** This includes training of personnel who are responsible for (1) implementing activities identified in the SWPPP, (2) conducting inspections, sampling, and visual observations, and (3) managing storm water. Training should address topics such as spill response, good housekeeping, and material handling procedures, and actions necessary to implement all BMPs identified in the SWPPP. The SWPPP shall identify periodic dates for such training. Records shall be maintained of all training sessions held.

6. **Waste Handling/Recycling.** This includes the procedures or processes to handle, store, or dispose of waste materials or recyclable materials.

7. **Recordkeeping and Internal Reporting.** This includes the procedures to ensure that all records of inspections, spills, maintenance activities, corrective actions, visual observations, etc., are developed, retained, and provided, as necessary, to the appropriate facility personnel.

8. **Erosion Control and Site Stabilization.** This includes a description of all sediment and erosion control activities. This may include the planting and maintenance of vegetation, diversion of run-on and runoff, placement of sandbags, silt screens, or other sediment control devices, etc.

9. **Inspections.** This includes, in addition to the preventative maintenance inspections identified above, an inspection schedule of all potential pollutant sources. Tracking and follow-up procedures shall be described to ensure adequate corrective actions are taken and SWPPPs are made.

10. **Quality Assurance.** This includes the procedures to ensure that all elements of the SWPPP and Monitoring Program are adequately conducted.

B. Structural BMPs.

Where non-structural BMPs as identified in Section A.8.a. above are not effective, structural BMPs shall be considered. Structural BMPs generally consist of structural devices that reduce or prevent pollutants in storm water discharges and authorized non-storm water discharges. Below is a list of structural BMPs that should be considered:

1. **Overhead Coverage.** This includes structures that provide horizontal coverage of materials, chemicals, and pollutant sources from contact with storm water and authorized non-storm water discharges.

2. **Retention Ponds.** This includes basins, ponds, surface impoundments, bermed areas, etc. that do not allow storm water to discharge from the facility.

3. **Control Devices.** This includes berms or other devices that channel or route run-on and runoff away from pollutant sources.

4. **Secondary Containment Structures.** This generally includes containment structures around storage tanks and other areas for the purpose of collecting any leaks or spills.

5. **Treatment.** This includes inlet controls, infiltration devices, oil/water separators, detention ponds, vegetative swales, etc. that reduce the pollutants in storm water discharges and authorized non-storm water discharges.

IX. Annual Comprehensive Site Compliance Evaluation

The facility operator shall conduct one comprehensive site compliance evaluation (evaluation) in each reporting period (July 1-June 30). Evaluations shall be conducted within 8-16 months of each other. The SWPPP shall be revised, as appropriate, and the revisions implemented within 90 days of the evaluation. Evaluations shall include the following:

A. A review of all visual observation records, inspection records, and sampling and analysis results.

B. A visual inspection of all potential pollutant sources for evidence of, or the potential for, pollutants entering the drainage system.

C. A review and evaluation of all BMPs (both structural and non-structural) to determine whether the BMPs are adequate, properly implemented and maintained, or whether additional BMPs are needed. A visual inspection of equipment needed to implement the SWPPP, such as spill response equipment, shall be included.

D. An evaluation report that includes, (i) identification of personnel performing the evaluation, (ii) the date(s) of the evaluation, (iii) necessary SWPPP revisions, (iv) schedule, as required in Section A.10.e, for implementing SWPPP revisions, (v) any incidents of non-compliance and the corrective actions taken, and (vi) a certification that the facility operator is in compliance with this Permit. If the above certification cannot be provided, explain in the evaluation report why the facility operator is not in compliance with this General Permit. The evaluation report shall be submitted as part of the annual report, retained for at least five years, and signed and certified in accordance with Standard Provisions V.D.5 of Attachment D.

X. SWPPP General Requirements

A. The SWPPP shall be retained on site and made available upon request of a representative of the Regional Water Board and/or local storm water management agency (local agency) which receives the storm water discharges.

B. The Regional Water Board and/or local agency may notify the facility operator when the SWPPP does not meet one or more of the minimum requirements of this Section. As requested by the Regional Water Board and/or local agency, the facility operator shall submit an SWPPP revision and implementation schedule that meets the minimum requirements of this section to the Regional Water Board and/or local agency that requested the SWPPP revisions. Within 14 days after implementing the required SWPPP revisions, the facility operator shall provide written certification to the Regional Water Board and/or local agency that the revisions have been implemented.

C. The SWPPP shall be revised, as appropriate, and implemented prior to changes in industrial activities which (i) may significantly increase the quantities of pollutants in storm water discharge, (ii) cause a new area of industrial activity at the facility to be exposed to storm water, or (iii) begin an industrial activity which would introduce a new pollutant source at the facility.

D. The SWPPP shall be revised and implemented in a timely manner, but in no case more than 90 days after a facility operator determines that the SWPPP is in violation of any requirement(s) of this Permit.

E. When any part of the SWPPP is infeasible to implement due to proposed significant structural changes, the facility operator shall submit a report to the Regional Water Board prior to the applicable deadline that (i) describes the portion of the SWPPP that is infeasible to implement by the deadline, (ii) provides justification for a time extension, (iii) provides a schedule for completing and implementing that portion of the SWPPP, and (iv) describes the BMPs that will be implemented in the interim period to reduce or prevent pollutants in storm water discharges and authorized non-storm water discharges. Such reports are subject to Regional Water Board approval and/or modifications. Facility operators shall provide written notification to the Regional Water Board within 14 days after the SWPPP revisions are implemented.

F. The SWPPP shall be provided, upon request, to the Regional Water Board. The SWPPP is considered a report that shall be available to the public by the Regional Water Board under Section 308(b) of the Clean Water Act.

ATTACHMENT H – STATE WATER BOARD MINIMUM LEVELS

The Minimum Levels identified in this appendix represent the lowest concentration of a pollutant that can be quantitatively measured in a sample given the current state of performance in analytical chemistry methods in California. These Minimum Levels were derived from data provided by state-certified analytical laboratories in 1997 and 1998 for pollutants regulated by the California Ocean Plan and shall be used until new values are adopted by the State Water Board. There are four major chemical groupings: volatile chemicals, semi-volatile chemicals, inorganics, pesticides & PCB's. "No Data" is indicated by "--".

TABLE II-1
MINIMUM LEVELS – VOLATILE CHEMICALS

Volatile Chemicals	CAS Number	Minimum Level* (μ/L)	
		GC Method[a]	GCMS Method[b]
Acrolein	107028	2.	5
Acrylonitrile	107131	2.	2
Benzene	71432	0.5	2
Bromoform	75252	0.5	2
Carbon Tetrachloride	56235	0.5	2
Chlorobenzene	108907	0.5	2
Chlorodibromomethane	124481	0.5	2
Chloroform	67663	0.5	2
1,2-Dichlorobenzene (volatile)	95501	0.5	2
1,3-Dichlorobenzene (volatile)	541731	0.5	2
1,4-Dichlorobenzene (volatile)	106467	0.5	2
Dichlorobromomethane	75274	0.5	2
1,1-Dichloroethane	75343	0.5	1
1,2-Dichloroethane	107062	0.5	2
1,1-Dichloroethylene	75354	0.5	2
Dichloromethane	75092	0.5	2
1,3-Dichloropropene (volatile)	542756	0.5	2
Ethyl benzene	100414	0.5	2
Methyl Bromide	74839	1.	2
Methyl Chloride	74873	0.5	2
1,1,2,2-Tetrachloroethane	79345	0.5	2
Tetrachloroethylene	127184	0.5	2
Toluene	108883	0.5	2
1,1,1-Trichloroethane	71556	0.5	2
1,1,2-Trichloroethane	79005	0.5	2
Trichloroethylene	79016	0.5	2
Vinyl Chloride	75014	0.5	2

Table II-1 Notes

a) GC Method = Gas Chromatography
b) GCMS Method = Gas Chromatography / Mass Spectrometry

* To determine the lowest standard concentration in an instrument calibration curve for these techniques, use the given ML (see Ocean Plan, Chapter III, "Use of Minimum Levels").

TABLE II-2
MINIMUM LEVELS – SEMI VOLATILE CHEMICALS

Semi-Volatile Chemicals	CAS Number	Minimum* Level (μg/L)			
		GC Method[a]	GCMS Method[b]	HPLC Method[c]	COLOR Method[d]
Acenapthylene	208968	--	10	0.2	--
Anthracene	120127	--	10	2	--
Benzidine	92875	--	5	--	--
Benzo(a)anthracene	56553	--	10	2	--
Benzo(a)pyrene	50328	--	10	2	--
Benzo(b)fluoranthene	205992	--	10	10	--
Benzo(g,h,i)perylene	191242	--	5	0.1	--
Benzo(k)floranthene	207089	--	10	2	--
Bis2-(1-Chloroethoxy) methane	111911	--	5	--	--
Bis(2-Chloroethyl)ether	111444	10	1	--	--
Bis(2-Chloroisopropyl)ether	39638329	10	2	--	--
Bis(2-Ethylhexyl) phthalate	117817	10	5	--	--
2-Chlorophenol	95578	2	5	--	--
Chrysene	218019	--	10	5	--
Di-n-butyl phthalate	84742	--	10	--	--
Dibenzo(a,h)anthracene	53703	--	10	0.1	--
1,2-Dichlorobenzene (semivolatile)	95504	2	2	--	--
1,3-Dichlorobenzene (semivolatile)	541731	2	1	--	--
1,4-Dichlorobenzene (semivolatile)	106467	2	1	--	--
3,3-Dichlorobenzidine	91941	--	5	--	--
2,4-Dichlorophenol	120832	1	5	--	--
1,3-Dichloropropene	542756	--	5	--	
Diethyl phthalate	84662	10	2	--	--
Dimethyl phthalate	131113	10	2	--	--
2,4-Dimethylphenol	105679	1	2	--	--
2,4-Dinitrophenol	51285	5	5	--	--
2,4-Dinitrotoluene	121142	10	5	--	--
1,2-Diphenylhydrazine	122667	--	1	--	--
Fluoranthene	206440	10	1	0.05	--
Fluorene	86737	--	10	0.1	--
Hexachlorobenzene	118741	5	1	--	--
Hexachlorobutadiene	87683	5	1	--	--
Hexachlorocyclopentadiene	77474	5	5	--	--
Hexachloroethane	67721	5	1	--	--
Indeno(1,2,3-cd)pyrene	193395	--	10	0.05	--
Isophorone	78591	10	1	--	--
2-methyl-4,6-dinitrophenol	534521	10	5	--	--
3-methyl-4-chlorophenol	59507	5	1	--	--
N-nitrosodi-n-propylamine	621647	10	5	--	--
N-nitrosodimethylamine	62759	10	5	--	--

Semi-Volatile Chemicals	CAS Number	Minimum* Level (µg/L)			
		GC Method[a]	GCMS Method[b]	HPLC Method[c]	COLOR Method[d]
N-nitrosodiphenylamine	86306	10	1	--	--
Nitrobenzene	98953	10	1	--	--
2-Nitrophenol	88755	--	10	--	--
4-Nitrophenol	100027	5	10	--	--
Pentachlorophenol	87865	1	5	--	--
Phenanthrene	85018	--	5	0.05	--
Phenol	108952	1	1	--	50
Pyrene	129000	--	10	0.05	--
2,4,6-Trichlorophenol	88062	10	10	--	--

Table II-2 Notes:

a) GC Method = Gas Chromatography
b) GCMS Method = Gas Chromatography / Mass Spectrometry
c) HPLC Method = High Pressure Liquid Chromatography
d) COLOR Method = Colorimetric

* To determine the lowest standard concentration in an instrument calibration curve for this technique, multiply the given ML by 1000 (see Ocean Plan, Chapter III, "Use of Minimum Levels").

TABLE II-3
MINIMUM* LEVELS – INORGANICS

Inorganic Substances	CAS Number	Minimum* Level (µg/L)								
		COLOR Method[a]	DCP Method[b]	FAA Method[c]	GFAA Method[d]	HYBRIDE Method[e]	ICP Method[f]	ICPMS Method[g]	SPGFAA Method[h]	CVAA Method[i]
Antimony	7440360	--	1000.	10.	5.	0.5	50.	0.5	5.	--
Arsenic	7440382	20.	1000.	--	2.	1.	10.	2.	2.	--
Beryllium	7440417	--	1000.	20.	0.5	--	2.	0.5	1.	--
Cadmium	7440439	--	1000.	10.	0.5	--	10.	0.2	0.5	--
Chromium (total)	--	--	1000.	50.	2.	--	10.	0.5	1.	--
Chromium (VI)	18540299	10.	--	5.	--	--	--	--	--	--
Copper	7440508	--	1000.	20.	5.	--	10.	0.5	2.	--
Cyanide	57125	5.	--	--	--	--	--	--	--	--
Lead	7439921	--	10000.	20.	5.	--	5.	0.5	2.	--
Mercury	7439976	--	--	--	--	--	--	0.5	--	0.2
Nickel	7440020	--	1000.	50.	5.	--	20.	1.	5.	--
Selenium	7782492	--	1000.	--	5.	1.	10.	2.	5.	--
Silver	7440224	--	1000.	10.	1.	--	10.	0.2	2.	--
Thallium	7440280	--	1000.	10.	2.	--	10.	1.	5.	--
Zinc	7440666	--	1000.	20.	--	--	20.	1.	10.	--

Table II-3 Notes

a) COLOR Method = Colorimetric
b) DCP Method = Direct Current Plasma
c) FAA Method = Flame Atomic Absorption
d) GFAA Method = Graphite Furnace Atomic Absorption
e) HYDRIDE Method = Gaseous Hydride Atomic Absorption
f) ICP Method = Inductively Coupled Plasma
g) ICPMS Method = Inductively Coupled Plasma / Mass Spectrometry
h) SPGFAA Method = Stabilized Platform Graphite Furnace Atomic Absorption (i.e., US EPA 200.9)
i) CVAA Method = Cold Vapor Atomic Absorption

* To determine the lowest standard concentration in an instrument calibration curve for these techniques, use the given ML (see Ocean Plan, Chapter III, "Use of Minimum* Levels").

TABLE II-4
MINIMUM* LEVELS – PESTICIDES AND PCBs*

Pesticides – PCB's	CAS Number	Minimum* Level (µg/L)
		GC Method[a]
Aldrin	309002	0.005
Chlordane	57749	0.1
4,4'-DDD	72548	0.05
4,4'-DDE	72559	0.05
4,4'-DDT	50293	0.01
Dieldrin	60571	0.01
a-Endosulfan	959988	0.02
b-Endosulfan	33213659	0.01
Endosulfan Sulfate	1031078	0.05
Endrin	72208	0.01
Heptachlor	76448	0.01
Heptachlor Epoxide	1024573	0.01
a-Hexachlorocyclohexane	319846	0.01
b-Hexachlorocyclohexane	319857	0.005
d-Hexachlorocyclohexane	319868	0.005
g-Hexachlorocyclohexane (Lindane)	58899	0.02
PCB1016	--	0.5
PCB1221	--	0.5
PCB1232	--	0.5
PCB1242	--	0.5
PCB1248	--	0.5
PCB1254	--	0.5
PCB1260	--	0.5
Toxaphene	8001352	0.5

Table II-4 Notes

a) GC Method = Gas Chromatography

* To determine the lowest standard concentration in an instrument calibration curve for this technique, multiply the given ML by 100 (see Ocean Plan, Chapter III, “Use of Minimum Leve

Appendix B

UF AND RO FEED WATER QUALITY

The following tables are analogs of that reported in Chapter 3, Section 3.2. However, the tables differ as they contain all observations, including periods of time where Reservoir 2 contained some level of potable water.

Table B1 UF Feed Water Quality Observations from Monitoring from July 2020 to July 2022

Parameter (units)	n	Min	10th %ile(1)	Av.	Med.	90th %ile(1)	Max
Calcium (mg/L)	1	61	-	61	61	-	61
Magnesium (mg/L)	1	27	-	27	27	-	27
Sodium (mg/L)	1	120	-	120	120	-	120
Potassium (mg/L)	1	17	-	17	17	-	17
Barium (µg/L)	2	15	-	19	19	-	23
Iron (mg/L) (2)	78	<0.005 (<0.02)	<0.010 (<0.02)	0.018 (<0.02)	0.018 (<0.02)	0.024	0.069
Manganese (µg/L) (2)	78	<2 (<2.7)	15.7	34.3	27.5	55.8	130.0
Total Alkalinity (mg/L $CaCO_3$)	75	110	120	143	140	166	190
pH (online) (3)(4)	67,520	3.0(3)	7.0	7.3	7.3	7.5	14(3)
pH (grab)	81	6.9	6.9	7.0	7.0	7.1	7.2
Sulfate (mg/L)	2	180	-	190	190	-	200
Chloride (mg/L)	2	150	-	160	160	-	170
Nitrate (mg/L-N)	17	7.0	7.2	8.0	7.8	9.0	9.9
Nitrite (mg/L-N)	17	<0.05	<0.05	<0.05	<0.05	<0.05	0.26
Total Nitrate + Nitrite (mg/L -N)	59	<0.036	6.60	7.88	7.90	9.50	12.0
Boron (mg/L)	2	0.37	-	0.38	0.38	-	0.38
Silica (mg/L SiO2)	76	14	16	19	19	22	24
Color (ACU)	1	10	-	10	10	-	10
TOC (grab) mg/L	31	5.2	6.1	7.1	7.0	8.3	9.7
Turbidity (online) (NTU) (3)	67,477	0.17(3)	0.38	0.81	0.56	1.27	26.4(3)
Turbidity (grab) (NTU)	75	0.41	0.47	0.70	0.62	0.91	2.08
Total Suspended Solids (mg/L) (2)	76	0.1 (<10)	0.4 (<10)	3.4 (<10)	1 (<10)	<10	<10
Temperature (online) (F)	67,392	64	68	74	74	79	81
Total dissolved solids (mg/L)	2	720	-	755	755	-	790

Notes:

(1) Where there are less than 10 observations, a 10th and 90th percentile was not reported. Statistics were calculated by substituting the detection limit. Where a value is non-detect it is reported as "< detection limit".

(2) Multiple laboratories were used resulting in multiple method reporting limits. Statistics in brackets show the maximum detection limit reported, while lower detection limits are shown for reference. To calculate statistics, non-detects were substituted with the value of the detection limit reported for each observation.

(3) Minimum and maximum values from online data are suspected to be influenced by short-term instrumental error and may not be representative. Corresponding grab sample verification data is shown for reference. Use of 10th and 90th percentiles for online data is considered more appropriate to describe variability.

(4) Measured in the combined UF filtrate and assumed to be the same as UF feed.

Table B2 RO Feed Water Quality Observations from Monitoring from July 2020 to July 2022

Parameter (units)	n	Min	10th %ile(1)	Av.	Med.	90th %ile(1)	Max
Calcium (mg/L)	32	60	61	69	67	82	109
Magnesium (mg/L)	20	27	28	32	32	36	50
Sodium (mg/L)	20	120	129	143	145	160	160
Potassium (mg/L)	20	15	16	18	18	20	20
Barium (µg/L)	20	10	14	23	25	31	32
Strontium (mg/L)	31	0.35	0.39	0.52	0.52	0.66	0.71
Iron (mg/L) (2)	76	<0.005 (<0.02)	<0.007 (<0.02)	0.014 (<0.02)	0.013 (<0.02)	0.020	0.055
Manganese (µg/L)	76	5.50	9.5	25	19	44	100
Free Ammonia (online) mg/L-N (3)(4)	67,534	0.05(3)	0.51	1.05	0.88	1.77	9.77(3)
Free Ammonia (grab) mg/L-N (4)	82	0.07	0.50	1.26	1.1	1.92	4.8
pH (online) (3)(5)	54,971	1.3(3)	6.3	6.6	6.6	6.8	12.8(3)
pH (grab) (5)	80	6.3	6.5	6.6	6.7	6.8	6.9
Sulfate (mg/L)	31	190	210	249	240	300	370
Chloride (mg/L)	20	150	150	172	175	190	200
Fluoride (mg/L)	20	0.47	0.56	0.61	0.62	0.67	0.68
Nitrate (mg/L-N)	16	7.0	7.4	8.1	7.9	9.2	9.9
Nitrite (mg/L-N)	16	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Nitrate + Nitrite (mg/L -N)	59	6.1	6.9	8.1	8.0	9.5	12.0
Orthophosphate (mg/L-P)	12	2.1	2.3	2.61	2.6	3.0	3.2
Boron (mg/L)	22	0.36	0.36	0.39	0.38	0.41	0.45
Silica (mg/L SiO_2)	76	15	16	19	19	22	23
TOC (online) (mg/L) (3)	49,390	0.0(3)	5.9	6.8	6.9	7.6	11.0(3)
TOC (grab) mg/L	76	5.4	5.7	6.7	6.6	8.0	9.3
Turbidity (online) (NTU) (3)(6)	199,944	0.011(3)	0.013	0.028	0.019	0.047	1.000(3)
Turbidity (grab) (NTU) (6)	207	0.04	0.06	0.07	0.07	0.09	0.16
Temperature (online) (F)	55,032	64	68	74	75	79	81
Conductivity (online) (µS/cm) (3)	55,033	874(3)	1,142	1,297	1,280	1,441	1,629(3)
Conductivity (grab) (µS/cm)	78	996	1,142	1,315	1,314	1,490	1,594

Notes:
(1) Where there are less than 10 observations, a 10th and 90th percentile was not reported. Statistics were calculated by substituting the detection limit. Where a value is non-detect it is reported as "< detection limit".
(2) Multiple laboratories were used resulting in multiple method reporting limits. Statistics in brackets show the maximum detection limit reported, while lower detection limits are shown for reference. To calculate statistics, non-detects were substituted with the value of the detection limit reported for each observation.
(3) Minimum and maximum values from online data are suspected to be influenced by short-term instrumental error and may not be representative. Corresponding grab sample verification data is shown for reference. Use of 10th and 90th percentiles for online data is considered more appropriate to describe variability.
(4) Measured in the UF filtrate and downstream of ammonia addition for chloramination.
(5) pH reported after acid addition of RO feed.
(6) The data set for all three individual UF membranes was combined to calculate statistics.

Appendix C

DEMO WATER QUALITY DATABASE

All external laboratory results collected from the Demo were grouped into a single excel data base. The Excel database is attached electronically as Appendix C.